Darwin Plus:
Overseas Territories Environment and Climate Fund
Annual Report

Important note *To be completed with reference to the Reporting Guidance Notes for Project Leaders:*

it is expected that this report will be about 10 pages in length, excluding annexes

Submission Deadline: 30 April

Darwin Plus Project Information

Project Ref Number	DPLUS033
Project Title	Enhancing biosecurity and biological control capacity in the Falkland Islands
Territory(ies)	Falkland Islands (FI), UK
Contract Holder Institution	CABI
Partner Institutions	Falkland Islands Government (FIG)
Grant Value	£ 107,539
Start/end date of project	1 April 2015- 31 March 2017
Reporting period (e.g., Apr 2015-Mar 2016) and number (e.g., AR 1,2)	Annual Report Year 1.
Project Leader	Dave Moore, transferring to Norbert Maczey March 2016
Project website	
Report author and date	Dave Moore, Norbert Maczey, Nick Rendell, March-April 2016

1. Project Overview

Please provide a brief overview of your project and what the project is aiming to achieve. For example, what environmental and/or climate change issue/s was the project designed to address? Why are they relevant, and for whom? Briefly describe the location (with a map if possible) of the project.

The Falkland Islands, as with many island ecosystems is vulnerable to invasive species, with wide ranging social and environmental consequences. The Darwin Plus (DP) project aims to improve the biosecurity capacity of FI by training and establishing an appropriate biosecurity/quarantine facility, and by developing an improved biosecurity policy for FIG. As a case study for this, the release of two tachinid parasitoids for the biological control of the European Earwig, *Forficula auricularia,* is carried out during the course of the project. European earwigs have become a problematic pest species, especially around Stanley, causing considerable damage to horticulture and being of health and safety concern. There is a considerable threat that their further spread into native grass- and heathland habitats will alter the composition of invertebrate communities. There are also fears that high densities of the *F. auricularia* in Stanley increase the risk of accidental introduction to South Georgia.

FIG has funded preliminary work on the earwig and its parasitoids, largely through collections in UK and studies on their rearing and host specificity. The DP enables FI to test their biosecurity facility and protocols on the release of the parasitoids.

The project focuses on the town of Stanley where the earwigs are most troublesome. With the support from the FIG the Government House Gardens at the western end of Stanley have been selected as the primary release site for both control agents. This site provides sheltered conditions, a high density of the target species and is also the location where the quarantine facility has been erected during 2015.

2. Project Progress

2.1 Progress in carrying out project activities

Please report on the progress in implementing the projects activities for this year. Have the activities been carried out in the manner and time planned? Please substantiate comments with evidence.

- If there have been any changes to your project plan, please provide an updated workplan/timeline as part of Annex I.

The key milestones of year 1 have been realized, although not necessarily in the quarters planned. The overarching goal to release the agents for the biological control of earwigs has achieved, but not to a degree (only release of low numbers) where a successful establishment is likely. A visit to FI by project scientists Norbert Maczey and Dave Moore in November 2015, matched with completion of improved FIG biosecurity and containment capacity (see figures 1 to 3). The CABI scientists carried with them pupae of both parasitoid species (*Triarthria setipennis* and *Ocytata pallipes*) and training was given to FIG personnel of handling protocols after emergence of the adult parasitoid flies.

Figure 1: Refitting a shed into a makeshift quarantine facility.

Fly pupae were stored within the new quarantine facilities and hatched under controlled conditions. At this stage of the biological control program the flies had already been licensed for release and quarantine facilities were mainly used to provide an additional layer of security, in this case to prevent the accidental introduction of hymenopteran hyperparasitoids. Hyperparasitoids associated with *T. setipennis* and *O. pallipes* develop only inside the fly puparium, therefore any adult flies can safely be removed from quarantine and released.

All hatched flies were transferred into small scale rearing tents positioned in the sheltered environment of a large polytunnel within the Government House Gardens in Stanley. Flies were kept in these tents for mating and feeding took place with a mixture of pollen-rich honey and marmite as well as a selection of cut flowers to provide a protein-rich food source. After 6-7 days the flies were released inside the polytunnel itself where there were free to leave the polytunnel altogether to find resting and feeding sites best fitting their requirements. To improve the chances of early establishment during the release phase earwig populations throughout the gardens were not controlled with pesticides. In addition, earwig hiding places consisting of grooved wooden boards were installed inside the polytunnel to encourage further aggregation of earwigs.

Figure 2: Double door entry system into the inner quarantine chamber

Figure 3: Sealed inner quarantine chamber

Emergence of *O. pallipes* was poor and most emerging flies either died at emergence, or shortly afterwards. Dissection of unhatched pupae showed that most were of a similar stage of development with the larvae having successfully developed into adult flies before they died. The most likely cause for this was the prolonged storage of fly pupae under cold conditions to synchronize hatching with southern hemisphere seasons and to prevent premature hatching before November. One major problem the project is facing is switching the lifecycle from a northern hemisphere rhythm to the seasons in the Falkland Islands. *Ocytata pallipes* normally remains in the pupal stage for only a short period (ten days to three weeks) and therefore we have tried to delay hatching until the Falkland summer through storage at lower temperatures hoping to slow down development. Unfortunately, our results indicate that the species does not tolerate being stored for long periods at low temperatures resulting in poor hatching rates. We are planning to address this this issue by shipping pupae of *O. pallipes* to Stanley several times between August and October 2016. A successful release in Stanley during this period will rely on creating a suitable local environment to allow for an initial infestation of the earwigs by this species. To create the right conditions we are planning to release flies in an artificially heated environment (greenhouse and/or polytunnel) warm enough to allow earwig and flies being active during the winter months. Earwigs are known to be active in polytunnels and green

houses in Stanley on warm days during winter even without additional heating. In addition, culturing of *O. pallipes* in greenhouses in Surrey showed that flies will hatch and produce viable eggs during winter months when kept warm enough.

A second, but in our opinion less likely cause for the low survival rate of this species during the pupal stage is that death had occurred due to a single event, which may have been exposure to some of the temperatures used to simulate overwintering in a shortened phase, or during transportation on the military plane used to reach FI. There were times during transportation, when the pupae were not in the hands of the CABI scientists and it is possible that the pupae were exposed to adverse conditions. This possibility is however not highly likely because the second species seems to have survived transport more or less unharmed.

It was planned to ship pupae of *T. setipennis* in form of at least 1,000 pupae to the Falklands during 2015. However, due to a breakdown of the parasitoid population in the collecting regions of the UK, less than 200 pupae were obtained, a number most likely too low to lead to a successful establishment. In Europe *T. setipennis* hibernates in the pupal stage. This species did not hatch at all in Stanley during November and December 2015, but started to emerge in January/February and at the time of writing the release of *T. setipennis* is still ongoing. Flies of this species were kept in the mating tent and after 6 days released into the polytunnel. It is known that encouraging an earlier (premature) emergence can lead to a less well synchronized hatching over a prolonged period and this is what we experienced with this species in Stanley. So far, the little synchronized emergence of an altogether low number of flies has resulted in a low probability of establishment of this species during our first release period. Because it is so difficult to break the dormancy of *T. setipennis* during the early part of the summer season on the Falklands (November) we now plan to conduct the second release of this species later in the season during January 2017. This will result in a much longer and more natural hibernation period whilst still allow hatching flies a sufficiently long period during the summer period in the Falklands for the completion of a full life-cycle. This approach is supported by a peak of hatching observed in Stanley in February 2016.

In summary, the low number of collected parasitoids in combination with low hatching rates in Stanley between November 2015 and February 2016 was not sufficient to enable a rapid establishment of either of the two species.

The other outputs – improved biosecurity and containment capacity and greater acceptance of Classical Biological Control (CBC) were achieved satisfactorily (see training activities below).

2.2 Project support to environmental and/or climate outcomes in the UKOT's

- The overarching objective of Darwin Plus is to provide support to the UKOT's to achieve strategic long-term outcomes for the natural environment. Please describe the progress the project has made in this year to support the achievement of this objective. Please substantiate any comments with evidence.
- What contribution is your project making to improve capacity to manage environmental assets in the UKOT's?

The project is strengthening the capacity of FIG to combat environmental threats from invasive species. The improved biosecurity facility is simple, but has all the requirements to enforce quarantine. This will assist FIG in reducing invasive species entering the islands and also be a resource for CBC attempts in the future. Training to use the newly installed facility is ongoing but the first release trial has already been conducted by local personnel with some supervision from the CABI team.

Engagement with the public at any stage of the project during the first year (4 presentations, 1 flyer, TV coverage, 2 radio interviews, open day [also covered by radio and TV]) has helped to gather a much wider support for using CBC as an environmentally and long term sustainable

control for invasive species. All meetings with stakeholders held in FI during 2015 were part of a strategy to develop greater acceptance of CBC. These and the case study activities conducted during 2015 are already supporting the FIG long term goal of tackling the threats of invasive species to the unique island ecosystem. The promotion of CBC also supports the long term goal to reduce the level of pesticides currently in use for earwig control.

The first release trial of parasitoids to control earwig populations has not immediately led to an establishment of the agents but this is rarely the case in biological control programs and valuable information to increase chances for establishment during the second trial has been collected. As with any biological control programs a significant control of the target species after successful establishment, will only become apparent after the end of this project.

2.3 Progress towards project outputs

Report on how overall progress has been made towards the project outputs and how likely the project is to achieve them by its close. Please substantiate comments with evidence.

- Improved capacity to manage invasive species and other biosecurity risks.

The improved biosecurity facility installed in Government House Gardens in Stanley during 2015 is simple, but has all the requirements to enforce quarantine. This will assist FIG in reducing invasive species entering the islands and also be a resource for CBC attempts in the future.

Training to use the newly installed facility is ongoing but the first release trial has already been conducted by local personal with some supervision from the CABI team. So far 3 FIG employees (Nick Rendell, Environmental Planning Department; Ross James, Department of Agriculture; Jeremy Poncet, Government House Gardens) have actively been involved in the project and capacity building activities and a number of citizen scientists are committed to support monitoring activities after a successful establishment of the control agents.

- Greater acceptance of CBC on FI at Government and population levels.

With the support from matched funding a range of awareness raising activities for CBC in general and the release of parasitoids for earwig control specifically were conducted in March 2015. These include several presentations, an information stall at the visitor centre, as well as TV and radio interviews. In addition discussions were held with a wide range of other stakeholders (growers, farmers, DoA, decision maker, conservation groups etc.). More details are given in a separate report provided to FIG in March 2015 (annex 1).

During the visit of the CABI team in November this was extended through additional updates in discussion with stakeholders, radio and newspaper announcements and a well perceived open day at the Government House Gardens introducing the new quarantine facilities and release activities first hand to a wider audience (figure 4).

- Significant control of earwigs achieved

As outlined in the proposal this target can only be achieved after termination of the project. However, during 2015 extensive discussion were held with the FIG planning department to secure funding for monitoring activities after the termination of the Darwin project.

Figure 3. Dave Moore demonstrating the fly rearing tents during open day at Government House gardens, Stanley in Nov. 2015 (photo: Sharon Jaffray, Penguin News).

2.4 Progress towards the project outcome

Please briefly report on progress made towards the project outcome.

- Is the project likely to achieve the outcome by end of funding?
- If not, what action will you take to ensure the situation can be improved?

Already at this stage of the project enhanced capacity to mitigate biosecurity risks in the Falkland Islands (FI) has been achieved both through the installation of a basic biosecurity unit and training of FIG staff.

Awareness activities and continuous engagement with the public, scientists and decision makers has in our opinion been able to dispel most of the initial concerns about CBC brought forward initially. Although this is difficult to be evidenced in a scientific way one indication of a much higher degree of acceptance and embracement of CBC is the decision of the environmental committee to support the release of control agents for earwig control and the lack of critical comments or complaints thereafter (a dedicated and widely advertised link on the FIG website inviting the public to share any concerns did not receive any submissions up to this point of the project).

Part of the outcome is the long term public support of CBC on the FI. Successful long term sustainable control of earwigs through CBC is expected to lead to a greater public support for this control method. Providing evidence for a successful implementation of the earwig case study conducted here is not within the scope of this project. However, we hope to still complete the first important phase of establishment of the control agents at the release site. Initial efforts have been hampered by a poor collecting season in the UK and difficulties in synchronizing the lifecycle of the control agents to southern hemisphere conditions. This will be addressed during 2016/2017 in the way described under 2.1. As this will require a second release of the main

control agent *T. setipennis* right before the end of the project in March 2017 it is likely that success or failure of establishment can only be reported through FIG and citizen scientists after the termination of the project. Public engagement and a very open and transparent conduct of the project have in itself already greatly improved the awareness for the danger invasive species pose to the unique environment of the Falkland Islands. This is reflected through a high interest of the public in this project reflected by countless discussions with individual residents of the FI, which allowed to explain and demonstrate the case study activities first hand to a comparably large proportion of the public (for example >30 visitors to an open day event held in November 2013 out of a population of less than 3,000 in Stanley). This has helped that the entire community is likely to embrace CBC in future projects. Already at this stage discussion about the feasibility to use CBC for other damaging invasive species such as Hawkweed and Calafate are being held.

2.5 Monitoring of risks

Monitoring of critical conditions (risks and assumptions) are crucial to project success. Report on whether the identified risks still hold true. If there have been changes in assumptions in what ways is the project meeting or managing these? Please substantiate comments with evidence.

The identified risks at the outset of the project were:

- Parasitoids do not adapt to southern hemisphere biological cycle of earwigs
- Parasitoid establish but do not exercise desired degree of control

Synchronising the lifecycle of the control agents to a southern hemisphere environment has turned out to be challenging indeed. However, the first release trial, which started in November 2015, at a seasonal stage comparable to the time when both parasitoid species start to emerge in Europe, provided us with sufficient information to set improved release procedures in place for 2016/17. This will include repeated shipments of *O. pallipes* at an earlier time in the year, whilst providing sufficient active hosts in artificially heated environment in polytunnels and greenhouses in Stanley. For the second species, *T. setipennis*, the time period for release has been revised to be delayed into 2017 towards the end of the project in order to maximise the chances for establishment.

Unfortunately, addressing the problem of a difficult synchronisation of seasons will lead to a delayed establishment of the control agents and it will not be possible to record both a full establishment and the initial impact on earwig populations during the lifetime of the project. However, the main objective of the project the capacity building (already mostly achieved) and introduction of the earwig control agents into the Falklands are still expected to be fully achieved. The major setback through the challenging transition of lifecycles for both agents is mostly impacting on the M&E section of the project. As a backup the project will continue to include PD activities to cover any aspects to midterm M&E activities but also the consideration of the introduction of alternative control agents beyond the termination of the project.

3. Project Stakeholders

Darwin Plus projects should engage/support key stakeholders. Please describe the support or engagement between all key stakeholders and this project, and how this has developed over the last year of the project.

- To what extent have stakeholders been involved in project planning and decision-making?
- Have there been particular achievements, lessons or challenges with the stakeholder(s)?
- Please support what you say with evidence.

This Darwin+ project on capacity building for CBC on the Falklands focuses very strongly on stakeholder involvement. In particular, it builds on a string of pre-project activities, which started with a Defra-funded feasibility study for CBC in the SAUKOTs in 2011/2012. The feasibility study used stakeholder engagement right from the beginning as an important tool to identify suitable target species for CBC. During a workshop held in Stanley, which was part of this study, earwigs were chosen jointly by decision makers, scientists and members of the public as the most suitable case study (compare: http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=N)

A tight collaboration with all key stakeholder groups continued through to a phase of host range testing and matched funding of FIG to the Darwin+ project specifically focused on awareness raising activities in March 2015 for CBC in general and the control of earwigs specifically. These activities were then followed up during the second visit in November 2015.

Part of the project activities focuses on encouraging active involvement of the public through engagement in planned monitoring activities of earwigs (see annex 2 and annex 3)

Stakeholder groups engaged with during 2015 included:

- Residents of the Falkland Islands
- Military operators at Mount Pleasant
- Farmers
- Horticultural Growers
- Pest controllers
- Members of the Legislative Assemblage (MLA)
- Environment Committee
- FIG Environmental Planning Department
- FIG Department of Agriculture (DoA)
- South Georgia Government
- Falkland Island Conservation (FIC)
- South Atlantic Environmental Research Institute (SAERI)

Stakeholder engagement took place through:

- Four presentations given in Stanley (2 at the Chambers of Commerce), Goose Green, and Mount Pleasant Airport, March 2015
- Information stall at Jetty Visitor Centre, Stanley, March 2015
- Open day at Government House Gardens in November 2015
- TV presentation at presentations at the Chambers of Commerce and during open day event at Government House Gardens; three radio interviews during 2015
- Project information website installed at FIG website including FAQ page and invitation to submit questions and queries
- Announcement and advertising of events in local newspaper and through radio
- Distribution of information fact sheets through supermarkets in Stanley
- Two meetings with MLAs at Gilbert House, Stanley
- One meeting with representatives of the Government of South Georgia
- Two meetings at the DoA
- Numerous meetings with individual stakeholders from the groups above

4. Monitoring and evaluation

If not covered in previous sections, discuss methods employed internally to monitor and evaluate the project this year. How can you demonstrate that the outputs and activities of the project actually contribute to the project Outcome? What are the indicators of achievements (both qualitative and quantitative) and how are you measuring these? Have there been any changes made to the M&E plan over the reporting period?

Milestones of all planned activities have been met and achievements for capacity building have been reached during the first project year. However, internal project monitoring has identified the need for a different scheduling of activities during the second project year. This mainly concerns adjustment of release methods for earwig parasitoids (e.g. creating a suitable environment for the release of *O. pallipes* towards the end of the winter in the Falklands and a shift of the release of *T. setipennis* into the early month of 2017.

Ultimately the impact of the released parasitoids will only become apparent after the termination of the project. Therefore a strong focus of any discussions between CABI, FIG and also SAERI has been on developing ways to set monitoring procedures in place, which will continue for several years after 2017. Monitoring stations for earwigs have already been installed at two sites in Stanley and the public has been encouraged to take part in additional volunteer support.

5. Lessons learnt

Use of lessons learned is a principal component of an organisational culture committed to continuous improvement and adaptive management. This can include lessons from all levels including administrative, management, technical, and M&E. Projects are asked to reflect on:

- What worked well, and what didn't work well, this past year?
- If you had to do it again, what would you do differently?
- What recommendations would you make to others doing similar projects?
- How are you going to build this learning into the project and future plans?

Collaboration with all involved project partners and stakeholders worked very well and there is great support for this project from residents of the Falkland Islands. As a direct result one of the major objectives of the project (capacity building) is far ahead of its schedule.

Progress on the case study part (release of biological control agents) is slower than expected and the challenge to adjust lifecycles of species highly adapted to seasonal phenology patterns proved more difficult than anticipated. This had also a direct impact on the possible scope of M&E activities as most of these are linked to the progress of the release program.

It is difficult to foresee problems of the type encountered and the nature of this type of work include generally a highly empirical approach, gaining knowledge during the duration of the project and requiring a continuous adjustment of methods. The only way to deal with delays caused by unforeseen difficulties (for example he unexpected breakdown of parasitoid population in the UK during 2015) would be the optional extension of the project allowing the cover of an additional release season.

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

Have you responded to issues raised in the review of your last year's annual report? What were the views of project partners on the review? Briefly describe what actions have been taken as a result of recommendations from last year's review, unless you have already clearly done so through a separate note or the half year report.

7. Other comments on progress not covered elsewhere

- Has the design of the project been enhanced over the last year, e.g. refining methods, or exit strategy?
- Discuss any significant difficulties encountered during the year and steps taken to overcome these if not already discussed elsewhere.
- Does the project face any particular risks?

Methods for the release of the parasitoids have been adapted as described above. We are still optimistic to achieve establishment of one or both parasitoid species during 2016/17 but as is the nature of biological control programme a success cannot be taken for granted. There is a continued possibility that establishment might fail as the consequences of unpredictable events (e.g. local climate not allowing long term establishment; insufficient recovery of parasitoid populations in the UK in 2016; adverse weather conditions during next release phase).

8. Sustainability

Discuss the profile of the project within the Territory (ies) and what efforts have been made during the year to promote the work. What evidence is there for increasing interest and capacity resulting from the project?

Is your planned exit strategy still valid given the project is now running, or have you, or are you planning to, make changes to what was originally proposed? Likewise, how do you plan to ensure a sustained legacy (e.g., social, economic, ecological, technical etc.) of your project outcome?

The residents of Stanley are well aware of the ongoing project activities and its funding support by the DI. Major activities are always publicly announced (newspaper, TV, website) and both the CABI team and project partners from FIG are constantly available to respond to questions or feedback of any kind from the public.

9. Darwin Identity

- What effort has the project made to publicise the Darwin Initiative, e.g. where did the project use the Darwin Initiative logo and promote Darwin funding opportunities or projects?
- Was the Darwin Initiative support recognised as a distinct project with a clear identity or did it form part of a larger programme? To what extent is there understanding of Darwin Initiative within in the territory(ies) and who is likely to be familiar with it?

At all stakeholder engagements it was pointed out that the funding for the release is being conducted with the support of the Darwin Initiative. The decision makers and residents of Stanley alike are aware of the Darwin Initiative not only through this projects but also through previous and ongoing other projects. Darwin funding opportunities are always discussed with regards to the future funding of activities building on this project or with regards to finding solutions to problems of a similar nature to this project.

Modern biological control programmes are usually funded by multiple donors and require a phased approach starting covering a range of work packages such as suitability assessment, survey for agents in the country of origin, host range testing, risk assessments, release and post release monitoring stretching over comparably long time periods. Equally this project is part of a longer string of individual projects on CBC on the Falklands and specifically the control of introduced earwigs.

10. Project Expenditure

Please expand and complete Table 1.

Table 1 Project expenditure during the reporting period (1 April 2015 – 31 March 2016)

Project spend (indicative) in this financial year	2015/16 Grant (£)	2015/16 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs			-5.5	staff costs and related to this overheads on staff costs have been slightly underspent during 2015 due to early closure of of the first release phase of BC agents caused by poor hatching rates; this is likely to be reversed during the second years of project for which additional releases are planned
Consultancy costs				
Overhead Costs			-4.5	
Travel and subsistence			-6.1	
Operating Costs			-21.9	
Capital items				
Others (Please specify)				
TOTAL			**- 7.5**	

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

11. OPTIONAL: Outstanding achievements of your project during the reporting period (300-400 words maximum). This section may be used for publicity purposes

I agree for the Darwin Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here)

In this section you have the chance to let us know about outstanding achievements of your project over the year that you consider worth highlighting to the Darwin Secretariat. This could relate to achievements already mentioned in this report, on which you would like to expand further, or achievements that were in addition to the ones planned and deserve particular attention e.g. in terms of best practice. We may use material from this section for various promotion and dissemination purposes, including for example, publication in the Defra Annual Report, Darwin promotion material, or on the Darwin website. As we will not always be able to ask projects on an individual basis for their consent to publish the content of this section,

please note the above agreement clause. Do you have project photographs that you are willing to share for publicity purposes? If so, who should we contact