

Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report

Important note *To be completed with reference to the Reporting Guidance Notes for Project Leaders:
it is expected that this report will be about 10 pages in length, excluding annexes*

Submission Deadline: 30th April 2019

Darwin Plus Project Information

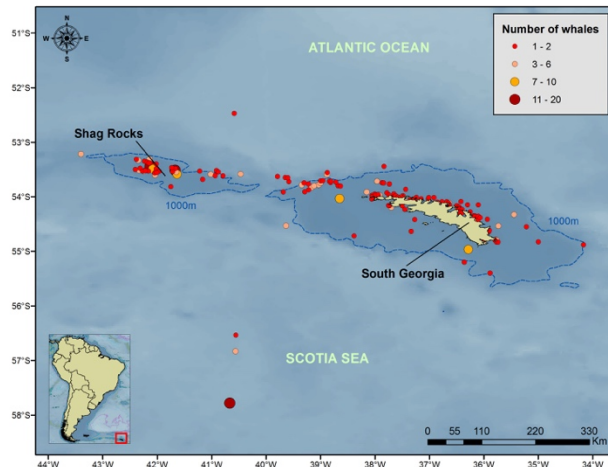
Project reference	DPLUS057
Project title	Population recovery of right whales in South Georgia waters
Territory(ies)	South Georgia
Lead organisation	British Antarctic Survey
Partner institutions	Sea Mammal Research Unit, School of Biology, University of St Andrews, Scotland/ University of Auckland, New Zealand International Fund for Animal Welfare, Woods Hole Oceanographic Institute, Massachusetts, USA Department of Biology, University of Utah, Instituto Aqualie, Minas Gerais, Brazil (NGO) Projeto Baleia Franca, Instituto Australis, Santa Caterina, Brazil (NGO) Happywhale.com University of Barcelona, Spain
Grant value	£312,738
Start/end date of project	April 2017 - December 2020
Reporting period (e.g., Apr 2018-Mar 2019) and number (e.g., AR 1,2)	Apr 2018-Mar 2019 Annual Report 2
Project leader name	Jennifer Jackson
Project website/blog/Twitter	
Report author(s) and date	

1. Project overview

Southern right whales are slowly recovering from whaling and are the most commonly seen whale in South Georgia (SG) waters. This summer feeding population is likely one of the most significant Antarctic krill consumers in SG waters, but its distribution, abundance and population recovery status has not been investigated. Whales summering in South Georgia have been directly linked, through photo-identification and satellite tagging, to winter calving grounds at Península Valdés (PV), Argentina. PV has had high calf mortalities in the last decade, causes of which are unknown. Growing evidence indicates that SG environmental conditions influence whale population dynamics, suggesting foraging success is a primary factor influencing reproductive-rates. It is therefore timely and important to conduct surveys of the feeding ground, to investigate prey sources, habitat-use between seasons and in relation to krill fishing within the Marine Protected Area, population abundance and connectivity with calving areas, health and population recovery status. In summary, the project will conduct a survey of South Georgia southern right

whale feeding ground recovery, post whaling, characterising the distribution, diversity, habitat use, health and calving ground connections, abundance and recovery status of this population following whaling.

The project is located in South Georgia; the map below also shows numbers of right whales sighted opportunistically in this region.



2. Project stakeholders/partners

Government of South Georgia and the South Sandwich Islands (GSGSSI)

The principal stakeholder in this project is the Government of South Georgia and the South Sandwich Islands. We have engaged with this stakeholder regularly over the past few months, giving presentations on the work (including at the 2018 South Georgia Stakeholders meeting at the Foreign Office, see Annex 3.1), and working closely with them on field planning and logistics.

GSGSSI officials have been closely involved in project development including in permitting research activities for the 2018/19 surveys. The GSGSSI provided logistical support and discounts on accommodation in order to support the 2018/19 surveys, and were kept closely informed of all the research activities conducted throughout the 2017/18 and 2018/19 season (see 2018/19 activity summary in Annex 3.2). They therefore remain closely involved in decision making about project field activities and are kept informed about project progress through reports and presentations as evidenced above.

A three day workshop on right whale recovery was held in the Falkland Islands during 6-8 March 2019 involving project stakeholders and partners, principally including the GSGSSI (a government member also gave the opening speech). The draft report of this workshop can be found in Annex 3.3.

So far this engagement with the stakeholder has worked well (and has also led to significant levels of in-kind support for project activities) and there are no lessons or challenges to share.

International Whaling Commission

The International Whaling Commission (IWC) are another project stakeholder, and receive annual updates on project progress through their Scientific Committee meetings in May (via the Southern Hemisphere sub-committee). In May 2018, report SC/67b/SH20 was presented, which documented the field expedition conducted during January/February 2018. The presentation was well received.

Discussions on South Georgia whale research during the Scientific Committee meetings developed into a proposal to develop a whale photo-identification guide for Antarctic tour operators to improve visibility of project activities within this community, which was endorsed by the Scientific Committee and subsequently supported by Southern Ocean Research Partnership funding (£1000). The IWC also agreed to fund a Southern Hemisphere-wide southern right whale catch history workshop to assist with the development of the past catch series for assessment of southern right whale recovery, offering £11,060 towards costs of travel and accommodation for participants.

In May 2019 a document detailing the genetic connectivity of South Georgia right whales to calving grounds in the South Atlantic (SC/68a/SH06REV) was submitted to the Southern Hemisphere sub-committee of the International Whaling Commission where it was positively received.

The reports of the International Whaling Commission are available online, and South Georgia project activities are discussed under Annex H (Supplement 20, <https://archive.iwc.int/pages/search.php?search=%21collection29&k=>) with the 2019 report due to be uploaded on the 17th June 2019.

So far engagement with the stakeholder has worked well (and has also led to both funding and endorsement support for project activities) and there are no lessons or challenges to share.

CCAMLR Scientific Committee

The project aims to engage with the CCAMLR Scientific Committee via provision of papers on whale habitat use to the CCAMLR Working Group on Ecosystem Monitoring and Management. So far two humpback whales (and no right whales) have been satellite tagged by the project during 2019 but there was insufficient time post-field to prepare a report on these two whales, so a full report on this topic will be provided to CCAMLR at their 2020 Working Group meeting, also including the last 15 years of satellite tracking data for humpback whales from their Brazilian wintering grounds (e.g. Zerbini et al. 2006; 2011). There therefore has been little engagement with the stakeholder to date, but engagement is planned in 2020.

Antarctic Tour Operators

Through our Project Partner Happywhale, we have been conducting outreach to encourage collection of whale images, in particular those of right whales within the Antarctic tourist community. Our engagement with Antarctic Tour Operators has followed two main avenues this year.

Firstly, we developed waterproof photo-ID placards (available for download at <https://iwc.int/sorp>), describing the different species that are commonly seen in the Antarctic Peninsula and Scotia Arc regions, with examples of poor vs good photo-ID images, and a placard explaining how the photo-IDs are used in research. The placards were presented by Taylor as a poster at the UK NERC Antarctic Science conference on 11th September 2018, and also published in a Norwegian newsletter about South Georgia/Islands Georgias del Sur (SG), Øyas Venner (<http://www.oyasvenner.org>). Four hundred placards were circulated widely among International Association for Antarctica Tour Operators (IAATO) staff via an IAATO meeting, through the IAATO Facebook page, and via an email circulation by IAATO head of communications. Placards were distributed to: (1) Tourist ships (2) Private operators, (3) National Antarctic operators (4) Krill and icefish fishery and observer vessels operating in SG waters (5) Port Lockroy Post Office (western Antarctic Peninsula) (5) The Grytviken Museum (SG), who made placards freely available to tour operators and mariners visiting throughout the 2018/19 season.

Total happywhale photo-ID submissions in 2017/18 from the Antarctic Peninsula and SG region (for all cetaceans) were 788, and during 2018/19, 1038 submissions were received (32% more). Within this figure, a record number of humpback whale submissions were received by www.happywhale.com during 2018/19 (927 submissions) compared to the 2017/18 season (703 submissions), while submissions for other cetaceans rose from 85 to 111. This suggests that the distribution of the placards had a positive impact on photo-ID collection by tour operators and citizens. Further circulation of these placards is now planned on an annual basis.

Secondly, we engaged directly with Antarctic tour operators by giving talks when tour operators visited South Georgia (five invited talks, Annex 3.1). We also contributed slides about the whale research and the need for collecting photo-ID images to a public talk which was given by the South Georgia museum to every tour vessel visiting Grytviken, to raise awareness about the whaling heritage of South Georgia and subsequent status of recovering whales in local waters.

So far engagement with the stakeholder has worked well, but we recognise that a lot of communication and networking connections with this community is necessary in order to keep making gains and building public awareness of whales in South Georgia and of the usefulness of citizens collecting good photo-ID images. This year we connected with core members of the

Polar Citizen Science Collective (<https://www.facebook.com/thepolarcollective>) and plan to build on this during the 2019/20 season to further establish whale photo-ID within their citizen science initiatives.

3. Project Progress

The project was originally anticipated to run for two years but with DARWIN support was extended to become a four year project.

3.1 Progress in carrying out project Activities

In relation to the planned field survey supported by Darwin (and delayed by one year due to problems obtaining a charter in 2019), all core activities are on track, with Activities 1.2.1 and 1.2.2 currently underway. This includes writing research permit applications and animal ethics protocols, and purchasing of equipment for the 2020 survey. The GSGSSI deadline for permit applications is July 2019, and the animal ethics application late June 2019.

3.2 Progress towards project Outputs

Project Output 1. *Report to GSGSSI on (i) status assessment of southern right whale SG distribution, habitat use and recovery patterns in the southwest Atlantic, (ii) risks to the population, (iii) recommended actions to mitigate risks*

The first of two planned workshops engaging with the GSGSSI was held on the 5-8th March 2019 in the Falkland Islands. These led to a workshop report and a series of recommendations for science and outreach activities to better understand SG distribution, habitat use and recovery (Annex 3.3). The final planned report will be written, considering risks and recommended actions, after the December 2020 UK based workshop following the 2019/20 field season. This activity is therefore on track.

Project Output 2. *Report key whale habitat use data to CCAMLR through a scientific paper to the EMM Working Group for consideration within spatial management proposals for regional krill fishery development.*

No southern right whales have been satellite tagged during the project to date (this activity is required in order to understand their fine-scale movements and habitat use), so this output cannot yet be delivered. However this activity is planned for the 2020 field season, and if tagging is successful the work will be reported to the CCAMLR Scientific Committee meeting in 2020.

During the 2019 field season, two humpback whales were opportunistically tagged during surveys, and their movements have been subsequently tracked through the summer and autumn (<https://www.bas.ac.uk/project/south-georgia-right-whale-project/south-georgia-right-whale-project-humpback-whale-tracking/>), providing us with information on autumn habitat use for another krill feeding whale species. These data are now being analysed in more detail in order to establish humpback whale habitat use patterns in relation to the Marine Protected Areas and krill fishery, and in relation to other krill predators. We have an agreement with Project Partner Zerbini to combine these tracks with all high latitude tracks from humpback whales tagged in Brazil since 2006 (>20 tracks) in order to better characterise patterns of Antarctic krill feeding by humpbacks in the summer, and establish areas of key importance for this species within the ecosystem. This work will be presented to the CCAMLR Scientific Committee in 2020.

This habitat use output is therefore delayed by one year to 2020, firstly because no right whale tracks are yet available for analysis, and secondly to allow time to combine analysis of humpback whale tracks with those made available from Brazilian collaborators, providing a fuller picture of whale habitat use at South Georgia for presentation to the CCAMLR Scientific Committee in 2020.

CONFIDENTIAL: We are also negotiating with Argentine researchers to obtain additional whale tracking data from their current southern right whale satellite tracking project based on the right whale calving grounds in the vicinity of Península Valdés (Argentina), to characterise South Georgia habitat use using the high latitude component of the data.

Project Output 3. *Report right whale connectivity and health assessment data to the IWC to address multiple scientific recommendations and concerns regarding threats and data gaps and contribute to the IWC Conservation Management Plan for this population.*

Population connectivity

Genetics:

Southern right whale biopsy samples collected during the 2018 survey (n=3), and n=12 additional samples collected during the first 1997 expedition to South Georgia (Moore et al. 1997) were analysed during 2018 and mitochondrial haplotypes and microsatellite genotypes generated. A genetic analysis was then conducted to assess the population identity of South Georgia whales in relation to the Southern Hemisphere calving grounds. This analysis was presented to the IWC Scientific Committee in 2019 (see SC/68a/SH06REV, Annex 3.4). This work found that South Georgia right whales are clearly associated with South Atlantic calving grounds, and slightly more connected to the southwest Atlantic (Brazil/Argentina) grounds than the southeast Atlantic (South Africa). No genetic distinction between Brazilian and Argentine grounds could be made, which is consistent with the idea that these two calving areas are part of one large single population of southern right whales. This work is now being prepared for publication.

Photo ID (Activity 0.3):

Overhead images of right whales could not be collected during the first two survey seasons due to poor weather conditions limiting UAV flight capacity. Side-on images of right whales were therefore collected and have been used to collate the South Georgia right whale photo-ID catalogue. Photo-ID based assessment of right whale connectivity with low-latitude calving grounds was carried out by matching South Georgia right whale images with the large catalogues held in Brazil (921 whales), Argentina (6887 whales) and South Africa (2084 whales). Of the 35 side-on images collected during the 2018 South Georgia season and contributed by Happywhale, 5 were suitable for comparison with the catalogues from Brazil and South Africa, and 13 were suitable for comparison with the Argentina catalogue. No matches were found, but kelp gull lesions were identified on the backs of four South Georgia whales, linking them to Península Valdés Argentina (the only location where kelp gulls are known to harass right whales). Photo-ID placard development (Section 2: Antarctic Tour Operators) has also enhanced our capacity to collect images.

Overall, the data suggest population connectivity with the southwest Atlantic (broadly as expected) and confirm direct individual connections with Argentina via kelp gull lesions. Further photo-ID matching is planned in 2020 following the Jan/Feb 2020 field season, in order to further assess connections.

In summary, this output has been delivered as anticipated, providing useful information about the genetic connections between South Georgia and calving grounds in the South Atlantic, and leveraging development of outreach tools to enhance photo-ID collection in the high latitudes. We plan to conduct further matching to the calving grounds of photo-IDs contributed to Happywhale during the 2018/19 season, and of those photo-IDs and biopsy samples collected during the upcoming 2019/20 field season, as detailed in the Logframe.

Health assessment (Activity 0.6)

An assessment into South Georgia right whale body condition was carried out using side-on images. This assessment is nearly complete and will be submitted for review at the IWC Scientific Committee next year. There were 26 images of whales with adequate coverage to conduct a health assessment. The cumulative scaled health score for individual animals ranged from 5 (the lowest, or “healthiest” animal) to 10 with a cumulative mean of 6.9 (+/- 1.6). More than half of the right whales analysed here received a “Good” rating for each of the four parameters overall, and no whale received a “Poor” body condition or rake marks rating. However, 41.9% of animals analysed for body condition were characterized as “Medium, indicating some level of body fat loss in the cervical region immediately caudal to the blowholes and 35.7% were given a “Poor” skin condition rating due to patches of sloughed skin, cyamids, or lesions on the body. Rake marks were somewhat prevalent (40% left side and 35.3% right side) near the blowholes as well. Inspection of the South Georgia catalogue also revealed the presence of kelp gull lesions on some animals. Lesions were positively identified on four whales and were possibly identified on an additional three animals. A further health assessment will be carried out on animals seen during the 2020 survey to see if there are any differences in body condition between years. These results are now being compared with health assessment data from the lower latitude calving grounds, which have more longitudinal data on whale health changes over time.

Further recommendations on scientific activities to better establish population connections and health status for southwest Atlantic right whales were agreed and reported in the Falkland Islands workshop report, Annex 3.3.

Project Output 4. *Calculate right whale depletion levels and recovery status in the southwest Atlantic, considering the population abundance in South Georgia and strength of linkages with calving areas.*

Calculation of right whale depletion levels necessitates a good understanding of the levels of past catch, and analysis of this has been carried out by project partners at the University of Barcelona in the past year. They have been measuring pre-modern catches from the American whalships in the southwest Atlantic, as well as struck but lost rates (i.e. whales struck during the whaling process, but not counted among catches due to catch inefficiency), see Section 3.1.5 Annex 3.3.

Logbooks from a number of voyages have been analysed to identify expeditions targeting the southwestern Atlantic Ocean whaling ground. Sighting and capture data were extracted from 255 whaling expeditions that took place during the period 1776-1923. In total, data from nearly 20,000 days of operation were obtained, rendering approximately 2,500 sightings and 650 captures of right whales. Exploitation strengthened in the first decade of the 19th century and the SPUE precipitated consequently around 1830. Thereafter, the species appeared to vanish from the area and only reappeared again in the 1880s, although SPUE in this latter period was one order of magnitude lower than that at the beginning of the 19th century. As data from the 18th century are fragmentary and probably underestimate catch levels, the 'struck and lost' rate was also calculated, highlighting that the proportion of whales that were actually caught was almost the same as the individuals that were struck and injured but lost at sea. Thus, the impact of whaling on the population was substantially heavier than that represented by the CPUE only. Finally, to further correct these estimates, a random sampling of existing voyages has been performed to evaluate the proportion of expedition focusing on the South Western Atlantic ground. According to preliminary results, between 30 and 40% of expeditions were somehow active in the area, and these data are representative of around the 10% of the existing logbooks over a random sampling of 2,000 voyages. These analyses are now being finalised in order to assess the total catch impact on right whales in the southwest Atlantic, for preparation for publication later this year.

Our next step with these catch data is to integrate these with South Georgia right whale abundance estimates in order to measure population recovery from 1800. We are currently seeking a researcher with knowledge of Sightings Per Unit Effort models to assist with the final stage of analysis of the catch records, in order to back-calculate likely abundance of southern right whales in the southwest Atlantic in 1800. This was originally planned to be led by the PI Jackson, but due to the time required to organise the third field season, additional researcher assistance is required to realise this goal by the end of 2019 as originally planned.

The IWC Scientific Committee has committed funding towards a dedicated workshop on southern right whale catch histories in order to further progress construction of pre-modern catch series' across the Southern Hemisphere, and finalise the southwest Atlantic southern right whale catch series. This is currently planned to happen in May 2020.

Project Output 5. *Create strong collaborative network of stakeholders to sustain project results, assist with further monitoring and broaden scope of baseline surveys to other whale species*

Our extensive engagement with project stakeholders is outlined in Section 2.

In regard to how these relationships will be used to sustain project result, assist with further monitoring and broaden scope:

- (1) The 2018/19 field season (Annex 3.2) provided an excellent opportunity to assess, with GSGSSI support, whether whale research could be conducted at a local scale from King Edward Point research station, because if this is possible then monitoring of whale populations could be continued regularly and at much lower cost than by chartering vessels to work offshore. We did not see right whales during these surveys, so cannot consider that this approach is feasible for monitoring right whales at South Georgia, but it was a highly successful activity in terms of encounters of humpback whales, demonstrating that it is useful for at least one species of whales using South Georgia waters (and therefore broadening the scope of our surveys). In Annex 3.2 we developed a series of recommendations for ways to

work more effectively from this location, and further surveys from this location are tentatively planned for 2021/22 once recommendations have been addressed.

- (2) The photo-ID placards (Section 2) have provided a means of directly communicating our project goals with the tourist industry and we hope that continued circulation of these placards will enhance future monitoring of whale populations through provision of photo-ID images.
- (3) We are in discussion with the GSGSSI about ways that their fisheries observer vessel could engage in supporting further whale research, as they spend extensive periods at the shelf break. One simple first assist would be to provide those on watch with a high-quality camera to collect photo-ID images. With further funding and in close collaboration with the GSGSSI, use of the fisheries observer vessel to conduct whale surveys during the summer would be an ideal way to continue and build on these initial research seasons, focussing on right whales in the nearshore region and Antarctic blue whales north of the shelf break (our sonobuoy results from the 2017/18 survey indicate that this is where they are located). This concept will be discussed with GSGSSI further in the next year, and funding sources identified to potentially support the activity.

3.3 Progress towards the project Outcome

To establish and publish baseline data on the status and recovery levels of South Georgia southern right whale feeding grounds, post whaling. Characterise abundance, distribution, diversity, habitat use, health and calving ground connections for conservation management.

We have now carried out two field surveys (Indicator 1), with the largest survey planned for 2019/20. In 2018/19, no southern right whales were seen.

We have satellite tracked two humpback whales and no southern right whales (Indicator 2 not complete), representing the first two whales ever tracked in South Georgia waters.

We have conducted photo-identification and microsatellite genotype matching between South Georgia and Argentine and Brazilian calving grounds from the first season of work, and presented genetic results to the IWC Scientific Committee (Indicator 3 halfway complete). Prior to this research, our baseline understanding based on past opportunistic photo-ID matching was that whales feeding in South Georgia migrate there from southwest Atlantic calving grounds, and the genetic results further confirm this supposition.

To date, stable isotope data from 3 right whales (and one humpback whale) biopsy sampled in 2017/18, have been compared with >10 zooplankton species to determine whale prey (partially completing indicator 4), with further analysis to be conducted following the 2019/20 field season (results presented in Annex 3.3). For baseline comparison, no studies of right whale trophic feeding level in South Georgia had been carried out prior to this point.

All available right whale sightings data have been collated and these data are currently in preparation for publication. There have been earlier initiatives collating this data (see Richardson et al. 2012; Moore et al. 1999), and this work updates these earlier initiatives.

Body condition analysis has been conducted on images from 26 southern right whales (see Project Output 3), but using side-on rather than overhead images due to the challenges of working with UAV in South Georgia waters. No health assessment of South Georgia right whales has been carried out prior to this activity. These now need to be compared with health assessments on the associated calving grounds in order to determine the significance of the assessment results for South Georgia. Hormone assays have not yet been conducted, but will be carried out following the 2019/20 survey, so Indicator 6 has been partially met.

Collation of oceanographic data associated with the South Georgia marine ecosystem will be conducted over the following year (2019/20) as humpback whale tracking data are analysed, and prior to the collection of right whale tracking data in the 2019/20 season. Oceanographic data have been collated regularly for South Georgia in the past, but not in the context of understanding whale habitat use.

Feeding ground connectivity with Argentina and South Africa has been assessed (Annex 3.4), and shows that genetically there is slightly more association between South Georgia and the southwest rather than southeast Atlantic (partly fulfilling Indicator 8, also see Indicator 3 and Project Output 3). Southern right whale abundance at South Georgia has not been assessed, as

the 2017/18 surveys were not conducted using a line transect design and the 2018/19 surveys were very close to shore. We plan to conduct an abundance assessment during the 2019/20 surveys.

Southwest Atlantic right whale catch history data have been collated (Indicator 9) and are now being analysed in order to build a catch series showing the impact of exploitation on this population since 1800 (see Project Output 4). This work is anticipated to be completed at the end of 2019. The last regional catch series was collated in 2001 (IWC 2001) and did not include the more recent logbook investigation into American whaleship catches (Smith *et al.*, 2012), substantially increases the estimated takes of southern right whales.

Population modelling of the historical trajectory of right whales in the southwest Atlantic is anticipated to be conducted during 2020, once the catch series has been fully constructed and abundance estimates have been collated. This will provide an assessment of the recovery of southern right whales from whaling in the southwest Atlantic, something which has not previously been undertaken (Indicator 10).

At present the project is likely to achieve its planned outcome by the end of the funding, although it is possible that some indicators (i.e. satellite tracking of ten whales, body condition analysis using overhead images) may not be fully met during the project period depending on the weather conditions during the 2020 survey.

CONFIDENTIAL: In relation to satellite tracking, we are liaising with collaborators in Argentina to use 5 satellite tracks of whale that they have deployed from Península Valdés and which went into the South Georgia and South Sandwich Islands marine ecosystem, to analyse the high latitude habitat use patterns of these tracks. These discussions are still in progress.

3.4 Monitoring of assumptions

Three critical risks in the project were originally identified:

- Equipment failure (i.e. data cannot be collected). To mitigate against this at least two items of all equipment required for conducting the fieldwork will be carried, including cameras, biopsy rifles, hexacopters, multiple sonobuoys, hydrophones, tag deployment systems. All equipment is well maintained and serviced. There is no change in these risks and how they are being met. This approach worked successfully in the field over two seasons.
- Bad weather (data cannot be collected). Due to the high costs of the charter, we can afford 33 days of survey (less than the 40 days proposed in the Logframe) and are seeking funds to lengthen this to >35 days. Assuming 8 days transit to/from South Georgia, this translates to 25 days in the field. With 50% bad weather days, 12-13 days may be workable. We will use acoustic localisation to maximise data collection opportunities when weather permits; however there is a risk that with poor weather our project outcomes may be limited, so we are seeking additional funds in order to lengthen the survey period.
- Personnel injury. All personnel are highly experienced with working on small boats and with fieldwork of this nature. The vessel will remain close to the north coast of South Georgia for the duration of the survey, within one day's sailing of King Edward Point station if urgent medical assistance is required. All personnel have first aid training. There are no changes to this risk and how it will be met.

Project assumptions: estimation of southern right whale abundance at South Georgia

A core assumption of our project activities is that we can use mark resight data (i.e. resights of whales using photo-ID or genetics) to measure abundance on the South Georgia feeding ground (Project Output 4). Sighting opportunity would be maximised by (1) acoustically localising whales using sonobuoys to maximise encounter rates, (2) encouraging tourist photo-ID submissions via Project Partner Cheeseman (www.happywhale.com), (3) using microsatellite genotypes to identify siblings and parents and conduct mark recapture using very close-kin. We will also minimise risk by using alternate means of measuring abundance, through analysis of (i) sightings data, (ii) acoustic detection densities and (iii) quantifying connectivity with SG calving ground (where abundance estimates are available).

Given the poor weather encountered during the 2017/18 survey (translating to a small number of photo-IDs, less than 50) and absence of southern right whales in the 2018/19, the likelihood of

getting enough photo-IDs during 2019/20 to obtain mark-resights is very small. We therefore need to use sightings data collated from more traditional visual surveys in order to provide any kind of abundance estimate. In order to obtain a broader estimate of whale abundance in the SGSSI region, we raised funds to put a team of four experienced marine mammal observers onto the RRS Discovery during January/February 2019, to collect sightings data and estimate regional whale abundance during a planned krill survey. The survey was designed to collect krill biomass data (rather than cetacean abundance data) however and did not include a full survey of the South Georgia shelf, focussing on an area of high krill biomass to the northwest and transiting the South Georgia coast only once. However fuller transects of the South Sandwich Islands (SSI) were conducted, likely more representative of that region. The sightings data yielded only 4 sightings of 5 right whales however, despite being conducted during the period which normally spans peak sightings rates for southern right whales (Moore *et al.*, 1999). We were therefore unable to use this effort to provide a regional abundance estimate for southern right whales, but had sufficient sightings of humpback whales to develop estimates of regional abundance from the two surveyed areas (South Georgia and South Sandwich Islands). The 2020 survey transect will be designed to collect data on regional abundance of southern right whales along the north coast, although the number of other science priorities and likely short time-period of good weather during the survey means that this has a medium likelihood of success.

One of the initial goals of the project was to measure southern right whale abundance in South Georgia on the basis that it could be biologically interpreted in terms of relative recovery of southern right whales on a key feeding ground in the South Atlantic. We knew prior to the study that some members of the southwest Atlantic population feed at lower latitudes (45-50S) on copepods and others in the higher latitudes (>55S) on krill (Valenzuela *et al.*, 2009), including at South Georgia (Moore *et al.*, 1999), and interpretation of trophic feeding patterns from baleen plates suggested that some animals have long-term fidelity to each site (Rowntree *et al.*, 2008), suggesting a degree of fixity in feeding ground use. However recent evidence from calving ground tracking (Zerbini *et al.*, 2018), and our finding that few southern right whales visited South Georgia waters in the Jan/Feb 2019 period (Baines *et al.*, 2019) suggests that right whales exhibit a good degree of plasticity in their summer distribution and habitat use patterns, almost certainly environmentally driven. In view of this, any interpretation of abundance based on regional sightings surveys (Output 4) is likely to be more closely related to environmental drivers than to natural increases due to population growth. Our ultimate outcome, to **measure southern right whale population recovery** in the southwest Atlantic is therefore going to be better addressed by looking at population abundance on the calving grounds rather than the high latitude feeding ground, which may vary substantially in abundance between years in ways not related to recruitment. Since estimates of abundance are available from the lower-latitude calving grounds (e.g. Cooke *et al.*, 2015), we can still achieve our outcome and propose to use relative proportions of whales using lower and higher latitude grounds as calculated from isotope analysis for example (Valenzuela *et al.*, 2009; Valenzuela *et al.*, 2018) to then suggest what proportion of the recovering population is feeding in higher latitudes and lower latitudes.

Project assumption: through OT stakeholder engagement we can develop a sustainable program of monitoring in the OT

OT stakeholder engagement has been working well (see Section 2) and has already created a framework in which local whale research from the King Edward Point research station at South Georgia is both feasible and affordable, with GSGSSI support. Capacity to conduct further monitoring offshore is best supported by the GSGSSI Fisheries Observer vessel, and the GSGSSI have been very proactive in their support of this idea. The barriers to using this vessel at present include the need for further discussions with the vessel owners about liability while using their small boats, and a funding model for supporting this work. Very positive working relationships with the South Georgia Heritage Trust and Friends of South Georgia Island have provided us with key additional funding support, so further development of this line of support could help to assist.

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

Of the five strategic objectives of our UKOT (South Georgia), our project aims to address three of these, as follows, with progress described.

Objective 2: To conserve the Territory's environment, minimise human impacts and, where practicable, restore the native biodiversity and habitats

Our aim as part of this project is to ensure whale distribution and habitat use is taken into account in Marine Protected Area (MPA) reviews for the OT, therefore contributing to conservation decisions that are made. To date we have not yet conducted right whale tracking but we anticipate to provide right and humpback whale habitat use information to the GSGSSI next year for consideration in the next MPA review.

Objective 3: To manage SGSSI fisheries to the highest international standards of operation, stewardship and sustainability

Arising from our 2019 field activities, we have been able to deliver preliminary regional abundance estimates of humpback, fin whales and baleen whales using the South Georgia and South Sandwich Islands ecosystems to the CCAMLR-EMM, providing improved information on baleen whale biomass which can be used in ecosystem models to estimate krill impacts (Baines *et al.*, 2019) and therefore suggest appropriate quotas for krill catches in this ecosystem. We will conduct further analyses of these sightings over 2018/19 in order to estimate the impact of our regional abundance estimates on krill biomass at South Georgia and the South Sandwich Islands.

Objective 5: To preserve where practicable, and bring to a wider international audience, the heritage of South Georgia

We have contributed to this objective through substantial outreach activities about whaling and whale recovery both to cruise ships and to public audiences in the UK (see Annex 3.1) and by providing live updates on our research activities to the South Georgia museum, who included this information in their presentations to tourists, displayed a poster explaining the nature of our work in the highly visited Grytviken museum and also distributed the whale photo-ID placards described in Section 2 (Antarctic Tour Operators). Through extensive distribution of whale photo-ID placards (Section 2), photo-ID submissions to happywhale.com have increased, suggesting that our work has led to increased visibility of whale research in the region and the value of citizen science inputs. Our current humpback whale tracking is being followed widely, and Brazilian scientists and NGOs have been using the approach of one whale to their wintering area to highlight whales and their recovery in Brazilian waters more generally.

We have loaned equipment and provide regular research advice to UKOT organisations working in the Falkland Islands, including Falklands Conservation and the South Atlantic Environmental Research Institute. These positive relationships have led to development of DPLUS funded (DP/100036) collaboration with Falklands Conservation conduct conservation management of sei and southern right whales in Falklands Islands waters.

Through the DARWIN and EU BEST projects we have been able to develop three seasons of whale data gathering at the UKOT, which has translated into two scientific reports to the International Whaling Commission (reference), one workshop including the GSGSSI to develop management recommendations (Annex 3.3), and one scientific report to CCAMLR (Baines *et al.*, 2019). We are currently well on track to put these findings forwards into the next UKOT MPA review, and are using our sightings survey data to provide new estimates of summertime whale biomass and krill consumption in the GSGSSI region which can be reviewed in the context of current krill biomass estimates, to assess whether quota levels are sustainable in relation to baleen whales. These outcomes are anticipated to be realised over the next 18 months of the project.

4. Monitoring and evaluation

Monitoring and evaluation of project progress has been done by the PI holding regular Skype calls with various project partners to progress different project strands, group email discussions and periodic natural report deadlines such as each Jan/Feb field season, the March 2019 workshop, and the Scientific Committees of the IWC and CCAMLR. This approach has worked

well so far, as all project partners have been proactive and timely in their contributions, so no delays are reported. Consequently there are no changes to the M&E plan to date.

Because the outputs and activities of this project refer to firstly scientific data gathering in order to contribute to policy outcomes, we can measure achievement of activities in terms of data points gathered, reporting of those scientific results into appropriate policy-determining fora (IWC, CCAMLR and GSGSSI strategic meetings), and then recording the outcomes from those fora. As we are still primarily in the data gathering stage, we cannot yet show strong links to the final project outcomes, but some mid-stage policy-oriented outputs (e.g. Annex 3.3, Baines *et al.*, 2019) have been produced, showing some progress in this second stage of the project.

5. Lessons learnt

The main lesson learnt in 2018 was that local weather and sea conditions are more prohibitive to some of the planned science than originally anticipated, and that certain types of science are more tractable to achieve in South Georgia waters (visual surveys, photo-ID and acoustic monitoring) than others (satellite tracking, drone deployment) due to local weather conditions. In the second year we spent a two-month period in the field in order to maximise survey opportunities over the summer period. We sighted humpback whales regularly, were able to satellite tag two and collect 13 skin biopsy samples from this species using local boats during this period, but never sighted southern right whales in coastal waters during our survey periods (15 expeditions during Jan/Feb 2019). Our lesson learned during this survey period (Annex 3.2) and from the additional survey conducted offshore (Baines *et al.*, 2019) is that not only are weather conditions unpredictable and challenging for our research activities, but whale summer densities may vary considerably between years, probably due to variation in environmental conditions (for example perhaps the presence and types of krill swarms). Consequently, focussing our research efforts towards one particular species or weather-dependent science activity can lead to limited science outcomes relative to the cost and efforts of survey.

We have therefore successively modified our science plan over the two years of research to ensure: it is adaptive to conditions, and it is designed to optimise the types of data gathering that are possible given the conditions.

Firstly, we have adapted to include other species in our field plan, with right whales as the primary focus but to enable other data to be gathered when right whales are not located. For example we have included humpback whales in our data gathering efforts (particularly in 2019), as the southwest Atlantic humpback whale breeding population regularly feeds in South Georgia waters, is abundant, and its habitat use and density patterns are of importance to the UKOT because they are also Antarctic krill feeders which feed in areas targeted by the krill fishery. This opportunistic activity has yielded substantial new information on their summer feeding habitat in the SGSSI region (e.g. <https://www.bas.ac.uk/project/south-georgia-right-whale-project/south-georgia-right-whale-project-humpback-whale-tracking/>) as well as a scientific report to CCAMLR (Baines *et al.*, 2019). The acoustic data on Antarctic blue whales collected during the 2018 field season are also being analysed to provide a review of the exploitation and recovery of this species in South Georgia waters, with additional funding for this activity provided by the South Georgia Heritage Trust. This work will be used to seek funds to conduct an offshore survey in the traditional Antarctic blue whaling grounds north of the South Georgia shelf break.

Secondly, we have broadened the science activities that can be conducted in medium weather conditions. This includes bringing a high-resolution echosounder on the 2020 cruise in order to acoustically characterise the prey field in the vicinity of whales to better understand their prey preferences (Outputs 1, 2). In order to maximise our chances of obtaining good quality photo-ID (Outputs 3, 4), we have also increased the number of expert photographers on the team.

In 2018, we reported that the first year of promotion of the project within IAATO/ the Antarctic tourist community was not very successful in terms of visibility. Consequently, we prepared and circulated laminated photo-ID guides for tour ships and other vessels during summer and autumn 2018 (and via the Grytviken Museum and Port Lockroy Penguin post office. Consequent photo-ID submissions by citizen scientists increased suggesting that this effort has helped increase the visibility of whale research in the region. Regular outreach conducted by way of presentations to South Georgia visitors was also conducted to increase visibility of the work.

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

In order to address the Section 2 comments and queries for the Project Leader, we:

- (1) Append 2016/17 steering group meeting minutes (Annex 3.5).
- (2) Report on all activities supported by DARWIN and BEST funds rather than DARWIN only.
- (3) Include all logframe assumptions in our discussions, see Section 3.4.
- (4) Modified the EU BEST project website to recognise both funders in the project activity
- (5) Provide evidence in support of progress achievements in the current report

7. Other comments on progress not covered elsewhere

8. Sustainability and legacy

Our work is well known within South Georgia, because we provided regular research updates to the Territory's museum staff which they have included in their daily talks to tourists, provided a large poster for the museum explaining our work, and gave a number of presentations on this topic to tour ships directly. Outreach activities conducted over the year are further shown in Annex 3.1. Evidence of increased interest is harder to gauge, but our parallel initiative to distribute photo-ID placards within the territories (see Section 2: Antarctic tour operators) seems to have resulted in increased numbers of submissions of photo-IDs to our project partner Happywhale, which suggests an increase in interest in whales and whale research by tour operators and tourists visiting the region.

We have no changes to our planned exit strategy, nor to our original plan for how to create a sustaining legacy (see more detail in Section 3.2, Project Output 5 above).

9. Darwin identity

We have used the Darwin Initiative logo on the front page of all project presentations, and advertising for our talks, on the posters that we presented on our work, in the South Georgia Grytviken Museum and at the 2018 SOLAMAC conference, we mention the Darwin project on our website and in the Facebook page (www.facebook.com/SGwhale).

To date the DARWIN element of the project has formed part of a larger program, but in the next 18 months it will take on a stronger identity as a distinct entity, because the analysis of past catches and population recovery of southern right whales in the southwest Atlantic (Output 4) are unique outcomes from the DARWIN arm of the project.

10. Project Expenditure

Table 1: Project expenditure during the reporting period (1 April 2018 – 31 March 2019)

Project spend (indicative) in this financial year	2018/19 D+ Grant (£)	2018/19 Total actual D+ Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs				
Consultancy costs				
Overhead Costs				
Travel and subsistence				

Operating Costs				
Capital items				
Others (Please specify)				
TOTAL				

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2018-2019 – if appropriate

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
<p>Impact</p> <p>Integrate whale abundance, status and habitat use data into GSGSSI MPA planning, CCAMLR krill management models, IWC Conservation Management Plan, supporting objectives of the Conventions on Biological Diversity and on Conservation of Migratory Species, and to IUCN Cetacean Specialist Group</p>			
<p>Outcome</p> <p>To establish and publish baseline data on the status and recovery levels of South Georgia southern right whale feeding grounds, post whaling. Characterise abundance, distribution, diversity, habitat use, health and calving ground connections for conservation management.</p>	<p>The project will provide the first baseline data on the feeding ground abundance and recovery population status of southwest Atlantic southern right whales.</p> <p>This data will contribute to (i) the GSGSSI's marine management through interim and final publicly available reports, in particular to inform MPA monitoring and review processes, (ii) CCAMLR krill spatial management modelling framework, (iii) the IWC Conservation Management Plan for this population</p>	<p>A full report against the indicators is found in Section 3.3.</p>	<p>Key actions are indicated in Section 3.3.</p>
<p>Activity 0.1 Five week field survey</p>		<p>The Jan/Feb 2020 field survey has not yet been completed. During Jan/Feb 2019, whale surveys were conducted over an eight week period from Cumberland Bay, South Georgia.</p>	<p>A vessel-based survey will be conducted during January/February 2020.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
Activity 0.2 Satellite tracking of ten whales		Two humpback whales were tracked during the 2018/19 survey.	Up to ten southern right whales will be tracked during the 2019/20 survey.
Activity 0.3 Photo-identification and microsatellite genotype matching between South Georgia over two field seasons and with Argentine and Brazilian calving grounds		Photo-ID matching has been conducted using 35 side-on photos collected from SG in 2018 with no matches found to Argentina and Brazil.	Further photo-ID matching is planned with images collected by citizen scientists during 2018-20 seasons and during the 2019/20 field survey.
Activity 0.4 Stable isotope data from up to 20 whales and 100 zooplankton samples to determine whale prey		Stable isotope data obtained from three right whales to date.	Stable isotope analysis of further whale biopsy samples and zooplankton (up to 20 whales).
Activity 0.5 Collation of all available right whale sightings data		These data have been collated.	Further collation with new sightings data collected in 2019/20.
Activity 0.6 Hormone assays and body condition photographs from up to 20 whales.		No progress on hormone analysis. Body condition assessed from 26 side-on images due to difficulty of gathering overhead images.	Planned for 2020.
Activity 0.7 Collation of oceanographic data associated with SG marine ecosystem		Some oceanographic data collected.	Further work planned.
Activity 0.8 Calculate abundance and feeding ground connectivity with Argentina and South Africa		No progress.	Planned for 2020
Activity 0.9 Collate right whale catch history data from southwest Atlantic		Collation of catch history data nearly complete.	To complete during 2019.
Activity 0.10 Conduct population modelling of the historical trajectory of right whales in the southwest Atlantic to measure population status and recovery levels.		No progress.	Planned for 2020
Output 1. Report to GSGSSI on (i) status assessment of southern right whale SG distribution, habitat use and recovery patterns in the southwest Atlantic, (ii) risks to the	Data compiled from cruise and combined with other sightings, incorporated into a single document available externally for viewing on the website of the GSGSSI.	The first of two project workshops was held on the 5-8 th March 2019 in the Falkland Islands. These led to a workshop report and a series of recommendations for science and outreach activities to better understand SG distribution, habitat use and recovery. The final planned report will be written, considering risks and recommended actions, after the December	

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
population, (iii) recommended actions to mitigate risks	Provides a baseline for measuring change in species characteristics in response to impacts, including climate change.	2020 UK based workshop following the 2019/20 field season. This activity is therefore on track.	
Activity 1.1 Virtual project planning meeting with all project partners and key stakeholders in GSGSSI in May 2017 with subsequent M&E meetings every six months.		Project planning meeting conducted in June/Dec each year involving Steering Group members	Continue with meetings every six months.
Activity 1.2.1 Obtain permits from GSGSSI and Animal Ethics approvals for fieldwork and scientific procedures.		All necessary approvals obtained for 2018/19 fieldwork.	Repeat process for 2020 survey.
Activity 1.2.2 Equipment purchase, permit applications, shipping of equipment to Falkland Islands as British Antarctic Survey cargo.		All necessary equipment obtained and shipped in time for 2018/19 fieldwork.	Repeat process for 2020 survey.
Activity 1.3 Travel to Falkland Islands for pre-cruise workshop in Stanley, Falkland Islands to discuss cruise details and expected outcomes with OT government officials, NGOs and Antarctic tour operators.		None.	This activity is planned for start of January 2020 prior to cruise departure in Falkland Islands.
Activities 1.4-1.12		These activities have not yet started for the 2019/20 cruise..	Activities planned for later in 2019/20.
Output 2. Report key whale habitat use data to CCAMLR through a scientific paper to the EMM Working Group for consideration within spatial management proposals for regional krill fishery development.	Right whale habitat use patterns in SG waters provided in 2019 scientific report to CCAMLR EMM group. This group has never previously considered information on whale habitat use in relation to krill fishery discussions. This is therefore a precedent breaking initiative.	No southern right whales have been satellite tagged during the project to date, so no progress has made on this output Tagging work is planned for the Jan/Feb 2020 season with a subsequent report to CCAMLR EMM Working Group in May/June 2020. Two humpback whales were tagged in 2018/19 and their habitat use patterns will also be considered in the spatial management discussions.	
Activity 2.1 Summarise results from Activities 1.4 and 1.7 to prepare CCAMLR scientific report on right whale habitat use		No progress to date	Planned for 2020.
Activity 2.2 Project member (Trathan) present report to CCAMLR EMM meeting discussing the relative consumption of krill by penguins, seals		Planned for May/June 2020	Planned for 2020.

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
and whales and the necessity for considering cetaceans in krill fisheries management			
Output 3. Report right whale connectivity and health assessment data to the IWC to address multiple scientific recommendations and concerns regarding threats and data gaps and contribute to the IWC Conservation Management Plan for this population.	Right whale health and connectivity parameters will be provided in a 2019 scientific report to IWC Scientific Committee. The GSGSSI final report (output 1) will also be submitted as further information. A series of recommendations and ways in which this work addresses Conservation Management Plan concerns will also be drafted for endorsement by the IWC Scientific Committee.	A summary report (SC/68a/SH06REV) has been provided to the IWC, assessing the genetic connectivity of South Georgia southern right whales to the South Atlantic calving grounds. This is publicly available through www.iwc.int . A further report is planned for 2019 to include photo-ID matching results. A preliminary health assessment has been conducted with side-on images of whales collected in 2018. This is in preparation for publication in 2018 and submission to the IWC Scientific Committee in 2019 following two further seasons of photo-ID data gathering and health assessment.	
Activity 3.1 Summarise results from activities 1.4, 1.6, 1.9, 1.10, 1.11 and 1.12 into IWC scientific report on right whale connectivity and health status on SG feeding grounds using all SG data collected to date.		A summary of some of these activities, arising from the 2018/19 season, was presented to the IWC Scientific Committee in May 2018.	Further photo-ID and biopsy collection and matching between South Georgia and calving grounds.
Activity 3.2 Present report to IWC Scientific Committee meeting		An IWC report on genetic connectivity was provided to Scientific Committee May 2019	Following the 2019/20 surveys, a second paper will be presented to the Scientific Committee May 2020
Output 4. Calculate right whale depletion levels and recovery status in the southwest Atlantic, considering the population abundance in South Georgia and strength of linkages with calving areas.	Complete population abundance and assessment paper in Nov 2020, for publication. Present for endorsement by the IWC scientific committee. Contribute to IUCN Cetacean Specialist Group for next threat status determination for southern right whales.	No progress on this outcome to report.	
Activity 4.1 PDRA Vighi to conduct in-depth review of southwest Atlantic right whale catches using historical material, including logbooks and		Review conducted. Catch series undergoing finalisation.	Catch series to be finalised June-December 2019.

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
import records. Generate a catch series (or series of catch series to capture the catch uncertainty).			
Activity 4.2 PL Jackson, PP Carroll, PP Zerbinini and PP Leaper to measure SG right whale abundance using mark recapture information from two seasons of surveys, also considering estimates derived from density data obtained from acoustic monitoring and sightings.		Not likely to be achievable, see Section 3.4.	Explore use of isotopic proportions derived from calving ground data (e.g. Valenzuela et al. 2008) to indicate relative abundance of southern right whales using high latitude waters.
Activity 4.3 PL Jackson, PP Carroll and PP Zerbinini use connectivity data (Activity 3.1) to quantify the degree of connection between SG and PV and measure abundance as proportion of PV abundance.		No progress, no direct matches yet identified using photo-ID or microsatellite genotypes.	Planned for 2020.
Activity 4.4 PL Jackson to build a density dependent Bayesian population modelling framework to assess the recovery status of southwest Atlantic right whales using results from activities 4.1, 4.2 and 4.3 above.		Activity not yet started.	Planned for 2020.
Activity 4.5 Present report to IWC Scientific Committee meeting for feedback and to obtain endorsement of the abundance calculations and population status estimates.		Activity not yet started.	Planned for 2020.
Output 5. Create strong collaborative network of stakeholders to sustain project results, assist with further monitoring and broaden scope of baseline surveys to other whale species	<p>5.1 Collaborative workshop at the close of the project involving all stakeholders in Stanley, Falkland Islands in order to communicate results and agree final recommendations arising from project and future work.</p> <p>5.2 Right whale photos made open access through public databases including through Antarctic tour industry portal happywhale.com and results promoted through stakeholder linkages to encourage</p>		

Project summary	Measurable Indicators	Progress and Achievements April 2018 - March 2019	Actions required/planned for next period
	future submission of right whale photographs for identification and matching.		
Activity 5.1 Organise a 3 day project summary workshop in UK, with 1 day open to all, presenting science summaries, and 2 days open to steering group and OT representatives to discuss and agree conservation recommendations, including South Georgia Government, key Falkland Islands environmental research institutes and NGOs and Antarctic tour operators. Krill fishery representatives will also be invited.		Activity not yet started.	Planned for 2020.
Activity 5.2 Compile conservation recommendations from steering group and stakeholders into project summary report		Activity not yet started.	Planned for 2020.
Activity 5.3 Write Darwin summary project report		Activity not yet started.	Planned for 2020.
Activity 5.4 Audit of project expenditure		Activity not yet started.	Planned for 2020.

Annex 2: Project’s full current logframe as presented in the application form (unless changes have been agreed) - if appropriate

N.B. if your application’s logframe is presented in a different format in your application, please transpose into the below template. Please feel free to contact Darwin-Projects@ltsi.co.uk if you have any questions regarding this.

Please note this logframe has been revised (June 2018)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
<p>Impact: Integrate whale abundance, status and habitat use data into GSGSSI MPA planning, CCAMLR krill management models, IWC Conservation Management Plan, supporting objectives of the Conventions on Biological Diversity and on Conservation of Migratory Species, and to IUCN Cetacean Specialist Group (Max 30 words)</p>			
<p>Outcome: To establish and publish baseline data on the status and recovery levels of South Georgia southern right whale feeding grounds, post whaling. Characterise abundance, distribution, diversity, habitat use, health and calving ground connections for conservation management. (Max 30 words)</p>	<p>The project will provide the first baseline data on the feeding ground abundance and recovery population status of southwest Atlantic southern right whales. This data will contribute to (i) the GSGSSI’s marine management through interim and final publicly available reports, in particular to inform MPA monitoring and review processes, (ii) CCAMLR krill spatial management modelling framework, (iii) the IWC Conservation Management Plan for this population</p>	<p>0.1 Five week field survey 0.2 Satellite tracking of ten whales 0.3 Photo-identification and microsatellite genotype matching between South Georgia over two field seasons and with Argentine and Brazilian calving grounds 0.4 Stable isotope data from up to 20 whales and 100 zooplankton samples to determine whale prey 0.5 Collation of all available right whale sightings data 0.6 Hormone assays and body condition photographs from up to 20 whales. 0.7 Collation of oceanographic data associated with SG marine ecosystem</p>	<p>Requires that fieldwork is successfully achieved. Two possible hindrances:</p> <ol style="list-style-type: none"> 1. Equipment failure (data cannot be collected). To mitigate against this at least two items of all equipment required for conducting the fieldwork will be carried, including cameras, biopsy rifles, hexacopters, multiple sonobuoys, hydrophones, tag deployment systems. All equipment is well maintained and serviced. 2. Bad weather (data cannot be collected). The 40-day length of the survey is designed to minimise the impact of bad weather on data collection. We take into account 3 bad weather days in 10 to give 21 survey days, and use acoustic localisation to maximise data collection opportunities when weather permits. 3. Personnel injury. All personnel are highly experienced with working on small boats and with fieldwork of this

		<p>0.8 Calculate abundance and feeding ground connectivity with Argentina and South Africa</p> <p>0.9 Collate right whale catch history data from southwest Atlantic</p> <p>0.10 Conduct population modelling of the historical trajectory of right whales in the southwest Atlantic to measure population status and recovery levels.</p>	<p>nature. The vessel will remain close to the north coast of South Georgia for the duration of the survey, within one day's sailing of King Edward Point station if urgent medical assistance is required. All personnel have first aid training.</p> <p>4. Mark resight abundance estimation requires that there are resightings of whales between years. To maximise resight opportunities we will (1) acoustically localise whales using sonobuoys to maximise encounter rates, (2) encourage tourist photo-ID submissions via Project Partner Cheeseman (www.happywhale.com), (3) use microsatellite genotypes to identify siblings and parents and conduct mark recapture using very close-kin. We will also minimise risk by using alternate means of measuring abundance, through analysis of (i) sightings data, (ii) acoustic detection densities and (iii) quantifying connectivity with SG calving ground (where abundance estimates are available)</p>
<p>Outputs:</p> <p>1. Report to GSGSSI on (i) status assessment of southern right whale SG distribution, habitat use and recovery patterns in the southwest Atlantic, (ii) risks to the</p>	<p>Data compiled from cruise and combined with other sightings, incorporated into a single document available externally for viewing on the website of the GSGSSI.</p>	<p>1.1 Achievement of 0.1-0.6 above</p> <p>1.2 Report for future MPA planning</p> <p>1.3 Falklands based workshop on project plans and feedback with</p>	<p>None envisaged</p>

<p>population, (iii) recommended actions to mitigate risks</p>	<p>Provides a baseline for measuring change in species characteristics in response to impacts, including climate change.</p>	<p>stakeholders including GSGSSI in Feb 2020</p> <p>1.4 UK based workshop in Nov 2020 with stakeholders including GSGSSI to share results and agree report recommendations</p>	
<p>2. Report key whale habitat use data to CCAMLR through a scientific paper to the EMM Working Group for consideration within spatial management proposals for regional krill fishery development.</p>	<p>Right whale habitat use patterns in SG waters provided in 2019 scientific report to CCAMLR EMM group. This group has never previously considered information on whale habitat use in relation to krill fishery discussions. This is therefore a precedent breaking initiative.</p>	<p>2.1 Information from 0.2, 0.4, 0.5 and 0.7 integrated into ARC GIS database and made publicly accessible through www.bas.ac.uk</p> <p>2.2 Report for CCAMLR prepared and publicly available through www.ccamlr.org</p>	<p>Assumes that a CCAMLR report on whale habitat use will be acceptable for discussion by the CCAMLR Scientific Committee who do not traditionally consider whales in their ecosystem management discussions.</p> <p>To address the risk that this information is rejected, we will seek recommendation for this work during the delayed 2018 joint IWC/CCAMLR meeting on ecosystem modelling through multiple IWC and CCAMLR Project Partners who will be involved in this joint meeting.</p>
<p>3. Report right whale connectivity and health assessment data to the IWC to address multiple scientific recommendations and concerns regarding threats and data gaps and contribute to the IWC Conservation Management Plan for this population.</p>	<p>Right whale health and connectivity parameters will be provided in a 2019 scientific report to IWC Scientific Committee. The GSGSSI final report (output 1) will also be submitted as further information. A series of recommendations and ways in which this work addresses Conservation Management Plan concerns will also be drafted for endorsement by the IWC Scientific Committee.</p>	<p>3.1 Information from 0.3, 0.4 and 0.6 collated into summary of population connectivity, diversity and health status which will be provided in a report to IWC, publicly available through www.iwc.int</p>	<p>None envisaged</p>

<p>4. Calculate right whale depletion levels and recovery status in the southwest Atlantic, considering the population abundance in South Georgia and strength of linkages with calving areas.</p>	<p>4.1 Complete population abundance and assessment paper in Nov 2020, for publication. Present for endorsement by the IWC scientific committee. Contribute to IUCN Cetacean Specialist Group for next threat status determination for southern right whales.</p>	<p>4.1 Catch series to be provided to the IWC Secretariat for databasing where it will be publicly accessible.</p> <p>4.2 Population assessment model made available as open source code in R</p> <p>4.3 Recorded endorsement of (i) abundance metric, and (ii) population status estimate by IWC scientific committee.</p>	<p>Abundance and connectivity measurement may require application of a variety of approaches. For example there is a risk that no whales are resighted between years for mark-recapture analysis. However two field seasons of data collection means estimation of connectivity with Brazil/Argentina will be more robust. Without resights we will use the connectivity estimate to derive a measure of the proportion of whales using SG from those grounds, and use established abundance estimates from breeding grounds as primary modelling info to establish population status.</p>
<p>5. Create strong collaborative network of stakeholders to sustain project results, assist with further monitoring and broaden scope of baseline surveys to other whale species</p>	<p>5.1 Collaborative workshop at the close of the project involving all stakeholders in Stanley, Falkland Islands in order to communicate results and agree final recommendations arising from project and future work.</p> <p>5.2 Right whale photos made open access through public databases including through Antarctic tour industry portal happywhale.com and results promoted through stakeholder linkages to encourage future submission of right whale photographs for identification and matching.</p>	<p>5.1 Workshop report publicly available (output 1),</p> <p>5.2 Press release and news report about workshop generated by BAS and through Project Partner press teams.</p> <p>5.3 happywhale.com tracks photo submissions during and after project to evaluate impact of project awareness on tourist interest in the project.</p>	<p>Through engagement with OT stakeholders throughout the project period, and including stakeholder-assisted development of conservation management recommendations, we hope to maximise chances of sustainability following this baseline work. Feedback into key scientific bodies (IWC and CCAMLR) as well as the IWC Conservation Management Plan will also provide internationally recognised recommendations which will provide additional impetus for assisting development of a South Georgia and South Sandwich Islands whale monitoring program in the future.</p>

Activities (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

Activity 1.1 Virtual project planning meeting with all project partners and key stakeholders in GSGSSI in May 2017 with subsequent M&E meetings every six months.

Activity 1.2.1 Obtain permits from GSGSSI and Animal Ethics approvals for fieldwork and scientific procedures.

Activity 1.2.2 Equipment purchase, permit applications, shipping of equipment to Falkland Islands as British Antarctic Survey cargo.

Activity 1.3 Travel to Falkland Islands for pre-cruise workshop in Stanley, Falkland Islands to discuss cruise details and expected outcomes with OT government officials, NGOs and Antarctic tour operators.

Activity 1.4 Survey embarks from Stanley, Falkland Islands for 5 weeks

Activity 1.4.1 Deploy DiFAR sonobuoys and use sonobuoy transmissions and sightings to locate whales

Activity 1.4.2 Skin samples collected from all encountered whales (50)

Activity 1.4.3 Photographs collected of all encountered whales (50-60, head shots collected via hexacopter)

Activity 1.4.4 Satellite tracking of up to 10 whales (PP Zerbini and Andriolo)

Activity 1.4.5 Blubber samples collected from 10-20 whales (PP Carroll)

Activity 1.4.6 Photogrammetry measurements taken by hexacopter from 10-20 whales

Activity 1.4.7 Blog about survey on British Antarctic Survey website, using blog, twitter and media outlets to share photos and videos from the voyage.

Activity 1.5 Biological samples shipped from the Falkland Islands to UK as British Antarctic Survey cargo in April 2019, transported at appropriate storage temperature.

Activity 1.6.1 Provide photo-ID catalogue to regional associates in Brazil and Argentina, also IWC secretariat for open access hosting and happywhale.com. Circulate copies of catalogue to tour operators working in the South Georgia region in order to encourage crowd-sourced photo submissions

Activity 1.6.2 Project Partners (Rowntree and Groch) conduct photo-ID matching with Argentine and Brazilian calving grounds. Project Partner Rowntree will also conduct photo-ID matching between the two South Georgia survey years to identify any resights.

Activity 1.7.1 Compile acoustic and sightings data from cruise years 1 and 2 (PP Leaper and PL Jackson)

Activity 1.7.2 Compile oceanographic data over two years of surveys to put sightings and satellite tracks in oceanic context (Trathan at BAS)

Activity 1.7.3 Construct right whale habitat models (PP Zerbini)

Activity 1.8.1 Provide cruise report, distribution patterns and habitat use analysis to International Whaling Commission (June 2020)

Activity 1.8.2 Report on right whale habitat use patterns from two years of surveys to South Georgia government (Sept 2020)

Activity 1.9.1 Zooplankton and whale isotope analysis (Stowasser at BAS)

Activity 1.9.2 Whale prey identification (Stowasser at BAS)

Activity 1.10.1 DNA extraction, microsatellite genotyping & mitochondrial DNA sequencing (PL Jackson, PP Carroll)

Activity 1.10.2 Measure population diversity of South Georgia and differentiation from calving ground, as well as matching microsatellite genotypes of individuals with those available from Península Valdés calving ground and with the 2019 SG survey (PP Carroll)

Activity 1.10.3 Measure assignment of South Georgia whales to calving grounds using global dataset held (PP Carroll)

Activity 1.11.1 Assay stress hormones in blubber samples e.g. cortisol (PP Hall)

Activity 1.11.2 Assay progesterone to measure pregnancy in blubber-sampled whales identified as female (PP Hall)

Activity 1.12 Photogrammetry analysis of whale body condition from photos (PP Moore)

Activity 1.13 Organise UK workshop in Nov 2020 with project partners and stakeholders to present science outputs from SG field surveys, conclude population recovery status of southwest Atlantic right whales and write conservation management recommendation report to GSGSSI.

Activity 2.1 Summarise results from Activities 1.4 and 1.7 to prepare CCAMLR scientific report on right whale habitat use

Activity 2.2 Project member (Trathan) present report to CCAMLR EMM meeting discussing the relative consumption of krill by penguins, seals and whales and the necessity for considering cetaceans in krill fisheries management

Activity 3.1 Summarise results from activities 1.4, 1.6, 1.9, 1.10, 1.11 and 1.12 into IWC scientific report on right whale connectivity and health status on SG feeding grounds using all SG data collected to date.

Activity 3.2 Present report to IWC Scientific Committee meeting

Activity 4.1 PDRA Vighi to conduct in-depth review of southwest Atlantic right whale catches using historical material, including logbooks and import records. Generate a catch series (or series of catch series to capture the catch uncertainty).

Activity 4.2 PL Jackson, PP Carroll, PP Zerbini and PP Leaper to measure SG right whale abundance using mark recapture information from two seasons of surveys, also considering estimates derived from density data obtained from acoustic monitoring and sightings.

Activity 4.3 PL Jackson, PP Carroll and PP Zerbini use connectivity data (Activity 3.1) to quantify the degree of connection between SG and PV and measure abundance as proportion of PV abundance.

Activity 4.4 PL Jackson to build a density dependent Bayesian population modelling framework to assess the recovery status of southwest Atlantic right whales using results from activities 4.1, 4.2 and 4.3 above.

Activity 4.5 Present report to IWC Scientific Committee meeting for feedback and to obtain endorsement of the abundance calculations and population status estimates.

Activity 5.1 Organise a 3 day project summary workshop in UK, with 1 day open to all, presenting science summaries, and 2 days open to steering group and OT representatives to discuss and agree conservation recommendations, including South Georgia Government, key Falkland Islands environmental research institutes and NGOs and Antarctic tour operators. Krill fishery representatives will also be invited.

Activity 5.2 Compile conservation recommendations from steering group and stakeholders into project summary report

Activity 5.3 Write Darwin summary project report

Activity 5.4 Audit of project expenditure

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	
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.	X with Annexes
Have you included means of verification? You need 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 want 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.	