

Darwin Plus: Overseas Territories Environment and Climate Fund Annual Report

To be completed with reference to the "Writing a Darwin Report" guidance:
(<http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms>). It is expected that this report
will be a **maximum** of 20 pages in length, excluding annexes)

Submission Deadline: 30th April 2020

Darwin Plus Project Information

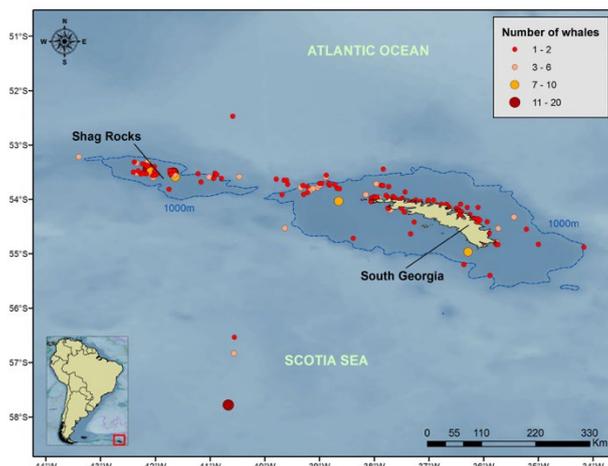
Project reference	DPLUS057
Project title	Population recovery of right whales in South Georgia waters
Territory(ies)	South Georgia
Lead organisation	British Antarctic Survey
Partner institutions	Sea Mammal Research Unit, School of Biology, University of St Andrews, Scotland/ University of Auckland, New 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 dates of project	April 2017 - December 2020
Reporting period (e.g. Apr 2019-Mar 2020) and number (e.g. Annual Report 1, 2)	Apr 2019-Mar 2020 Annual Report 3
Project Leader name	Jen Jackson
Project website/blog/social media	www.facebook.com/SGwhale
Report author(s) and date	Jen Jackson

1. Project summary

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 (GSGSSI). We have engaged with this stakeholder regularly over the past year, in particular during field planning for the 2020 South Georgia expedition. As mentioned in the 2019 Annual report, the Government provided significant in-kind support to our 2019 expedition, funding 100hrs of boat time for whale surveys, and attended the 2019 workshop on “South Georgia right whales: past, present, future” in the Falklands in 2019 (see Annex in 2019 report). The Project Leader also attended the annual GSGSSI Stakeholders meeting in September 2019 (<http://www.gov.gs/sept-19/#News-4>), and contributed to discussions of next steps for management of wildlife recovery at South Georgia.

The Project Leader was invited to participate in a new artistic collaboration between GSGSSI and SGHT, to commission new artwork to re-develop the whaling station “flensing plan” at South Georgia (<http://www.sght.org/the-story-of-the-whale-at-south-georgia/>) and help raise the profile of South Georgia’s whaling heritage and the positive subsequent story of whale recovery.

Following the 2020 expedition, government officials met with the expedition team to discuss initial findings, attended a public presentation of the voyage (held in the Falklands in 10th Feb 2020, see Annex 3.1 and were provided a copy of the cruise report (Annex 3.2).

As a consequence of the good relationship developing with this stakeholder:

(1) Working with GSGSSI, we will analyse ship strike risk to whales in South Georgia using the habitat use analysis provided by the 2020 DARWIN survey. This report will support the GSGSSI developing mitigation measures for reducing ship strike risks to whales (See Section 4, this work addresses Objective 2 of the UKOT’s strategic objectives).

(2) We have obtained approval to collaborate with the GSGSSI and organise future whale research surveys on board their Fisheries Patrol Vessel Pharos, as Patrol Vessel time and logistics permit.

South Georgia Heritage Trust and Friends of South Georgia Island

A second key stakeholder who is also becoming a significant source of funding for our work is the South Georgia Heritage Trust and its American arm the Friends of South Georgia Island (three grants awarded since 2018). They contributed £86,000 towards the 2020 expedition and regularly promote our work across their social media networks (e.g. <http://www.sght.org/the-story-of-the-whale-at-south-georgia/>, <http://www.fosgi.org/news-2/latest-news/>, <http://www.fosgi.org/what-we-do-2/what-we-do/>). The trust are largely funded by tourist

donations and are anticipated to provide a sustainable avenue for support of future whale monitoring in SG waters; it is a positive and mutually beneficial relationship, as they use our project results to enhance the Antarctic visitor experience, through the outreach material (slides and images) we provide to the South Georgia museum, which keeps them updated with project news. More details are given in Section 10.

International Whaling Commission: The International Whaling Commission (IWC) receive annual updates on project progress through their Scientific Committee meetings in May (via the Southern Hemisphere sub-committee). In May 2019, the Scientific Committee were informed about progress on genetic analysis of southern right whale samples at South Georgia (SC/68a/SH06, subsequently published as Carroll et al. 2020 <https://doi.org/10.1093/ihered/esaa010>). The lack of observations of southern right whales during the 2019 expedition was highlighted (Item 6.1.2, IWC 2020)¹.

In May 2020, report SC/68b/CMP22 was presented (Annex 3.2), which documented the field expedition conducted during January/February 2018 and provided an opportunity for Scientific Committee feedback. The presentation was positively received (Items 8.2.2 and 8.2.3.4, IWC In press)¹. Blue whale photo-IDs opportunistically collected by the 2020 expedition were also matched with the existing Antarctic blue whale catalogue (no matches found, indicating that these are all “new” whales). This result is reported in Annex 3.6. These images will contribute to the upcoming IWC Antarctic blue whale assessment, which is using photo-ID images to provide a new estimate of circumpolar blue whale abundance.

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. As mentioned in the 2020 DARWIN report, we presented CCAMLR with preliminary estimates of whale abundance in South Georgia and the South Sandwich Islands at the 2019 EMM meeting (Annex 3.3, Baines et al. 2019), available at <https://www.ccamlr.org/en/wg-emm-2019/27>. Using these data, more in-depth habitat models have been explored since September 2019, and an updated analysis will be completed by the end of the Darwin project period, for presentation at the 2021 CCAMLR-EMM meeting.

Two humpback whales and two right whales were satellite-tagged during the 2019 and 2020 expeditions respectively, in order to track their movements (<https://www.bas.ac.uk/project/south-georgia-right-whale-project/south-georgia-right-whale-project-whale-tracking/>), providing some information on habitat preferences of the two species. However a summary report on these whales has not been provided to CCAMLR in 2020, as the 2020 CCAMLR virtual agenda was very reduced. These data will be analysed intersessionally and will also include the last 15 years of satellite tracking data for humpback whales from their Brazilian wintering grounds included (e.g. Zerbini et al. 2006; 2011) in order to provide an assessment of South Georgia and South Sandwich Islands habitat use patterns to the 2021 CCAMLR meeting (see Section 3.2).

Antarctic Tour Operators: Our project aimed to increase the visibility of whale research within the Antarctic tourist community and to build sustainable collaborative relationships with IAATO members. Visibility of whale research has been raised through circulation of the photo-ID placards (see IWC section above and 2019 Darwin Report), giving a number of presentations to tour vessels (in 2019), and by the South Georgia museum director and her staff providing whale project news and updates during their presentations to tourists in 2019 and 2020 summer seasons. The South Georgia museum staff give well-attended talks to nearly all tour vessels visiting South Georgia.

We have worked closely with Project Partner Ted Cheeseman (who runs the photo-ID matching website www.happywhale.com) to enhance visibility of the project within this community, and to increase IAATO engagement with high latitude whale research through the placard scheme. The impetus created by the photo-ID placards has also led to a new initiative to build a humpback whale photo-ID catalogue for South Georgia, using the Happywhale website as the catalogue sharing repository, and comparing these photo-IDs with the Brazilian wintering ground to look for matches. So far, 258 South Georgia humpback fluke photo-IDs have been collected (including 89 from the four BAS whale expeditions associated with DARWIN, more detail evidencing this activity in Section 3.2). Four individuals feeding at South Georgia have been matched with

¹ All IWC Scientific Committee reports are available for download at <https://iwcc.org/documents>
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Brazilian catalogues to date, supporting the hypothesis that these grounds are connected. We will prepare a report on this result before the end of the Darwin project.

3. Project progress

3.1 Progress in carrying out project Activities

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 main activity planned for 2019/20 was the execution of a vessel-based field survey at South Georgia, using visual and acoustic observations in order to locate southern right whales. Project planning was carried out via regular meetings with project partners, as required to progress organisation of the cruise (Activity 1.1). The field expedition was successfully organised and carried out on time (Activity 1.2,1.4). However travel coordination *en route* to the Falklands did not leave sufficient time for a pre-cruise workshop (Activity 1.3). The PI produced a cruise plan for the team which was circulated to expedition members and stakeholders (Annex 3.7). The expedition team then met with the GSGSSI and other stakeholders following the expedition, and gave a public talk on the expedition findings (Annex 3.1).

The South Georgia survey was very comprehensive, covering 1,354 nautical miles (nm) in 23 days including survey effort in the rarely visited south side of the island, and collecting all of the data listed under Activity 1.4 (Annex 3.2). However, very few right whales were sighted, so significantly less right whale data was collected than was proposed for collection against each Activity 1.4.1-1.4.6 (see Annex 1). Under activity 1.4.1, 31 sonobuoys were deployed. Of these, only two failed. Right whales were detected on three sonobuoys (see detail in Annex 3.2). Under activity 1.4.2, skin samples were collected from 7 right whales (up to 50 samples anticipated, Annex 2). Under activity 1.4.3, photo-IDs were collected from 11 right whales (side-on) and for 6 of these animals overhead images were also collected (up to 50-60 whale photo-IDs were originally proposed, Annex 2). Under activity 1.4.4, two right whales were satellite tracked on the 28th January (up to ten whales were originally proposed for tracking, Annex 2). One transmitted until 23rd May 2020 and the other is still transmitting: <https://www.bas.ac.uk/project/south-georgia-right-whale-project/south-georgia-right-whale-project-whale-tracking/>. Under activity 1.4.5, blubber samples were collected from 7 right whales (original proposal, blubber collection from 10-20 individuals, Annex 2). Under activity 1.4.6, photogrammetry measurements were taken from 6 right whales via hexacopter (original proposal, photogrammetry measurements from 10-20 individuals, Annex 2).

The team also collected a significant quantity of opportunistic data from non-target species, in particular humpback and blue whales, as detailed in the Annex 1 Logframe.

Expedition activities were promoted (Activity 1.4.7) via blogs on the highly accessed British Antarctic Survey website (<https://www.bas.ac.uk/blogpost/bas-south-georgia-whale-expedition-in-full-swing-a-season-of-humpbacks-and-blue-whales/>, <https://www.bas.ac.uk/blogpost/blue-whale-comeback-at-south-georgia/>), Facebook posts on the main project website (www.facebook.com/sgwhale) and through a highly publicised press release after the expedition (<https://www.bas.ac.uk/media-post/return-of-the-whales-to-south-georgia/>). This became a viral news story and was reported internationally across major news outlets, including The Week magazine (Annex 3.1). Following the expedition, biological samples were shipped back to the UK (Activity 1.5) and contents will be inspected at the end of July.

Photo-ID matching (Activity 1.6) with calving grounds is underway, and should be completed by December 2020. Activity 1.7 aimed to analyse right whale habitat use patterns in South Georgia waters. However since only two right whales were successfully tracked (see description in Annex 3.2, and <https://www.bas.ac.uk/project/south-georgia-right-whale-project/south-georgia-right-whale-project-whale-tracking/>), it was not possible to do right whale specific habitat use analysis (Activity 1.7, 1.8.2). Habitat use analysis will therefore be conducted with both humpback and right whales combined, to investigate the habitat use patterns of krill-feeding whales in general (see Section 3.2). Activities 1.7.1 and 1.7.2 are underway for Sept-Dec 2020.

A detailed expedition report was provided to the IWC Scientific Committee and the GSGSSI (Activity 1.8.1, Annex 3.2).

Stable isotope analysis of zooplankton (~10 candidate prey species) and right whales (n=7 right whales) is underway in order to assess whale prey (Activity 1.9). This analysis has now been completed for the 2018 expedition samples and is included in the publication of the expedition (Annex 3.4). However this analysis has also highlighted that right whales could be feeding on krill or copepods in South Georgia waters, and cannot strongly discriminate between these two prey sources (see Section 3.2)

The genetic identification of the South Georgia right whales (Activity 1.10) has been completed for the 2018 expedition using mitochondrial DNA and microsatellite genotypes (Activity 1.10.1) and are now published (Carroll et al. 2020 <https://doi.org/10.1093/jhered/esaa010>). These data provide an estimate of South Georgia right whale diversity (Activity 1.10.2) and show that right whales feeding at South Georgia are more closely connected to southwest Atlantic calving grounds than those in the southeast (Activity 1.10.3). To conduct these activities with the 2020 samples, the 2020 right whale samples need to be sent to New Zealand for PP Carroll to analyse. However current COVID shipping restrictions mean that these samples may not arrive in New Zealand until September, so this activity may be delayed by up to three months.

Hormone analysis (Activity 1.11) is on track and will begin when samples (from seven right whales, 15 humpbacks and 8 blue whales) are sent to St Andrews in August 2020.

Photogrammetry images of 6 right whales to assess body condition (Activity 1.12) have been sent to PP Moore. Moore proposed that researcher Dr Fredrik Christiansen would be best placed to conduct a comparative analysis of South Georgia right whale body condition in relation to the other Southern Hemisphere calving grounds, as he holds a Southern Hemisphere wide dataset. Dr Christiansen has agreed to conduct this analysis in August/September 2020, which will be contributed to Outcome 3.

A UK-based workshop summarising findings was originally planned for Nov 2020 (Activity 1.13). However, anticipating that travel will be restricted at this time due to COVID-19, we plan instead to conduct this workshop remotely over multiple days.

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.

Insufficient right whale data were collected to deliver a right whale habitat use analysis (Activity 2.1) to identify spatial overlaps with the South Georgia krill fishery. We therefore plan to provide a humpback whale habitat use analysis using satellite tags deployed on humpbacks by PP Zerbini, as well as the two collected during the current study (<https://www.bas.ac.uk/project/south-georgia-right-whale-project/south-georgia-right-whale-project-whale-tracking/>), and include the right whale data as a comparative additional component. Given that humpback whales exclusively feed on krill in South Georgia waters, this work will be informative for the upcoming CCAMLR krill risk assessment and will be presented to the 2021 CCAMLR meeting.

Our 2018 survey observations, coupled with the initial stable isotope results, cast questions on whether right whales are feeding exclusively on krill in South Georgia waters (see Annex 3.4 for more details), and we now think they may feed on a mixture of copepods and krill. Further analysis of the trophic chemistry of the whales and their prey is needed to assess this question in more detail and establish what they are eating.

Analysis of the relative consumption of krill by whales is underway, using abundance data for (i) all baleen whales and (ii) humpback whales obtained from the Jan/Feb 2019 sightings survey to South Georgia and the South Sandwich Islands (Annex 3.3). This will be used to deliver the results of Activity 2.2 to the 2021 CCAMLR EMM meeting in June 2021 (after the project close).

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.

The activities compiling photo-ID, genetic and health data (Activity 3.1) are now underway and will be completed by project close. However reporting to the IWC Scientific Committee will take place after the project close (May 2021).

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.

An in-depth review of southwest Atlantic right whale catches by whaleships was conducted by Vighi (Activity 4.1) and this paper is now in review (Annex 3.5). Estimation of right whale abundance at South Georgia (Activity 4.2) could not be conducted as there were insufficient sightings of right whales to carry out mark resight analysis. We originally aimed to use population connectivity data to estimate the degree of connectivity between South Georgia and Península Valdés. However no matches have been made between these areas with our photo-IDs to date (Annex 3.4), and the ~15 newly collected photo-ID images from the 2020 expedition (including photos contributed from Happywhale) are not expected to provide a statistically useful measure of connectivity, as so few right whales were seen in 2020 (Annex 3.2).

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

The organisation of an end of project workshop (Activity 5.1) cannot be conducted due to the current travel restrictions, but will be organised as a 3-day remote conference instead. The other activities 5.2-5.4 are still on track and have not yet been started.

3.2 Progress towards project Outputs

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

Few southern right whales have been sighted over the project period (Annexes 3.2-3.4), so our capacity to report on these parameters for right whales alone is very limited. However we can assess distribution, habitat use and risks to baleen whales and humpback whales within the South Georgia EEZ, using survey data collected in 2019 (Annex 3.3) and 2020 (Annex 3.2). This is valuable to the GSGSSI for assessing the likely impact of whales as krill consumers within the ecosystem, and for assessing (and mitigating) the risks of ship strikes on whales across the EEZ. Both of these activities can be delivered in the timeframe of the DARWIN grant. However, reporting of these outputs to the CCAMLR and IWC Scientific Committees will take place in late spring 2021.

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.

As mentioned above, we cannot provide a robust right whale habitat use analysis due to the lack of right whale sightings data and satellite tracks, but we have collected substantial sightings data for humpback whales (who are also krill consumers). We are therefore planning to use satellite tracking data collected by this project, combined with that previously collected by PP Zerbini (e.g., Zerbini et al. 2006, Zerbini et al. 2011) to assess humpback whale distribution in relation to the krill fishery. This report will include a component where right whale habitat use is also analysed using the two right whale tracks, to see if patterns differ from those of humpbacks. This output is being produced by a PhD student supervised by the PI and PP Trathan, in close collaboration with PP Zerbini. This analysis is on track to be completed by December 2020 and the results will be reported to CCAMLR EMM in 2021.

In order to progress the individual-based analysis of right whale habitat preference (identification of right whale prey, Activity 1.9), stable isotope analysis of 2020 right whale samples and zooplankton prey is on track to be completed by the project close. We will also endeavour to carry out fatty acid analysis on both sample types, which can provide more accurate discrimination between candidate copepod and euphausiid (krill) prey. This will provide an indirect means of assessing right whale habitat use, by establishing preferred prey sources for right whales in South Georgia waters. The results will be reported to the next IWC Scientific Committee meeting (May 2021).

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.

This output is on track. Reporting to the IWC will however take place after the project close, at the next IWC Scientific Committee meeting (May 2021).

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 exploitation patterns has been achieved via an in-depth analysis of whaleship logs, providing estimates of catch impact and whaling efficiency (Annex 3.5). This provides key data to inform right whale population assessment.

The second component (estimation of right whale abundance at South Georgia) has not been possible due to a lack of sightings. We will therefore instead generate estimates of overall baleen whale abundance and humpback whale abundance in South Georgia using sightings from surveys conducted over the project lifespan (Annex 3.2 and 3.3). These will be used to assess the levels of annual krill consumption by whales in South Georgia waters, for reporting to CCAMLR EMM in 2021. This information is important for the upcoming CCAMLR krill risk assessment.

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

Through the DARWIN project and companion EU BEST project we have built a strong network of stakeholders, which has already enabled us to broaden the number and scope of baseline surveys (e.g. Annex 3.3), providing a useful review on the presence of other species (e.g. Annex 3.6) and conducting a successful pilot season in 2019 doing locally-based surveys at King Edward Point base. The principal project stakeholder is the GSGSSI, who have provided us significant ongoing logistical support for this research. In return we will provide the GSGSSI with whale habitat use maps for South Georgia (for MPA planning and ship strike assessment) and estimates of whale abundance (to inform the krill risk assessment). The GSGSSI have indicated that they are keen to support future whale surveys on a broader range of species and may also be able to assist with surveys with their dedicated Fishery Patrol Vessel.

The pilot season we conducted at King Edward Point (KEP) in 2019 demonstrated that whale research is feasible from small local vessels. With GSGSSI approval, whale photo-ID and observation has now been added into the KEP 2020 Science Plan (Annex 3.10) as a regular science activity to be conducted by the South Georgia science team.

We have engaged regularly with IAATO members about South Georgia whale research (both through our PP Cheeseman and via many talks given on IAATO vessels, and research slides presented by South Georgia museum during their vessel outreach). In particular we have highlighted the value of tourists collecting good quality photo-ID images to find out about whale movements. This led to the development of a photo-ID placard that was widely circulated during the 2018/19 season (www.iwc.int/sorp). We are now working with PP Cheeseman to develop further photo-ID tools to help tour operators collect good quality photo-ID images and upload them to www.happywhale.com while they are onboard.

Our right whale photo-ID images from 2020 are currently being quality controlled and matched between 2018, 2019 and 2020, and the whole catalogue will then be submitted to happywhale (September 2020), to form an open-access right whale photo-ID repository for others to view and match with. We have already completed this action with our humpback whale photo-ID images (89 flukes; <https://happywhale.com/org/609;svy=22043>, <https://happywhale.com/org/696>).

Our collaboration with PP Cheeseman has led to a new initiative, arising from the humpback whale data we have collected, to match humpback whale photo-IDs collected in South Georgia by tour operators and by our expeditions (one re-sight so far). Collaboratively we have created a "South Georgia" humpback whale catalogue and PP Cheeseman is now matching humpback whales with their low-latitude South Atlantic wintering grounds, to assess connectivity patterns (four matches with South Georgia discovered so far). We aim to create a sustainable legacy from

these surveys by providing the South Georgia museum, local SG scientists and visiting tour vessels with a reference photo-ID catalogue for the key cetacean species regularly encountered at South Georgia (humpbacks, right whales and killer whales), which is updated by local SG scientists as part of their annual work.

We are now advising the South Georgia museum on a new display of information about current whale recovery at South Georgia alongside the whaling artefacts, a display which will increase understanding of the population recovery of whales at South Georgia and also ensure enduring visibility of our project work to visitors to South Georgia.

3.3 Progress towards the project Outcome

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.

Of the two Outcome indicators that we specified in the log-frame (Annex 1), only the second is still adequate for measuring achievement of the Project outcome (that is: provision of data contributing 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). The first indicator (the first baseline data on the feeding ground abundance and recovery population status of southwest Atlantic southern right whales) cannot be met due to insufficient right whale sightings. We have submitted a change request to propose that this indicator be modified to refer to the feeding ground abundance and recovery of whales in general, rather than right whales specifically.

By the project close:

We will provide and publish baseline data on the status of South Georgia feeding grounds for whales (but not specifically southern right whales) post whaling, using overall estimates of whale abundance to estimate regional krill consumption rates and inform upcoming krill risk assessments. To date, we have provided preliminary whale abundance estimates to CCAMLR EMM (Annex 3.3).

We will characterise abundance, habitat use and distribution for humpback whales (the most commonly seen species). Habitat use patterns will be derived from the visual surveys using the data collected in Annex 3.3 and 3.2, to provide marine management advice to GSGSSI on ship strike risks, to help them decide appropriate mitigation measures. Some preliminary analyses of habitat use have already been conducted (for discussion with the GSGSSI) and can be seen in Annex 3.8.

For southern right whales we will characterise diversity, health and calving ground connections, and contribute these to the IWC Scientific Committee to be considered in the context of the conservation management plan for this population. To date, population diversity and connectivity estimates have been provided to the Scientific Committee (Carroll et al. 2020) and a health assessment is in review for publication (Annex 3.4)

Timing-wise our analyses are on track to provide preliminary reports to DARWIN at the time of project close, and we expect to realise these outcomes through reports to the relevant scientific bodies (IWC and CCAMLR) within a year of the project close.

3.4 Monitoring of assumptions

Three critical risks in the project were originally identified, which were specific to the expedition aspect of the project (the most critical aspect). We were able to mitigate all three risks adequately during the 2020 expedition.

- Equipment failure (i.e. data cannot be collected). To mitigate against this at least two items of all equipment required for conducting the fieldwork were carried, including cameras, biopsy rifles, hexacopters, multiple sonobuoys, tag deployment systems. All equipment was well maintained and serviced. This approach worked successfully in the field this season (see Annex 3.2).

- Bad weather (data cannot be collected). The 2020 expedition team had a larger, faster vessel than in 2018, and also included a very experienced mariner with many years South Georgia sailing experience. On his advice, the team were able to get the vessel leeward of the island relative to storms coming through and maximise good weather opportunities, and the team were able to achieve over 1300 nautical miles of visual survey during the 23 day period when they were working at South Georgia. This spanned the islands waters (north and south sides) and provided enough sightings data to estimate density for humpback and blue whales (Annex 3.2).
- Personnel injury. All personnel were highly experienced with working on small boats and with fieldwork of this nature, and had first aid training. To mitigate risk, substantial risk assessments were also compiled and training provided where necessary (for example with handling of liquid nitrogen). There were no medical incidents on board the 2020 expedition.

A risk that we had not anticipated prior to the project would be that there would not be many southern right whales present in South Georgia waters during summer 2020. Previous reports indicated that they were the most commonly seen species (Moore et al. 1997; Richardson et al. 2012), although our subsequent compilation of sightings data now suggests that humpbacks have become the most commonly seen species, since 2015 (Annex 3.4). We maximised our right whale encounter opportunities by sending a team of very experienced whale observers as well as using innovative technology to detect right whales acoustically. In 2018 we regularly sighted and acoustically detected right whales (Annex 3.4), but in 2019 they were rarely seen (Annex 3.3). Our project has therefore uncovered substantial interannual variation in how many right whales use South Georgia waters each summer.

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

A core assumption of our original project activities was that we could 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). However the lack of sightings of right whales in 2019 and 2020 means that we have been unable to achieve this objective. Reviewing this issue in previous Darwin project reports, we revised our approach for estimating abundance, and aimed to use spatially structured visual surveys in 2020 to estimate right whale abundance instead. However the 2020 survey (Kennedy et al. 2020) did not sight sufficient right whales to make this approach viable.

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. However, as explained in the 2019 Darwin report, the substantial variation in numbers of right whales seen seasonally at South Georgia (Jackson et al. in review; Baines et al. 2019; Kennedy et al. 2020) means that abundance there is more likely driven by environmental drivers than biological recovery from whaling. Consequently, we concluded that our ultimate outcome (to **measure southern right whale population recovery** in the southwest Atlantic) would be better addressed by doing the assessment using population abundance on the calving grounds rather than on the high latitude feeding ground. We considered if the proportion of high and low latitude animals identified by stable isotope data could provide an assessment of the relative abundance of right whales using polar front versus lower latitude waters (Valenzuela et al. 2009, Valenzuela et al. 2018). However this idea is challenged by the fact that stable isotopes reflect areas where animals have been feeding ~5 months prior, but not for example 9 months prior. So they may for example feed at South Georgia in spring and then spend an extended summer and autumn period feeding on the Patagonian Shelf, and the isotope signature will reflect the latter, subsequent feeding area, and not reveal that the whale was also in South Georgia. Another problem is that isotope data can distinguish between whales feeding north and south of the Polar Front, but not which areas they are feeding in south of the Polar Front. Recent satellite tracking work shows that southern right whales also feed in the southern Scotia Arc region and indicates that whales range across a broad range of high latitude habitat (<http://www.siguiendoballenas.org/en/home/>), so we cannot make the isotope proportion of animals using high latitudes equivalent to the proportion that feed in South Georgia.

Output 2: Assumption 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.

To mitigate this potential problem, we originally sought to obtain recommendation for this work during the delayed 2018 joint IWC/CCAMLR meeting on ecosystem modelling through multiple IWC and CCAMLR Project Partners involved in this joint meeting. However this meeting between IWC and CCAMLR did not take place. Nevertheless, this assumption is no longer considered a concern; the upcoming krill risk assessment for South Georgia requires that information on whale habitat use is included, and the 2019 meeting saw multiple whale papers reviewed in the context of the Antarctic Peninsula krill risk assessment, particularly by PP Trathan, who is a key member of that risk assessment team.

Output 4: 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.

This assumption relates closely to the “Estimation of southern right whale abundance at South Georgia” assumption above. We have not obtained sufficient right whale data to provide accurate measures of either connectivity or abundance.

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

OT stakeholder engagement continues to go well (see Section 2) and has led to whale research now being incorporated into the routine work conducted at King Edward Point station (Annex 3.10), as well as GSGSSI support in principle for further whale surveys on the GSGSSI Fisheries Observer vessel. Very positive working relationships with the South Georgia Heritage Trust and Friends of South Georgia Island have provided us with significant additional funding support, while collaborations with IAATO have led to further initiatives including development of a South Georgia photo-ID catalogue for humpbacks and widespread dissemination of a photo-ID instruction placard.

4. 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 during the project lifetime we have now generated whale distribution data from two sightings surveys (Annex 3.2 and 3.3) which are being analysed to provide information on whale habitat use patterns, for analysis of ship strike risks, and identification of areas of particular importance for whales. These analyses are on track to be completed by December 2020. Prior to the next MPA review, these data will be used to help the OT decide appropriate mitigation to minimise risks of ship strikes on whales.

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

In relation to fisheries sustainability: we are using whale sightings data to estimate regional densities of whales (Annex 3.3) and calculate annual krill consumption by baleen whales in South Georgia and South Sandwich Islands waters. This information will be used by CCAMLR in their upcoming krill risk assessment for these two areas, providing a measure of the likely impact of whales on krill, and therefore informing krill quota setting for the region.

In relation to fisheries operation and stewardship: the analysis of ship strike risks (see Objective 2 above) will be conducted to help the GSGSSI determine appropriate mitigation measures to minimise risks of fishery vessels striking whales, and identify whale hotspot areas where other measures may be employed to minimise negative vessel interactions.

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

Our work has brought significant international attention to South Georgia, through multiple BBC articles, including global reporting about the discovery of blue whales), and inclusion of the South Georgia right whale story in the recent Seven Worlds One Planet series (references in Annex 3.1). Through a partnership with South Georgia Heritage Trust, we are using the whale story to help the Trust raise further funds to preserve South Georgia heritage, while also building the visibility of whale research in these waters <http://www.sght.org/the-story-of-the-whale-at-south-georgia/>.

We continue to provide regular research advice to UKOT organisations working in the Falkland Islands, including Falklands Conservation and are involved in an ongoing DPLUS funded (DP/100036) collaboration with Falklands Conservation to 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 in the UKOT, which has translated into three scientific reports to the International Whaling Commission (Annex 3.2, <https://archive.iwc.int/?r=12261&k=2d2fce5f70> and <https://archive.iwc.int/?r=9357&k=14b502f0cf>), one published paper (Carroll et al. 2020, <https://doi.org/10.1093/jhered/esaa010>) and three more in review (Annex 3.4-3.6), one workshop including the GSGSSI to develop management recommendations (see 2019 Darwin report), and one scientific report to CCAMLR (Baines et al. 2019). We are currently well on track to provide whale habitat use information into the next UKOT MPA review (this is anticipated to take place in 2023; the last was in 2018, <https://www.gov.gs/environment/marine-protected-area/>). Sightings survey data will also be used 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 6 months of the project.

5. OPTIONAL: Consideration of gender equality issues

The leadership of this project (PI Jackson, Co-I Carroll and field team leader Kennedy) are all female. Throughout this project, we have maintained an equal gender balance in the field teams embarking on expeditions.

6. Monitoring and evaluation

Monitoring and evaluation of project progress has been done by the PI holding regular 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. Our most recent project meeting minutes are provided in Annex 3.7.

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 translation of work into publications (Annex 3.4-3.6). The project has been designed so that the outputs and activities are closely linked to the overall project outcome, with evidence of progress in these areas given in Section 3.

7. Lessons learnt

A second unexpected problem encountered this year was that the PI underwent an extended period of illness (Oct-Jan) and was unable to lead the 2020 expedition. However the project

member who replaced her on the team was very experienced with working in the South Georgia marine environment, did an excellent job managing the science and was able to help the expedition work in areas of South Georgia that are difficult to get to, while the PI produced a comprehensive cruise plan for the team which was pre-reviewed by project members (Annex 3.9) and was able to produce regular social media communication about the expedition in the UK on behalf of the team while they were in the field (this proved difficult in previous years due to poor bandwidth in the field).

Despite some setbacks this year (PI illness, funding shortages), these obstacles were overcome to deliver a 2020 expedition that was a success in terms of the area of South Georgia surveyed and the range of science that was carried out. We produced a comprehensive expedition report, and submitted this for review at a virtual meeting of the IWC Scientific Committee (Annex 3.2). The 2020 expedition yielded a huge amount of press coverage, because the expedition team sighted ~55 Antarctic blue whales (Annex 3.1). Antarctic blue whales are a critically endangered whale subspecies which is very rarely encountered in much of the Southern Ocean, but were heavily exploited at South Georgia. This sighting result yielded very positive press stories around the world for South Georgia and for the GSGSSI, highlighting the return of blue whales to South Georgia as a positive conservation story for the species and for South Georgia. The expedition also collected substantial amounts of sightings and tissue samples for genetic, hormone and stable isotope work on humpback and blue whales (Annex 3.2) which can be used to establish diversity, connectivity patterns and prey preferences for other recovery whale populations.

On the downside, the 2020 expedition mirrored the right whale pattern seen in 2019, with very few right whales seen. Consequently, some of our outcomes, which were predicated on the successful collection of right whale sightings to estimate abundance and habitat use, have to be modified, and our sample collections fall below the proposed sampling levels in the original Logframe. The absence of right whales in the last two years was fully unforeseen at the start of the project; even during the 2018 expedition, right whales were regularly seen despite the bad weather.

Satellite tracking of whales in South Georgia waters has proven particularly tricky; over three seasons of effort, only four whales (two right whales, two humpback whales) have been tagged; we initially proposed to tag 10 right whales. The reason for the low success rate of the satellite tagging effort is that the weather at South Georgia is rarely calm enough to allow for tagging operations to continue safely, and furthermore, the behaviour of the whales we encountered (usually solo or in pairs, so very aware of approaching boats and evasive) made it difficult to approach them closely. This has been the case over three years of effort.

If we were to repeat the project, given that we were conducting work in an area where very little systematic surveys have taken place, we would not have focussed the project so closely on one species, and allowed for some adaptation in the planning which could allow for project deliverables to be less species-specific. The lack of right whale sightings was a surprise, but the lack of data was not down to a failure to adequately survey for them. If right whales had been at similar or even half the densities of humpbacks in South Georgia waters in 2019 and 2020, we would have been able to deliver on both the habitat use analysis and abundance estimates anticipated in the project. We did not foresee the southern right whales being so flexible in their seasonal use of feeding grounds; there were no other southern right whale feeding ground studies that could have informed us of this, and our prior information (and our review of the sightings data in Annex 3.4) suggested they were the most abundant species. Hence, a more viable approach would be to estimate habitat use patterns of krill feeding whales in general at South Georgia, rather than specifically right whales.

With respect to satellite tracking, we suggest that the most productive way to tag whales at South Georgia is to do this working from small boats at King Edward Point station; this provides a lower-cost and logistically simpler way to work in South Georgia for an extended period, reducing the costs and risks associated with vessel charter and increasing the opportunity of good weather periods in which tagging is possible. On the downside, the area that can be safely surveyed with this approach is limited to a small area along the north coast, and it has only proven feasible to study humpback whales within this area; very few other species were encountered so close to the coast in 2019. In the short term, we will raise funds to send a team to King Edward Point again, to repeat the 2019 surveys close to the coast and tag additional humpback whales.

Further summer surveys are required to better establish the environmental factors which influence the seasonal abundance of different whale species, and these surveys should include collection of prey data at the same time, for example using echosounders to identify local zooplankton swarms and the types of swarms present. A key data gap is what types of zooplankton swarms different whale species target; we now think right whales may feed on both krill and copepods in South Georgia waters (e.g. Annex 3.4), while humpbacks are anticipated to be exclusively krill feeders. These combined surveys will help to better ground any future species-specific research with an understanding of the environmental drivers involved, and therefore where the vulnerabilities are.

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

Output level assumptions do not appear to have been reviewed despite a statement in Section 6 that they have been. Please fully review all assumptions in future reports.

All assumptions have now been reviewed.

The report states it is unlikely that enough data will be collected for mark-resight methodology and that the measurement of population recovery is better addressed by measuring population abundance at calving grounds, rather than feeding grounds. The project now proposes to use available population data from lower latitude feeding grounds and to use relative proportions of whales using lower and higher latitude grounds — as calculated by isotope analysis — to suggest relative proportions of the recovering whale population feeding in higher and lower latitudes. However, since isotope data has been obtained from only three whales to date (target = 20) and >10 zooplankton samples (target = 100), and bad weather remains a risk during the 2020 field season, is this proposal viable?

Our proposal was to use the information from previously published isotope data on the calving ground, which comprises n=196 individuals (Valenzuela et al. 2018). These patterns would reflect where whales seen on the calving ground were feeding during the previous summer, providing a measure of the proportion feeding south and north of the polar front. However please see Section 3.4 for further discussion of this proposal and why we did not pursue it further.

There is significant risk that the 2020 survey season will be hampered by bad weather and it is understood the project is seeking additional funding to extend the survey. What is the fundraising strategy and, if unsuccessful, how will the project effectively mitigate the risk of bad weather.

We applied for and secured £86,000 of funding through South Georgia Heritage Trust and Friends of South Georgia Island in order to cover charter costs for 32 days, which amounted to ~23 survey days in South Georgia waters. We could not mitigate the risk that weather would make our capacities limited during the survey period, but we did include a team member who was able to minimise the impact of the bad weather on survey effort, due to his extensive knowledge of South Georgia waters.

The report states the project has delivered preliminary regional abundance estimates of humpback, fin whales and baleen whales to suggest appropriate quotas for krill catches in the SG ecosystem. However, the report does not identify this research and the paper referenced is not appended to the annual report so this statement cannot be corroborated. Please provide evidence.

This report is available on request via this link: <https://www.ccamlr.org/en/wg-emm-2019/27>. The full report is also appended to this document as Annex 3.3.

9. Other comments on progress not covered elsewhere

10. 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. One high profile way in which whale recovery at South Georgia was highlighted is through the South Georgia right whale segment within the BBC series “Seven Worlds One Planet” (Antarctica episode: <https://www.bbc.co.uk/programmes/m0009tt8>, see Annex 3.1). The PI liaised closely with the series producers on the South Georgia whale story, and provided footage which was collected by a 2019 expedition team member (Darryl MacDonald), with funding from the BBC; both individuals are credited in this episode.

Evidence of increased interest at South Georgia is hard 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. The relationships we are building with a key local stakeholder (South Georgia Heritage Trust and Friends of South Georgia Island) have led to a collaboration for a new high-profile artistic commission related to whales (<http://www.sght.org/commission-grytviken-whaling-station-south-georgia/>) and we are working with the South Georgia museum to develop a new display area telling the story about whale recovery since whaling ended (Section 3.2, Project Output 5). This work is now on hold because no tourists are anticipated for the upcoming summer season.

Overall, we have no changes to our planned exit strategy, nor to our original plan for how to create a sustaining legacy. The original project has already broadened to include multiple new elements and collaborations, as the datasets grow in size, providing opportunities for many downstream studies (e.g. Annex 3.6) and spin-off projects (see project meeting minutes Annex 3.7 Section 6). Furthermore, through the DARWIN project we have developed a strong mutually beneficial relationship with a local stakeholder (South Georgia Heritage Trust), who has now provided over £100,000 in funding towards South Georgia whale research (awarded £19,632 in 2018/19, £3,840 towards abundance estimation and £86,000 towards expedition costs in 2019/20). In turn this funder is keen to use South Georgia whale research in public outreach, which enhances the Antarctic tourist experience as well as increasing the profile of the island. We will continue to develop this relationship in order to embed monitoring of whale populations (both acoustically and with visual surveys) into GSGSSI and BAS regular activities and continue building the profile of this recovering feeding ground.

11. 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 South Georgia Association meetings. We mention the Darwin project on our website and in the Facebook page (www.facebook.com/SGwhale) and in all press releases (e.g. <https://www.bas.ac.uk/media-post/return-of-the-whales-to-south-georgia/> and <https://www.bas.ac.uk/media-post/migratory-secrets-of-recovering-whale-species/>) and authored articles about our work (e.g. April 2020 edition of <https://southgeorgiaassociation.org/newsletters/>).
- While the DARWIN element of the project has formed part of a larger program, it has been very clearly associated with the 2020 South Georgia expedition as the main funder, and with the recent catch series development. DARWIN is highlighted in all expedition stories (e.g. <https://www.bas.ac.uk/blogpost/blue-whale-comeback-at-south-georgia/> and <https://www.bas.ac.uk/blogpost/bas-south-georgia-whale-expedition-in-full-swing-a-season-of-humpbacks-and-blue-whales/>) and acknowledged in all reports and publications arising from this work.
- There is a good understanding of the Darwin Initiative in the South Georgia region as Darwin has made a substantial contribution to our understanding of regional biodiversity and has underpinned multiple conservation management projects. [evidence]
- The project Facebook page (www.facebook.com/sgwhale) notes DARWIN as a key funder and provides links to DARWIN in blog posts. This page has >650 followers. DARWIN is referenced in blog posts on the BAS website (see above) and in Twitter outreach about the expedition, both by @BAS_News, and project partners like @EmziCarroll.

12. Safeguarding

The British Antarctic Survey is a well-respected UK scientific research organisation, with many safeguarding procedures in place, including those of the parent bodies that include NERC and UKRI. There is zero tolerance of bullying, harassment, sexual exploitation and abuse, and a clear code of conduct for all staff. Official procedures are in place to report and investigate any untoward behaviour, and infringements can be reported to higher management in a protected manner, should they occur. The excellent reputation of BAS provides evidence that those involved in this project were protected at all times.

13. Project expenditure

Figures are not yet available and will be provided as soon as possible.

Table 1: Project expenditure during the reporting period (1 April 2019 – 31 March 2020)

Project spend (indicative) in this financial year	2019/20 D+ Grant (£)	2019/20 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				

Highlight any agreed changes to the budget and **fully** explain any variation in expenditure where this is +/- 10% of the budget. Have these changes been discussed with and approved by Darwin?

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2019-2020 – if applicable

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	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>Positive impacts on biodiversity have not yet been realised by this stage of the project.</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>0.1 A five week field survey was carried out in South Georgia waters, with a focus on right whales. However only 11 right whales were sighted over 1,354 nm of survey, so estimation of abundance was not possible (see IWC Report SC/68b/CMP22).</p> <p>0.2 Two right whales were satellite tracked: https://www.bas.ac.uk/project/south-georgia-right-whale-project/south-georgia-right-whale-project-whale-tracking/</p> <p>0.3 Eleven photo-identifications and genetic samples from 7 individuals were collected for matching between seasons and with calving grounds</p> <p>0.4 Stable isotope data was collected from 7 individuals and zooplankton data were collected from ~8 candidate prey species.</p> <p>0.5 Right whale sightings data have been collated and are summarised in Jackson et al. (in review)</p>	<p>We will conduct a (i) ship strike risk assessment and (ii) habitat use analysis of baleen whales and humpback whales, and provide this information to GSGSSI for consideration in relation to ship strike mitigation measures, and MPA planning.</p> <p>We will estimate krill consumption by baleen whales in South Georgia waters and provide these estimates to CCAMLR in 2021 to be included in the upcoming krill risk assessment.</p> <p>We will complete our assessment of right whale prey preferences through analysis of stable isotopes and fatty acids, in order to establish whether they are feeding on krill at South Georgia (and therefore should be considered within the krill risk assessment framework)</p> <p>We will provide a baseline analysis of right whale health at South Georgia, compiling all health related information gathered from photogrammetry, hormone analysis</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
		<p>0.6 Six samples were collected for hormone analysis and images from six individuals for body condition analysis</p> <p>0.7 Collation of oceanographic data will be carried out 2020/21</p> <p>0.8 Right whale abundance cannot be calculated due to an absence of sightings. Right whale connectivity to date published by Carroll et al. (2020) and will be analysed at finer (genomic) scale with new samples.</p> <p>0.9 Collate right whale catch history. Analysis of whaling logbooks and catch efficiency has been completed (Vighi et al. in review)</p> <p>0.10 Population modelling has not yet been conducted (for 2020/21)</p>	<p>and side-on body condition analysis and provide a summary report to the IWC's southwest Atlantic Conservation Management Plan Working Group.</p>
<p>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</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>Provides a baseline for measuring change in species characteristics in response to impacts, including climate change.</p>	<p>The first of two project workshops 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. The final planned report will be written, considering risks and recommended actions, after the December 2020 UK based meeting following the 2019/20 field season. Given the current pandemic, this meeting will be held virtually. This activity is on track.</p>	
<p>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.</p>		<p>Project planning meeting conducted in July 2020 involving Steering Group members. Was not able to organise Dec 2019 project planning meeting, but used group email to keep project on track</p>	<p>Final project meeting to be held in December 2020 during virtual project wrap-up meeting.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
<p>Activity 1.2. Obtain permits from GSGSSI and Animal Ethics approvals for fieldwork and scientific procedures, equipment purchase, permit applications, shipping of equipment to Falkland Islands as British Antarctic Survey cargo.</p> <p>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.</p>		<p>1.2 All necessary approvals and equipment obtained for 2019/20 fieldwork.</p> <p>1.3 Team travelled to Falkland Islands. Was not possible to organise a workshop (PI was absent and travel coordination left little time for pre-project discussion). Therefore the PI produced a comprehensive cruise plan for the project which was circulated to the team and stakeholders for comment (Annex 3.9).</p>	<p>Actions now completed.</p>
<p>Activity 1.4 Survey embarks from Stanley, Falkland Islands for 5 weeks</p> <p>Activity 1.4.1 Deploy DiFAR sonobuoys and use sonobuoy transmissions and sightings to locate whales</p> <p>Activity 1.4.2 Skin samples collected from all encountered whales (50)</p> <p>Activity 1.4.3 Photographs collected of all encountered whales (50-60, head shots collected via hexacopter)</p> <p>Activity 1.4.4 Satellite tracking of up to 10 whales (PP Zerbini and Andriolo)</p> <p>Activity 1.4.5 Blubber samples collected from 10-20 whales (PP Carroll)</p> <p>Activity 1.4.6 Photogrammetry measurements taken by hexacopter from 10-20 whales</p> <p>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.</p>		<p>1.4 The expedition embarked from Stanley, Falkland Islands successfully.</p> <p>1.4.1 There were 31 sonobuoys deployed; two of these failed. Right whales were detected on three sonobuoys. When detected the sonobuoy transmissions were used to locate right whales.</p> <p>1.4.2 Skin samples were collected from 7 right whales. Opportunistically, skin samples were also collected from 9 blue whales and 17 humpback whales.</p> <p>1.4.3 Photo-IDs were collected from 11 right whales (side-on) and 6 right whales (overhead), 48 humpback whales, 25 blue whales, 6 fin whales and 33 killer whales.</p> <p>1.4.4 Two right whales were satellite tracked on Jan 28th. One transmitted until 23rd May 2020 and the other is still transmitting: https://www.bas.ac.uk/project/south-</p>	<p>Actions now completed. Activity 1.4.7 continues, with regular updates about the project via the project Facebook page from the PI.</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
		<p>georgia-right-whale-project/south-georgia-right-whale-project-whale-tracking/</p> <p>1.4.5 Blubber samples were collected from 7 right whales, 15 humpback whales and 8 blue whales, for hormone analysis</p> <p>1.4.6 Photogrammetry measurements were taken from 6 right whales by hexacopter</p> <p>1.4.7 The expedition was covered via blog posts on the BAS website (www.bas.ac.uk/project/south-georgia-right-whale-project/) and multiple posts on the project Facebook site www.facebook.com/sgwhale</p>	
Activity 1.5 Biological samples shipped from the Falkland Islands to UK as British Antarctic Survey cargo in April 2020, transported at appropriate storage temperature.		Samples have been shipped from Falklands to UK and are now at BAS. They have not yet been inspected due to site visit restrictions.	Sample inspection and shipping to appropriate collaborators for downstream analysis.
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.		1.6.1 This activity is underway and should be completed by Dec 2020. 1.6.2 This activity will be undertaken Sept-October.	Continue with catalogue building and matching activities July-Dec 2020
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 Zerbinini)		1.7.1 This compilation has been done very simply (see Annex 3.2 and 3.4), but the data are too sparse to provide a useful habitat model for right whales. Acoustic data are being used to make a full description of southern right whale feeding sounds, which will be used to	1.7.2 This activity will be undertaken Sept-Nov 2020 1.7.3 This is not possible for right whales alone as data are too sparse. We will attempt this for right (n=2) and humpback whale (n=2) satellite

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
		<p>help distinguish them from other whale calls and improve acoustic identification of this species in future.</p> <p>See Actions ahead</p>	<p>tracks, in combination with additional humpback tracks provided by PP Zerbini (for animals tracked from Brazil).</p>
<p>Activity 1.8.1 Provide cruise report, distribution patterns and habitat use analysis to International Whaling Commission (June 2020)</p> <p>Activity 1.8.2 Report on right whale habitat use patterns from two years of surveys to South Georgia government (Sept 2020)</p>		<p>1.8.1 Report provided to IWC Scientific Committee in May 2020 (Annex 3.2)</p>	<p>Right whale habitat use patterns cannot be deduced from the data (see 1.7 above). We will provide a combined assessment of right and humpback whale habitat use instead.</p>
<p>Activity 1.9.1 Zooplankton and whale isotope analysis (Stowasser at BAS)</p> <p>Activity 1.9.2 Whale prey identification (Stowasser at BAS)</p>		<p>Zooplankton and whale isotope analysis was completed for 2018 survey and is being published in Jackson et al. (in review), Annex 3.4. Whale prey were identified as being a mixture of krill and copepods.</p>	<p>This work will be carried out July-Dec 2020 with the samples collected from the 2020 expedition. A whale faecal sample was also collected and will be analysed to genetically identify prey sources.</p>
<p>Activity 1.10.1 DNA extraction, microsatellite genotyping & mitochondrial DNA sequencing (PL Jackson, PP Carroll)</p> <p>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)</p> <p>Activity 1.10.3 Measure assignment of South Georgia whales to calving grounds using global dataset held (PP Carroll)</p>		<p>2020 expedition data have been collected and shipped to UK (see Activity 1.4 and 1.5). Samples need to be sent to New Zealand for PP Carroll to analyse.</p>	<p>Given current travel restrictions, there may be delays in shipping samples to New Zealand for analysis. Activities 1.10.1-1.10.3 will be carried out once samples are in New Zealand.</p>
<p>Activity 1.11.1 Assay stress hormones in blubber samples e.g. cortisol (PP Hall)</p> <p>Activity 1.11.2 Assay progesterone to measure pregnancy in blubber-sampled whales identified as female (PP Hall)</p>		<p>2020 expedition data have been collected and shipped to UK (see Activity 1.4 and 1.5).</p>	<p>Samples need to be sent to St Andrews for PP Hall to analyse. This is anticipated to take place in August. Analyses will then be conducted over the next six months.</p>
<p>Activity 1.12 Photogrammetry analysis of whale body condition from photos (PP Moore)</p>		<p>Photogrammetry images from 6 right whales have been sent to PP Moore for analysis.</p>	<p>Moore proposed that a collaborator (Fredrik Christiansen) would be best placed to conduct the analysis as he has comparative data from Península</p>

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
			Valdés. Christiansen has agreed to analyse these data in Aug/Sept 2020.
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.		No progress on this action to date. It cannot be held in person due to COVID-19 travel restrictions.	This workshop is planned for Dec 2020, to be held over three days via Zoom.
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 2020 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.	It is not possible to produce this output for right whales alone due to the scarcity of sightings during 2019 and 2020. However we have now obtained density estimates for all baleen whales and for humpback whales (who are entirely krill feeders in South Georgia) which are being used to estimate krill consumption by baleen whales at South Georgia, and to build habitat use models for humpbacks. These results will be presented to the 2021 CCAMLR EMM group and used in the upcoming krill risk assessment.	
Activity 2.1 Summarise results from Activities 1.4 and 1.7 to prepare CCAMLR scientific report on right whale habitat use		Insufficient right whale data were collected to deliver a right whale habitat use analysis. We therefore plan to provide a humpback whale habitat use analysis, and include the right whale data as a comparative/extra component	Habitat use analysis of humpback and right whales in the CCAMLR areas.
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		A report was provided to the 2019 CCAMLR EMM meeting estimating total abundance of baleen whales in SG/SSI (Annex 3.3), which is now being developed to estimate the total whale biomass and krill consumption rates.	Analyses will be conducted Aug-Dec and this report (for all baleen whales) will be presented to the 2021 CCAMLR EMM meeting.
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	Right whale genetic connectivity estimates were presented to IWC in 2019 (SC/68a/SH06) and published as Carroll et al. (2020). The 2018 health assessment is being published as Jackson et al (in review, Annex 3.4) and this plus the new health assessment will be presented as a combined report to the Working Group on Conservation Management Plans at the IWC 2021 Scientific Committee.	

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
	Management Plan concerns will also be drafted for endorsement by the IWC Scientific Committee.		
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.		Photo-ID, genetic and health data have been collected (see Activity 1) and will be analysed this coming year.	This activity will be conducted over July-April 2021
Activity 3.2 Present report to IWC Scientific Committee meeting		Not yet started.	This report will be presented in May 2021.
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.	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.	The analysis of right whale depletion by whaleships has been conducted by PPs Vighi and Aguilar and is being published (Vighi et al. in review, Annex 3.5). Right whale abundance cannot be calculated for South Georgia as right whale sightings have been too sparse in 2019 and 2020. We will estimate connectivity with the newly acquired photo-ID data, to see if this is informative about relative connectivity to South Georgia.	
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).		This catch review has been completed and is now in review with ICES Marine Science (Annex 3.5).	This review will be combined with other historical catch sources in order to develop a complete catch series for southwest Atlantic right whales.
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.		Over the project period we have had insufficient sightings of right whales to obtain a mark recapture estimate of abundance, nor a density-based estimate of abundance.	No further action. See Section 3.2.
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.		New photo-ID data have been collected (Activity 1) which will be matched to calving grounds to look at connectivity patterns. However the small size of the dataset means it is unlikely this can be estimated with accuracy.	This analysis will be conducted when new photo-IDs have been matched with Peninsula Valdes (Activity 1.6.2)
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.		This activity has not yet started.	Activity to be conducted during July 2020-March 2021.

Project summary	Measurable Indicators	Progress and Achievements April 2019 - March 2020	Actions required/planned for next period
Activity 4.5 Present report to IWC Scientific Committee meeting for feedback and to obtain endorsement of the abundance calculations and population status estimates.		This activity has not yet started.	Activity to be conducted during July 2020-March 2021.
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 future submission of right whale photographs for identification and matching.</p>	<p>These activities are on track for completion in the coming year, albeit that 5.1 has to be conducted via web. DARWIN funding has already helped to catalyse further survey work (e.g. the DY098 survey, Baines et al. 2019) with stakeholder support, and has led to a much broader array of whale data than originally envisaged, with substantial data now collected on humpback whales (48 fluke IDs, 15 genetic samples and two abundance surveys) and blue whales (25 IDs, 8 genetic samples and one abundance survey).</p> <p>Right whale photos will be published on happywhale.com and we will continue to develop the photo-ID placard scheme, along with web-based tools to encourage Antarctic tourists to submit photo-IDs in future.</p>	
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.		This activity has not yet started.	This workshop will now be organised as a remote, web-based activity in Dec 2020, given the travel restrictions due to COVID-19.
Activity 5.2 Compile conservation recommendations from steering group and stakeholders into project summary report		This activity has not yet started	This activity will be carried out after Activity 5.1
Activity 5.3 Write Darwin summary project report		This activity has not yet started	This activity will be carried out at the project close.
Activity 5.4 Audit of project expenditure		This activity has not yet started	This activity will be carried out at the project close.

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

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:</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>(Max 30 words)</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>(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.</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>0.1 Five week field survey</p> <p>0.2 Satellite tracking of ten whales</p> <p>0.3 Photo-identification and microsatellite genotype matching between South Georgia over two field seasons and with Argentine and Brazilian calving grounds</p> <p>0.4 Stable isotope data from up to 20 whales and 100 zooplankton samples to determine whale prey</p> <p>0.5 Collation of all available right whale sightings data</p> <p>0.6 Hormone assays and body condition photographs from up to 20 whales.</p> <p>0.7 Collation of oceanographic data associated with SG marine ecosystem</p> <p>0.8 Calculate abundance and feeding ground connectivity with Argentina and South Africa</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 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

		<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>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 population, (iii) recommended actions to mitigate risks</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>Provides a baseline for measuring change in species characteristics in response to impacts, including climate change.</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 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>None envisaged</p>
<p>2. Report key whale habitat use data to CCAMLR through a scientific paper to the EMM Working Group for consideration within spatial</p>	<p>Right whale habitat use patterns in SG waters provided in 2019 scientific report to CCAMLR EMM group. This group has never</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>Assumes that a CCAMLR report on whale habitat use will be acceptable for discussion by the CCAMLR Scientific Committee who do not</p>

<p>management proposals for regional krill fishery development.</p>	<p>previously considered information on whale habitat use in relation to krill fishery discussions. This is therefore a precedent breaking initiative.</p>	<p>2.2 Report for CCAMLR prepared and publicly available through www.ccamlr.org</p>	<p>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</p>	<p>5.1 Collaborative workshop at the close of the project involving all stakeholders in Stanley, Falkland Islands in order to communicate</p>	<p>5.1 Workshop report publicly available (output 1),</p>	<p>Through engagement with OT stakeholders throughout the project period, and including stakeholder-assisted development of conservation management recommendations,</p>

baseline surveys to other whale species	<p>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>5.2 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>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>
<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)</p> <p>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.</p> <p>Activity 1.2.1 Obtain permits from GSGSSI and Animal Ethics approvals for fieldwork and scientific procedures.</p> <p>Activity 1.2.2 Equipment purchase, permit applications, shipping of equipment to Falkland Islands as British Antarctic Survey cargo.</p> <p>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.</p> <p>Activity 1.4 Survey embarks from Stanley, Falkland Islands for 5 weeks</p> <p>Activity 1.4.1 Deploy DiFAR sonobuoys and use sonobuoy transmissions and sightings to locate whales</p> <p>Activity 1.4.2 Skin samples collected from all encountered whales (50)</p> <p>Activity 1.4.3 Photographs collected of all encountered whales (50-60, head shots collected via hexacopter)</p> <p>Activity 1.4.4 Satellite tracking of up to 10 whales (PP Zerbin and Andriolo)</p> <p>Activity 1.4.5 Blubber samples collected from 10-20 whales (PP Carroll)</p> <p>Activity 1.4.6 Photogrammetry measurements taken by hexacopter from 10-20 whales</p> <p>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.</p> <p>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.</p> <p>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</p> <p>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.</p> <p>Activity 1.7.1 Compile acoustic and sightings data from cruise years 1 and 2 (PP Leaper and PL Jackson)</p> <p>Activity 1.7.2 Compile oceanographic data over two years of surveys to put sightings and satellite tracks in oceanic context (Trathan at BAS)</p> <p>Activity 1.7.3 Construct right whale habitat models (PP Zerbin)</p>			

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

Annex 3 Supplementary material