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	DPLUS189
Project title	Evaluating climate change risks to Patagonian and Antarctic toothfish
Territory(ies)	South Georgia and South Sandwich Islands
Lead Organisation	British Antarctic Survey
Project partner(s)	Centre for Environment, Fisheries and Aquaculture (Cefas) Government of South Georgia and the South Sandwich Islands (GSGSSI)
Darwin Plus grant value	£241,145.00
Start/end dates of project	1 June 2023 – 30 June 2026
Reporting period (e.g. Apr 2024-Mar 2025) and number (e.g. Annual Report 1, 2)	April 2024 - March 2025 Annual Report 2
Project Leader name	Rachel Cavanagh
Project website/blog/social media	https://www.bas.ac.uk/project/evaluating-climate-change-risks-to-patagonian-and-antarctic-toothfish/
Report author(s) and date	Rachel Cavanagh (BAS), Oliver Hogg (Cefas), Sue Gregory (GSGSSI) 30th April 2025

1. Project summary

This project has brought together an experienced multi-disciplinary science team with relevant stakeholders to support the Government of South Georgia and the South Sandwich Islands (GSGSSI) in addressing the need to integrate climate change considerations into fisheries management. Climate change is altering marine ecosystems around the world yet is conspicuously absent from fisheries management policy and implementation. This project is focused on South Georgia and the South Sandwich Islands (SGSSI), a rapidly changing area within the Southern Ocean, and on high value toothfish caught in this region. This project will synthesise relevant environmental and biological information and use this to undertake a risk assessment of climate-driven change to toothfish in SGSSI. Together with project stakeholders, we will translate the risk assessment into recommendations for fisheries management to reduce and manage the risks that climate change presents to toothfish and the wider ecosystem of which they are part. We will develop an evaluation framework that will also be applicable to other species and regions, addressing the challenge of integrating climate change into fisheries management more widely.

The results are relevant to, and will directly inform, SGSSI toothfish fishery management and the SGSSI Marine Protected Area (MPA) and enhance the Marine Stewardship Council (MSC) certification of the South Georgia fishery, with broader biodiversity benefits for the region in line with the SGSSI Biodiversity Action Plan (BAP). The outcomes will also be highly relevant to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) for whom this area of work is a high priority.

SGSSI are an archipelago of sub-Antarctic islands that form part of the Scotia Arc, a predominantly submarine ridge that extends from South America to the Antarctic Peninsula (Fig 1). The two island groups are distinctly different with South Georgia experiencing large inter-annual variability in temperatures and the South Sandwich Islands are more Antarctic in character, with lower, more stable, annual temperature ranges and the presence of seasonal sea ice for up to ~200 days per year at the southern end. SGSSI are a globally important site of abundant and diverse marine fauna, including vast colonies of penguins, seals, nesting seabirds and recovering whale populations. The region's waters are protected by the 1.24 million km^2 SGSSI Marine Protected Area (MPA) established by the Government of SGSSI (GSGSSI) (Fig 2), which aims to conserve marine biodiversity, as well as allowing some sustainable fishing. Fisheries are managed by GSGSSI within the framework of CCAMLR.

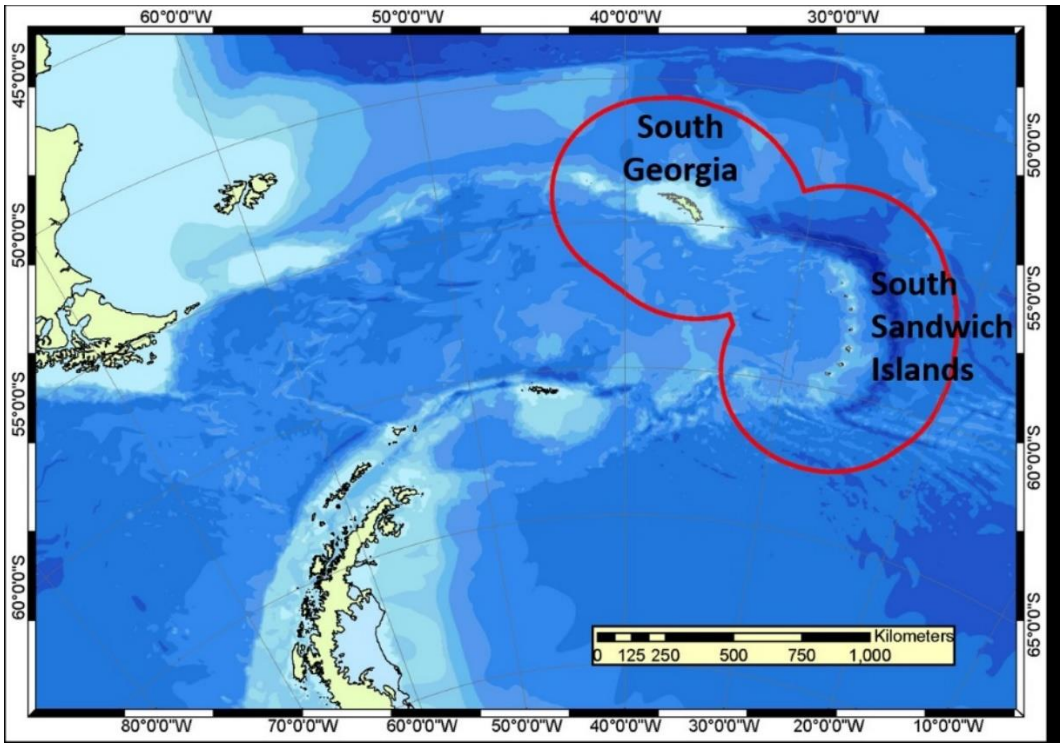

Fig. 1 SGSSI in a regional context

Fig. 2 SGSSI MPA including additional new closed areas announced in 2024 following a 5-yearly MPA review.

2. Project stakeholders/partners

Together with the lead organisation British Antarctic Survey (BAS) the project has two partners: Centre for Environment, Fisheries and Aquaculture (Cefas) and Government of SGSSI (GSGSSI). Given the importance of this conservation and fisheries management issue, the focal region, and the expertise required, this partnership is critical to the success of the project. BAS has well-established links with both organisations, and all were closely involved in the project development. This close involvement has continued since the project launch, including in the project kick-off workshop (see Annual Report 1 (AR1)); in regular meetings to develop and progress the science; and through representation on the Project Board. All partners have access to the project's collaborative space in Microsoft Teams and all project meetings are hybrid.

Achievements during this reporting period have included active partner engagement in advancing research on present-day toothfish–environment relationships, particularly through the sharing of knowledge and expertise during the development and interpretation of analyses, the foundation for two peer-reviewed papers for scientific journals, currently in preparation[1,2].

A strength of the partnership, in addition to the combined expertise and commitment to the project, is that all are represented on the UK delegation to CCAMLR, enabling us to ensure that progress and outputs from this project are presented to CCAMLR in a timely manner. During this reporting period this has included a paper submitted to CCAMLR's Working Group on Fish Stock Assessment (WG-FSA) on present-day toothfish-environment relationships[3]. The purpose of WG-FSA is to contribute to the conservation of Antarctic Marine Living Resources through the provision of expert advice on the status and management of fish stocks, including consideration of the impacts of climate change. Members of the project team from BAS and partner Cefas participated in WG-FSA 2024 and presented the paper[4].

The project also forms a component of the new King Edward Point (KEP) Science Plan which outlines a five-year research framework to provide scientific insights aligned with GSGSSI priorities, supporting effective management of the territory. A focus of the KEP Science Plan is to integrate climate-change considerations into science planning, research and monitoring. This includes our project as a specific research project on toothfish in the region, as well as more broadly as an exemplar for conducting similar research on other species.

Furthermore, the project was highlighted during presentations and discussion at the UK CCAMLR Scientific Priorities Workshop in March 2025, convened by the project PI and attended by representatives of project partners and two of our key stakeholders, at which climate change and fisheries management was a priority topic.

Key stakeholders have been involved since the project development stage. A related project is under development with one of our stakeholders (Marine Stewardship Council - MSC) in which our project forms a case study in considering key elements to account for climate change within the MSC Fishery Standard.

Our project is being enhanced through our links with external scientists, including in the UK with the University of Bangor, and with those working on toothfish in other regions such as the Ross Sea, with collaborations underway. To facilitate such collaborations, our findings to date were presented[5] at a dedicated toothfish research meeting held at BAS in September 2024, attended by members of the project team and other toothfish experts. Our work also featured in a keynote talk given by a project Co-I at the UK Joint Marine Modelling Programme Annual Meeting in 2024.

Members of the project team and key collaborators had lead roles in the establishment of the Scientific Committee on Antarctic Research (SCAR) new Action Group on Fish "SCARFISH"[6] (endorsed August 2024). SCARFISH seeks to foster collaboration to address critical gaps in Southern Ocean fish research, promote communication between policy and research communities, and broaden participation of Southern Ocean fish researchers, with climate change being of high priority to the work of this group and our project being central to informing this. SCAR is part of the International Science Council (ISC), charged with initiating, developing and coordinating high quality international scientific research in the Antarctic region. SCAR also provides independent scientific advice to the Antarctic Treaty Consultative Meetings (and other organisations such as the UNFCCC and IPCC) on issues of science and conservation in Antarctica. The Project Leader (PL) is a member of the SCARFISH Executive group, with involvement from the wider team in the Consultancy group and Work Packages, ensuring that our project is connected to, and in many aspects driving, a wider international effort.

3. Project progress

3.1 Progress in carrying out project Activities

During this reporting period the focus has been progressing Output 2 (i.e. ecological risk assessment of the effects of climate change on toothfish) activities concerned with present-day toothfish-environment relationships (activities 2.1-2.6 and 2.12), as well as Output 3 (i.e. climate change evaluation framework) initial stages (activity 3.1). Output 1 was largely completed during the first annual reporting period (see AR1), with the exception of provision of information for the SGSSI MPA Data Portal (activity 1.9). The work undertaken in this reporting period under Output 2 will facilitate progress with this activity. We will determine and extract what is useful and relevant from our analyses and provide it to the Portal following publication of our forthcoming peer-reviewed scientific papers[1,2] to ensure consistency, accuracy, and alignment with the published findings. Furthermore, as noted in AR1, we will refine how the knowledge-base is summarised and visualised (activity 1.6), again, alongside forthcoming papers.

<u>Activities under Output 2 during this reporting period:</u>

As noted in Section 2 (above), the PL, Postdoctoral Research Assistant (PDRA) and other project team members submitted a paper for consideration by CCAMLR WG-FSA in September 2024[3] (i.e. the first paper for WG-FSA in activity 2.12, see also logframe indicator 2.1). The paper detailed the work undertaken to understand present-day toothfish-environment relationships (activities 2.1-2.6), from the identification of candidate variables that may be influential in driving patterns in the distribution and abundance of toothfish, and determining the analytical approach, through to the development of distribution models informed by relationships with these variables. In addition, the paper examined temporal variation in abundance of early life-stages of Patagonian toothfish around South Georgia, as a first step towards identifying whether temporal variation in juvenile toothfish abundance is related to environmental factors. This work provides the foundation for determining species-environment

relationships across different life-stages, offering insights into important determinants of distribution, as a basis for better understanding the effects of climate change.

The paper was well-received and discussed in detail, with acknowledgement that the work aligns with, and contributes to, the need for WG-FSA to integrate climate change into the management of fish stocks (see CCAMLR Report WG-FSA-IMAF, 2024, paragraphs 4.12-4.14[7]), particularly their current work reviewing toothfish stock assessments. The paper also contributed to CCAMLR's work to integrate the recommendations from its 2023 Climate Change Workshop (see AR1) into its workplan (see CCAMLR Report of the Scientific Committee, 2024, paragraphs 7.1-7.11[8]).

The PDRA and PL incorporated feedback received from WG-FSA on the paper, and the PDRA went on to develop the analyses in more detail. As such, two peer-reviewed papers[1,2] are now in preparation (activity 2.12, see also logframe indicator 2.1). Notably, while the original proposal anticipated a single journal article resulting from these activities, the scope and significance of the work completed have exceeded expectations, generating sufficient novel content for two peer-reviewed publications, focused on temporal variation and spatial variation, respectively. These papers will complete the present-day analyses (activities 2.1-2.6), providing the basis for the projections work to follow (activities 2.7-2.13), for which initial development is underway.

Activities under Output 3 during this reporting period:

The data acquisition, analysis, and visualisation components of the evaluation framework (3.1) are currently being partially addressed through the development of the two peer-reviewed papers[1,2] mentioned above. We have also begun to draft the structure for the projections work to follow. The nature of the work underpinning these papers contributes directly to all three elements of the framework, with further development under this output planned for later in the project, as per the logframe.

3.2 Progress towards project Outputs

Output 1 - Knowledge base of relevant environmental, biological and fishery information for both species of toothfish created, providing the basis for understanding toothfish sensitivity to environmental parameters.

The baseline condition was a range of disparate, difficult to access environmental, biological and fishery information for toothfish. The indicators for this output are being measured directly by the corresponding means of verification, the status of which are almost complete (see AR1). Apart from the elements noted in Section 3.1, Output 1 is complete and provides a solid foundation for the activities underpinning Output 2.

Output 2 - Ecological risk assessment of the effects of climate change on toothfish.

The baseline condition was that the effects of climate change on toothfish in SGSSI are largely unknown. The analyses undertaken by the project will drive a shift from this position to an evaluation of risks. The indicators for this output are being measured directly by the corresponding means of verification. We are making good progress with this output (as noted in Section 3.1) as per the logframe and implementation plan. The CCAMLR WG-FSA paper associated with indicator 2.1 is complete[3], also summarised in the 2024 WG-FSA report[7] (means of verification 2.1) and SC-CAMLR report[8]. As noted in Section 3.1, the planned journal paper associated with indicator 2.1 has evolved into two separate publications[1,2], reflecting the depth and quality of the work undertaken. These papers are nearing submission to a peer-reviewed journal. Producing two distinct outputs on this work adds considerable value and strengthens the overall contribution of the project to this area of research. We have a project meeting planned for April 2025 to discuss development of the work for indicator 2.2.

Output 3 - Climate change evaluation framework for toothfish fishery management.

The baseline condition was a lack of guidance on integrating climate change into management of toothfish fisheries in SGSSI (and elsewhere). Later in the project we will provide a framework for incorporating measures to reduce climate change risks. The indicators for this output are being measured directly by the corresponding means of verification, the current status of which are incomplete. We are in the early stages of progress with this output, as noted in Section 3.1, and as per the logframe and implementation plan. Progress with activities under Output 2 is contributing directly to all three elements of the framework noted in indicator 3.1. Furthermore, the role of the PL, members of the project team, stakeholders and collaborators in CCAMLR-related work on integrating climate change into fisheries management (see AR1, Section 2, Section 3.1), has meant that consideration of appropriate frameworks has begun, helping to shape the development of this output.

3.3 Progress towards the project Outcome

Outcome – An evaluation of the risks that climate change poses for toothfish in SGSSI informs ecosystem-based fishery management such that it can incorporate measures to reduce these risks.

The project is on track to achieve the Outcome.

Indicator 0.1. Baseline conditions: lack of documented information on the relationship between toothfish and climate change. Progress during this reporting period: CCAMLR papers[3] submitted, presented, discussed; and cited in CCAMLR meeting reports[7,8;] two scientific papers are in preparation[1,2].

Indicator 0.2. Baseline condition: lack of guidance on integrating climate change into management of toothfish fisheries. Progress during this reporting period: progress has been made with components of the evaluation framework, specifically data acquisition, modelling approach, and in consideration of potential frameworks (Sections 3.1, 3,2).

Indicator 0.3 – Baseline condition: existing Toothfish Fishery Management Plan needs to incorporate climate change considerations. Progress during this reporting period: this will be a key output of the stakeholder workshop towards the end of the project, however, due to our continued lead role on this topic within CCAMLR[3.7.8] there has been progress on consideration of this for toothfish fisheries more widely, involving members of the project team, and linked to this project.

Indicator 0.4 – Baseline condition: no consideration of this work in the SGSSI MPA. Progress during this reporting period: our project was included in a presentation to an SGSSI MPA meeting in March 2025.

Indicator 0.5 – Baseline condition: no information on this work in the MPA Data Portal. Progress during this reporting period: we are in the process of preparing journal papers[1,2] based on the knowledge-base (see AR1). As noted in Section 3.1 we will extract what is useful and relevant for the Portal alongside these forthcoming papers.

3.4 Monitoring of assumptions

We had one minor assumption change detailed in AR1. All other assumptions hold true.

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

The project will contribute to the overarching objective of Darwin Plus more so later in the project. At this stage we have an experienced multi-disciplinary science team and relevant stakeholders supporting GSGSSI in addressing the pressing need to integrate climate change considerations into fisheries management in the UKOTs. The work we undertake at the regional level has the potential to influence international efforts, leading by example in CCAMLR and beyond. Through our work in this reporting period, including to better understand toothfish-environment relationships[1,2] towards an ecological risk assessment of the effects of climate change, we have begun to directly address research needs in the SGSSI MPA

Research and Monitoring Plan, particularly Themes 5 (Harvested species – fish) and 9 (Climate change and variability); the SGSSI Biodiversity Action Plan (https://gov.gs/document/sgssi-nbap-2016-2020/), particularly the objective "enhance knowledge of the biodiversity and habitats of SGSSI through research, monitoring and review, including the establishment of scientific baselines from which to assess environmental change, including the potential effects of climate change", which is mapped onto the Convention on Biological Diversity (CBD). GSGSSI has ratified CBD and the project has the potential to make a longer- term contribution to how GSGSSI delivers on relevant aspects of the Global Biodiversity Framework. Progress this reporting period has included the input of project information via papers and presentations to relevant fora including CCAMLR[8] (e.g. WG-FSA3,[7]); KEP plan (see Section 2); UK CCAMLR science priorities workshop; and collaboration on an associated project on climate change and the MSC Fishery Standar[d] (see Section 2).

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	

We are committed to equality, diversity and inclusion see https://www.bas.ac.uk/jobs/working-for-bas/our-cultural-values-equality-and-diversity/ and https://www.cefas.co.uk/about-us/careers/equality-statement/. BAS has been a member of the Athena Swan Charter since 2014. Athena Swan is used across the globe to support and transform gender equality within higher education and research. BAS holds an Athena Swan Silver Award (https://www.bas.ac.uk/media-post/athena-swan-silver/). Cefas is committed to draw on talent from the widest possible range of backgrounds, holds an Athena Swan bronze accreditation and is a signatory of the BiTC Race at Work Charter. During the development of this project, assembling of the project team and consulting with stakeholders, we considered gender equality and achieved a good balance, and are committed to ensuring equality in workshop participation and involvement in outputs.

6. Monitoring and evaluation

The project M&E plan remains largely unchanged, aside from minor improvements to project meetings noted in AR1, and additional adjustments this reporting period to reflect the change in

the project team and extended timeframe (see CR24-022). As a result, rather than monthly, project and Board meetings are now convened to align with the availability of progress to report within the extended delivery schedule. Currently this is approximately every 3 months, although frequency will likely increase during the final year of the project. We also have frequent "subgroup" meetings based on specific expertise required for tasks (see Section 7). The M&E work is led by the PL and therefore the lead organisation (BAS), including BAS Finance Office, but this work is shared with the partners via their engagement on the Project Board. Progress is shared with the project team via the Microsoft Teams site, with priority activities and outputs (aligned with the logframe and implementation plan) highlighted at team meetings. We update stakeholders informally (in person and email) and formally, the latter includes sharing reports. Broader stakeholder engagement and outreach will increase in the coming period, particularly as we begin to share key findings from the publications and develop the framework. To date, the partial completion of the Outcome indicators demonstrates the clear relationship between undertaking the Activities to deliver the Outputs to achieve the Outcome. For example, during this reporting period, progress with Activities 2.1-2.6, building on Output 1 activities (see AR1) forms part of Outcome indicators 0.1 (papers and reports) and 0.2 (evaluation framework). We measure achievements via Output and Outcome indicators, together with aspects that add value to these such as presentations associated with findings and papers. There are also qualitative aspects, for example the lead roles that members of the project team have in related fora such as CCAMLR in this area of work.

7. Lessons learnt

Elements that have worked well over the past year include the forming of subgroups to focus on specific aspects of the project, such as modelling, coordination of input to relevant for a such as CCAMLR, and the initial scoping of outputs, has been particularly effective. While draft outputs are shared with the wider team via Microsoft Teams, we have found that requesting targeted input at key stages has proven to be an efficient and productive approach. Another area of success has been the strong analytical focus by the PDRA, which has resulted in significant progress this reporting period. As noted in Section 3.1, originally, we anticipated a single journal article from the work on present-day toothfish-environment relationships; however, the depth and scope of the analysis have exceeded expectations, now supporting two peer-reviewed publications, focused on temporal and spatial aspects, respectively[1,2]. As for challenges, the main one was the change to the project team which also necessitated adjusting the project's timeline (see CR24-022). This change has not hindered the quality or ambition of the project, but it has required a shift in how we manage its implementation. We have adapted effectively, for example by spacing out team meetings to align with progress milestones (see Section 6).

A key recommendation for others working in this area is to actively seek opportunities to connect and share relevant knowledge. Our multidisciplinary team, stakeholders, and collaborations have positioned us well in this regard. Notably, we are beginning to see a positive feedback loop: by highlighting the importance of this work, we are helping to elevate it as a priority both in the OT region and internationally, and in turn, our project is being used as an example of what is needed.

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

The comments from the review of last year's Annual Report (DPLUS189 AR1R, Section 2) are included below together with our responses:

- Reviewer comment: *"The Impact is essentially identical to the Outcome - better knowledge will lead to better management. The Impact should be - better management will lead to better fish stocks. See also section 8."*

- The Impact has been re-phrased accordingly, with the caveat that while we will develop the information collaboratively and present it in an accessible way, implementation is beyond our control. However, as the reviewer noted (DPLUS 189 AR1R, Section 8), "*benefits to the environment relate to project Impact and will only be delivered after the project has ended. Darwin projects typically do not attempt to measure their impact.*." New wording for the Impact, also included in the logframe below, conveys the potential positive impact, without implying a guaranteed result: "*Improved ecosystem-based fisheries management, incorporating climate change risks, supports the long-term sustainability of toothfish stocks in South Georgia and the South Sandwich Islands (SGSSI)*."

- *Reviewer comment: No minutes were supplied with the AR, it would be useful to include example meeting outputs with the next AR/FR.*
    - We have included example meeting outputs[9,10] (see Annex 4)

The review also included comments in Section 8 (DPLUS189 AR1R) on actions taken in response to previous reviews, noting "*it doesn't seem worth a CR just to update these indicators, the intent is clear*". As such, we are content to retain the original text.

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9. Risk Management

The risk register is submitted with this report.

Changes to the project team at the beginning of this reporting period resulted in an extension to the duration of the project and associated reprofiling of the budget. These changes were approved via a Change Request (CR24-022).

10. Scalability and durability

Ecosystem conservation and management planning in SGSSI is driven by a process of symposiums and workshops, to which our project is already actively contributing (see AR1 and Section 2 above). GSGSSI were closely involved in project development and continue to be closely engaged. In terms of scaling up, many of our team members represent the UK within CCAMLR. Our project and team are not only communicating findings to CCAMLR[3], but are actively involved in driving the research and policy agenda in terms of integrating climate change into ecosystem-based management[7,8].

This area of work is increasingly recognized as a priority, and there is a growing need for guidance, best practices, and frameworks, which our project is working to provide. We are on track to deliver a climate change evaluation framework, supported by a robust knowledge base and risk assessment, with continuous input from partners, stakeholders, and collaborators.

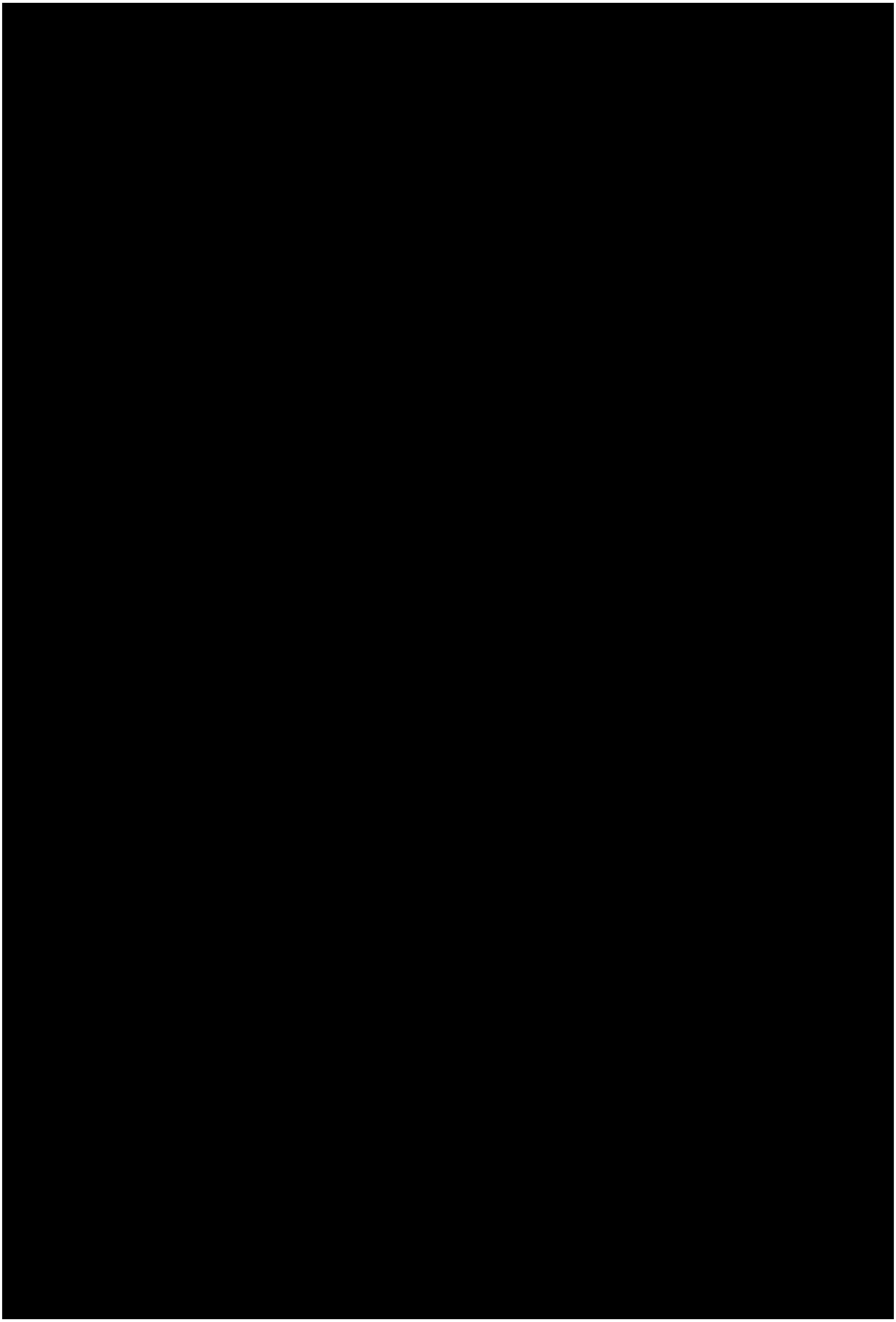
In terms of scalability, the evaluation framework is expected to be applied to additional areas and species. Our exit strategy is robust and continued collaboration will sustain the integration of project findings into ecosystem-based management in the region and beyond, ensuring the legacy of the project extends beyond its lifetime.

11. Darwin Plus identity

The Darwin Plus logo has been used in presentations and on the project webpages, and Darwin Plus has been acknowledged as funder in written material. BAS and Cefas continue to promote Darwin Plus funding opportunities and projects. Darwin Plus was acknowledged as a key funder of high-impact Southern Ocean and UKOT research at the UK CCAMLR Science Priorities Workshop (see Section 2). Within GSGSSI there is a high level of understanding and appreciation of Darwin Plus. We will increase outreach associated with the project in the coming period, particularly in sharing key findings from the forthcoming outputs.

12. Safeguarding

Please note, the information in this table is at the BAS level, as lead organisation of this project.



13. Project expenditure

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

Project spend (indicative) in this financial year	2024/25 D+ Grant (£)	202/25 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	**55,279.14**	**52,955.2**		

Travel and Subsistence, operating costs and capital items differ from those in the original proposal budget for 2024/25. These changes are due to reprofiling in relation to an extension in the project duration and were agreed via Change Requests (CR24-022; CR24-085; CR24-163).

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]		BAS and Cefas overhead costs, and staff costs for contributions from GSGSSI.
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.

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)

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

Project summary	Progress and Achievements April 2023 - March 2024	Actions required/planned for next period
Impact Potential risks of climate-driven change to toothfish in South Georgia and the South Sandwich Islands (SGSSI) are better understood and made available to inform ecosystem-based fisheries management in the region (*Original agreed Impact statement*). Improved ecosystem-based fisheries management, incorporating climate change risks, supports the long-term sustainability of toothfish stocks around South Georgia and the South Sandwich Islands (SGSSI). (*Amended Impact statement, according to AR1 review comments (DPLUS189 AR1R, Section 2), see also Section 8 above*),	Contributions of the project this reporting period to ecosystem management in the face of climate change include contributions to: - CCAMLR WG-FSA[3,7] and SC[8] on integrating climate change into CCAMLR's work (see Sections 3.1, 3.2, Annex 4)	[redacted]
Outcome An evaluation of the risks that climate change poses for toothfish in SGSSI informs ecosystem-based fishery management such that it can incorporate measures to reduce these risks.		
Outcome indicator 0.1 Scientific papers and reports on the ecological risk assessment of the effects of climate change on both species of toothfish will be prepared at regular intervals during the project (2023, 2024, 2025, 2026). Scientific papers will be submitted for publication in peer-reviewed literature (Apr 2025; Apr 2026). Papers will be submitted to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR; Oct 2023, 2024, 2025, 2026). Reports will be made available on the project and GSGSSI websites (Sep 2023, May 2026).	Papers available or in prep (see Sections 3.1, 3.2 and Annex 4): - Paper[3] presented at CCAMLR WG-FSA (October 2024) - Two papers[1,2] on the relationship between toothfish and the environment (present day) in preparation for peer-reviewed journal.	Complete papers on toothfish and climate change
Outcome indicator 0.2 Stakeholder workshop report presenting the climate change evaluation framework encompassing data acquisition, analyses	Elements underpinning the evaluation framework are underway - data acquisition complete (DPLUS189 AR1); present-day modelling undertaken[1,2] (see Sections 3.1, 3.2	Complete Output 2 to underpin the evaluation framework

and visualisation, and management recommendations (May 2026).	and Annex 4); development of projections modelling approach in initial stages; consideration of appropriate frameworks.	Consider existing frameworks and how they might be adapted for our project
Outcome indicator 0.3 Revised SGSSI Toothfish Fishery Management Plan that includes consideration of climate change and addresses the outcome of this project (Jun 2026).	Contribution to work through CCAMLR[3,7,8] for toothfish fisheries more widely, including on monitoring the potential effects of environmental variability and climate change on stock assessments and key stock productivity parameters (see Sections 3.1, 3.2 and Annex 4).	Plan and prepare for Stakeholder Workshop
Outcome indicator 0.4 Preliminary project results considered in the upcoming review of the SGSSI Marine Protected Area (MPA) (potentially end 2023, to be determined).	Completed during previous reporting period (AR1). Project was included in a presentation to an SGSSI MPA meeting, March 2025	
Outcome indicator 0.5 Project outputs provided for inclusion in the MPA Data Portal (Dec 2023; Mar; May 2025).		Extract relevant findings for the MPA Data Portal

Output 1 Knowledge base of relevant environmental, biological and fishery information for both species of toothfish created, providing the basis for understanding toothfish sensitivity to environmental parameters.		
Output indicator 1.1 Project kick-off workshop report (Aug 2023).	Completed during previous reporting period (AR1)	
Output indicator 1.2 Information paper submitted to CCAMLR Working Group on Fish	Completed during previous reporting period (AR1)	

Stock Assessment (WG-FSA) (Oct. 2023).		
Output indicator 1.3 Project knowledge base established for both species of toothfish (Dec 2023).	Completed during previous reporting period (AR1)	Refine how the knowledge-base is summarised and visualised for the website
Output indicator 1.4 Relevant information provided for inclusion in the SGSSI MPA Data Portal (Dec 2023).		Extract relevant findings for the MPA Data Portal
Output 2. Ecological risk assessment of the effects of climate change on toothfish		
Output indicator 2.1 Scientific paper submitted to CCAMLR WG-FSA (Oct 2024) on toothfish life history, identifying life-stages that may be particularly susceptible to changing climate, also prepared for submission to peer-reviewed journal (Apr 2025).	Paper submitted and presented at WG-FSA 2024[3]. Two journal papers in preparation[1,2]. (See Section 3.1 and Annex 4)	Complete and submit papers to peer-reviewed journal
Output indicator 2.2. Scientific paper **(**a preliminary version will be submitted to CCAMLR WG-FSA Oct 2025) that considers projected climate change impacts to both species of toothfish submitted to peer-reviewed journal, describing the model projections	Initial development for analyses and paper on projected change underway. (See Section 3.1)	Submit preliminary outline to CCAMLR WG-FSA, develop analyses and prepare the scientific paper for a peer-reviewed journal

and the risk assessment (~~Mar 2025~~ Apr 2026).		
Output indicator 2.3 Relevant outputs from the risk assessment provided for inclusion in the SGSSI MPA Data Portal (~~Dec 2024, Mar 2025~~ May 2026).	Steps to underpin the risk assessment are underway. (See Section 3.1)	Undertake risk assessment and determine relevant information for the MPA Data Portal
Output 3. Climate change evaluation framework for toothfish fishery management		
Output indicator 3.1 Report from stakeholder workshop, presenting evaluation framework for climate change risk for both species of toothfish which encompasses data acquisition, analyses and visualisation, to management recommendations (May 2026).	Elements underpinning the evaluation framework are underway - data acquisition completed (DPLUS189 AR1); present-day modelling[1,2] (see Sections 3.1 and Annex 4); development of projections modelling approach in initial stages; consideration of appropriate frameworks.	Continue to develop work for the evaluation framework. Plan and prepare for Stakeholder Workshop
Output indicator 3.2 Project outputs and recommendations incorporated into the SGSSI Toothfish Fishery Management Plan (Jun 2026).		Plan and prepare for Stakeholder Workshop, an output of which will include recommendations for the Toothfish Fishery Management Plan based on project findings
Output indicator 3.3 Paper submitted to CCAMLR WG-FSA that presents project outputs and recommendations (prepared Jun 2026, submitted Oct 2026).		Plan and prepare for Stakeholder Workshop, an output of which will be a report that forms the basis for this paper.

Project Summary	SMART Indicators	Means of Verification	Important Assumptions
Impact: [redacted]			
Outcome: (Max 30 words) An evaluation of the risks that climate change poses for toothfish in SGSSI informs ecosystem-based fishery management such that it can incorporate measures to reduce these risks.	0.1 Scientific papers and reports on the ecological risk assessment of the effects of climate change on both species of toothfish will be prepared at regular intervals during the project (2023, 2024, 2025**, 2026**). Scientific papers will be submitted for publication in peer-reviewed literature (~~Dec 2024~~ **Apr 2025**; ~~Mar 2025~~ **Apr 2026**). Papers will be submitted to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR; Oct 2023, 2024**, 2025, 2026**). Reports will be made available on the project and GSGSSI websites (Sep 2023, May ~~2025~~ **2026**). 0.2 Stakeholder workshop report presenting the climate change evaluation framework encompassing data acquisition, analyses and visualisation, and management recommendations (~~Apr 2025~~ **May 2026**). 0.3 Revised SGSSI Toothfish Fishery Management Plan that includes consideration of climate change and addresses the outcome of this project (~~May 2025~~ **Jun 2026**).	0.1 Project reports will be made publicly available via the project website and the Government of South Georgia & the South Sandwich Islands (GSGSSI) website as appropriate. Scientific papers will be published as open access. Papers submitted to CCAMLR will be cited in the CCAMLR meeting reports and made available on the project website. 0.2 Workshop report will be published on project webpage and GSGSSI webpage. 0.3 Approved updated fishery management plan published on the GSGSSI website. 0.4 MPA review report includes preliminary project results (potentially end 2023, date of review to be determined). 0.5 MPA Data Portal includes project outputs (~~May 2025~~ **Jun 2026**).	0.1 Successful appointment of a PDRA with the required skillset. 0.1 Reports and papers are prepared and submitted on time. 0.2 Engagement and feedback from stakeholders to ensure the outputs are relevant and useable. 0.3 Stakeholders engage in management discussions to incorporate scientific advice into future fishery management decision-making. 0.4 SGSSI MPA review is completed on schedule, with an opportunity for preliminary project results to be submitted for consideration. 0.5 Outputs are suitable for inclusion in the MPA Data Portal.

	0.4 Preliminary project results considered in the upcoming review of the SGSSI Marine Protected Area (MPA) (potentially end 2023, to be determined). 0.5 Project outputs provided for inclusion in the MPA Data Portal (Dec 2023; ~~Mar;~~ ~~May 2025,~~ **Jun 2026**).		
Outputs: **1**. Knowledge base of relevant environmental, biological and fishery information for both species of toothfish created, providing the basis for understanding toothfish sensitivity to environmental parameters.	1.1 Project kick-off workshop report (Aug 2023). 1.2 Information paper submitted to CCAMLR Working Group on Fish Stock Assessment (WG-FSA) (Oct. 2023). 1.3 Project knowledge base established for both species of toothfish (Dec 2023). 1.4 Relevant information provided for inclusion in the SGSSI MPA Data Portal (Dec 2023).	1.1 Report published on project website 1.2 Paper included in WG-FSA report, and also made publicly available on project website. 1.3 Knowledge base for both species made available via project website. 1.4 Information accessible via the SGSSI MPA Data Portal.	1.1 Availability of key scientists and stakeholders to engage in the kick-off workshop. 1.2 Paper prepared on time for submission to WG-FSA. 1.3 Relevant restricted information made available (e.g., toothfish occurrence data on request to CCAMLR). 1.4 SGSSI MPA Data Portal updated in timely manner.
2. Ecological risk assessment of the effects of climate change on toothfish.	2.1 Scientific paper submitted to CCAMLR WG-FSA (Oct 2024) on toothfish life history, identifying life-stages that may be particularly susceptible to changing climate, also prepared for submission to peer-reviewed journal (~~Dec 2024~~, **Apr 2025**). 2.2 Scientific paper **(a preliminary version will be submitted to CCAMLR WG-FSA Oct 2025)** that considers projected climate change impacts to both species of toothfish submitted to peer-reviewed journal, describing the model projections and the risk	2.1 Scientific paper will be published in a journal as open access. Paper mentioned in WG-FSA report. 2.2 Scientific paper will be published in a journal as open access. Paper mentioned in CCAMLR/WG-FSA report (verifiable after project end date due to timing of WG-FSA meeting*). 2.3 Outputs made available via the SGSSI MPA Data Portal.	2.1 Available predictor variables usefully explain observed variance in species distribution. 2.2 Prognoses of key predictor variables are available at the appropriate scale. 2.3 Dependent on Indicators 2.2 and 2.3

	assessment (~~Mar 2025~~ **Apr 2026**). ~~Note this will also be submitted to CCAMLR WG-FSA Oct 2025.~~ 2.3 Relevant outputs from the risk assessment provided for inclusion in the SGSSI MPA Data Portal (~~Dec 2024, Mar 2025~~ **May 2026**).		
3. Climate change evaluation framework for toothfish fishery management.	3.1 Report from stakeholder workshop, presenting evaluation framework for climate change risk for both species of toothfish which encompasses data acquisition, analyses and visualisation, to management recommendations (~~Apr 2025~~ **May 2026**). 3.2 Project outputs and recommendations incorporated into the SGSSI Toothfish Fishery Management Plan (~~May 2025~~ **Jun 2026**). 3.3 Paper submitted to CCAMLR WG-FSA that presents project outputs and recommendations (prepared ~~May 2025~~ **Jun 2026***submitted Oct ~~2025~~ **2026**).	3.1 Stakeholder workshop report published on project and GSGSSI websites. 3.2. Approved updated fishery management plan published on the GSGSSI website. 3.3 *Paper cited in CCAMLR WG-FSA meeting report, proposing incorporation of outputs into CCAMLR Conservation Measures (CMs) (verifiable after project end date). Paper will also be made publicly available on project website.	3.1 Availability of key scientists and stakeholders, engagement in the final workshop. 3.2 Stakeholders engage in management discussions to incorporate scientific advice into future fishery management decision-making. 3.3: Project Leader (PL) submits CCAMLR WG-FSA paper after the end of the project. *Note that the CCAMLR ~~2025~~ **2026** annual meetings will take place after the end of the project, but the papers will be prepared during the project and submitted by the PL to CCAMLR WG-FSA in Oct ~~2025~~ **2026**. Note that CCAMLR CMs are agreed by consensus, therefore there is no guarantee that they will be adopted, even if most Members are supportive.

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. Each activity should start on a new line and be no more than approximately 25 words.)

Output 1 Relevant environmental, biological and fishery information for toothfish synthesised, providing the basis for understanding toothfish sensitivity to environmental parameters

1.1 Advertise, interview and appoint a PDRA for the project.
1.2 Establish project webpage to keep partners and stakeholders informed of progress and create appropriate online collaborative space for the project team.
1.3 Organise and prepare for kick-off workshop, finding suitable date for workshop to enable maximum participation.
1.4 Convene workshop with scientists and stakeholders to co-design objectives and identify required information and sources for the knowledge base, together with timeframes and reference points.
1.5 Source and collate information into useable format to establish knowledge base.
1.6 Determine how the information needs to be synthesised, summarised and visualised.
1.7 Prepare and disseminate workshop report, including making available on the project website.
1.8 Prepare and submit information paper to CCAMLR WG-FSA.
1.9 Provide relevant information for inclusion in SGSSI MPA Data Portal.

Output 2 Ecological risk assessment of the effects of climate change on toothfish

2.1 Interrogate knowledge base to identify appropriate dependent variables representing distribution and abundance of key life stages of both species.
2.2 Interrogate knowledge base to identify candidate predictor variables for species-environment modelling.
2.3 Determine candidate analytical and modelling approaches for species-environment relationship modelling.
2.4 Identify the most suitable approaches based on objectives and variables.
2.5 Identify an appropriate way to represent uncertainties in climate change projections in the results of the chosen species-environment modelling approach.
2.6 Apply approach from 2.4 to develop species-environment models.
2.7 Extract prognoses of predictor variables from the knowledge base representing timeframes identified in consultation with stakeholders.
2.8 Use the results of 2.5, 2.6 and 2.7 to project the change in suitable habitat within the identified timeframes, and associated uncertainties.
2.9 Develop method (simple model/calculation) to translate projections of the distribution of key life stages into estimates of population size for both species.
2.10 Apply results of 2.8 in combination with the approach in 2.5 to assess climate change risk to species distributions based on the distribution reference points identified in 1.4.
2.11 Apply results of 2.9 in combination with the approach in 2.5 to assess climate change risk to species abundance based on the population reference points identified in 1.4.
2.12 Prepare two scientific papers, one on present-day, one on projections.
2.13 Provide relevant information (e.g., maps of predicted present/future habitat) and the risk assessment for inclusion in the SGSSI MPA Data Portal.

Output 3 Climate change evaluation framework

3.1 Develop a framework to evaluate climate change for toothfish (encompassing data acquisition, analyses and visualisation, management recommendations).
3.2 Stakeholder workshop held to discuss project results, consider current management, refine framework and develop recommendations.
3.3 Prepare workshop report.
3.4 Input to SGSSI Toothfish Fishery Management Plan.
3.5 Provide recommendations to CCAMLR.

Table 1 Project Standard Indicators

Please see the Standard Indicator guidance for more information on how to report in this section, including appropriate disaggregation.

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-B02	Number of new/improved species management plans available and endorsed	0.3	Number		0	0		0	1
DPLUS-C01	Number of best practice guides and knowledge products published and endorsed	0.2	Number		0	0		0	1
DPLUS-C08	Number of Media related activities		Number		0	0		0	3

Note that it is difficult to fit many of the Standard Indicators to this project. Note in AR1, we included two that are no longer available (C18 and C19).

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)
*Defining the relationship between Patagonian toothfish and their environment in Subarea 48.3	Paper to CCAMLR (grey literature)	Cavanagh, R., Jones, T., Cleeland, J., Hollyman, P., Thorpe, S. and Collins, M. (October, 2024).	Female	British	N/A	https://www.bas.ac.uk/project/evaluating-climate-change-risks-to-patagonian-and-antarctic-toothfish/

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?	Yes
Is the report less than 10MB? If so, please email to BCF-Reports@niras.com putting the project number in the Subject line.	Yes
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.	No
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.	Yes
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.	Yes
If you are submitting photos for publicity purposes, do these meet the outlined requirements (see section 15)?	N/A
Have you involved your partners in preparation of the report and named the main contributors	Yes
Have you completed the Project Expenditure table fully?	Yes
Do not include claim forms or other communications with this report.	