Darwin Plus: Final 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: no later than 3 months after agreed end date.

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

Darwin Plus Project Information

Project reference	DPLUS167
Project title	Pathogens as a threat to seabirds in the Falkland Islands
Territory(ies)	Falkland Islands
Lead Organisation	University of Glasgow
Project partner(s)	- South Atlantic Environmental Research Institute - Falklands Conservation - Marine and Environmental Sciences Centre - Centre for Functional and Evolutionary Ecology
Darwin Plus Grant value	£98,135.00
Start/end date of project	01/07/2022 – 30/06/2024
Project Leader name	Amandine Gamble
Project website/Twitter/blog etc.	- facebook.com/FalklandsWildlifeHealth (was deleted by Facebook)
Report author(s) and date	Gamble, 31 October 2024 (submitted 6 July 2025 after financial audit closed)

1 Project Summary

Infectious diseases are increasingly acknowledged as a threat to biodiversity conservation. The ongoing highly pathogenic avian influenza (HPAI) panzootic, which is estimated to have caused the death of tens of thousands of wild birds and mammals, a likely very large underestimate, illustrates the need for better wildlife disease surveillance and response systems.

In the Falklands Islands (FI), recurrent seabird die-offs have been reported, but their cause(s) remain elusive. Considering the importance of the FI for avian populations (with 122 species, including 8 globally threatened species and 3 endemic species, and 23 Important Bird and Biodiversity Areas), and, reciprocally, the importance of avian populations for the identity and economy (notably via tourism) of the FI, it is critical for this territory to be equipped to lead appropriate surveillance and response to wildlife disease outbreaks. In particular, as HPAI spreads through South America, the FI wildlife is expected to take a hard toll – it is critical to build the capacity to detect the virus, understand its transmission pathways and assess its impact on the local wildlife. This also holds true for other pathogens susceptible to cause wildlife mortality events such as avian cholera *Pasteurella*, poxviruses, etc…

This project aims to investigate the presence of seabird pathogens on the archipelago, characterize their dynamics across species, space and time, as well as their impact on the local

seabird populations. Based on this novel knowledge and capacity building, this project will improve surveillance and response protocols against infectious diseases in the Falkland Islands. To reach this objective, we will:

1. Build a database on potential pathogen detection and quantification in the seabirds of the FI through biological sample collection and laboratory analyses.
2. Increase our knowledge of epidemiological dynamics in the FI through the description of the patterns revealed by the biological data generated by the project.
3. Increase our understanding of the likely drivers and consequences of infectious agent dynamics in the system through statistical models exploring associations between ecological and epidemiological patterns.
4. Improve disease surveillance and response system by engaging with local and international stakeholders, optimizing field protocols and laboratory analysis pipelines, and building local capacity.

To do so, the project team includes both local and international partners, and works with a network of stakeholders including private landowners and governmental and non-governmental organizations in the Falkland Islands and abroad (Figure 1).

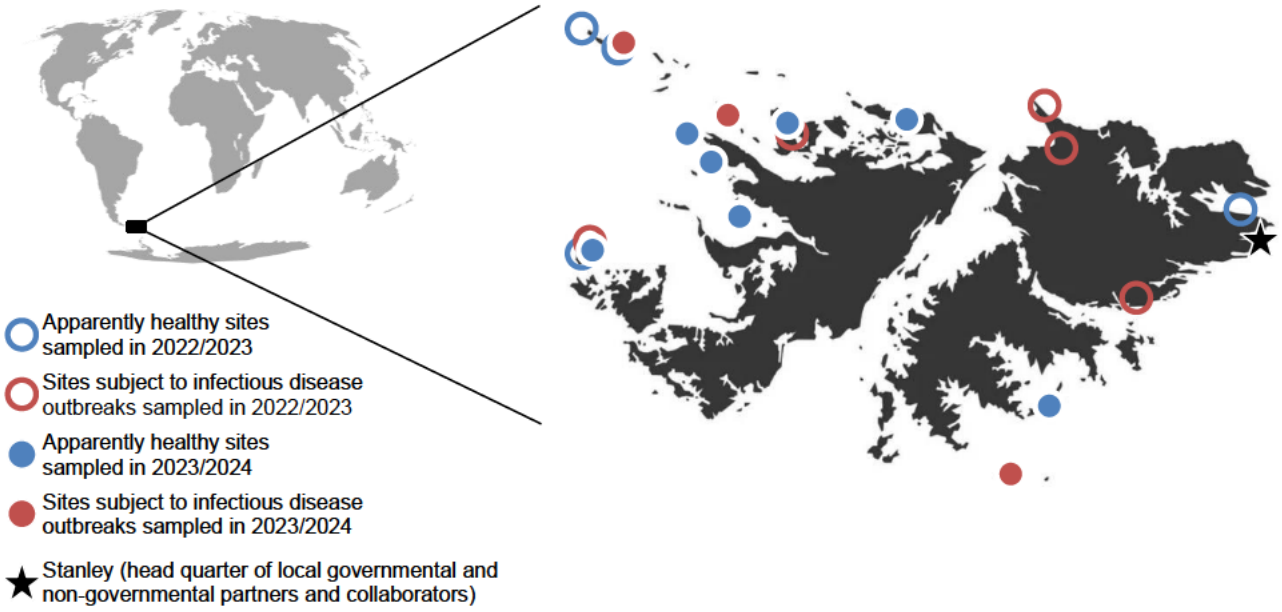

Figure 1. Study sites of the project.

2 Project Partnerships

This project is led by a consortium of local non-governmental institutions and international academic institutions providing scientific expertise and capacity.

Locally, the project itself is based on demand stemming from SAERI, a local non-governmental institution leading research in the FI. It also involves Falklands Conservation, a local nongovernmental institution leading ecosystem monitoring and conservation programs. It is also supported by the Falkland Islands Government (FIG).

Year 2 of the project was focused on strengthening and expanding collaborations between the project partner and local stakeholders, in particular the FIG and private landowners.

Engagement of the FIG was discussed during regular dedicated **in-person meetings** with the

FIG Veterinary Services (Zoe Fowler and collaborators) and Environmental Department (Denise Blake and collaborators). The interest of the FIG for the project was confirmed by the attendance of the several representatives to the **public talk and discussion session** led by the project team in Stanley (Figure 2). This public talk and discussion session also attracted members of the broader community, including conservation experts, media and tourism

specialists, and visiting researchers, and other inhabitants and visitors of Stanley. Perspectives from those discussions include:

1. **Exchange of protocols and data related** to wildlife disease surveillance and response, in particular in the context of the HPAI panzootic.
2. **Collaborative applications to external funding** to improve local facilities.

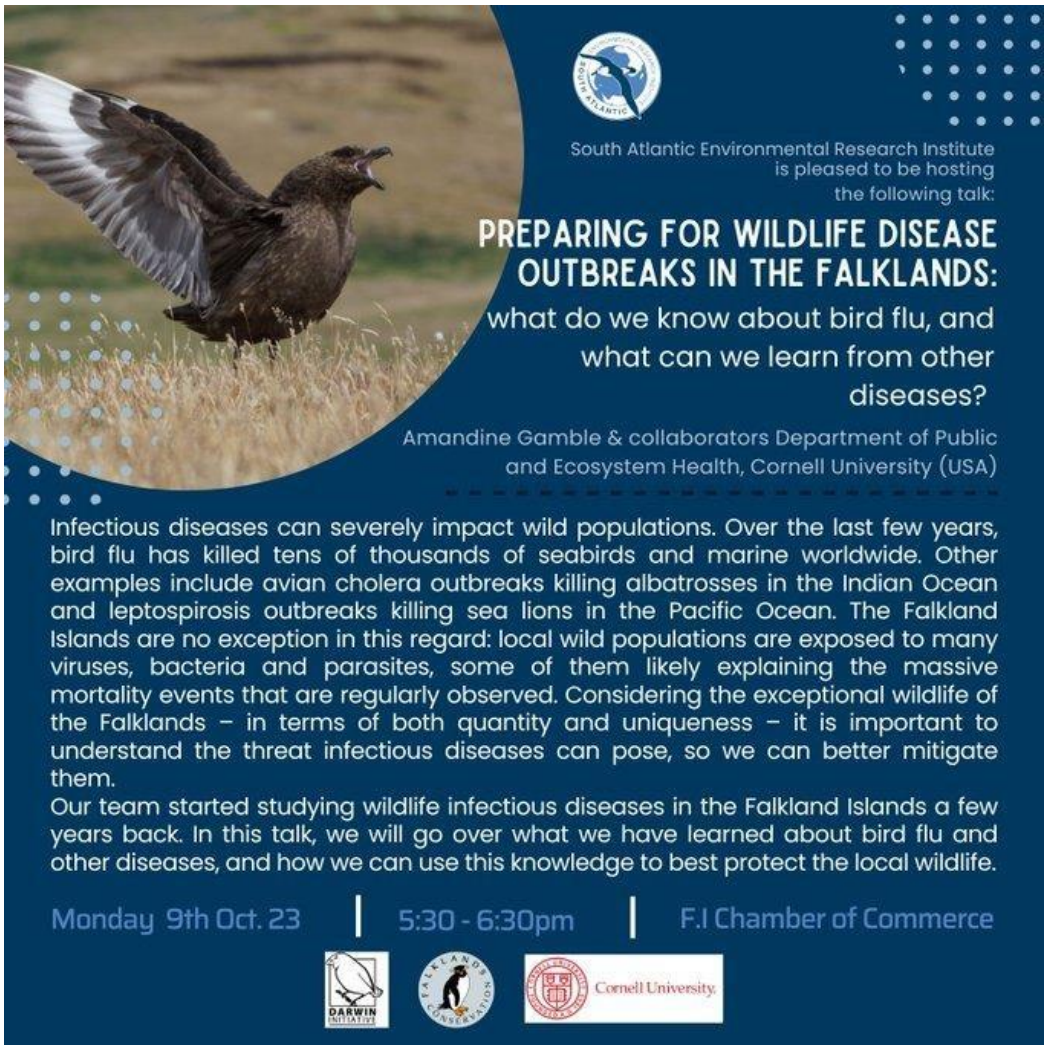

Figure 2. Flyer of the public talk and discussion session led in Stanley by the project team (advertised on Facebook, X and on Falklands Radio, and attended by ~50 people, corresponding to the full capacity of the seminar room).

Engagement of private landowners was discussed **during site visits**. These included, in addition to the sites sampled in 2022/2023:

- 1 site from which data and samples were collected as a response to suspected wildlife disease outbreaks (Carcass Island).
- 6 new sites for which baseline data and samples were collected (West Point Island, Hummock Island, Pebble Island, Bleaker Island, Sealion Island, Dunbar).

The trend observed last year regarding community engagement was confirmed, with **more direct involvement of the academic partners in the investigation of suspected wildlife disease outbreaks, considerably increasing the capacity to lead those investigations** (previously led primarily by the FIG Veterinary Services). Suspected wildlife disease outbreaks were either **reported to the project team via the FIG Veterinary Services**, **reported directly to the project team**, or directly observed by the project team while conducting routine fieldwork. This allowed us to investigate 3 suspected wildlife disease outbreaks in 2023/2024 (Figure 1). We also collected data and samples from 7 apparently healthy sites (no massive mortality event reported) (Figure 1) that nevertheless revealed the wider circulation of HPAI and pox (those results will be reported in the final report to be submitted in September 2023 once all

the samples have been analysed). Laboratory analyses of the collected samples are ongoing – results are shared with the FIG Veterinary Services and the involved landowners as soon as they are available.

The fact that a suspected wildlife disease outbreaks was directly reported by a landowner to the project team, and the fact that several landowners have expressed interest, or even actively initiated contacts with the research team, regarding the possibility to collect baseline data and samples from their sites are particularly rewarding and illustrate the engagement of the community in wildlife disease surveillance and response. In parallel, real-time data exchange between the FIG Veterinary Services and the project team allowed both parties to trigger rapid responses (policy responses by closing HPAI-infected sites and research response by conducting targeted field investigations).

In parallel with our efforts to connect with the local community, we also widely **engaged with international institutions**. Project member Amandine Gamble joined the High Pathogenicity H5N1 Avian Influenza Intersessional Group of the Agreement for the Conservation of Albatrosses and Petrels (ACAP). We also maintained regular interactions with the Antarctic Animal Health Network of the Scientific Committee for Antarctic Research (SCAR), which project members Amandine Gamble and Thierry Boulinier are member of. We are pursuing efforts to engage with the international community as international conferences and will present the project outputs and lead workshops at the International Albatross and Petrel Conference and the International Seabird Group Conference in the coming months.

3 Project Achievements

3.1 Outputs

Database on potential pathogen detection and quantification in the seabirds of the FI (Output 1)

Field data and sample collection and census is **on track** and has been highly successful so far. **Our sample bank went from 407 to 3,475 individual birds, expanding from 6 to 16 bird species, and from 1 to 12 sites within the FI** [**Indicators 1.1-2**]. This surpassed our expectations as we targeted samples from 750 new individuals but reached more than twice this number. This was notably permitted by matched funding (*Remove Disease* project, BiodivERsA initiative, granted to Thierry Boulinier CEFE) enabling us to increase our field team. By covering a diversity of species and sites, those samples will allow us to explore associations between ecological and epidemiological patterns in the study system, which will be critical is enriching our mechanistic understanding of pathogen dynamics in the FI (Outputs 2-3).

The laboratory analyses of the samples collected prior to the project and during Years 1 and 2 have been completed for five pathogens (HPAI, flaviviruses, paramyxoviruses, poxviruses and *Toxoplasma gondii*) [**Indicators 1.3-5**]. These data are the core focus of 2 manuscripts submitted, and 1 to be submitted for publication in peer-reviewed journals; they will be made public on the Falkland Islands Data Portal as soon as scientific manuscripts are accepted for publication.

Increased knowledge of epidemiological dynamics in the FI based on the mapping of potential pathogen occurrence across species, space and time (Output 2)

Data have been shared with local stakeholders through a dynamic visualization framework that highlights patterns of pathogen prevalence across space, time, and species for the pathogens for which we obtained data as part of Output 1 (**Figure 3**) [**Indicators 2.1-4**]. We have been able to identify clear patterns that we are now using to identify likely drivers of those pathogen dynamics (e.g., heterogeneities in host species' exposure rates and response to infection).

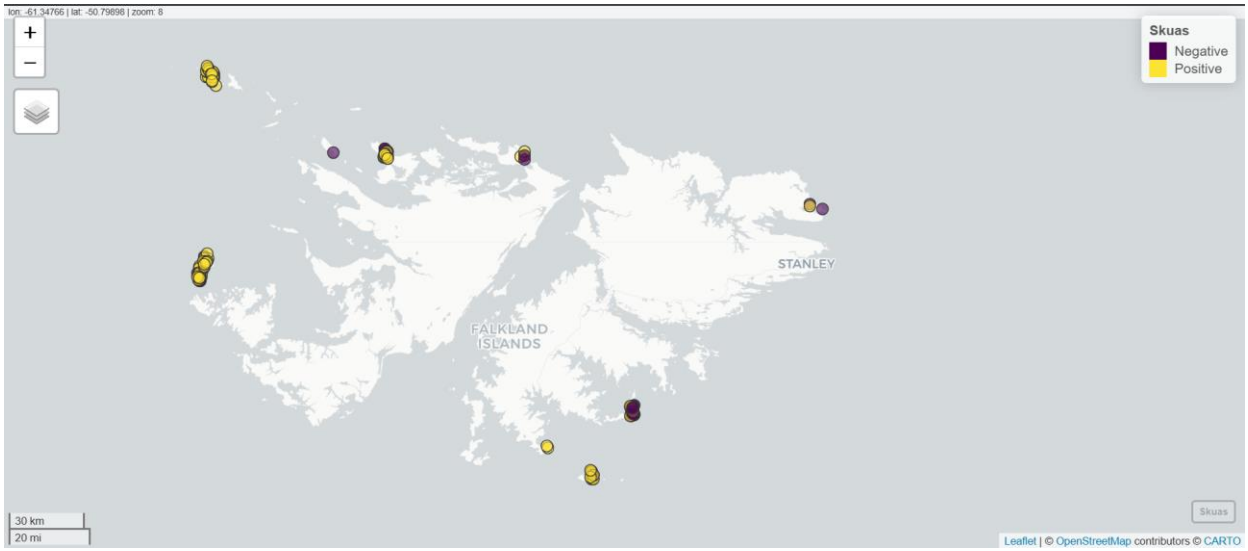

Figure 3. Example of data visualization. Screenshot of a dynamic map showing how exposure to HPAI in scavenging birds varies across islands.

Increased knowledge of the likely drivers and consequences of infectious agent dynamics in the system (Output 3)

In parallel with the data aggregation and synthesis effort of Output 2, we developed theoretical models aimed at formalizing the hypothetic drivers of epidemiological dynamics, including impact of infection on the hosts, host species community composition, ecological traits of the host species, and host connectivity [**Indicators 3.1-5**]. This is the core focus of a manuscript to be submitted for publication in a peer-reviewed journal.

Improved disease surveillance and response system via increased local engagement and capacity and revised protocols (Output 4)

Activities related to community engagement and capacity building were highly successful, resulting in a significant increase of community engagement, including notably the local government and private landowners, facilitating the investigations of suspected wildlife disease outbreaks (see Section 2). This was notably highlighted by high participation in public talks delivered by the team in the FI and social media engagement [**Indicators 4.4-5**]. This local trend was accompanied by a similar one on the global scale as HPAI outbreaks have brought people's attention to wildlife disease. We have been capitalizing on this trend to engage with both the wildlife research and conservation community and the general public. Protocols for monitoring wildlife diseases [**Indicators 4.1-3,6-7**] were tested through the 2023/2024 (and 2024/2025) HPAI outbreaks, with sampling and testing run hand in hand by the project team and the Department of Agriculture.

3.2 Outcome

Our project aimed to build a framework for the long-term monitoring of seabird pathogens in the FI, including practical tools and shared knowledge (outreach and training), and rooted in a network of local and international collaborators. We successfully achieved this outcome, notably as we obtained novel biological data, and rose a wide interest of the local and global community for wildlife infectious disease, resulting in the facilitation of the investigations of suspected wildlife disease outbreaks (see Sections 2 and 3.1). This was showcased by the quality of the HPAI outbreak investigations following the introduction of the virus into the FI in 2023/2024. These investigations enabled the detection of several outbreaks and informed response to the outbreaks (e.g., site closure) [example of **Indicator 0.2**]. Importantly our data and research showed that (1) the FI wildlife was naïve, hence particularly vulnerable, to influenza viruses, (2) different species responded differently to infection (e.g., high impact on albatrosses, low on skuas), and (3) the virus was way more widespread than mortality event observation only could reveal [example of **Indicator 0.1**].

3.3 Monitoring of assumptions

Assumption 1. Data acquisition pipeline is functional (from sample acquisition and data compilation to laboratory analyses)
Comment. Still holds true: the results from the laboratory analyses have been obtained without any unexpected challenge (see Section 3).

Assumption 2. At least one infectious agent was detected (pilot data from banked samples suggest that at least two of the targeted infectious agents are present on the FI)
Comment. Still holds true: all the targeted infectious agents are present in the FI except *Toxoplasma gondii* (see Section 3).

Assumption 3. The local actors are willing to engage (several collaborators have already expressed their support of the project)
Comment. Still holds true: this was confirmed by several means such as high attendance to an international workshop and a local public talk and discussion session on the topic of wildlife infectious disease and the willingness of various actors to facilitate the investigation of wildlife disease outbreaks (see Sections 2 and 3).

Assumption 4. Banked samples are available for analyses (1,500 identified samples are currently available at CEFE)
Comment. Still holds true: samples from 407 individual birds (corresponding to > 2,000 samples) are available at CEFE and listed in an appropriate data base (see Section 3).

Assumption 5. Laboratories for analyses are accessible
Comment. Still holds true: the results from the laboratory analyses have been obtained without any unexpected challenge (see Section 3).

Assumption 6. Protocols are functional (protocols for 5 of the 6 targeted infectious agents have already been validated for use on seabird samples by the project partners)
Comment. Still holds true: the results from the laboratory analyses have been obtained without any unexpected challenge (see Section 3).

Assumption 7. Ecological data are available (most of the data are already available at SAERI, FC and MARE and only need to be compiled)
Comment. Still holds true: data were shared between project partners.

Assumption 8. In the event of an HPAI outbreak in the FI, field data and sample collection will still be possible
Comment. Still holds true: the FIG Environmental Department has supported the possibility to maintain field investigations in the event of an HPAI outbreak, provided that appropriate biosecurity measures are respected (for the safety of both wildlife and people), and that field investigations are justified. Such field investigations would notably help understand the transmission pathways of the virus and assess its impact on the local wildlife, informing response to the outbreak. We have started working on adjusted protocols (as part of Activities 4.2-3, initially scheduled for Year 2 but moved forward in response to the high likelihood of HPAI introduction to the FI in the coming months). This notably involves (1) interactions with the FIG Environmental Department and Veterinary Services, and (2) risk assessment and guideline production led by the SCAR Wildlife Health Monitoring Group (in which 2 of the project team members are involved; see Section 3).

Assumption 9. Our Change Request for rolling over unspent fund from Year 1 to Year 2 is accepted (accepted).
Comment. The signature of the Collaboration Agreement has been delayed, which has been delaying expenses (related to Operating costs only). Unspent fund (£49,088.97) were rolled over from the 2022/2023 financial year to the 2023/2024 financial year. Contribution to Darwin Plus Programme Objectives

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

The expected outputs of this project will enrich our understanding of the threat posed by pathogens to globally significant seabird populations in the FI. This novel knowledge will be

used to improve response to pathogen outbreaks in the FI, in parallel with improving capacity locally through community engagement and training. This project will thus directly support the

FI Environment Strategy, in particular with regard to the “Biodiversity and Ecosystem Integrity” and “Science and Innovation” objectives. Accordingly, this project is supported by the FIG.

Globally, considering the exceptional avian community present in the FI, this project will also support FIG’s commitments to the **Convention on Biological Diversity**. In particular this project will directly address the articles 7 (Identification and Monitoring), 12 (Research and Training), 13 (Public Education and Awareness),17 (Exchange of Information) and 18

(Technical and Scientific Cooperation) of the convention. The project will also contribute to the Convention on the **Conservation of Migratory Species of Wild Animals** by bringing insights on the impact of pathogens carried and potentially spread by migratory species. Finally, all the genetic data generated will be managed following the **Nagoya Protocol** on Access and Benefit Sharing.

The **Agreement on the Conservation of Albatrosses and Petrels** (ACAP) has recognized the potential impact of infectious diseases on this group of seabirds, and has rightfully encouraged actions to improve knowledge and management of diseases of concern; i.e. “…review evidence for impacts of pathogens and parasites on ACAP species and effectiveness of mitigation measures”; “… implement long-term disease surveillance programs” and “…thoroughly investigate albatross disease/mortality events when they occur”. We have reinforced the connection of our work with ACAP through the fact that project member Amandine Gamble joined the ACAP High Pathogenicity H5N1 Avian Influenza Intersessional Group. This has led to more frequent exchanges with other members of the ACAP community, including frequent updates on the insights generated by this project.

We have also made significant progress to support the FI into their achievement of strategic long-term outcomes for the natural environment.

Through the **collection of baseline data and samples critical to survey the occurrence of wildlife pathogens** in the FI (see Section 3, activities 1.1-3), the project is on track to:

- Contribute to article 7 (Identification and Monitoring) of the Convention on Biological Diversity.
- Serve as a basis to “implement[ing] long-term disease surveillance programs” as encouraged by ACAP.

Through our work on the **procedures for the reporting and investigation of suspected wildlife disease outbreaks** (see Section 3, activities 4.2-3), the project is on track to:

- Contribute to articles 18 (Technical and Scientific Cooperation) of the Convention on Biological Diversity.
- Contribute to the “implement[ation of] long-term disease surveillance programs” and “investigat[ion of] albatross disease/mortality”.

Through **community engagement and capacity building** (see Section 3, activities 4.4-6), the project is on track to:

- Contribute to articles 12 (Research and Training), 13 (Public Education and Awareness), and 17 (Exchange of Information) of the Convention on Biological Diversity.

The activities scheduled for the end of the project will keep on supporting the FI commitment to the strategic objectives listed above. We are also currently working at the scaling-up of the project to initiate changes in surveillance programs and response protocols to disease outbreaks inside, but also outside of the FI. We are notably finalizing a gift agreement of $250K USD from a private company dedicated to this purpose – contact with this company was possible through our outreach work. We will use this funding to deploy field laboratories and train international staff to use it. This will be facilitated by the wide network of collaborators of the research team.

3.5 Gender Equality and Social Inclusion (GESI)

Please quantify the proportion of women on the Project Board[1].	1/5
Please quantify the proportion of project partners that are led by women, or which have a senior leadership team consisting of at least 50% women[2].	2/5

The project team working on the development and delivery of this project involves both women and men. For instance, out field team for the 2022/2023 campaign was led by a woman, and involved 2 women and 2 men, from institutions from 3 different countries. All the project products are be made freely available to anyone, independently of gender or other individual characteristic such as ethnicity or socio-economic background. When organizing events involving the community (outreach events and workshops) we target women and men equally by using complementary announcement channels (online blog, radio and newspaper advertising, mailing lists), and participation is open to anyone independently of gender. In line with this, efforts have been made to identify the communication channel the most widely used in the FI, and led us to create a Facebook page. We also joined several Facebook community groups capturing the diversity of inhabitants and visitors of the FI (e.g., Falkland Islands Community Board, Falkland Islands Pictures…) where we stay in touch with the community and share project communications.

Consideration is also be given to ensure that project products to not promote gender bias. For instance, we use inclusive language and diverse illustrations. The same consideration is be given to other individual characteristics such as ethnicity or socioeconomic background.

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	

Within the project team, we aim for our team members to all have equal access to opportunities. We are proud for instance for having trained 2 early career researchers with no previous field experience to field work up to full autonomy, and to have given the opportunities

[1] A Project Board has overall authority for the project, is accountable for its success or failure, and supports the senior project manager to successfully deliver the project.

[2] Partners that have formal governance role in the project, and a formal relationship with the project that may involve staff costs and/or budget management responsibilities.

to present their own specific contributions to conferences and through scientific publications. Outside of the project team, we aim to empower local community with capacity to lead epidemiological surveillance without depending on external institutions. This year, we notably widely exchanged with, and trained when needed, inhabitants of remotes islands in the FI to safely collect samples for HPAI surveillance, building upon the protocols shared by the FIG. By the end of the project, we aim to expand this to laboratory analyses notably by providing training to local staff, in the FI and in other territories, empowering the local community to run the full data acquisition pipeline independently of external institutions.

4 Monitoring and evaluation

Monitoring of project progress and indicators is a key part of the role of all project staff but in particular is the responsibility of the project leaders, and the other project principals. Budget dedicated to M&E primarily consist in staff time. In particular, for each output, we monitor and review **database entry** and **result publication**, in addition to **meetings, and outreach and training event reports**. We track progress in community awareness and capacity building through **attendance** of in-person events and **post analytics** for online content. We compare those with the SMART indicators and Means of Verification of the logframe. Based on this approach, the project is on track to reach the targeted Outcome, despite slight changes in the relative scheduling of the different activities (some being delayed, and some being moved forward; see Section 3). Those changes are due to (1) delay in the signature of the Collaboration

Agreement, slowing down expenses related to activities to be conducted in partner institutions and (2) shifted priorities towards the surveillance and response to a potential HPAI outbreak in the FI (see Section 3).

We will maintain this strategy thorough the end of the project. In addition, we planned to implement regular surveys shared with the stakeholders of the projects aiming at assessing their understanding of the project results and their confidence contributing or leading infectious disease surveillance and response in the future – this aspect has mostly been implemented informally, but we are in the process of recruited a student to dedicate his time to this.

5 Lessons learnt

The project was successful, notably due to successful (1) field data and sample collection campaigns (see Section 3) and (2) local community engagement (see Sections 2 and 3). This could only be achieved thanks to the involvement of local institution in the project (SAERI and FC) and long periods of time spent by the project leader on site.

In-person interactions and close interactions with the local community appeared to be critical to the success of the project. The involvement of an anthropologist in the project (see Section 10) has helped make progress on these points. It notably pointed towards values shared by the local community, including a worry around “parachute science” and, on the contrary, a strong interest for long-term research built together with the community, which perfectly aligns with the objectives of the project.

The implementation of the project could have been optimized by:

- Transferring a larger part of the budget to on-site institutions to facilitate field expenses. However, this would also have been challenged by the delays in the signature of the Collaboration Agreement, as this has prevented funding transfer from the lead partner to the other partners (but see below).
- Expecting longer delays in the signature of Collaboration Agreement. This could probably be avoided in the future by starting to work on the Collaboration Agreement earlier (we started working on it a month before the start of the project) or by making the start of the project coincide with the start of the financial year (to have a full year to solve this issue instead of only a few months).

6 Actions taken in response to Annual Report reviews

We appreciate the feedback received on previous reports. We have tried to address all the reviews.

7 Sustainability and Legacy

The project aimed to equip the FI with skills and resources to efficiently monitor and respond to seabird diseases and maintain high scientific standards. Years 1 and 2 have focused on knowledge acquisition and community engagement (see Sections 2 and 2), and Year 3 on training of local staff and identification of pathways to financial sustainability.

We strengthen collaborations with the FIG leading for instance to collaborative sample collection (e.g., the government collects samples for disease diagnostic, and we conduct follow-up field investigations and laboratory analyses including pathogen sequencing to retrace transmission pathways). The research team has also carried on attending bi-annual meetings regarding response to avian influenza outbreaks.

We received £[redacted] from the Antarctic Science International Bursary (ASIB) to invest and deploy sequencing equipment in the FI (which will remain on site after the end of the project), and a £[redacted] gift from Griffin Catalyst (managed through Cornell University, where Amandine Gamble is now based) to expand this approach in terms of capacity (additional equipment including a real-time thermocycler and a sequencer left at the Department of Natural resources) and spatially to the Antarctic Region (including South Georgia and South Sandwich Islands).

8 Darwin Plus Identity

Our project has a clear identity (“Falklands Wildlife Health”), and Darwin Plus is identified as the principal funder of this project. References to Darwin Plus are included in all media (either directly in the media, e.g., scientific presentations, or via centralization of the relevant media on the project webpages with references to Darwin Plus).

9 Risk Management

The main adjustments the project had to make were related to introduction of HPAI to the FI. We have detailed above how we have accounted for this new risk by shifting our priorities and developed adjusted protocols (see Section 3). This has allowed to pursue the project as planned.

10 Safeguarding

11 Finance and administration

11.1 Project expenditure

Project spend (indicative since last Annual Report	2023/24 Grant (£)	2023/24 Total actual Darwin Plus Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others				
TOTAL	85,235	79,510		

11.2 Additional funds or in-kind contributions secured

Matched funding leveraged by the partners to deliver the project	Total (£)
UofG (salary)	[redacted]
SAERI (salary, admin and logistical support)	
FC (salary, admin and logistical support)	
CEFE (salary)	
MARE (salary)	
TOTAL	

Total additional finance mobilised for new activities occurring outside of the project, building on evidence, best practices and the project	Total (£)

Antarctic Science International Bursary (sequencer, poxvirus sequencing)	[redacted]
Griffin Catalyst (sequencer, follow-up field campaign and laborator analyses)	
Cornell University (movement trackers to further investigate pathways of pathogen spread)	
Cornell K. Lisa Yang Center for Wildlife Health Catalyzing Conservation Fund (follow-up project to be led in the New-Zealand Subantarctic Islands)	
TOTAL	

11.3 Value for Money

This project yielded very high value for money. Examples include: capitalizing on banked samples, securing additional follow-up funding, and cooperation with existing infrastructures and programs on site (notably the Department of Agriculture).

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

Project summary	Progress and Achievements
Impact: Improved monitoring of seabird pathogens in the FI, influencing management decisions to improve wildlife health. Improved response to disease outbreaks through increased knowledge of the baseline epidemiological situation	Improved reporting of suspected wildlife disease outbreaks through increased community engagement and strengthen collaborations with local institutions (see Sections 2 and 3). Increased knowledge of pathogen occurrence in the FI wildlife (see Section 3).
Outcome: Framework for the long-term monitoring of seabird pathogens in the FI, including practical tools and shared knowledge (outreach and training), and rooted in a network of local and international collaborators	0.1. Gathered banked samples, collected new samples, and started leading laboratory analysed 0.2. Engaged with the community (in particular the government and private landowners), discussed protocol revisions and capacity building
Output 1. Database on potential pathogen detection and quantification in the seabirds of the FI	
Indicator 1.1. Banked samples listed and gathered at the CEFE, CNRS partner, ready for laboratory analyses [Year 1, Quarter 2]	Completed (n = 807 individual birds).
Indicator 1.2. Novel samples for Y1 gathered (~750 samples) [Y1, Q4] and Y2 (~250 samples) [Y2, Q4]	Year 1 completed (n = 1,459 individual birds – higher than expected thanks to matched funding enabling more staff). Year 2 completed (n = 1,712 individual birds – higher than expected thanks to matched funding enabling more staff).

Indicator 1.3. Dataset of antibody quantification (immunoassays) for 6 families of infectious agents, across > 7 seabird species across the archipelago [Y1, Q4]	Done for 4 pathogens (additional focus was put on HPAI, not leaving time to be put in more pathogens), for > 15 species
Indicator 1.4. Dataset of infectious agent genetic material quantification (PCR) of key infectious agents (2 to 5 depending on which were detected by immunoassay); generated using the equipment acquired by SAERI in the context of the Covid19 Rapid Response project CV19RR02 [Y1, Q1]	Done
Indicator 1.5. Update of data base with results from samples collected in Y2 [Y2, Q4]	Done
Output 2. Increased knowledge of epidemiological dynamics in the FI based on the mapping of potential pathogen occurrence across species, space and time	
Indicator 2.1. Prevalence map for 6 families of infectious agents for > 7 species [Y2, Q1]	Done for 4 pathogens (additional focus was put on HPAI, not leaving time to be put in more pathogens), for > 15 species
Indicator 2.2. Temporal series of the incidence of key infectious agents on selected sites [Y2, Q1]	Done
Indicator 2.3. Synthesis of the spatiotemporal patterns of incidence for all the targeted infectious agents; publication of at least one peer-reviewed publication [Y2, Q1]	Done
Indicator 2.4. Update of analyses with results from samples collected in Y2 [Y2, Q4]	Done
Output 3. Increased knowledge of the likely drivers and consequences of infectious agent dynamics in the system	
Indicator 3.1. Ecological data gathered from the partner (for > 7 seabird species, 10 years and 10 sites across the FI) [Y2, Q2]	Done
Indicator 3.2. Estimates of infectious agent impact (% mortality explained) on seabird demography for each detected infectious agent [Y2, Q2]	Done
Indicator 3.3. Estimates of the effect of host community composition on infectious agent incidences (probability of outbreak in the colony and island as a function of community composition) [Y2, Q2]	Done

Indicator 3.4. Estimates of host ecological traits on infectious agent incidences (probability of outbreak in the colony and island as a function of the traits of the seabird species present) [Y2, Q3]	Done
Indicator 3.5. Estimates of host connectivity on infectious agent spread (probability of outbreak in the colony and island as a function of connectivity with other colonies and islands) [Y2, Q3]	Done
Indicator 3.6. Synthesis of the drivers and consequences of infectious agent dynamics in the system; publication of at least one peer-reviewed publication [Y2, Q3]	Done
Output 4. Improved disease surveillance and response system via increased local engagement and capacity and revised protocols	
Indicator 4.1. Identification of the likely principal infectious threats posed to the seabirds of the FI, and appropriate surveillance protocol [Y2, Q4]	Done
Indicator 4.2. Revision of the procedure for unusual observation reporting [Y2, Q4]	Done
Indicator 4.3. Development of standardized protocols for proactive pathogen monitoring tailored to the FI and aligned with the guidelines of the Wildlife Health Monitoring Group of the Scientific Committee for Antarctic Research [Y2, Q4]	Done
Indicator 4.4. Production of outreach material (at least one flyer and one video) [Y1, Q2]	Done
Indicator 4.5. At least two public talks attended by 50 people each [Y2, Q4]	Done
Indicator 4.6. At least one workshop attended by 10 people [Y2, Q4]	Done
Indicator 4.7. Synthesis of the available material (protocols, outreach and training) and actors' engagement [Y3, Q1]	Done

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 monitoring of seabird pathogens in the FI, influencing management decisions to improve wildlife health. Improved response to disease outbreaks through increased knowledge of the baseline epidemiological situation			
Outcome: Framework for the long-term monitoring of seabird pathogens in the FI, including practical tools and shared knowledge (outreach and training), and rooted in a network of local and international collaborators	0.1. Evidence base (data base and novel biological insights) and tools (protocols and statistical tools) to inform surveillance protocols and decision-making 0.2. Functional framework for wildlife pathogen monitoring developed and implemented (published material, trained personnel, long-term collaboration established)	0.1. Dataset available through FI IMS-GIS data centre and the FI Wildlife Disease Group 0.2. Standardized protocols available on the project page and distributed to the relevant actors (research community, conservation institutions and governmental institutions); FI integrated into the Wildlife Health Monitoring Group of the Scientific Committee for Antarctic Research	Data acquisition pipeline is functional (from sample acquisition and data compilation to laboratory analyses) At least one infectious agent was detected (pilot data from banked samples suggest that at least two of the targeted infectious agents are present on the FI) The local actors are willing to engage (several collaborators have already expressed their support of the project)
Outputs: 1. Database on potential pathogen detection and quantification in the seabirds of the FI	1.1. Banked samples listed and gathered at the CEFE, CNRS partner, ready for laboratory analyses [Year 1, Quarter 2]* 1.2. Novel samples for Y1 gathered (~750 samples) [Y1, Q4] and Y2 (~250 samples) [Y2, Q4] 1.3. Dataset of antibody quantification (immunoassays) for 6 families of infectious agents, across > 7 seabird species across the archipelago [Y1, Q4] 1.4. Dataset of infectious agent genetic material quantification (PCR) of key infectious agents (2 to 5 depending on which were detected by immunoassay); generated using the equipment acquired by	1.1. Samples available at SAERI and CNRS (depending on the analyses) 1.2. Additional samples available 1.3. Dataset of antibody quantification available on a data portal published via a public facing webGIS project page; report submitted to the relevant actors and the Darwin Initiative 1.4. Dataset of infectious agent genetic material quantification available on a data portal published via a public facing webGIS project page 1.5. Database updated with data from new samples [Y2, Q2]	Banked samples are available for analyses (1,500 identified samples are currently available at CEFE) Laboratories for analyses are accessible Protocols are functional (protocols for 5 of the 6 targeted infectious agents have already been validated for use on seabird samples by the project partners)

	SAERI in the context of the Covid19 Rapid Response project CV19RR02 [Y1, Q1] 1.5. Update of data base with results from samples collected in Y2 [Y2, Q4]		
2. Increased knowledge of epidemiological dynamics in the FI based on the mapping of potential pathogen occurrence across species, space and time	2.1. Prevalence map for 6 families of infectious agents for > 7 species [Y2, Q1] 2.2. Temporal series of the incidence of key infectious agents on selected sites [Y2, Q1] 2.3. Synthesis of the spatiotemporal patterns of incidence for all the targeted infectious agents; publication of at least one peer-reviewed publication [Y2, Q1] 2.4. Update of analyses with results from samples collected in Y2 [Y2, Q4]	2.1. Incidence map shared with collaborators, published on the project webpage, and updated webGIS database (developed by SAERI in the context of the Covid19 Rapid Response project CV19RR02) 2.2. Temporal series shared with collaborators and available on the project webpage, and updated webGIS database 2.3. Report submitted to the relevant actors and the Darwin Initiative 2.4. Maps and temporal series updated with results from samples collected in Y2 [Y2, Q2]	- At least one infectious agent was detected (pilot data from banked samples suggest that at least two of the targeted infectious agents are present on the FI)

3. Increased knowledge of the likely drivers and consequences of infectious agent dynamics in the system	3.1. Ecological data gathered from the partner (for > 7 seabird species, 10 years and 10 sites across the FI) [Y2, Q2] 3.2. Estimates of infectious agent impact (% mortality explained) on seabird demography for each detected infectious agent [Y2, Q2] 3.3. Estimates of the effect of host community composition on infectious agent incidences (probability of outbreak in the colony and island as a function of community composition) [Y2, Q2] 3.4. Estimates of host ecological traits on infectious agent incidences (probability of outbreak in the colony and island as a function of the traits of the seabird species present) [Y2, Q3] 3.5. Estimates of host connectivity on infectious agent spread (probability of outbreak in the colony and island as a function of connectivity with other colonies and islands) [Y2, Q3] 3.6. Synthesis of the drivers and consequences of infectious agent dynamics in the system; publication of at least one peer-reviewed publication [Y2, Q3]	3.1. Dataset available through FI IMS-GIS data centre 3.2. Table of estimates of infectious agent impact on seabird demography available on the project webpage 3.3. Table of estimates of host community composition on infectious agent incidences available on the project webpage 3.3. Table of estimates of host ecological traits on infectious agent incidences available on the project webpage 3.5. Table of estimates of host connectivity on infectious agent spread available on the project webpage 3.6. Report submitted to the relevant actors and the Darwin Initiative	- Ecological data are available (most of the data are already available at SAERI, FC and MARE and only need to be compiled)

4. Improved disease surveillance and response system via increased local engagement and capacity and revised protocols	4.1. Identification of the likely principal infectious threats posed to the seabirds of the FI, and appropriate surveillance protocol [Y2, Q4] 4.2. Revision of the procedure for unusual observation reporting [Y2, Q4] 4.3. Development of standardized protocols for proactive pathogen monitoring tailored to the FI and aligned with the guidelines of the Wildlife Health Monitoring Group of the Scientific Committee for Antarctic Research [Y2, Q4] 4.4. Production of outreach material (at least one flyer and one video) [Y1, Q2] 4.5. At least two public talks attended by 50 people each [Y2, Q4] 4.6. At least one workshop attended by 10 people [Y2, Q4] 4.7. Synthesis of the available material (protocols, outreach and training) and actors' engagement [Y3, Q1]	4.1. List of pathogens of interest published on the project website and distributed to the relevant actors 4.2. Updated procedure for unusual observation reporting published by the FI Wildlife Disease Group 4.3. Protocols published on the project website and distributed to the relevant actors 4.4. Outreach material available on the project website 4.5. Public talk recording available on the project website 4.6. Workshop report and material available on the project website 4.7. Report submitted to the relevant actors and the Darwin Initiative	- The local actors are willing to engage (several collaborators have already expressed their support of the project)

Activities
1.1. Census of banked samples (expected n = 1462).
1.2. Sample collection in the field (expected n = 750 in year 1 and n = 250 in year 2).
1.3. Immunological analyses of all the samples for all the infectious agents.
1.4. PCR analyses of the samples collected in sites with antibody-positive individuals (based on results of activity 1.2).
1.5. Database update with samples from year 2.
2.1. Cleaning and mapping of the immunological and PCR data.
2.2. Estimation of infectious agent incidence across species, space and time by integrating immunological and PCR data.
2.3. Redaction of the report and publication presenting the patterns of infectious agent incidence across species, space and time.
2.4. Analyses update with results from samples from year 2.
3.1. Ecological data compilation and cleaning.
3.2. Statistical analyses linking infectious agent incidence to demographic dynamics.
3.3. Statistical analyses linking host community composition to infectious agent incidence.
3.4. Statistical analyses linking host ecological traits to infectious agent incidence.
3.5. Modelling of the relationship between host connectivity to infectious agent incidence.
3.6. Redaction of the report and publication presenting the associations between ecological conditions and infectious agent incidence.
4.1. Result synthesis and surveillance protocol redaction.
4.2. Revision of the procedure for unusual observation reporting.
4.3. Coordination of the protocol with the Wildlife Health Monitoring Group of the Scientific Committee for Antarctic Research.
4.4. Outreach material production.
4.5. Public talk organization and delivery.
4.6. Workshop organization and delivery.
4.7. Synthesis of the project products.

Table 1 Project Standard Indicators

DPLUS Indicator number	Name of indicator	Units	Disaggregation	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
DPLUS-A01	People who attended (in-person) the workshop *Surveillance and monitoring responses to Highly Pathogenic Avian Influenza (HPAI)*	People	Male Female	27 20			47	47
DPLUS-A01	People who attended (in-person) the public talk and discussion session *Infectious disease in the Falklands wildlife: what are the threats, and where do we go from there?*	People	Male Female	30 20			50	50
DPLUS-A01	People who attended (in-person) the public talk and discussion session *Preparing for wildlife disease outbreaks in the Falklands*	People	Male Female	30 20			50	50
DPLUS-A07	Institutions with enhanced awareness and understanding of wildlife infectious disease and associated biodiversity and local community issues	Government institutions	National, environmental	3	4		7	5
DPLUS-B05	Number of people with increased participation in suspected wildlife disease outbreak reporting	People	Male Female	7 9	10 11		37	30
DPLUS-C05	Contribution with data, insights, and case studies to national Multilateral Environmental Agreements (MEAs) related reporting processes and calls for evidence	MEAs	Convention on Biological Diversity ACAP	1 1	1 1	1 1	6	4
DPLUS-C12	Social Media presence	Highest number of views	Twitter Facebook	24.7K 27	10K 56	5K 10	41K	50K
DPLUS-C13	People who view the recordings of the workshop *Surveillance and monitoring responses to Highly Pathogenic Avian Influenza (HPAI)*	Number of views	None	356	56	10	422	300
DPLUS-C15	Number of Media related activities	Number of publications	TV Radio Podcast Online press	1 0 1 1	1 1 0 3	0 0 0 2	10	10

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)
Recommendations for combatting the incursion of Highly Pathogenic Avian Influenza (HPAI) into North Atlantic seabird populations: an interim report from the 15th International Seabird Group conference.	Scientific peer-reviewed publication	Cunningham, E. J. A., Gamble, A., Hart, T., Humphreys, E. M., Philip, E., Tyler, G., & Wood, M. J. (2022).	Female	British	Seabird	
Surveillance and monitoring responses to Highly Pathogenic Avian Influenza (HPAI)	Workshop recordings	Gamble, A., Philip, E., & Wood, M. J.	Female	French / Australian	YouTube	https://youtube.com/playlist...
The risk of highly pathogenic avian influenza in the Southern Ocean: a practical guide for operators and scientists interacting with wildlife	Scientific peer-reviewed publication	Dewar M. L., Wille M., Gamble A., Vanstreels R., Boulinier T., Smith A., Varsani A., Ratcliffe N., Black J. & Lynnes A. (2023).	Female	Australia	Antarctic Science	https://doi.org/10.1017/S0954102023000342
Unexpected delayed incursion of highly pathogenic avian influenza H5N1 (clade 2. 3. 4. 4b) in the Antarctic region.	Scientific peer-reviewed publication	Lisovski S., Günther A., Dewar M., Ainley D., Aldunate F., Arce R., Ballard G., Bauer S., Belliure J., Banyard A., Boulinier T., Bennison A., Braun C., Cary C., Catry P., Clessin A., Connan M., Correia E., Cox A., Cristina J., Elrod M., Emerit J., Ferreiro I., Fowler Z., Gamble A., Granadeiro J. P., Hurtado J., Jongsomjit D., Lesage C., Lejeune M., Kuepfer A., Lescroël A., Li A., McDonald I. R., Menéndez-	Male	Germany	Influenza and Other Respiratory Viruses	https://doi.org/10.1101/2023.10.24.563692

		Blázquez J., Morandini V., Moratorio G., Militão T., Moreno P., Perbolianachis P., Pennycook J., Raslan M., Reid S. M., Richards-Babbage R., Schmidt A. E., Sander M. M., Smyth, L., Soutullo A., Stanworth A., Streith L., Tornos J., Varsani A., Herzschuh U., Beer M. & Wille M. (2024).				
Connectivity of marine predators over the Patagonian Shelf during the highly pathogenic avian influenza (HPAI) outbreak	Scientific peer-reviewed publication	Riaz J., Orben R. A., Gamble A., Tierney M., Catry P., Granadeiro J. P., Campioni L. & Baylis A. M. M. (2023)	Male	Australian	Ecography	https://doi.org/10.1101/2023.12.12.570574
A detailed eco-epidemiological investigation of highly pathogenic avian influenza on a Subantarctic archipelago sheds light on transmission dynamics	Conference presentation	Clessin A., Mathilde L., Kuepfer A., Streith L. Emerit J., Militão T., Correira E., Granadeiro J. P., Catry P., Boulinier T., Fowler Z. & Gamble A. (2024)	Female	French / Australian	International Albatross and Petrel Conference, Mexico	

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, type of report (i.e. Annual or Final), and year) and **deleted the blue guidance text** before submission?	x
Is the report less than 10MB? If so, please email to BCF-Reports@niras.com putting the project number in the Subject line.	x
Is your report more than 10MB? If so, please discuss with BCF-Reports@niras.com about the best way to deliver the report, putting the project number in the Subject line. All supporting material should be submitted in a way that can be accessed and downloaded as one complete package.	x
If you are submitting photos for publicity purposes, **do these meet the outlined requirements (see section 14)?**	
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.	x
Have you involved your partners in preparation of the report and named the main contributors	x
Have you completed the Project Expenditure table fully?	x
Do not include claim forms or other communications with this report.	