Darwin Plus Main & Strategic: Annual Report

To be completed with reference to the "Project Reporting Information Note" (https://darwinplus.org.uk/resources/information-notes)

It is expected that this report will be a **maximum of 20 pages** in length, excluding annexes)

Submission Deadline: 30th April 2025

Submit to: BCF-Reports@niras.com including your project ref in the subject line

Darwin Plus Project Information

Scheme (Main or Strategic)	Main
Project reference	DPLUS179
Project title	Characterising pelagic biodiversity at South Georgia through novel sampling methods
Territory(ies)	South Georgia and the South Sandwich Islands
Lead Organisation	British Antarctic Survey
Project partner(s)	Government of South Georgia and the South Sandwich Islands (GSGSSI) and Marine Biological Association (MBA)
Darwin Plus grant value	£336,538
Start/end dates of project	1st October 2022 to 31st August 2025
Reporting period (e.g. Apr 2024-Mar 2025) and number (e.g. Annual Report 1, 2)	1 April 2024 to 31 March 2025, Annual Report 3
Project Leader name	Cecilia Liszka
Project website/blog/social media	https://www.bas.ac.uk/project/south-georgia-pelagic-biodiversity/
Report author(s) and date	Cecilia Liszka, Victoria Fowler

1. Project summary

The zooplankton community of South Georgia is a critical component of the Scotia Sea ecosystem, connecting primary producers, supporting globally important populations of higher predators, and sustaining valuable commercial fisheries. Zooplankton and ichthyoplankton are also key bioindicators of environmental change since they are small, have short life-cycles and respond rapidly to environmental changes. Establishing a pelagic biodiversity baseline at South Georgia is crucial to assess the stability of this system and its response to climate-related changes and species invasions. Whilst routine sampling of the plankton is regularly carried out, analysis is currently limited to a small range of taxa such as euphausiids, fish and *Themisto* spp. Detailed monitoring of a wider range of taxa, particularly the extremely abundant copepods, is vital if we are to understand and monitor changes to the ecosystem. However, achieving this through net sampling alone is costly and time-consuming, and it can miss important fractions of the plankton community, for example gelatinous taxa that can be easily damaged in net retrievals, and non-native or invasive taxa, especially when present in small numbers.

Through this project, funded through Darwin Plus, and in partnership with the Government of South Georgia and South Sandwich Islands (GSGSSI) and the Marine Biological Association (MBA) we are addressing this by employing novel image-based and molecular analyses, validated by conventional net sampling. We are analysing historically-collected zooplankton

samples both microscopically and optically to construct a baseline, and collecting reference samples to improve our image classification library. In the field, we have concurrently deployed zooplankton nets, a UVP6 optical profiler, Niskin bottles to collect water for molecular analysis, and a CTD to collect contextual environmental data. Data generated by all three zooplankton sampling approaches are being used to develop indices of plankton biodiversity, enabling comparisons of the methods and their applications in understanding and monitoring zooplankton and ichthyoplankton communities.

Results are also being fed into the management of the South Georgia and South Sandwich Islands Marine Protected Area (SGSSI MPA) through their five yearly review process and with reference to their associated Research and Monitoring Plan, to inform future monitoring of the zooplankton and ichthyoplankton community, including under-sampled and invasive taxa, and in relation to holistic ecosystem monitoring.

2. Project stakeholders/partners

British Antarctic Survey (BAS) remains the lead partner on the project and is responsible for engagement with other formal partners and stakeholders. Other formal partners in the project from the beginning are the Government of South Georgia and South Sandwich Islands (GSGSSI) and the Marine Biological Association (MBA). These partnerships were developed due to the roles and expertise of the respective partners, and their shared interest in the value of effective plankton monitoring delivered by the project in terms of conservation, management and methodological developments. Whilst BAS took the lead in project development, all partners were involved in the project design and planning. GSGSSI was key to ensuring that the project plan met the objectives of the conservation and management of the OT, that it can feed into the Research and Monitoring Plan, and that it can be logistically supported. The MBA were key to developing robust methods of analysing and verifying collected data from optical and molecular methods as well as adding to the project through their expertise in zooplankton taxonomy.

As the project has developed, our relationship with the MBA has changed as the key person involved in that relationship left the organisation and started their own consultancy (Plankton IDology), through which they are providing professional plankton consultancy services. As a result, this relationship has not been lost; if anything, it has been strengthened, with additional contributions to the project through provision of independent plankton analysis and image verification expertise. In addition, the relationship with the MBA is still strong, has benefitted from its involvement in this project and will hopefully lead to more fruitful partnerships in the future.

Since project inception, a collaboration with SAERI has been developed, led by Dr Siobhan Vye. Dr Vye is working on a project examining invasive species in locations around the South Atlantic and Southern Ocean, supported by National Geographic funding. This focuses on plankton net samples and eDNA analyses. Our work is complementary rather than overlapping, focusing on different sampling locations and objectives, so we have discussed opportunities to share data, methodologies and insights to the advantage of both projects. We are also hosting Dr Vye at BAS over the coming weeks to facilitate analysis of net and eDNA samples, and are building on this collaboration already with proposals that we hope lead to shared publications.

We have also built a collaboration with researchers at the Heinrich Heine Universitat Dusseldorf (HHU) who are developing machine learning pipelines for rapid plankton image analysis and we are working with them by sharing training data generated through our project for them to develop new models that improve our ability to predict zooplankton image classes from newly collected image data in the future. Progress against this was presented at a recent meeting of the ICES Working Group on Zooplankton Ecology and these slides can be made available upon request.

Overall, these additional collaborations have been incredibly beneficial to the project, complementing its original objectives and providing scope to develop them. The main challenge is the additional time required to develop and maintain these relationships, but this is a small cost in comparison to the benefits gained from the expertise and ideas of our colleagues that will help build on the project in the future.

Formal project partners are kept involved with project progress through emails and meetings, both informal and annual project meetings where progress against the logframe and any relevant issues are discussed. Our next annual project meeting is scheduled for Friday 23rd May 2025. Previous annual project meetings occurred on 17th May 2023 and 5th February 2024.

3. Project progress

3.1 Progress in carrying out project Activities

Within this reporting period a key activity has been the completion of routine monitoring patrols every 4-6 weeks on *Pharos SG* (**Activity 2.1**). The fieldwork began in July 2023 (Y2Q2) with a number of project members participating in this initial sampling campaign. Fieldwork continued with sampling campaigns taking place on a near monthly basis and regular sampling occurring until June 2024 (Y3Q2), completing a full year of sampling efforts. During this fieldwork, the deployment of the optical profiler (UVP6), Niskin bottles and zooplankton nets on the *Pharos SG* was continued and data the collection methodologies were refined (**Activities 3.2, 3.3**). Protocols have been revised accordingly, in line with DPLUS-C01. Working versions of these guides have already been shared with KEP scientists and *Pharos SG* crew, as well as colleagues at SAERI and BAS. Final versions will be made available to all project partners and others as requested at the end of the project. More detailed reporting on the fieldwork, including the training and testing element in in July 2023, and interim progress made towards activity 2.1 from subsequent monthly surveys, have been published on the project website (https://www.bas.ac.uk/project/south-georgia-pelagic-biodiversity/#data).

Taxonomic identification of historical samples through light-microscopy and bench top image analysis (**Activity 2.2**) has been completed. Light microscopy of six historical samples, collected using RMT1 nets in 2006 (selected due to being the most complete year for which historical samples existed) by project partners is complete and data are held by BAS. 71 historical samples (covering 2003 to 2022) have been processed through the bench-top imager (ZooScan) and uploaded onto EcoTaxa, an online image classification platform. Image classification is ongoing due to the large volumes of data collected (~53,000 images).

Verification of the 2006 images is currently ongoing; however, a preliminary analysis of the 2006 RMT1 data has been completed. In general, ZooScan analysis estimated a greater number of objects than light microscopy (Table 1), likely due to differences in classification approaches. Analysis with ZooScan images all objects encountered in a frame, including non-living material, such as detritus and artefacts introduced during scanning whereas, in general, taxonomic analysis through microscopy focuses on specific taxa, for which it can also offer finer taxonomic resolution. To standardise data comparisons, all recorded categories were grouped into 25 classes, 19 of which represent 'living' taxa (e.g., Copepoda, Euphausiacea, Chaetognatha), and these 19 groups are being used for further analyses. When considering only living groups, ZooScan still estimated a higher abundance of organisms than light microscopy (Table 1), reflecting its sensitivity to detecting a broad range of particle sizes and types. Overall, individual densities showed strong seasonal fluctuations, with ZooScan detecting particularly high abundances in November and December, while microscopy recorded peaks in October and December, coinciding with the summer months (Table 1).

Table 1: Monthly estimates of zooplankton abundance (individuals per m^3) around SG, based on light microscopy and ZooScan imaging analysis of RMT1 nets collected during 2006. ZooScan data are presented as total particle counts, including non-living material such as detritus and artefacts, and separately as counts restricted to living organisms only. The "living only" category was produced by grouping categories into 25 groups, of which 19 represented living taxa (e.g., Copepoda, Euphausiacea, Chaetognatha).

Month	Individuals per m^3		
	Microscope	ZooScan	ZooScan (living only)
Jan		12.18	9.75
Feb	7.27		

Mar		97.92	52.96
Apr	8.04		
May		8.70	5.69
Jun	7.43	22.27	14.42
Jul		18.91	14.37
Aug	10.02	20.96	14.69
Sep		67.53	58.37
Oct	153.31		
Nov		306.47	258.15
Dec	182.43		

Species diversity, as measured by Simpson's Index, show consistently low values across the year, indicating a dominance of a few taxa in the zooplankton community (Table 2). Values ranged from 0.004 to 0.373, with the highest diversity recorded by microscopy in February (0.373) and the lowest in October (0.004). ZooScan results generally reflected this low-diversity pattern, although slightly higher diversity estimates were observed in August (0.210). Overall, both methods indicated low evenness and diversity throughout most of the year. Diversity remained consistently higher when assessed via microscopy compared to the ZooScan, suggesting that the latter may underestimate community complexity, particularly during periods of higher biodiversity. These results, whilst not yet complete, highlight the complementary strengths and limitations of both methods, with microscopy providing finer taxonomic resolution and ZooScan offering rapid quantification of community structure.

Table 2: Monthly Simpson's diversity index values based on higher taxonomic classifications for zooplankton communities around SG, as assessed by light microscopy and ZooScan imaging analysis of RMT1 nets collected during 2006. Values indicate low community evenness throughout the year, with light microscopy generally recording higher diversity than ZooScan where both measurements are available.

Month	Simpson's index	
	Microscope	ZooScan
Jan		0.075
Feb	0.373	
Mar		0.178
Apr	0.215	
May		0.074
Jun	0.079	0.066
Jul		0.097
Aug	0.091	0.210
Sep		0.005
Oct	0.004	
Nov		0.121
Dec	0.014	

All newly collected samples from the fieldwork period (July 2023-June 2024) were returned to Cambridge, resulting in 31 mini bongo net and 69 RMT1 net samples. From these, 28 mini bongo nets and 22 RMT1 net samples, have been processed through the ZooScan. These samples were prioritised to ensure a full year of coverage for both nets for Cumberland Bay and a representative selection from those collected at the Eastern Core Box 1 transect. Image classification of these new samples is underway (**Activity 2.2**), and data analysis has begun, alongside curation of the datasets which will form the baseline data outputs (**Activity 3.1**). In addition to processing through the ZooScan, 18 newly collected mini bongo net samples and 10 newly collected RMT1 samples have been microscopically analysed in full by project partners. Data collected using the UVP6 has been sent to Cambridge regularly allowing classification of

images to be carried out on an ongoing basis (**Activity 2.3**). Images collected from July 2023 to June 2024 have been classified and verified in collaboration with colleagues with specific taxonomic expertise. This involved manual classification of many thousands of images and the development of a novel UVP6 Southern Ocean training dataset that is currently being used to develop a new machine learning model for rapid plankton image classification. Analysis of this data is going alongside development of the optical methodology that will be applied in the future, by examining aspects such as (but not limited to) optimal data acquisition conditions, frequency of data collection, depth integration and classification categories **(Activity 3.2)**. Analysis of the data collected through these methodologies is currently ongoing and will be feeding into a report being prepared for submission to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Working Group on Ecosystem Monitoring and Management (WG-EMM) ahead of their meeting in July 2025 and will be developed further into a peer-reviewed manuscript (**Activity 5.1**) that will incorporate baseline data from the suite of methods tested (**Activity 3.1**).

In addition to routine sampling, a small-scale eDNA filtration experiment was carried out at South Georgia in March 2024 to compare the three methodologies used within this project (peristaltic pump, vacuum pump and hand syringe). Water samples were collected from the jetty at King Edward Point (KEP) and different volumes (250, 500 and 1000 ml) were filtered through each of the three methods. The first batch of filtered water samples for eDNA (covering July 2023-April 2024 and the methodology experiment) were returned to Cambridge in June 2024 on the RRS Sir David Attenborough during her transit north. DNA extraction from 95 filters (20m and 75m filters from July 2023 to January 2024, in addition to 20 filters from the methodology experiment) has been carried out (**Activity 2.4**). A Qiagen DNeasy blood and tissue kit was trialled for extraction, however, this method initially resulted in negligible volumes of DNA being extracted. Modifications to the methodology were made after seeking advice from experienced colleagues within BAS **(Activity 3.3)**, which included steps to break down filters and increasing extraction solution volumes. This will be reflected in an updated extraction protocol that will also be discussed with colleagues from SAERI who are performing similar analyses **(Activities 3.3, 4.3)**. The 95 filters were processed using the optimised methodology and each was split into three separate samples to allow different primers to be added before amplification. The different primers being used are 16S, 18S and COI which will enable different DNA sequences to be sequenced. The first batch of samples was sent to Novogene, Cambridge for sequencing in February 2025, with data being received in late March 2025 (Y3Q4). The remaining samples are prepared and ready to be sent for sequencing once the first batch has been properly reviewed.

A collaboration is underway with SAERI around our complementary approaches towards invasive species monitoring, with Dr Siobhan Vye from SAERI coming to BAS in May 2025 to learn eDNA extraction and zooplankton imaging techniques, and the intention to build on this partnership with shared outputs **(Activity 4.3)**. We also have regular communication with GSGSSI in regards to management of the MPA, and appropriate opportunities to contribute to future changes to the MPA Research and Monitoring Plan (**Activity 4.1**) (DPLUS-C05). Whilst changes to this may be beyond the timescale of this project, we have already contributed to the revision of the King Edward Point Science Plan 2024 with the incorporation of the mini bongo and UVP6 as additional plankton sampling deployments as a new time-series. This will enable ongoing analysis of the pelagic ecosystem and monitoring against the baselines developed in this project and can be fed into future GSGSSI MPA review processes.

Fieldwork and laboratory data has now been collected and collated and discussions with the UK Polar Data Centre have been initiated to develop a data management pathway which will enable all data produced within the project to be properly accessioned and made available with DOI (**Activity 5.2**). As the project nears completion in August 2025, a workshop will be planned to disseminate outputs and findings with project partners and stakeholders (**Activity 5.3**).

3.2 Progress towards project Outputs

Output 1: Capacity created for improved sensitivity and cost-effectiveness of zooplankton biodiversity monitoring at SG

This is now complete and was done through purchasing fieldwork equipment and training science staff at SG in the use and deployment of the optical profiler, zooplankton nets and Niskin bottles. Several staff have now been trained and are continuing to use the techniques beyond the scope of this project, increasing capacity to carry out similar work. The optical profiler has now been gifted to the OT, allowing cost effective zooplankton biodiversity monitoring to take place (DPLUS-A03).

Output 2: Acquisition of data on lower trophic level biodiversity and distribution, including zooplankton, ichthyoplankton and non-native taxa or parasites

Fieldwork was successfully completed in June 2024, with an annual data set collected. This resulted in the acquisition of net samples, image data and molecular data. The scanning of historical and newly collected samples using a benchtop imager has been completed, resulting in an extensive zooplankton image library. Historic and newly collected net samples have been analysed microscopically allowing creation of a baseline dataset and comparative analyses across different methodologies and time scales to be started. Image classification of both historical samples and those obtained from the UVP6 has been started and is nearing completion, with subsamples of the UVP6 and historical ZooScan images being classified and verified by taxonomic experts. Image data from EcoTaxa has been downloaded and is currently being analysed. Water samples collected from Niskin bottles have been processed for eDNA. 95 filters have undergone eDNA extraction, with sequencing being carried out.

Output 3: New zooplankton and ichthyoplankton data and bioindicator assessment tools developed for direct application to monitoring and management

Progress on this output has been made through the collection of data from the historical and newly collected samples and the development of methodologies. New samples have been collected during the fieldwork have been processed with analysis ongoing. Once complete, data and assessment tools will be made available to GSGSSI to inform monitoring and management strategies, progressing this output and contributing to DPLUS indicators C01 and C02.

Output 4: Updates to SGSSI monitoring and management activities to improve consideration of zooplankton and ichthyoplankton biodiversity and community composition as bioindicators (e.g. differences in species dominance) and to incorporate invasive or non-native species monitoring

Progress has been made towards this output by presenting the project at the 5 Yearly SGSSI MPA Review Workshop in June 2023 (DPLUS-C05) and contributing to subsequent discussions. The project continues to be in regular communication with GSGSSI in regards to management with a view to influencing future updates to the Research and Monitoring Plan as appropriate. The project has also worked closely with the King Edward Point Science and Fisheries Managers with the result that additional net and UVP6 deployments have been added into the KEP Science Plan, providing the framework for research to feed into future GSGSSI MPA reviews (DPLUS-C05) .

Output 5: Publication and dissemination of results

Progress on this output is being made in the form of a report being prepared for submission to CCAMLR WG-EMM. This report will form the basis of a peer-reviewed manuscript which will be submitted during 2025. Further publications and project results will be made available at the end of the project (DPLUS-C03).

3.3 Progress towards the project Outcome

Outcome: Improved effectiveness of MPA management via development of technical and analytical tools for comprehensive zooplankton biodiversity and non-native species monitoring through three synergistic methods, and input into GSGSSI management activities.

The project continues to make strong progress across all key indicators, ensuring it stays on track for successful completion and the delivery of ongoing activities. This progress has been largely driven by successful completion of fieldwork in June 2024, which resulted in valuable data and samples. These have supported subsequent laboratory work and further data collection activities throughout 2024 and early 2025, with data analysis ongoing.

Development of the project's technical and analytical tools is ongoing. Protocols have now been established for all fieldwork equipment and have been reviewed regularly. In particular, the eDNA water filtration methodology has been refined to ensure effective monitoring of zooplankton biodiversity, and final eDNA and optical methodologies reflecting developments during the project are being produced. Data analysis across all methodologies is currently underway and will be completed by the end of the project.

We have maintained strong communication with GSGSSI throughout the project's development and implementation to ensure continued alignment with MPA management objectives. We remain confident that our indicators are appropriate for tracking progress toward the project's outcomes and that we are on course to achieve these within the current funding period.

3.4 Monitoring of assumptions

1.1 Recruitment process runs to schedule

Comment: This was completed at the time of the last report.

1.2 Manufacturer and shipping of equipment not held up by Covid-19 or other delays

Comment: This was completed at the time of the last report.

2.1 Bad weather or other logistical issues not disrupting the usual sampling regime

Comment: The sampling regime was carried out every 4-6 weeks from July 3023 to June 2024, with little disruption. There have been some logistical issues including the *Pharos SG* being required to respond to the avian influenza outbreak and going into dry dock during February 2024 resulting in the *Pharos SG* not being able to carry out any routine monitoring that month. Since then, monthly surveys resumed and all remaining surveys between March and June 2024 were completed as planned.

2.2 Data are provided on time by contractors and samples are effectively preserved and backed up at KEP and shipped back to Cambridge without issue

Comment: All collected data and samples are now with the project team in Cambridge. A number of external hard drives were used to back up and store image data and were returned to Cambridge regularly. These hard drives have been backed up onto internal systems. Discussions are underway with the BAS Polar Data Centre (PDC) to develop a data pathway for appropriate data management and archiving for all data collected. Samples, consisting of preserved net catches and filter papers for eDNA extraction, collected during sampling campaigns carried out by the *Pharos SG* were transported back to Cambridge either via the *RRS Sir David Attenborough* or commercially freighted, with the assistance of the BAS Stanley Office. The final batch of eDNA filters (May-June 2024, collected after the RRS SDA had sailed north after the 2023/24 season) were delayed in their return to the UK due to requirements to be kept frozen. Various options were explored and attempted. They were eventually carried north by an external colleague via the MOD and couriered on to Cambridge, in a lN2 dry shipper that was filled on board the RRS SDA at the start of her 2024/25 season.

3.1 Data quality and quantity sufficient to be able to carry out adequate analyses in a timely manner

Comment: Overall, data quality and quantity ought to be sufficient for our planned analyses. For net samples, sufficient data has been obtained from ZooScan and microscopy analysis. After initial scrutiny of the UVP6 data, the acquisition frequency was increased from the manufacturer's default setting as the number of images being acquired was considered quite low in the early part of the project. The impact of this will be assessed with sensitivity analyses with data collected later at the higher frequency. It is normal for a significant proportion of UVP6 image data to be low quality or difficult to identify; however, due to the large amount of data collected overall (258,000 images) this has resulted in sufficient high-quality images to be able to carry out our planned analyses. For the eDNA data, the initial sequencing report suggests that sufficient data have been generated to support our analyses and we will verify this before sending the remaining batches for sequencing. Data analysis of net and image data is

presently ongoing. Analysis of the eDNA data will follow when all sequencing data has been received and this assumption will continue to be reviewed.

4.1 Dependency on GSGSSI for updates to be made to relevant documents

Comment: This remains an assumption and is likely to occur beyond the timescale of this project. We continue to be in regular communication with GSGSSI to understand opportunities to feed into their management processes and have already contributed to the 2023 Five Year Review process with information about the project. As results and recommendations emerge from this project, we will consider how best to feed that into the next Five-Year Review (scheduled 2028) and for any relevant changes to be made to the Research and Monitoring Plan in response.

4.2 Next 5 Year review process is in 2023 so engagement and/or submissions will likely be based on interim data or initial findings

Comment: As reported previously, we presented initial information and progress on the project at the GSGSSI MPA Five Year Review Workshop in June 2023 and intend to present relevant results and recommendations at the next one in 2028. In the meantime, we are submitting a paper to CCAMLR WG-EMM with initial results of relevance to ecosystem monitoring and management that will also be of interest to GSGSSI.

5.1 Publication of peer-reviewed papers is likely to occur after the end of the project due to the time constraints of the review process.

Comment: This assumption remains. A paper outlining early results and analysis is currently in preparation for submission to CCAMLR WG-EMM in June 2025 and this will form the basis of a data paper that will be submitted for peer review, likely after the end of the project.

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

The project has contributed significantly to supporting the Overseas Territory (OT) in achieving its environmental and climate-related outcomes, primarily through (i) the acquisition of samples and data, along with the development of protocols during regular sampling operations, and (ii) the analysis of historical zooplankton samples from South Georgia waters. Throughout the course of fieldwork, protocols for the deployment of the UVP6, Niskin bottles, and zooplankton nets, as well as filtration methods for eDNA extraction, have been developed and refined. The creation of robust, practical protocols will facilitate continued sampling in a consistent and comparable manner beyond the lifetime of the project.

Project members are collaborating closely with the Government of South Georgia and the South Sandwich Islands (GSGSSI) and King Edward Point (KEP) staff to ensure that the project's outputs align with current monitoring efforts and inform the next phase of the KEP science plan, which directly supports GSGSSI's management objectives. In addition, the purchase of an optical profiler through the project has provided the OT with ongoing capability for rapid, cost-effective, and lower-carbon monitoring of zooplankton and ichthyoplankton populations beyond the scope of this project.

The analysis of historical zooplankton samples represents an important first step toward building a comprehensive zooplankton baseline, which will enable the OT to monitor biodiversity changes over time and better deliver management and conservation strategies. This baseline will be strengthened with new samples and data generated through the project's fieldwork activities. By producing a long-term dataset and establishing standardised, routine monitoring protocols, the project aims to directly support the SGSSI Biodiversity Action Plan (BAP), particularly the goal of enhancing knowledge of SGSSI's biodiversity and habitats through research, monitoring, and the establishment of scientific baselines to assess environmental change, including the potential impacts of climate change.

5. Gender Equality and Social Inclusion (GESI)

GESI Scale	Description	Put X where you think your project is on the scale
Not yet sensitive	The GESI context may have been considered but the project isn't quite meeting the requirements of a 'sensitive' approach	
Sensitive	The GESI context has been considered and project activities take this into account in their design and implementation. The project addresses basic needs and vulnerabilities of women and marginalised groups and the project will not contribute to or create further inequalities.	
Empowering	The project has all the characteristics of a 'sensitive' approach whilst also increasing equal access to assets, resources and capabilities for women and marginalised groups	X
Transformative	The project has all the characteristics of an 'empowering' approach whilst also addressing unequal power relationships and seeking institutional and societal change	

Equality, diversity and inclusion (EDI) in all its forms has been a core consideration throughout our project and remains so. As the lead partner, BAS has engrained EDI in its cultural values and is part of a community of international polar organisations, national science bodies and leading employer organisations working together to make Polar science more diverse and inclusive. BAS has also been a member of the Athena Swan Charter since 2014 and is proud to hold an Athena Swan Bronze Award. Whilst there is limited opportunity for GESI to be incorporated in project execution, as there is no local community involved, GESI was directly considered throughout recruitment of the project PDRA, and indirectly through BAS and our partners approaches to recruitment of other project team members.

The BAS project team has a good gender split, with 4 female team members and 3 male team members, all of whom represent diversity in terms of career stage. The science staff that assist the project at KEP have been recruited by BAS, in line with its policy on being an equal opportunities employer and embracing diversity and represent a 50:50 gender split. When recruiting for the PDRA we advertised the project across a range of professional and social media networks to attract a diverse range of applicants which was successful.

We also proposed a NERC-funded Research Experience Placement (REP) based on our project. These offer summer research project experiences to undergraduates through the Doctoral Training Partnership system. Our project was offered through the GW4 DTP which is exclusively targeted at researchers from under-represented backgrounds. The successful candidate unfortunately was unable to take up their place last year due to unforeseen circumstances but we have offered a similar project through the same DTP this year.

6. Monitoring and evaluation

Monitoring and evaluation of progress against our objectives is regularly carried out with direct reference to the log frame, checking the progress of each of the activities and indicators against the timeframe indicated in the implementation plan. This is led by the PI with input from other project members as required. We have held annual full project team meetings where progress of the project is presented and discussed, and review of progress towards our activities discussed. This is supported by regular 121s between the PI and PDRA, meetings with other

project team members as required, and the PI's line management meetings. This has kept the project broadly on track and able to respond to challenges when they have arisen. Where issues have arisen requiring changes to the initial project plan, the PI has submitted change requests which have all been approved.

Clear communication has existed between the project, GSGSSI and the BAS Environment Office to ensure compliance with environmental permits, along with follow up by the BAS Operations team following completion of fieldwork.

Financial management is carried out both by the PI and the BAS Finance team, for whom the key contact point is Michael Walters. Day to day financial management is carried out by the PI who monitors spend against the budget and receives regular expenditure reports from Finance. Finance are responsible for checking that spend and claims are in line with what was forecast, helping manage the remaining budget, and bringing any queries to the attention of the PI. There is also £2000 allocated in the budget for an audit at the end of the project.

7. Lessons learnt

The main points of learning from this project have been to build in contingency and establish good communication between relevant partners. In general, the project has gone well this year when judged against the implementation plan and logframe. The project is on track with the majority of activities and is preparing to complete sample processing and data analysis. The fieldwork element has been very successful. However, there have been a few minor unexpected challenges. Firstly, external factors such as bad weather and the *Pharos SG* being required to respond to other events resulted in minor delays to field campaigns. This was reported on in more detail in the previous annual report. However, we have not deviated from the original plan of carrying out sampling campaigns every 4-6 weeks. In general, campaigns took place every month, with the exception of February 2024 when the *Pharos SG* was in dry dock. This led to the longest period between regular patrols of 6 weeks between January and March 2024. However, contingencies were considered when planning fieldwork and the frequency of sampling regimes was planned to be flexible and the aim of sampling every 4-6 weeks was maintained. The project team were able to manage changes in schedules through regular communication with members of the GSGSSI and science staff based at South Georgia to ensure relevant project members were informed of any potential delays.

A further issue that arose within this reporting period was with transporting samples back to Cambridge. All samples collected up until March 2024 were transported to Cambridge via the RRS Sir David Attenborough. However, fieldwork continued until June 2024, meaning that samples collected from April to June needed to be transported back via a different route. Net samples were transferred from ethanol to formaldehyde and were air freighted using the military airbridge via Brise Norton to Cambridge. However, the filters collected from water samples for eDNA were required to remain frozen during shipping. The original plan was to request to fill a liquid nitrogen (lN2) shipper in the Falklands using the Agricultural Department's supply. However, their machine was broken and replacements were not due within an acceptable timeframe for our project. We therefore had to identify an alternative. The frozen samples were transported to the BAS Stanley Office where they were stored in the freezer until they could be sent onwards. Initially, a dry shipper containing liquid nitrogen was sent to the BAS Stanley office to transport the samples back in, however, this was found to be empty upon its arrival in Stanley. A second attempt was made ensuring the shipper was fully charged with lN2, however, MOD flight delays meant that the shipper did not arrive in Stanley for several weeks resulting in loss of cold storage. Throughout this, communication with BAS Stanley office and BAS logistics was maintained and it was decided that the shipper could be refilled with lN2 from the RRS Sir David Attenborough during port call at the start of her next season, with an external collaborator agreeing to carry it back to Brize Norton in December 2024 followed by onward courier to BAS over the Christmas period. Much of this was outside our control, however the main learnings from this were that maintaining regular communication with a globally distributed logistics team was essential, as was discussing the issue widely with colleagues and at team meetings (including those unrelated to the project) who were able to suggest ideas and potential solutions. We considered all options, even those outside our

budget, with a view to attempting to source additional money if required (it was not). We also learnt from our first attempt to send the shipper down to check that instructions were clear and to build in sufficient time to enable checks to be carried out. Finally, it was very important to thank everyone for their cooperation, as many people were involved at various points and prepared to go above and beyond to help if they could.

Building on the learning from this and the points in our previous annual reports, we will continue to build contingencies into our planning and maintain communication throughout the project to minimise risks and manage any that arise appropriately.

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

Most answers to the feedback from our last annual report was provided in the last half year report submitted in October 2024 so we summarise that briefly here, and add any relevant developments since then.

1. A lack of formal evidence of training was noted. Training within the project was primarily delivered through informal processes. Before commencement of fieldwork, project staff familiarised themselves with equipment by reading manuals, consulting colleagues, and conducting initial testing. This preparation enabled the core team to successfully deploy equipment during a trial on the *MV Pharos SG* in July 2023, where two KEP science staff and *Pharos* crew members also received hands-on training. During this period, protocols for all field equipment were developed and made available to KEP scientists and ship crew. Following this, trained KEP science staff continued informal peer-to-peer training, including for incoming and visiting scientists, using these protocols.
2. A formal training course was also completed on the use of the UVP6, further enhancing operational knowledge. Evidence of the success of this training is demonstrated by the KEP Science team completing a full year of sample collection, meeting the original training objectives. Additionally, elements of sampling (miniBongo and UVP deployments) have been integrated into ongoing KEP monitoring, providing further indirect evidence of training effectiveness.
3. It was also noted that evidence of analysis of historical samples would be a beneficial addition to future reports. Analysis of these samples is ongoing and will be incorporated into future publications, however, we evidence progress on this by inclusion of some preliminary tables and text within section 3.1 of this report.
4. The project fed into the GSGSSI Five Year MPA review in June 2023 but was at a very early stage at this point with fieldwork yet to begin. GSGSSI are also a partner on the project and were involved in developing the project and ensuring it was relevant to management. Whilst the most recent Review is now complete, our activities are closely aligned with research needs identified in the current Research and Monitoring Plan (RMP), particularly Themes 2 (Pelagic Ecosystems – Lower Trophic Levels) and 9 (Climate Change). This is in the process of being updated and we will review it once it is published. We will also feed any results from the project, or recommendations based on our monitoring activity, into the next review process which is expected to start in 2028. In terms of direct impact, it is most likely that this project provides baseline data against which future changes to the pelagic community can be monitored and will form part of the approach to holistic ecosystem management that relies upon an understanding of dynamics at the base of the food web. We are also collaborating with Dr Siobhan Vye (SAERI) on a related project assessing invasive species around SG and are hosting Dr Vye at BAS to provide training on eDNA and imaging techniques to analyse samples taken on a separately funded project.
5. The project has been successful in demonstrating the relative simplicity of deploying the miniBongo and UVP6, and the value of the data collected. As a result, these two aspects have been incorporated into the KEP Science Plan, core activities of which are funded between GSGSSI, FCDO and BAS. This has achieved an uninterrupted new monthly time-series of physical plankton samples and plankton image data from July 2023 to April 2025 and ongoing. Future analysis of samples will be carried out in

conjunction with the BAS Ecosystems team under ongoing workstreams, and new projects that are seeking additional funding.

9. Risk Management

No new risks have arisen in the last 12 months.

Risk register attached.

10. Scalability and durability

So far our project has resulted in the direct training of science staff within the OT and for this training to be replicated peer-to-peer as staff members change. This has demonstrated the sustainability of the project activities, which was reflected in the incorporation of additional net sampling and UVP6 deployments in the KEP Science Plan 2024 (available upon request) based directly on the work of this project, illustrating both the scalability and durability of the project longer term.

In addition to this, this project has provided the groundwork for further plankton imaging work that is being incorporated into BAS science, including the deployment of a UVP6 on a mooring in the Western Core Box region at South Georgia that will provide a complimentary dataset to that being collected in the ECB region through this project and its continuation through the KEP Science Plan.

There is wide external interest in the methods being developed in this project, as illustrated by an invitation to give a talk at the ICES WGZE on progress in this project and how it is leading to the development of an imaging work programme at BAS. This is also feeding into wider interest and collaborations with UK and international partners on developing image libraries and classification tools, with this project producing some of the first training datasets for plankton image classification in the Southern Ocean. This will have far reaching impact as these workstreams are developed further and is reflective of a wide drive of funders and the science community to adopt new technologies that facilitate scalable data collection with a greater degree of autonomy and potential for lower carbon costs.

Beyond the immediate project, we are ensuring that wider stakeholders are made aware of our project through talks such as that delivered at ICES WGZE; discussion with colleagues at other science meetings such as the BIOCARBON Annual Science Meeting, where we discussed our image analysis approaches with colleagues working on similar ideas elsewhere; and through our planned paper submission to CCAMLR WG-EMM.

Referring to our exit plan, we are on track to ensure that our project remains durable through the development of protocols that have already been shared beyond the immediate project; the development of image libraries that are well underway and being used by external collaborators already; and the development of DNA sequence sets. The supply of capital equipment (UVP6) to the OT has already been made and data reporting discussions are underway with the PDC with plans, including budget, in place for ensuring appropriate stewardship of all the data collected through the project and protocols developed for the collection and accession of data collected similarly in the future.

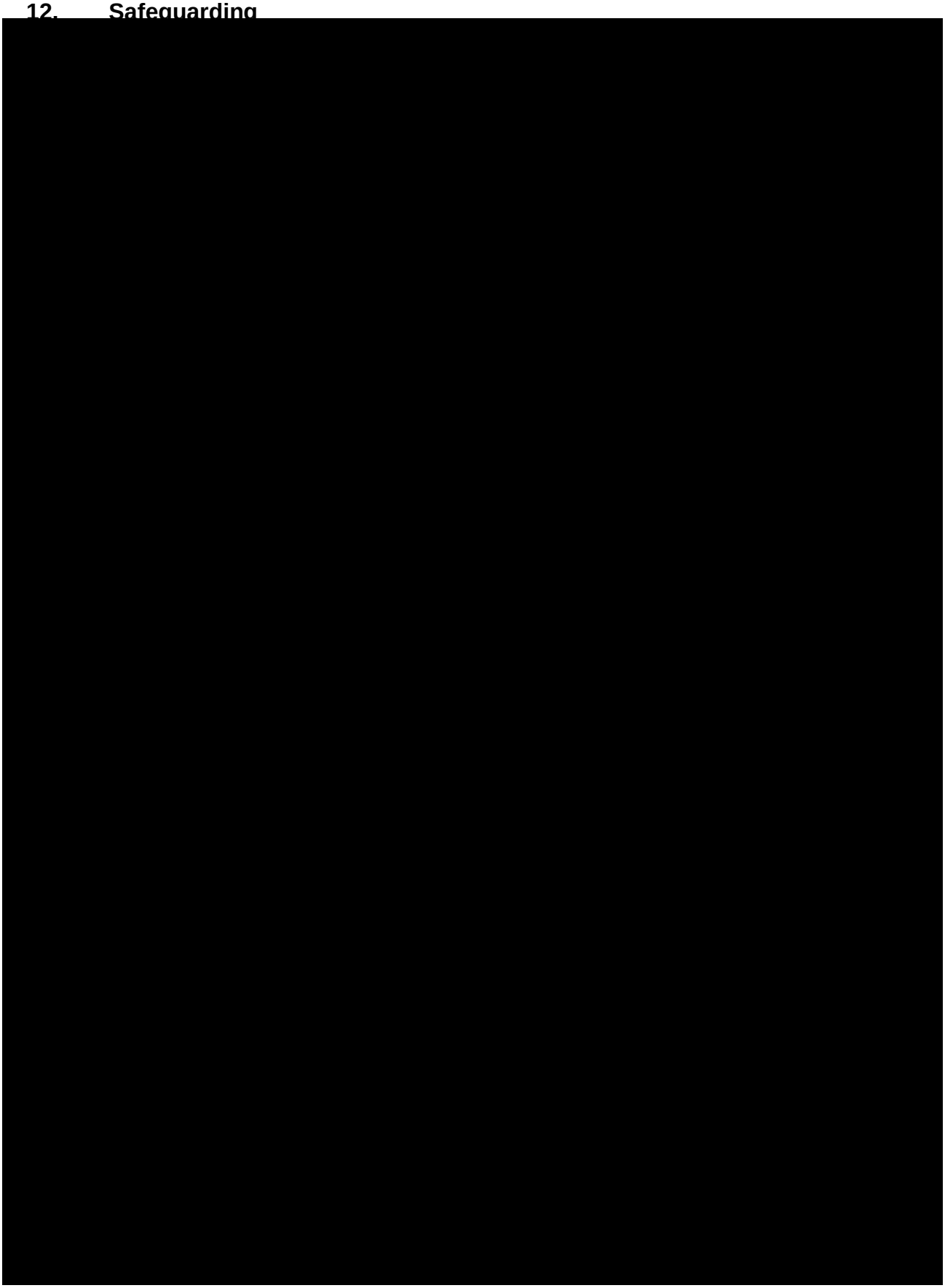
11. Darwin Plus identity

The Darwin Plus logo is prominently placed on our project website where Darwin is also acknowledged as being the project funder: https://www.bas.ac.uk/project/south-georgia-pelagic-biodiversity/ . The logo and funding acknowledgement is displayed on all reports uploaded to the website and is displayed on all presentation materials e.g. talks given at the GSGSSI Five Year MPA review workshop and at the ICES Working Group on Zooplankton Ecology talk in Faros, Portugal, April 2025.

Although there is no resident population in the OT, there is good familiarity of Darwin Plus within the Government of South Georgia and the South Sandwich Islands and throughout BAS, and the project is well-known to be funded by Darwin Plus.

Darwin Plus/ Defra funding will be acknowledged in the CCAMLR WG-EMM paper and in any future manuscripts arising from the project.

12. Safeguarding



13. Project expenditure

Table 1: Project expenditure <u>during the reporting period</u> (1 April 2024 – 31 March 2025)

Project spend (indicative) in this financial year	2024/25 D+ Grant (£)	2024/25 Total actual D+ Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others (Please specify)				
TOTAL	**122,663.24**	**121,083.70**		

Table 2: Project mobilised or matched funding during the reporting period (1 April 2024 – 31 March 2025)

	Secured to date	Expected by end of project	Sources
Matched funding leveraged by the partners to deliver the project (£)	[redacted]		
Total additional finance mobilised for new activities occurring outside of the project, building on evidence, best practices and the project (£)			

14. Other comments on progress not covered elsewhere

N/A

15. OPTIONAL: Outstanding achievements or progress of your project so far (300-400 words maximum). This section may be used for publicity purposes.

I agree for the Biodiversity Challenge Funds to edit and use the following for various promotional purposes (please leave this line in to indicate your agreement to use any material you provide here).

Nothing in addition to what is mentioned elsewhere in this report and the images submitted last year.

File Type (Image / Video / Graphic)	File Name or File Location	Caption including description, country and credit	Social media accounts and websites to be tagged (leave blank if none)	Consent of subjects received (delete as necessary)
				Yes / No
				Yes / No
				Yes / No
				Yes / No
				Yes / No

Annex 1: Report of progress and achievements against logframe for Financial Year 2024-2025

Project summary	Progress and Achievements April 2024 - March 2025	Actions required/planned for next period
Impact Improved management and climate change resilience of the SG MPA through improved technological and institutional capacity to monitor the SG pelagic community, and improved cost- and carbon-efficiency of biodiversity monitoring	In progress. Fieldwork was completed in June 2024, data processing and analysis are underway.	
Outcome Improved effectiveness of MPA management via development of technical and analytical tools for comprehensive zooplankton biodiversity and non-native species monitoring through three synergistic methods, and input into GSGSSI management activities.		
Outcome indicator 0.1 Development of technical and analytical capacity to deploy novel optical and molecular sampling equipment by end Y3Q2	Complete. Science staff have been trained to deploy sampling equipment.	
Outcome indicator 0.2, First zooplankton and ichthyoplankton biodiversity baseline produced by end Y4Q1	In progress. Collection and processing of historical and new samples has been completed. Analysis of these data sets is underway.	Data analysis will take place over the coming months to build a biodiversity baseline.
Outcome indicator 0.3 Development of molecular methodology by which to detect invasive, non-native or unknown species by end Y4Q1	Complete. Samples for molecular analysis have been collected and eDNA extraction methodology has been designed allowing the successful extraction.	
Outcome indicator 0.4 Update of management plans as required to take account of new information and methodologies by end Y4Q2	In progress. Communication with SSGSSI and KEP staff is ongoing with project methodologies and results feeding into future management plans.	Engagement to continue throughout project
Output 1 Capacity created for improved sensitivity and cost-effectiveness of zooplankton biodiversity monitoring at SG.		
Output indicator 1.1 Recruitment of PDRA by end of Y1Q3	Complete. The PDRA has been recruited and started in post.	
Output indicator 1.2, Optical profiler, protective sampling frame, miniBongo net and GoFlo bottles for eDNA sampling purchased and sent to the OT by end of Y2Q1	Complete. Equipment has been received and sent to the OT for fieldwork.	
Output indicator 1.3 Mounting and testing of deployment of profiler and sampling bottles on the *Pharos SG* by end of Y2Q2	Complete. The profiler and sampling bottles were mounted and tested on the *Pharos SG* in July 2023	
Output indicator 1.4. Science staff trained on use and deployment of the optical profiler and the collection and storage of samples obtained from net-based, optical and eDNA methods by end of Y2Q2	Complete. Science staff have been trained in the use of equipment and sample collection and storage.	

Output 2. Acquisition of data on lower trophic level biodiversity and distribution, including zooplankton, ichthyoplankton and non-native taxa or parasites		
Output indicator 2.1. Successful participation in routine monitoring patrols on *Pharos SG* at 4-6 weekly intervals to collect a full year of samples by the end of Y3Q2	Complete. Field work was carried out between July 2023 and June 2024, with samples collected every 4-6 weeks during this period.	
Output indicator 2.2. Taxonomic identification and quantification of historical and newly collected net samples, using light-microscopy and bench-top image analysis by end of Y3Q3	Complete. Processing of historical samples through the ZooScan has been completed. A number of historical samples have been microscopically analysed by project partners.	
Output indicator 2.3 Classification and verification of images obtained with the optical profiler by end Y3Q4	In progress. Images obtained with the optical profiler from July 2023 to June 2024 have been classified and verified by a taxonomic expert. Further checks will be carried out over in early Summer 2025.	Further validation checks will be carried out over the coming months.
Output indicator 2.4 Extraction, amplification and sequencing of eDNA metabarcodes from filtered water samples by end Y3Q4	In progress. Training in extraction, amplification and sequencing of eDNA metabarcodes has taken place. All filtered samples have been received in Cambridge. eDNA extraction has been carried out on samples collected between July 2023 and March 2024. Sequencing of these samples is underway and initial analysis will take place in May 2025.	Further sequencing and analysis will take place in early summer 2025.
Output 3. New zooplankton and ichthyoplankton data and bioindicator assessment tools developed for direct application to monitoring and management		
Output indicator 3.1. Baseline zooplankton and ichthyoplankton biodiversity data (e.g. lowest taxonomic name, abundance, diversity, size-spectra) from the three methods (optical, net-based and molecular) cross-checked, calibrated and submitted to the UK Polar Data Centre (UK PDC) and the GSGSSI Data Portal (DPLUS069) by end Y4Q1	In progress. Data collected from net samples and the UVP6 has been collated and conversations with the UK PDC have been started. Data from eDNA sequencing will be incorporated once complete.	Data collected from the three methods will to be collated and analysed before being submitted to the UK PDC by the end of August 2025.
Output indicator 3.2. Development and refinement of novel optical methodology that can augment current net based monitoring capabilities by end Y4Q1	In progress. The methodology of deploying the optical profiler has been developed and we are developing a data processing and analysis method. We will augment this based on results of data analysis.	This will continue over the coming months.
Output indicator 3.3 Development and refinement of eDNA methodology as 'early warning' system to detect non-native species and poorly sampled or other hitherto unknown species including fish eggs, by end Y4Q1	In progress. The development of field based eDNA has taken place. Laboratory methodologies for eDNA extraction have been trialled and refined using initial field-based techniques. Initial sequencing has taken place. Further development and refinement will be required for later field methodologies.	Analysis of current sequencing results will be carried out prior to further methodology refinements and more sequencing taking place.
Output 4. Updates to SGSSI monitoring and management activities to improve consideration of zooplankton and ichthyoplankton biodiversity and community composition as bioindicators (e.g. differences in species dominance) and to incorporate invasive or non-native species monitoring		

Output indicator 4.1. SGSSI MPA Research and Monitoring Plan (RMP) (Theme 2 specifically and others e.g. Themes 6 and 8 as appropriate) updated to incorporate ongoing plankton monitoring as a research need, and be reflected in relevant projects/ activities by end Y4Q2	Ongoing. A presentation describing the project was given at the GSGSSI MPA Review Workshop communication has been maintained.	Engagement to continue throughout project.
Output indicator 4.2. Engagement with 2023 MPA 5 Year Review assessment by end Y2Q3	Ongoing. A presentation describing the project was given at the GSGSSI MPA Review Workshop in June 2023 and further discussion has been had.	Communication will be maintained with GSGSSI and any further information required will be supplied promptly.
Output indicator 4.3. Contribute to GSGSSI priority activities on biosecurity and non-native species monitoring in partnership with SAERI by end Y4Q2	Collaboration with SAERI is underway to align work and explore joint outputs.	Engagement to continue throughout project.
Output 5. Publication and dissemination of results		
Output indicator 5.1. Preparation of paper(s) for publication in peer-reviewed journals: submission by end of Y4Q2; publication within 1 year of project completion	In progress. Data analysis has begun and a publication for submission to EMM is in preparation. Further analysis and publications will be produced later in the project.	Further discussions will take place following data analysis to plan and begin preparing papers with submission likely happening after the project has been completed.
Output indicator 5.2. Accession of all data to image libraries, OA databases and the BAS PDC by end of Y4Q2	In progress. Initial discussions have taken place to create a data pathway and ensure data are managed appropriately.	Data management plans need developing.
Output indicator 5.3 Workshop held to share outputs and learnings with partners, stakeholders e.g. CCAMLR, SAERI, other OTs and wider networks e.g. SCAR ANTOS (Antarctic Near-shore and Terrestrial Observation System) Working Groups, as appropriate at end of Y4Q2	In progress. Preparations and discussions are underway to deliver a workshop to share project findings with partners and stakeholders.	Preparations will start to take place shortly, with a workshop to share findings taking place in late summer 2025.

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

Project Summary	SMART Indicators	Means of Verification	Important Assumptions

Impact: Improved management and climate change resilience of the SG MPA through improved technological and institutional capacity to monitor the SG pelagic community, and improved cost- and carbon-efficiency of biodiversity monitoring			
Outcome: Improved effectiveness of MPA management via development of technical and analytical tools for comprehensive zooplankton biodiversity and non-native species monitoring through three synergistic methods, and input into GSGSSI management activities.	1. Development of technical and analytical capacity to deploy novel optical and molecular sampling equipment by end Y3Q2 2. First zooplankton and ichthyoplankton biodiversity baseline produced by end Y4Q1 3. Development of molecular methodology by which to detect invasive, non-native or unknown species by end Y4Q1 4. Update of management plans as required to take account of new information and methodologies by end Y4Q2	1. New optical and molecular equipment, and training on use of equipment, provided to scientists and staff at KEP, GSGSSI and *Pharos SG* 2. Baseline data provided on plankton abundance, diversity, size-spectra and distribution provided to GSGSSI 3. Method statement produced and shared with GSGSSI and stakeholders 4. South Georgia Research and Monitoring Plan updated with new projects/activities and published on GSGSSI website	
Outputs 1 Capacity created for improved sensitivity and cost-effectiveness of zooplankton biodiversity monitoring at SG	1. Recruitment of PDRA by end of Y1Q3 2. Optical profiler, protective sampling frame, miniBongo net and GoFlo bottles for eDNA sampling purchased and sent to the OT by end of Y2Q1 3. Mounting and testing of deployment of profiler and sampling bottles on the *Pharos SG* by end of Y2Q2 4. Science staff trained on use and deployment of the optical profiler and the collection and storage of samples obtained	1. PDRA in post and on payroll at BAS 2. Audit trail, photographic documentation and equipment confirmed as received by BAS/ GSGSSI office in Stanley, Falkland Islands (FI) 3. Photographic evidence and written protocols for installation, setup and deployment of equipment produced 4. Production of training logs, successful trial deployments of	3. Recruitment process runs to schedule 4. Manufacturer and shipping of equipment not held up by Covid-19 or other delays

	from net-based, optical and eDNA methods by end of Y2Q2	equipment and written method statements	
Output 2. Acquisition of data on lower trophic level biodiversity and distribution, including zooplankton, ichthyoplankton and non-native taxa or parasites	1. Successful participation in routine monitoring patrols on *Pharos SG* at 4-6 weekly intervals to collect a full year of samples by the end of Y3Q2 2. Taxonomic identification and quantification of historical and newly collected net samples, using light-microscopy and bench-top image analysis by end of Y3Q3 3. Classification and verification of images obtained with the optical profiler by end Y3Q4 4. Extraction, amplification and sequencing of eDNA metabarcodes from filtered water samples by end Y3Q4	1. Samples acquired and catalogued, and reported to project lead at the end of every patrol 2. Quality controlled microscopy data received by BAS from MBA and successful acquisition of images backed up on hard drives and shipped to BAS upon completion of surveys 3. Dataset of classified images saved in EcoTaxa software for further analysis 4. Successful acquisition and filtering of water samples for eDNA, and sequenced data received back from external contractor.	1. Bad weather or other logistical issues not disrupting the usual sampling regime 2. Data are provided on time by contractors and samples are effectively preserved and backed up at KEP and shipped back to Cambridge without issue
Output 3. New zooplankton and ichthyoplankton data and bioindicator assessment tools developed for direct application to monitoring and management	1. Baseline zooplankton and ichthyoplankton biodiversity data (e.g. lowest taxonomic name, abundance, diversity, size-spectra) from the three methods (optical, net-based and molecular) cross-checked, calibrated and submitted to the UK Polar Data Centre (UK PDC) and the GSGSSI Data Portal (DPLUS069) by end Y4Q1 2. Development and refinement of novel optical methodology	1. Baseline data archived under embargo with BAS PDC and GSGSSI Data Portal 2. Image analysis protocol developed and made available to GSGSSI staff, KEP scientists, *Pharos SG* crew 3. Molecular analysis protocol developed and made available to GSGSSI staff, KEP scientists, *Pharos SG* crew	3.1 Data quality and quantity sufficient to be able to carry out adequate analyses in a timely manner

	that can augment current net based monitoring capabilities by end Y4Q1 3. Development and refinement of eDNA methodology as 'early warning' system to detect non-native species and poorly sampled or other hitherto unknown species including fish eggs, by end Y4Q1		
Output 4. Updates to SGSSI monitoring and management activities to improve consideration of zooplankton and ichthyoplankton biodiversity and community composition as bioindicators (e.g. differences in species dominance) and to incorporate invasive or non-native species monitoring	1. SGSSI MPA Research and Monitoring Plan (RMP) (Theme 2 specifically and others e.g. Themes 6 and 8 as appropriate) updated to incorporate ongoing plankton monitoring as a research need, and be reflected in relevant projects/ activities by end Y4Q2 2. Engagement with 2023 MPA 5 Year Review assessment by end Y2Q3 3. Contribute to GSGSSI priority activities on biosecurity and non-native species monitoring in partnership with SAERI by end Y4Q2	1. Updated RMP document published on GSGSSI website 2. Participation in 2023 MPA 5 Year Review process by attendance at relevant meetings/ workshops and submission of interim findings where appropriate 3. Engagement via meetings and/or workshops with GSGSSI and SAERI on biosecurity and non-native species mitigation activities	1. Dependency on GSGSSI for updates to be made to relevant documents 2. Next 5 Year review process is in 2023 so engagement and/or submissions will likely be based on interim data or initial findings.
Output 5. Publication and dissemination of results	1. Preparation of paper(s) for publication in peer-reviewed journals: submission by end of Y4Q2; publication within 1 year of project completion	1. Paper(s) submitted to peer-reviewed journals 2. Data made available Open Access via EcoTaxa, International Nucleotide Sequence Database	5.1 Publication of peer-reviewed papers is likely to occur after the end of the project due to the time constraints of the review process

	2. Accession of all data to image libraries, OA databases and the BAS PDC by end of Y4Q2 3. Workshop held to share outputs and learnings with partners, stakeholders e.g. CCAMLR, SAERI, other OTs and wider networks e.g. SCAR ANTOS (Antarctic Near-shore and Terrestrial Observation System) Working Groups, as appropriate at end of Y4Q2	Collaboration (INSDC) or other appropriate molecular database, and published with a DOI by the BAS PDC 3. Report of workshop published on BAS and GSGSSI websites	

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)

1.1 Recruitment of PDRA by end of Y1Q3

1.2 Optical profiler, protective sampling frame, miniBongo net and GoFlo bottles for eDNA sampling purchased and sent to the OT by end of Y2Q1

1.3 Mounting and testing of deployment of profiler and sampling bottles on the *Pharos SG* by end of Y2Q2

1.4 Science staff trained on use and deployment of the optical profiler and the collection and storage of samples obtained from net-based, optical and eDNA methods by end of Y2Q2

2.1 Participation in routine monitoring patrols on *Pharos SG* at 4-6 weekly intervals to collect a full year of samples by the end of Y3Q2

2.2 Taxonomic identification and quantification of historical and newly collected net samples, using light-microscopy and bench-top image analysis by end of Y3Q3

2.3 Classification and taxonomic analysis of images obtained with the optical profiler by end Y3Q4

2.4 Extraction, amplification and sequencing of eDNA metabarcodes from at the same sampling opportunities and comparison against published databases by end Y3Q4

3.1 Baseline zooplankton and ichthyoplankton biodiversity data (e.g. lowest taxonomic name, abundance, diversity, size-spectra) from the three methods (optical, net-based and molecular) cross-checked, calibrated and submitted to the UK Polar Data Centre (UK PDC) and the GSGSSI Data Portal (DPLUS069) by end Y4Q1

3.2 Development and refinement of novel optical methodology that can augment current net based monitoring capabilities by end Y4Q1

3.3 Development and refinement of eDNA methodology as ‘early warning’ system to detect non-native species and poorly sampled or other hitherto unknown species including fish eggs, by end Y4Q1

4.1 SGSSI MPA Research and Monitoring Plan (RMP) (Theme 2 specifically and others e.g. Themes 6 and 8 as appropriate) updated to incorporate ongoing plankton monitoring as a research need, and be reflected in relevant projects/ activities by end Y4Q2

4.2 Engagement with 2023 MPA 5 Year Review assessment by end Y2Q3

4.3 Contribute to GSGSSI priority activities on biosecurity and non-native species monitoring in partnership with SAERI by end Y4Q2

5.1 Preparation of papers for publication in peer-reviewed journals: submission by end of Y4Q2; publication within 1 year of project completion

5.2 Accession of all data to image libraries, OA databases and the BAS PDC by end of Y4Q2

5.3 Workshop held to share outputs and learnings with partners, relevant stakeholders e.g. Dissemination of results at relevant GSGSSI and CCAMLR, other OTs meetings, and wider networks e.g. SCAR ANTOS (Antarctic Near-shore and Terrestrial Observation System) Working Groups, as appropriate at end of Y4Q2

Annex 3: Standard Indicators

Table 1 Project Standard Indicators

DPLUS Indicator number	Name of indicator	If this links directly to a project indicator(s), please note the indicator number here	Units	Disaggregation	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
DPLUS-A03	Number of local/national organisations with improved capability and capacity as a result of project		Number of organisations	Organisation type		1	1	2	2
DPLUS-C01	Number of best practice guides and knowledge products published and endorsed.		Number	Product typology		3		3	2
DPLUS-C03	New assessments of habitat conservation action needs published		Number	Ecosystem					1
DPLUS-C02	Number of new conservation or species stock assessments published.		Number	Taxa					1
DPLUS-C05	Number of projects contributing data, insights, and case studies to national Multilateral Environmental Agreements (MEAs) related reporting processes and calls for evidence.		Number	Information typology					1

Table 2 Publications

Title	Type (e.g. journals, best practice manual, blog post, online videos, podcasts, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)

Checklist for submission

	Check
Different reporting templates have different questions, and it is important you use the correct one. Have you checked you have used the **correct template** (checking fund, scheme, type of report (i.e. Annual or Final), and year) and **deleted the blue guidance text** before submission?	
Is the report less than 10MB? If so, please email to BCF-Reports@niras.com putting the project number in the Subject line.	
Is your report more than 10MB? If so, please consider the best way to submit. One zipped file, or a download option, is recommended. We can work with most online options and will be in touch if we have a problem accessing material. If unsure, please discuss with BCF-Reports@niras.com about the best way to deliver the report, putting the project number in the Subject line.	
Have you included means of verification? You should not submit every project document, but the main outputs and a selection of the others would strengthen the report.	
Have you provided an updated risk register? If you have an existing risk register you should provide an updated version alongside your report. If your project was funded prior to this being a requirement, you are encourage to develop a risk register.	
If you are submitting photos for publicity purposes, do these meet the outlined requirements (see section 15)?	
Have you involved your partners in preparation of the report and named the main contributors	
Have you completed the Project Expenditure table fully?	
Do not include claim forms or other communications with this report.	