Darwin Initiative – Final Report

*(To be completed with reference to the Reporting Guidance Notes for Project Leaders (http://darwin.defra.gov.uk/resources/reporting/) - it is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)*

Darwin project information

Project Reference	18-019
Project Title	Mapping benthic biodiversity of the South Georgia continental shelf and slope
Host country(ies)	South Georgia, Falkland Islands and UK
UK Contract Holder Institution	British Antarctic Survey
Other Partner Institution(s)	Shallow Marine Surveys Group
Host Country Partner Institution(s)	Government of South Georgia and South Sandwich Islands
Darwin Grant Value	£218,560
Start/End dates of Project	01 Apr 2010/ 30 Jun 2012
Project Leader Name	David K A Barnes
Project Website	http://www.antarctica.ac.uk/sgmarbase
Report Author(s) and date	Oliver Hogg, David Barnes, Martin Collins, Paul Brickle, Paul Brewin

1 Project Background

The project was designed to establish baseline data on the macro- and mega-benthic biodiversity of the continental shelf and slope around the archipelago of South Georgia (Atlantic sector of the Southern Ocean, see arrow in Fig 1). At ~54°S,37°W South Georgia forms part of the Scotia Arc mountain chain, and is a large, isolated area of continental shelf, 300 km south of the Polar Front (PF).

The project links expertise in the UK and Falkland Islands with those in the Government of South Georgia and South Sandwich Islands (GSGSSI). The work aims to identify key (endemic) species and biodiversity hotspots and utilise data to formulate management strategies for the conservation of biodiversity in the South Georgia Maritime Zone. The proposal will establish the status of benthic biodiversity of the continental shelf and slope waters around the island of South Georgia, make this data universally available and to use it to establish current threats, future loss and conservation strategy. The funding would be to take original samples (from shallows to deep sea), to identify existing collections, to catalogue and identify all species and to map these into a fully spatially referenced database. South Georgia's biodiversity is a key component of that for UK overseas territories due to the island's great age and isolation. Benthos probably constitutes about two thirds of all of species which occur at South Georgia and a much greater proportion of its endemics. This project would fulfil a key role of the Darwin Initiative in mapping biodiversity in an area which is suspected to be highly diverse, but very poorly studied and uniquely threatened by climate change (seas around South Georgia are amongst the fastest warming on the planet).

2 Project support to the Convention on Biological Diversity (CBD)

The work of this project was central to the objectives of the CBD, particularly articles 7 (identification and monitoring) and 8 (In-situ conservation).

Our first paper (Supplement 1) assessed the importance of implementing the CBD at South Georgia. Through this we argued that ecosystem vulnerability is likely to be most acute where hotspots of species endemism, range limits and physiological sensitivity overlap with areas of most rapid physical change. South Georgia is identified as one such vulnerable region, but with its baseline biodiversity largely un-quantified loss would be difficult to measure, let alone reduce. Through a process of data collation, databasing, mapping and analysis, our second manuscript (supplement 2) presented the first georefernced repository of South Georgia's marine biodiversity. In a first for Southern polar waters, this information was then fully integrated with seabed topography and physical oceanography.

This high quality dataset of South Georgia's benthic macro-fauna has now been provided to the host region, South Georgia, the Falkland Islands and the GSGSSI, filling a gap in what was their weakest area of biological data. The results should enable them to meet CBD requirements in establishment of biodiversity baselines and associated planning on how to minimise future loss. The work will contribute significantly to the understanding and long-term management of the South Georgia marine environment. This has proved to be particularly important and timely as the GSGSSI has recently reviewed our data during its implementation of a marine protected area (MPA) covering over 1 million Km^2 of the South Georgia and South Sandwich Islands Maritime zone (one of the largest anywhere in the world). Furthermore data from this Darwin Grant was also central to discussions at a follow-up GSGSSI workshop hosted by BAS Cambridge to consider the need for further spatial and temporal protection within the MPA.

Ultimately this project has enabled the region to better meet CBD criteria. This is also a key region of the planet for both migratory species (e.g. feeding and breeding grounds for many megafauna, such as seals) but also for endangered species. As such the information produced by this report is also highly relevant to the agreements of CITES and CMS but are not discussed further as were not the main aim of the current project.

3 Project Partnerships

Project partnerships: Throughout the project, collaboration between the British Antarctic Survey (BAS, the UK lead institution), the GSGSSI (host country partner) and Shallow Marine Surveys Group (SMSG) of the Falkland Islands has proved a very successful partnership. Over the past two years effective communication and co-operation between lead, host and partner organisations has remained fundamental to the successful delivery of project outcomes. The effectiveness of these relationships is reflected in the successful planning and undertaking of two highly productive research cruise to South Georgia, and the analysis, publication and communication of project findings.

The management structure of the project has remained unchanged throughout. This operated with David Barnes responsible for overall finance and the BAS lead components, including data capture, publication, cruise planning, preparation and undertaking of RRS James Clarke Ross fieldwork. Oliver Hogg (line managed by David Barnes at BAS) has undertaken most of the literature searching, data input, analysis and was involved in cruise participation and planning. Mark Belchier (BAS) has provided contextual advice (e.g. on regional fisheries) and strengthened liaison between host, UK lead and Falkland Island partner. Paul Brickle has driven the SMSG-lead components of the project (such as the

Pharos SCUBA-based scientific cruise). Paul Brewin (line managed by Paul Brickle) has undertaken fieldwork and data analysis for the *MV Pharos SG* SCUBA-based work and participated in the James Clark Ross (JCR) scientific cruise. Martin Collins (GSGSSI) has been fully informed and provided feedback on every component of the work. Relationships were mainly managed via e-mail, though we have also phoned when closer communication is needed. Large file sharing of data and photos for outreach and presentation purposes has taken place effectively though file sharing FTP sites. In addition Martin Collins has travelled to UK several times over the course of the project for consultations at BAS. Paul Brickle has likewise travelled to the UK for meetings with BAS partners whilst also accompanying other members of SMSG to South Georgia for fieldwork. Paul Brewin and Oliver Hogg have both worked co-operatively during research in South Georgia waters, with Paul also travelling to the UK to present along with David and Oliver at an international conference.

The collaborative partnership between BAS, GSGSSI and SMSG has strengthened throughout the project. This is reflected in further collaborative work planned during 2012/13 in which BAS and SMSG will work together on similar biodiversity assessments at the British overseas territories of Ascension Island and Tristan da Cunha. Furthermore, in an attempt to further maximise value from the South Georgia dataset BAS and GSGSSI will collaborate later this year to incorporate fisheries data into the analysis.

In addition to the three project partners, science cruise JR262 involved the combined expertise of a truly global science team. Experts from the USA (Auburn University), Germany (Alfred Wegner Institute; Ruhr-Universität Bochum) and Norway (University Centre in Svalbard) all collaborated to ensure a productive and successful research trip.

Additional partnerships, such as with the Joint Nature Conservation Committee, Natural History Museum, London; Zoological Society London; Hamburg University, Germany; the international Census of Antarctic Marine Life (CAML) programme, South Georgia Heritage Trust and other minor collaborations in Northern Ireland (UK), Argentina, Chile, Uruguay, Brazil and the US have all supported the project in terms of identifications and contextual information about species, communities and assemblages. There has also been considerable work in kind by non-project staff in BAS, namely Peter Enderlein, Huw Griffiths, Peter Fretwell and Chester Sands. Thus the UK lead institution has increased its knowledge, understanding and communication to be a more effective project partner.

Other Collaboration: Over the last 2 years the project has collaborated with other projects in the region, notably a PhD on information potential from fisheries vessels (e.g. bycatch) and databasing work in BAS but also bipolar hub work funded by (CAML) and an Overseas Territories Environment Programme hosted at BAS. The common goal of these various projects is increasing information resolution and accessibility with a view to supporting biodiversity conservation.

4 Project Achievements

This project presents a baseline geo-referenced database of South Georgia marine biodiversity. Data was collated through literature review, checked taxonomically, and mapped along with physical oceanographic and topographic features onto the South Georgia shelf. Currently standing at 24, 000 records and spanning ~1,800 species, it is the largest dataset of its kind anywhere in the Southern Ocean with fully geo-referenced samples allowing biodiversity to be measured over spatial and temporal scales. This is of key importance as a tool for quantifying the effects of a changing physical environment, and effectively monitoring biogeographical change at a site that is both very rich in biodiversity and potentially harbouring rare, range-edge and endemic species.

This massive data resource has been made open access for not only the project partners but also to any interested party. This will help ensure that the value/legacy of the work conducted during this DI grant will continue to pay dividends well beyond the two-year term of the project. Already this has seen a team of Antarctic scientists use the database in conjunction with data from the Antarctic Peninsula region in an attempt to investigate how marine life at South Georgia might respond to warming oceans. It is

anticipated that this will be the first of many secondary outputs arising from the foundations laid by this DI project.

The major analytical output from the project came in the form of three scientific papers. The first paper published in Antarctic Science detailed the direction and potential for the project arguing the need to implement the CBD at South Georgia. This was followed by a publication in PLoSONE, which included comprehensive biogeoraphical analysis of the South Georgia shelf, fully utilising the South Georgia dataset to assess spatial variability in species distributions, identified biodiversity 'hotspots' and 'coldspots'. It also included analysis on the prevalence of endemic and geographical range edge species at South Georgia. It was the analysis conducted for this paper that allowed us to maximise output from scientific cruise JR262 to South Georgia in Nov 2011 by enabling us to effectively target species rich or sampling poor regions. The third paper is currently undergoing final corrections before submission. This paper focuses on the importance of South Georgia as a hotspot for marine endemic species, and attempts to understand the physical and biological processes occurring at South Georgia that might drive such biogeographical patterns. A fourth paper (accepted subject to revision) provides another example of high levels of endemism, this time in the sponges, in South Georgia's shallow subtidal. Numerous papers are envisioned as taxonomic specialists complete the analyses of 51 new records and new species to science currently identified among the shallow subtidal flora and fauna. Still in progress is the analysis of over 280 benthic images, which will provide the first quantitative study of species and habitat distribution in the shallow subtidal across 15 sites along South Georgia's north coast.

Beyond the project completion, the work presented will aid in the management strategy for conservation of the South Georgia shelf. In the short to medium term this will be in the form of targeted conservation of regions of interest, be it areas of high biodiversity or endemism, globally rare or endangered species. Over a longer time scale the data can be used as a biodiversity baseline crucial in order to assess changes in biodiversity or biogeography.

The data presented thus far through this project offers us the best assessment yet of South Georgia's marine biodiversity. Arising from two fantastically productive DI research trips however are thousands of benthic samples that over the coming years have the potential to set South Georgia aside as a truly remarkable biogeographic study. It will be through the analysis of these new datasets that we can start to more effectively make assessments outlined in the CBD and begin to answer more comprehensively than ever complex questions such as the effects of changing physical environments on marine biodiversity and consequently the most effective conservation and remedial efforts for the region.

4.1 Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

Is there evidence that the project outcomes have contributed to improve biodiversity conservation in the host country? Yes much of the information and team members have been heavily influential in the number, size and siting of proposed no-take zones within the largest Marine Protected Area in the World. Biodiversity indicators will be monitored to measure impact but it is too early for this stage right now.

4.2 Outcomes: achievement of the project purpose and outcomes

The project has achieved its purpose above and beyond what was expected at the time of writing the initial proposal. The three main project partners worked well and harmoniously together. The gathering, collation and analysis of biodiversity records for the region was completed on time and written up and published to considerable media attention. This information was used to plan an effective cruise as envisaged. The research cruises were little affected by equipment reliability, crew illness or bad weather and we sampled using all planned gears in many of our ambitious shopping list of target sites. We are still in the process of disseminating this information, but overall everything has worked better than we even hoped for.

4.3 Outputs (and activities)

Construction of robust, long term links between the three project partners.

Proposals for specific higher designation zones within the Marine Protected Area.

An open access database with 24,000 geo-referenced historical records of species presence, spanning 129 years of polar exploration. These records totalled ~1800 species from 22 phyla.

A huge specimen collection spread across global taxonomists which will ultimately be lodged in the Natural History Museum, London.

Scientific papers (2 published, 2 in press and 2 in preparation.

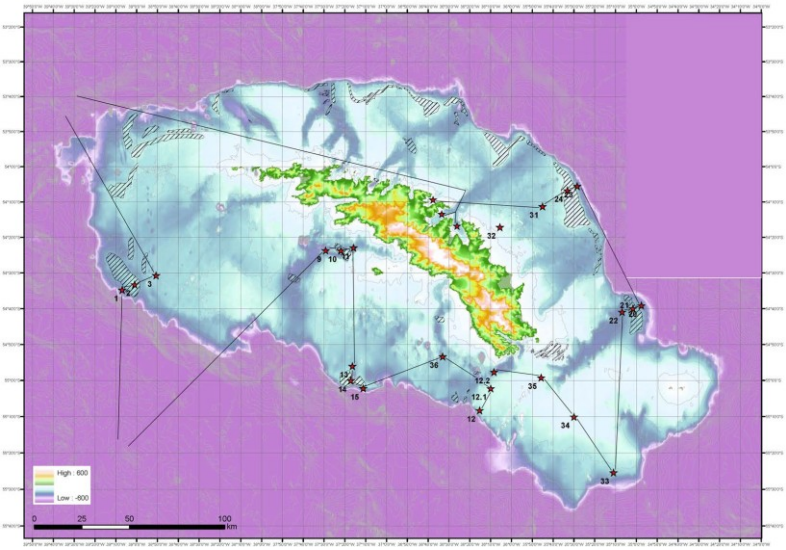
Successful science cruises including training for 3 students.

Design of a new and unique underwater camera system to quantify abundance, density and carbon standing stock of benthos.

Strong coverage across multi-media (newspapers, interviews, talks and blogs for schools) and a project website.

Marine biodiversity stamps – using painted images from specimens collected by fieldwork partly funded by the Darwin Initiative.

Figures; stamps based on paintings of specimens collected by a science cruise which was part Darwin funded (below left). Route and sample sites (red star) of science cruise JR262 by the RRS James Clarke Ross around the continental shelf of South Georgia in November 2011 (below right, see Annex 1 for web link))



4.4 Project standard measures and publications

6A. Oliver Hogg received training to use ArcMap GIS software, deck working on vessels at sea (PST certificate), first aid training for Antarctic fieldwork and training in the use of boat based sampling equipment (Agassiz trawling and Epibenthic sledge deployment/recovery). Paul Brewin received training to use ArcMap GIS and PST Certificate.

7. Two types of training materials have been produced, the first of which has been primary publications (One in Antarctic Science the other in PLoS One). The second has been a massively upgraded source of accessible geo-referenced marine biodiversity information – from 3000 records prior to Apr 2010 to 23000 checked records in Apr 2011.

8. Paul Brickle and Paul Brewin along with other members of SMSG undertook SCUBA sampling at South Georgia during Nov/Dec 2010. Oliver Hogg and Paul Brewin each spent three weeks on a collaborative science cruise organised by the GSGSSI in Jan/Feb 2011. David Barnes, Oliver Hogg, Paul Brewin along with a number of other collaborators (as detailed in section 2) spent a month on a BAS led research cruise to South Georgia in Oct/Nov 2011.

9. The information produced by this Darwin project is currently still in the process of aiding environment management plans to be produced for the Government of South Georgia but currently information on benthos is not advanced enough to produce such plans at the resolution of 'species' or 'habitat'.

10 A field guide to the marine fauna, to which this Darwin Project has contributed images and information, is currently under production. More importantly than this though is the work being undertaken by specialists on the specimens collected by the Darwin science cruises which will give a robust record of what lives where. Many rare species here require specialist identification and the first step on some (undescribed species) will be publishing species descriptions and then evaluating how important each species is to South Georgia's environment.

11A. Two papers published in peer-reviewed journals, one in Antarctic Science and one in PLoSONE (a high impact factor open access journal). A further paper is in internal review with the intention to submit for publication in the very near future.

12A. The entire dataset totalling ~24,000 records has been handed over to all project partners including the host country.

13B. Species reference collections are split between BAS, SMSG and taxonomic experts in a process that may take several years to complete entirely but will provide a large collection of speces/genetic information.

14A. We (BAS) have hosted two workshops which have included presentation and use of Darwin data towards the goals of conservation of marine biodiversity and living resources in the South Georgia region.

14B. In year 1 Oliver Hogg reported the project concept, planning and initial findings to the European Marine Biology Symposium in August 2010 and gave further results at the South Georgia 'Science-industry' meeting in Sept 2010. This was followed in 2011 by presentation to the World Conference on Marine Biodiversity and a final assessment of Darwin project findings at the GSGSSI Marine protected areas workshop in April 2012. Paul Brewin also led an oral presentations at the World Conference on Marine Biodiversity focussing on SMSG's involvement in the Darwin Initiative project.

15B. An article was submitted to DIVE magazine article (by NMNI) and locally the project has been covered by both Penguin News and the GSGSSI newsletter (online). In the Falkland Islands an update of the SMSG webpage details project work and progress. There is currently a manuscript in preparation to submit to an international journal on SG biodiversity and biological conservation with some of the preliminary conclusions of the project's work.

15C. A press release was published to coincide with the publication of the project results in the Journal PLoSONE. The resulting media attention included a radio interview on BBC World Service: Science in Action featuring lead author Oliver Hogg, a double page spread in the Independent newspaper, and an

article in Scientific American. In total at least 20 news stories resulted from this proactive press release across radio, print and online. In newspaper print alone this represented a circulation of ~ 218,000.

22. Over 4300 intertidal and subtidal samples were collected on the Pharos cruise, To date processing of the intertidal samples progressing as planned, with approximately 1/3 of intertidal samples processed. Over 400 subtidal and intertidal quadrate images have been prepared for quantitative analyses of species and habitat composition. Several hundred benthic samples containing several thousand specimens of species have just arrived in Cambridge that were collected during the Darwin Initiative cruise JR262 are currently being sent to taxonomists across at least 16 countries.

4.5 Technical and Scientific achievements and co-operation

The main technical achievement was the design and build of a new and unique underwater camera system to quantify abundance, density and carbon standing stock of benthos. The components were bought but assembled to our original design; the winch to deploy them was borrowed and the software to run the camera was entirely created in-house.

Most of the Scientific achievements are likely to occur over the next decade from the samples that have been collected, but just collecting in the areas we did (to such a tight scientific sampling design) could be viewed as a considerable achievement.

A new highly effective co-operation was built not only between the three main project partners but also between other international institutes and experts – some of which have already now begun work together on other projects.

4.6 Capacity building

There are several aspects to the capacity building this project has undertaken. Two BAS early career staff; Oliver Hogg & Ashley Cordingley were given experience and training to be on the first benthic research cruise. Two staff from our project partner, SMSG, also had both training and their first opportunity to work on a BAS ship and also in deeper, offshore situations. Finally PhD students were trained and participated from US, German and Norwegian universities. Thus capacity was aided in certificated training prior to the science cruise, on-the-job training of biodiversity sampling during the research cruise and team-working and networking skills were developed during and post-cruise during workshops.

4.7 Sustainability and Legacy

The main legacy will be the database, the quality of data within it and the data which will ultimately be deposited following the identification of the specimens collected. The cruise itself, the first Polar Darwin Initiative, was the biggest single biodiversity collection ever at South Georgia and thus will remain one the key inputs into establishing the nature and distribution of biodiversity there. Once the international community has made significant progress there an additional legacy will be the science underpinning that this data then gives to setting up the biodiversity value, threats and protection plan.

5 Lessons learned, dissemination and communication

One of the key lessons learned was always test novel equipment in sea trials before taking them on the primary expedition – we are very glad that we did. Another major plan is that it pays to be both ambitious and pragmatic; we planned far more field work that we could possibly achieve within the time we had. This allowed greater choice and flexibility with weather, fitting in with other work programmes for the vessel and in maximising efficiency when there were temporary mechanical problems.

Dissemination of information has proved very effective and has occurred in multiple countries from primary school through local to national news and science conferences to previous journals. Unusually quick for such information, it has even started to impact policy in terms of decisions on Marine Protected Area zoning.

5.1 Darwin identity

The Darwin Initiative funded work represented a massive ramp-up in preliminary work that had started to assess South Georgia's biodiversity. It was recognised as a distinct project with clear identity and was prominently acknowledged in every output arising from the project. For published manuscripts this consisted of reference to the DI explicitly in the text and a final acknowledgment section at the end of each paper. At all talks given, including presentations at two international conferences, the DI and DEFRA logos featured prominently. Reports arising from the project such as South Georgia cruise report also bore both DI and DEFRA logos. The project webpage features DI and DEFRA logos prominently at the top of the webpage. In addition the webpage also features an active link that the user can click on to transfer to the DI website. The projects press release following publication in PLoSONE acknowledged the DI as the organisation funding the research and provided a paragraph of information outlining DI's background and mission statement.

6 Monitoring and evaluation

Throughout the project the design remained unchanged.

Please explain your activities in support for the logframe based monitoring and evaluation (M&E) system of DI projects and give an outline of results. For example, what baseline information (if any) was collected (eg scientific, social, economic), and were the logframe indicators developed during project design at project outputs, purpose (outcome indicators), and final (impact indicators) goal levels) effective and useful?

In terms of evaluation of the work presented, it was, and remains to be the intention to make all data, findings and analysis freely available. In doing so all publications underwent both internal (BAS, GSGSSI, SMSG) and external (peer review) assessment. Furthermore the projects findings have been presented to several conferences, workshops and seminars which offered an open forum for discussion and evaluation. Ultimately by opening up all data and analysis to the wider scientific community it is presented to the best forum for effective evaluation. Since publication in PLoS ONE for example our paper has been read by 1,400 readers and downloaded by 340 individuals.

Looking back over the life of the project, was the M&E system practical and helpful to provide useful feedback to partners and stakeholders?

6.1 Actions taken in response to annual report reviews

We were given permission to combine our annual and final reports so have not yet had reviews to act on.

7 Finance and administration

7.1 Project expenditure

Total project expenditure Year 1 was £

Total project expenditure Year 2 was £

Total project expenditure Year 3 was £

Of these total costs expenditure of Darwin funding was **£** (as detailed in our first annual finance report), in the year 2010/2011. In the following year it was **£** in the year 2011/2012 (as detailed in our second annual finance report) and this year it was **£** projected. Total expenditure was thus **£** – just over **£**6k less than expected.

7.2 Additional funds or in-kind contributions secured

No additional funds secured but work in kind on the samples collected will add up to thousands GBP in this year alone. Specialist taxonomists' time, and also SMSG divers – 6 volunteers on Pharos cruise for 10 days + pre and post trip planning and logistics and smsg equipment.

7.3 Value of DI funding

Annex 1 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements April 2010 - March 2012	Actions required/planned for next period
Goal: *To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve* *The conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources* *Determine the benthic biodiversity of the South Georgia shelf and slope.*		(report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity e.g. steps towards sustainable use or equitable sharing of costs or benefits)	(do not fill not applicable)
Purpose To establish baseline data on the macro- and mega-benthic biodiversity of the South Georgia shelf and slope, identify key (endemic) species and biodiversity hotspots and utilise data to formulate management strategies for the conservation of biodiversity in the South Georgia Maritime Zone.	The project will provide the first detailed study of benthic biodiversity on the South Georgia shelf and slope	Over 24,000 records were collated, checked taxonomically and added to database. The biogeography of the South Georgia shelf was mapped onto topographic and physical oceanographic data. Database and mapping was used to (i) identify data poor/ biodiversity rich regions to effectively plan a research trip to South Georgia, and (ii) analysis the state of knowledge of marine biodiversity at South Georgia to produce the first baseline measure of biodiversity for the region. Two strong publications in International journals, with a further manuscript in the final stages of completion. Three presentations to major international conferences reporting project findings, in addition to a number of smaller international South Georgia workshops, seminars and meetings. Two research trips planned and undertaken involving sampling from	Samples collected during first research trip (SMSG - Nov 2010) are being processed in Falkland Islands with many samples in the hands of specialist taxonomists around the globe. Samples collected during second research trip (BAS - Nov 2011) have recently arrived back in the UK. Processing and distribution to taxonomists has already begun and will continue over the coming months. Georeferenced data from both trips, once processed will be integrated into the most comprehensive measure of baseline biodiversity anywhere in the Southern Ocean. In line with the goals of the project, all this data will be made available on a freely accessible open-access platform.

		shoreline to shelf edge in press. Total samples collected well in excess of 10,000.	
Output 1. Baseline georeferenced database of South Georgia benthos, hosted by BAS/GSHSSI, openly available to researchers with the option of supplementation by samples collected during Darwin funded cruises and also any future work.	Data from variety of sources incorporated into Arc GIS system for analysis and available externally for viewing on the SGGIS and SCARMarBIN. Provide a baseline for measuring change in biodiversity and species characteristics in response to impacts, including climate change.	All data has been submitted to the international database SCARMarBIN and will soon be able to be visualised both on SGGIS (www.sggis.gov.gs).and SCARMarBIN but is in the process of being checked and synchronised. Specimens have been sent to international taxonomic specialists and database queried to provide first baseline of benthic biodiversity (PLoS One paper), which in turn generated 'coldspots' of sample effort which were targeted by the research cruise JR262.	
Activity 1.1 Literature search for georeferenced data		Over 24,000 records collated, checked taxonomically, entered into Databases and mapped onto South Georgia shelf. Much of the data from both cruises has been sent to taxonomists for identification will be carried out in the next period – and website will go live.	
Activity 1.2. Checking georeferenced species records		Over 24,000 records representing over ~1800 species have been checked against the World Record of Marine Species (WORMS) for validity.	
Activity 1.3 Input of georeferenced data into the South Georgia GIS		All records have been added to database (www.sggis.gov.gs).and www.SCARMarBIN.be and can be visualised through project website (http://www.antarctica.ac.uk/sgmarbase). New records will be added in as they become available.	
Output 2. Collation and verification of existing sample collections (BAS cruises; GSGSSI trawl surveys).	BAS/GSGSSI collections identified and catalogued. Verified material passed to the NHM, London. Problematic material/new species sent to taxonomic experts.	Cataloguing of BAS specimens and previously catalogued collections in NHM have been located. New collections are now with taxonomists. This indicator is good but will be hard to gage within the project lifespan (ie it is longer term). We have sent genetic samples for CO1 (Census of Marine Life bar coding project) analysis and are awaiting results from Guelf University.	
Activity 2.1 Identification of samples		Some samples identified and new ones collected by SMSG survey. Most samples identified are already with taxonomists or await coarse level sorting.	
Activity 2.2. Search for taxonomists		Taxonomists identified for most taxa and happy to receive material though processing time cannot be guaranteed.	
Activity 2.3 Sending samples away		Samples being processed by taxonomists and identified material sent for barcoding – this will continue until project end. For example within the last few weeks our specialist in Uruguay reported that this has just yielded a new flatworm species for South Georgia.	
Output 3. Identification of key regions (hotspots) and of key species	Investigate the biodiversity hotspots on the SG shelf/slope and inshore areas.	2 Scientific papers published on the biodiversity of South Georgia outreach (talks, posters) to fishing industry (through annual GSGSSI meetings),	

(endemics; species at range edge).		tourists (cruise ships, museum), and other stakeholders (e.g. FCO, SGHT).
Activity 3.1 Using database		The database was used (i) for the first paper detailing the ideas and potential of the project, (ii) was fully utilised to map the biogeography of South Georgia for the PLoS ONE paper analyses proving extremely powerful and useful, and (iii) to identify regions of the shelf to target for cruise sampling to maximise output (i.e. by targeting species rich and/or sampling poor sites.
Activities 3.2 and 3.3 Identifying hotspots and coldspots respectively		Sampling and biodiversity hotspots and coldspots are identified in detail in our PLoS ONE paper. Hotspots are all to the north of the island, mainly around Cumberland East Bay. Cold spots are mainly across the southern shelf particularly at the east and west ends.
Activity 3.4 Prioritising areas		Highest priority areas were planned for sample sites for JR 262 cruise, as outlined in 3.1 (cruise report forms supplement 3)
Activity 3.5 Scientific papers		First two scientific papers accepted and published in 'Antarctic Science' and 'PLoS ONE'. A third paper to follow before end of July 2012.
Output 4. Long-term management strategy for conservation of South Georgia biodiversity. Advice for areas and methods for monitoring and protection of key locations, habitats and species.	Provision of rapid assessments of geographic status on all suspected endemics, edge or range and regionally rare species.	Data presented has two clear conservation benefits. (i) Facilitating target conservation strategies through the identification of biodiversity hotspots and regions which species of conservation interest (e.g. endemic, globally rare, endangered). (ii) Providing a biodiversity baseline by which changes in biodiversity/ biogeography can be assessed and used as a framework for future strategies. GSGSSI has recently announced the establishment of one of the worlds largest marine protected areas (SG MPA Press Release), along with a management plan for the region which draws directly from research carried out through this project (SG MPA Management Plan). Furthermore following a recent workshop in Cambridge new consideration is been given as to areas around South Georgia could be total 'no take' zones. This Darwin project was well represented at the meeting with four presentations.

Annex 2 Project's final logframe, including criteria and indicators

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Goal: Effective contribution in support of the implementation of the objectives of the Convention on Biological Diversity (CBD), the Convention on Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species (CMS), as well as related targets set by countries rich in biodiversity but constrained in resources.			
Project Sub-Goal: Determine the benthic biodiversity of the South Georgia shelf and slope.	Accessible and searchable data on the abundance and distribution of hundreds of benthic species around South Georgia.	Visualisation of data in databases and quality control by all species presence being linked to original report of data.	
Purpose: To establish baseline data on the macro- and mega-benthic biodiversity of the South Georgia shelf and slope, identify key (endemic) species and biodiversity hotspots and utilise data to formulate management strategies for the conservation of biodiversity in the South Georgia Maritime Zone.	The project will provide the first detailed study of benthic biodiversity on the South Georgia shelf and slope	South Georgia Govt will legislate to protect areas of high biodiversity or hotspots of important endemics.	
Outputs 1. Baseline georeferenced database of South Georgia benthos hosted by BAS/GSHSSI, available to researchers and can be database supplemented by future work.	Data from variety of sources incorporated into Arc GIS system for analysis and available externally for viewing on the SGGIS. Provide a baseline for measuring change in biodiversity and species characteristics in response to impacts, including climate change.	(a) Data visualised on SGGIS (see: www.sggis.gov.gs).and SCARMarBIN (b) Direct provision of data to a variety of sources from secondary schools to international taxonomic specialists and climate change modellers	**None envisaged**
2. Collation and verification of existing sample collections (BAS cruises; GSGSSI trawl surveys).	BAS/GSGSSI collections identified and catalogued. Verified material passed to the NHM, London. Problematic material/new species sent to	• Catalogued specimens donated to NHM and available to taxonomists and as reference material In progress	Willingness of taxonomic experts to engage. Expertise in BAS on mollusca, bryozoa, Links already to NHM (polychaetes), NUI Galway (octopods). ZSL (corals), University of Glasgow

	taxonomic experts. Material now being identified, sent to experts or already with experts.	• Provision of genetic samples for CO1 (Census of Marine Life bar coding project) and other phylogenetic analysis. In progress	(brachiopods), Hamburg University (Acari, Isopods, tanaids), University of Seville (hydroids), Université de Bourgogne (echinoids), University of Montevideo (flatworms), Royal Belgian Institute of Natural Sciences (Amphipods).
3. Identification of key regions (hotspots) and of key species (endemics; species at range edge).	Investigate the biodiversity hotspots on the SG shelf/slope and inshore areas. Cruise JR262 has done this well	(a) Scientific paper(s) on the biodiversity of South Georgia ✓ (b) outreach (talks, posters) to fishing industry (through annual GSGSSI meetings), tourists (cruise ships, museum), and other stakeholders (e.g. FCO, SGHT). ✓	Data is of sufficient quality and distribution to meaningfully assign hotspots of richness or of endemics (rather than simply sample representing effort)
4. Long-term management strategy for conservation of South Georgia biodiversity. Advice for areas and methods for monitoring and protection of key locations, habitats and species.	Provision of rapid assessments of geographic status on all suspected endemics, edge or range and regionally rare species. We now have the specimens which should allow us to do this.	(a) Incorporation into South Georgia Management Plan In progress (b) Formulation of protected areas in SGMZ to protect key areas/species. Will happen but requires species identifications	New genetic studies support the validity of endemics and distributions. Many species are currently being analysed at Guelph University, Canada.
5. Development of expertise in identifying benthos, thus aiding future assessment of wider impacts of fisheries and recognition of alien species arrival or spread.	Training skills transfer. Within the team in identification of bryozoans and molluscs (from BAS), in fish (from GSGSSI), in shallows benthos (from SMSG) and from expert taxonomists in other taxa. Important for recognition of future change or alien arrival. Also training in sample design and strategy, IT approaches to georeferenced data visualisation and use.	(a) Identification workshop held in Stanley, FI. Some identity work done on JCR, broader aspects discussed at UK workshop. (b) Publication (web-based) of a guide to South Georgia benthos This will gradually be constructed as identifications come in from specialists	Identification error rate is small. So far is proving true

Activities (details in workplan)

1.1 Literature search Completed in 2011

1.2 Verification of records Completed in 2011

1.3 Data input Completed in 2011

2.1 Identification of samples Completed for previous collected, in progress for material we collected (on JR262)

2.2 Search for taxonomists Completed in 2011

2.3 Sending samples away In progress
3.1 Using database Used for production of two manuscripts and to advise SG government
3.2 Identifying hotspots Used for workshop
3.3 Identifying coldspots Used for workshop
3.4 Prioritising areas Used for workshop
3.5 First scientific paper Completed in 2011
4.1 deep cruise planning Completed in 2011

4.2 shallow cruise planning Completed in 2011

4.3 scientific cruises Completed in 2011

4.4 Observer training In progress through 2011/12
4.5 Sorting of samples In progress
5.1 Data analysis Some completed, more in progress
5.2 Writing papers 4 written, 1 in progress probably 3 more to be written.
5.3 Conferences 3 attended during project
5.4 Press release Various undertaken across local and international scales.
6.1 Biodiversity data goes live In progress

6.2 Lesson planning In progress for schools but has been used for undergraduates
6.3 Biodiversity guide In progress
6.4 Lecture preparation Completed in 2012
6.5 Liaison with stakeholders In workshops

Monitoring activities:

Indicator 1 Provision of (literature) data in the South Georgia GIS database ✓

Indicator 2 Provision of specimens in key institutions – *they have been collected and are being sent to taxonomists.*

Indicator 3 Hotspot & coldspot information provided to stakeholders, submission of scientific paper ✓

Indicator 4 Scientific cruises and specimens from these ✓

Indicator 5 Provision of 'route map' for biodiversity conservation and protected area planning ✓ *but this will continue as a long term dynamic plan as information keeps coming in from the specimens collected.*

Indicator 6 Workshop ✓, biodiversity guide – *in progress (+ papers on sponges & brittlestars)*, lecture for tourist ships – *in progress*

Annex 3 Project contribution to Articles under the CBD

Project Contribution to Articles under the Convention on Biological Diversity

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use	5	Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring	80	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	5	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity		Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training		Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	2.5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources	5	Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.

Article No./Title	Project %	Article Description
16. Access to and Transfer of Technology		Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information	2.5	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution		Smaller contributions (eg of 5%) or less should be summed and included here.
Total %	100%	Check % = total 100

Annex 4 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	4 = 2 in 2010/11 + 2 in 2011/12 as planned (Oliver Hogg, Jana Doemel, Ash Cordingley, Vlad Laptikhovsky)
6b	Number of training weeks not leading to formal qualification	4 weeks each for 4 people in 6a
7	Number of types of training materials produced for use by host country(s)	4 (guides to identification; SCUBA survey designs to monitor biodiversity status, designs of panels to monitor alien species)
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	22 (20 planned) = 6 in 2010/11 + 16 in 2011/2012
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	Environment management plan in progress. Species/habitat not possible until specimen identifications processed.
10	Number of formal documents produced to assist work related to species identification, classification and recording.	3 (2 new science papers on identity of sponges & brittlestars) – including 15 new species described.

Code	Description	Totals (plus additional detail as required)
11a	Number of papers published or accepted for publication in peer reviewed journals	3 (3 published, 1 submitted, 1 awaiting submission)
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	1
13a	Number of species reference collections established and handed over to host country(s)	None yet because they are in the process of being identified.
13b	Number of species reference collections enhanced and handed over to host country(s)	1
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	2 (South Georgia workshops at BAS).
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	6
15a	Number of national press releases or publicity articles in host country(s)	Articles written for SG heritage trust news and South Georgia Association news
15b	Number of local press releases or publicity articles in host country(s)	2 (in Falkland Islands)
15c	Number of national press releases or publicity articles in UK	3 (1 for PLoS One paper, 1 for stamps and 1 for SG marine protected areas)
15d	Number of local press releases or publicity articles in UK	0
16a	Number of issues of newsletters produced in the host country(s)	2 in Penguin News
16b	Estimated circulation of each newsletter in the host country(s)	1000 (nearly entire population!)
18a	Number of national TV programmes/features in host country(s)	1
18b	Number of national TV programme/features in the UK	1 (SG marine protected areas coverage)
18d	Number of local TV programme features in the UK	0
19a	Number of national radio interviews/features in host country(s)	2 (undertaken by partner organisation SMSG)
19d	Number of local radio interviews/features in the UK	0
Physical Measures		

Code	Description	Totals (plus additional detail as required)
20	Estimated value (£s) of physical assets handed over to host country(s)	25k camera but still in the process of updating it to be used by host country and BAS in a new Darwin project.
22	Number of permanent field plots established	26 (sites sampled on cruise JR262)
23	Value of additional resources raised for project	0 (but more than half the project paid for in matched funding).

Annex 5 Publications

Type * (eg journals, manual, CDs)	Detail (title, author, year)	Publishers (name, city)	Available from (eg contact address, website)	Cost £
Journal	Highly diverse, poorly studied and uniquely threatened by climate change: An assessment of marine biodiversity on South Georgia's continental shelf, Hogg O.T. *et al.*, 2011.	PLoSONE	Hogg et al. (2011)	1000
Journal	The need to implement the Convention on Biological Diversity at the high latitude site, South Georgia, Barnes *et al*., 2011.	Antarctic Science	Barnes et al. (2011)	Nil
Journal	Observations of the ophiuroids from the West Antarctic sector of the Southern Ocean. Sands *et al*	Antarctic Science	In press; not yet released	Nil
Journal	Sponge Biodiversity of South Georgia with description of fifteen new species. Goodwin *et al*	Zootaxa	Accepted with revision	Nil
Journal	Large, old and isolated: Does the Southern Ocean Island of South Georgia fir the paradigm of high endemism? Hogg, O.T. & Barnes, D.K.A.	t.b.c.	See Supplement 3 for abstract	t.b.c
Journal	A new species of marine planarian from South Georgia. Volonterio and Brewin	JMBA	In progress	
Report	South Georgia Expedition report,	Online	SMSG Expedition Report	Nil

	Brickle, P and Brewin, P. 2011			
Report	JR262 South Georgia cruise report, Barnes, D.K.A. and Hogg, O.T. et al. 2011	Online	JR262 Cruise Report	Nil
Report	South Georgia Seaweeds, Wells, E., Brewin PE, Brickle, P 2011	Online	http://smsg-falklands.org/images/Reports_Publications/south%20georgia%20seaweed%20report.pdf	Nil
Report	Intertidal Assemblage of South Georgia. Brewin PE, Wells E, Volonterio O, Brickle P. 2011	Online	http://smsg-falklands.org/images/Reports_Publications/sg_intertidal_report_2011.pdf	

Annex 6 Darwin Contacts

Ref No	18-019
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	shelf and slope
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Partner 1	
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Partner 2 (if relevant)	
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