



Darwin Plus: Overseas Territories Environment and Climate Fund Final Report

*To be completed with reference to the "Writing a Darwin Report" guidance:
(<http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms>). It is expected that this report
will be a **maximum** of 20 pages in length, excluding annexes)*

Darwin Project Information

Project reference	DPLUS 043
Project title	Consolidating local capacity for sustainable restoration and monitoring of Protected Areas in the Virgin Islands (UK)
Territory(ies)	British Virgin Islands (BVI)
Lead organisation	National Parks Trust for the Virgin Islands (NPTVI)
Partner institutions	Jost van Dykes Preservation Society (JVDPS)
Grant value	£85,413
Start/end date of project	1 st April 2016 – 31 st March 2019
Project leader name	Lynda Varlack
Project website/Twitter/blog etc.	Facebook: National Parks Trust of the Virgin Islands Facebook: Jost Van Dykes Preservation Society
Report author(s) and date	Nancy Pascoe, May 28 th 2019

1 Project Overview

The BVI has over 60 islands with key areas for biodiversity conservation due to the distribution of endemic and threatened species of plants and birds. Invasive vertebrates, especially feral goats have been destroying native vegetation and seabird nesting habitats across the BVI.

NPTVI has undertaken research on threatened plant species in the BVI with the Royal Botanic Gardens Kew (Kew) since 1999 and feral goats are one of the two biggest threats to native plants, with land clearance being the second. The steep slopes of the BVI result in highly eroded soils once overgrazing occurs and topsoil is exposed. Also, research by NPTVI and Kew revealed that whilst mature trees might exist in these areas, the ability of seedlings to become established and then mature is low due to goat grazing. After one heavy rainfall event at Great Tobago National Park a landslide occurred on a very steep slope adjacent to the Magnificent frigatebird (*Fregata magnificens*) colony which is one of the largest in the Eastern Caribbean, resulting in nesting birds being buried downslope. This is directly linked to erosion and overgrazing.

Over 900 goats had been removed from Great and Little Tobago National Parks (The Tobagos) prior to this project using a combined approach of live capture and shooting, but total eradication was not completed. This was made possible by an EU BEST 1.0 funded project entitled, "Conserving Species and Sites of International Importance by the Eradication of Invasive Alien Species in the Caribbean UK Overseas Territories" (2013-2015). NPTVI partnered locally with JVDPS and internationally with the Royal Society for the Protection of Birds (RSPB) and the UK Animal and Plant Health Agency (APHA). This project also included a rat eradication feasibility

study for the Tobagos National Park. During this BEST 1.0 project UK specialists from APHA conducted the culling and trained one NPTVI staff member in firearms use so that invasive species removal could continue once the BEST 1.0 project ended.

One of the goals of this DPLUS project was to provide the funding to continue the culling at the Tobagos National Parks and to begin culling at two new sites, as boat fuel and staff time are the largest costs but as local capacity was used the overall expenditure was much lower than if international specialists were brought in on a short-term basis.

The second goal was to begin rat control at two important seabird nesting sites: Green Cay (14 acres) and the Seal Dogs (9 acres) using a combination of rodenticide and A24 traps. Predators including Black rats (*Rattus rattus*), Brown rats (*R. norvegicus*) have a direct impact on bird and bird and reptile populations. Seabirds are particularly vulnerable to mammalian predators and rat predation of seabird eggs and chicks had been observed in the BVI through field research conducted in previous seabird surveys.

The presence of rats, when combined with goats, had contributed to the reduction in nesting seabirds at the DPLUS043 six selected locations of Great and Little Tobago National Parks (the Tobagos), Green Cay, East and West Seal Dogs and Prickly Pear National Park.



Figure 1. Map of the British Virgin Islands identifying the DPLUS043 project sites

In the last decade there was a globally-important population of Roseate terns (*Sterna dougallii*) that would nest annually at Green Cay, but they abandoned this site and relocated to smaller, less successful colonies due to the threats faced on Green Cay from invasive species, specifically rats and goats.

Before this DPLUS project there had been one successful rat eradication project in the BVI, at Sandy Cay Habitat Management Area (HMA) conducted by the Island Resources Foundation in 2002. This was the first rat eradication on a small island to take place in the BVI and the lessons learnt from this were utilised by JVDPS in this DPLUS project. Whilst Sandy Cay HMA is directly managed by the NPTVI, the ongoing monitoring following the rat eradication was subcontracted to JVDPS and this task has continued to present.

JVDPS had previous experience of invasive species removal following a mongoose eradication project on Little Jost Van Dyke in the BVI and helped to trial the A24 (previously known as the “Stanley Trap” and has been following its development since 2011.

2 Project Stakeholders/Partners

The key stakeholders in this DPLUS project were NPTVI, JVDPS, and the local communities that will benefit in the long run from the restoration of these islands that are part of the BVI's tourism 'product', as removal of the feral goats and rats will enable the vegetation to regenerate and nesting seabirds to return to the offshore cays. However, the general public was not directly involved in this project due to the culturally sensitive topic of feral goat removal, other than when the public notices were sent out about proposed goat removal at Green Cay.

During the previous BEST 1.0 project (2013-2015) that was mentioned in Section #1, NPTVI held community meetings with neighbouring islands to discuss concerns over goat culling at the Tobagos National Parks as this has been perceived negatively by some members of the community who think that goats are part of the BVI's culture and should roam free. Negative messaging was put out on social media on this topic and so the DPLUS project team decided this time not to publicise the goat culling and just focus on the actual work.

However, to address this perception NPTVI and JVDPS collaborated on a parallel project in partnership with RSPB and the Royal Botanic Gardens Kew (Kew) through an EU BEST 2.0 funded project entitled, "Securing pockets of paradise in the Caribbean: embedding capacity for invasive alien species management in UKOT based organisations" (2016-2019). Some of the activities under this project included raising public awareness of invasive species and goats were selected as one of the species to highlight through a mixture of radio PSAs, billboards and signage. The goal was to begin to change the perception of the local community from thinking that goats are part of the BVI's natural landscape to understanding that they are introduced farm animals that are now feral. Rats were also included in this public awareness campaign.

In addition to this, whilst not originally identified in the project application as stakeholders, NPTVI and JVDPS invited the Environmental Health Department (EHD), the Department of Agriculture (DOA), the Conservation and Fisheries Department (CFD) in addition to a representative from a local pest control company who works on several private islands in the BVI to attend a workshop on rat eradication techniques for wildlife conservation in order to share information on the A24 technology. These stakeholders were not involved in the DPLUS project delivery, but their participation in the awareness raising stage continues the BVI long term goal of increasing local capacity to conduct invasive species removal.

The EHD is responsible for rat control in urban areas within the BVI. The DOA has the legal remit for liaison with farmers for livestock management, inclusive of goats and is also the agency that issues permission for importation of rat poison. CFD has overall environmental responsibility within the BVI and assists JVDPS and NPTVI in bird monitoring activities.

NPTVI and JVDPS sought advice from previous project partners, RSPB at the project development and design stage.

As the main project stakeholders are also the project leaders and partners, full involvement through regular planning meetings has taken place throughout the project. Communication has mostly been via phone or email due to NPTVI and JVDPS being based on different islands, with meetings in person taking place as needed. Overall NPTVI and JVDPS operating independently as the goat culling was managed by NPTVI and rat control by JVDPS, so communication between the two organisations tended to focus on equipment purchases and updates on sightings of goats or rats whilst in the field.

3 Project Achievements

3.1 Outputs

Output 1: Invasive goats eradicated on 4 ecologically important islands in the BVI

At the onset of this project NPTVI had just completed the EU BEST 1.0 funded project mentioned in Section #1 which focused on goat eradication at Great and Little Tobago National Parks in partnership with the Royal Society for the Protection of Birds (RSPB) and the UK Animal and Plant Health Agency (APHA).

APHA hunters had carried out several culling missions in partnership with NPTVI staff, removing 700 goats and certifying a NPTVI Park Warden as a trained firearms officer. However, the project was not completed as not all goats were eradicated due to the terrain, plus there were new restrictions on firearms use imposed by the Royal Virgin Islands Police Force. Through this DPLUS project NPTVI sought to complete this goat eradication work at the Tobagos National Parks and expand removal to two additional islands, Prickly Pear National Park and Green Cay proposed protected area.

At the time the estimated goat population was less than 100 individuals. The recent qualification of an NPTVI Warden as a trained and licensed firearms officer meant that there was in house capacity that would result in a flexible, cost and time-efficient schedule for finalising the eradication. Previous project partners at RSPB and APHA shared confidence in the NPTVI's ability to take on continued work alone and encouraged and supported the submission of a DPLUS application.

NPTVI began goat removal in June 2016 at the Great and Little Tobago National Parks (265 acres and 55 acres respectively). Due to the geographic location of the Tobagos National Park at the far westerly end of the BVI the visitation schedule was planned around the weather and sea conditions, as these restrict access to the islands. These islands are largely inaccessible during the winter months, so project activities had to be focused in the summer months, from May through October. The Tobagos represented the most difficult and largest of the group so these sites were prioritised. This was also important in order to limit goat reproduction, seeing as not all the goats had been eradicated in 2016.

As the sea conditions became less favourable in the winter months, the focus shifted and more time was spent on goat removal at Prickly Pear National Park (180 acres) and finally, the smallest island of Green Cay (15 acres) was started last as it had relatively few goats and was easy to access. This DPLUS project represented the first time that NPTVI had embarked upon goat removal at these two islands, but the experience gained at the Tobagos informed operational planning.

The NPTVI team has made a total of 228 field visits between June 2016 and March 2019 to undertake goat removal at the four project sites. (See Annex for site visit log) A total of 97 goats were removed from Great Tobago National Park, 22 from Little Tobago National Park and 354 from Prickly Pear National Park through a combined methodology of setting nets and shooting. No goats were observed on Green Cay after the time period elapsed following the NPTVI issuance of a public notice on the neighbouring island of Jost Van Dyke which informed the public of the upcoming goat removal exercise and the deadline to remove any goats with owners. The island was monitored up to the end of the project to ensure that all goats had been removed and this was confirmed.

Goats were removed through a variety of methods including live capture and removal off the island (for later consumption), radio collaring a judas goat to track movement to identify where small groups might be hiding, feeding goats to attract them to certain areas and firearms to shoot and kill on site. Safety was a priority whenever live firearms were in use, with signage and red flags displayed, in addition to an NPTVI staff member on watch at all times in case any other vessels approached the island.

Monitoring of remaining goat numbers has been conducted through a combination of visual site surveys and review of imagery from game cameras. This has been conducted on a weekly basis, as seen by the goat removal log in the Annex.



Figure 2. Warning signs at Great Tobago and Prickly Pear National Parks

The NPTVI team estimated at the end of the DPLUS project that the following number of goats remained: Great Tobago (24-30), Little Tobago (24), Prickly Pear (16-25). NPTVI will continue to remove goats from these sites as this activity has now been included into the recurrent budget of the NPTVI as part of the biodiversity conservation programme. The greatest expenses are boat fuel and staff time, but it is essential that culling does not stop in order to prevent a rebound in goat populations.

This project suffered a major setback when the category 5 plus hurricane Irma made a direct hit on the BVI on the 6th of September 2017, this was followed by another category 5 hurricane Maria two weeks later. The BVI experienced catastrophic damage across the Territory, impacting NPTVI staff lives, capital infrastructure such as houses, cars and boats and access to necessities such as food, water and fuel. There was a period from September 2017 until the end of February 2018 where DPLUS043 activities could not take place as basic needs were being addressed personally and at the organisations of NPTVI and JVDPS as new office premises had to be found, vessels repaired and a consistent supply of fuel identified.

Hurricanes were identified as a potential risk to the project, but the likelihood was ranked as low and the impact ranked as medium, due to the historic record of low direct hits by hurricanes. However hurricane Irma was the strongest recorded Atlantic hurricane in history and it tracked directly over the BVI and the 2017 hurricane season was the most active season ever experienced in the BVI. The level of impact could never have been anticipated as it was record breaking in the Caribbean. To resolve the resulting disruption to project activities NPTVI requested a one-year extension from Darwin and this was approved.

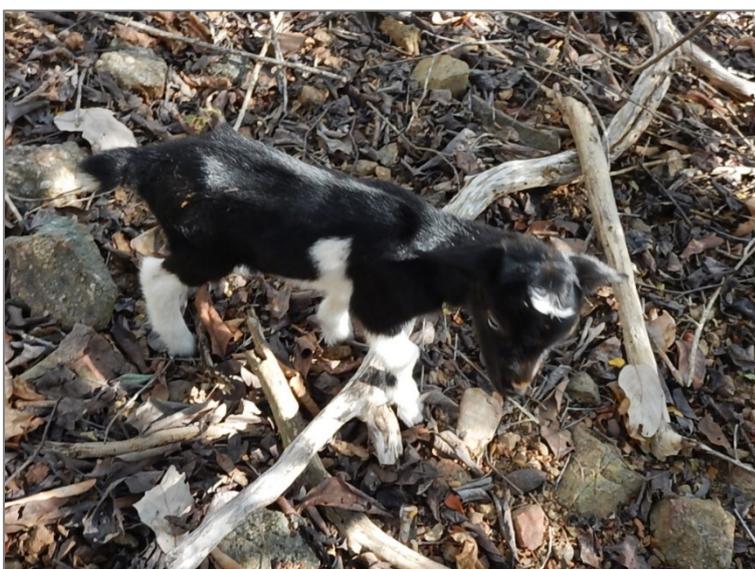


Figure 3. Newborn goat at Prickly Pear National Park, February 2017

Output 2: System of long-term control of rats implemented on Green Cay and the Seal Dogs

JVDPS launched a long-term rat control programme in the first project year by reviewing previously drafted feasibility and operational plans for the 3 target islands (East Seal Dog, West Seal Dog and Green Cay).

Two consultants from Puerto Rico (HR Reefscaping) who had successfully completed eradications on small cays using automatic re-setting A24 traps visited the BVI in September 2016. Their role was to visit the project sites and review the proposed operational plans, in addition to presenting at a workshop that was held at the NPTVI's JR O'Neal Botanic Gardens, consisting of stakeholders from the Department of Agriculture (DOA), the Vector Unit of the Environmental Health Department (EHD), the Conservation and Fisheries Department (CFD), NPTVI, JVDPS and a local pest control company. HR Reefscaping provided practice advice on use of A24s. A short memo on their visit can be found at the following DPLUS project drop box location:



Figure 4. Hector Ruiz and Jose Vargas of Reefscapes, Puerto Rico with NPTVI staff Finfun Peters and Nancy Pascoe at the NPTVI office prior to the workshop held in September 2016

There was a delay in receiving the DPLUS funds in the first project year which meant that the A24 rat traps could not be ordered until the third quarter. The traps are produced by the company GoodNature which is based in New Zealand and by the time these were shipped to the BVI and received it was the winter months when sea conditions are not conducive to landing on these offshore islands.

Rat Control at the Seal Dog Islands

JVDPS did opt to mobilize early in the project and immediately began work on the Seal Dog Islands in 2016, establishing a 30M Grid with 27 bait stations. Tracks were cut and trials for uptake of bait were carried out on Seal Dog Islands to determine rat densities and bait needs and the locations for bait stations were marked. A link to the summary table on the baiting missions at Seal Dog Islands can be found in the DPLUS project drop box folder at:

In total, 27 days have been spent in the field at the Seal Dog Islands, and while tracking of rats was originally at about 35%, tracking has gone to zero since November 2016 and has remained at 0 throughout the project. Initially, 13 game cameras (8 on West Seal Dog and 5 on East Seal Dog) were placed in the field for long term monitoring; however, all equipment on the Seal Dog islands was destroyed during Hurricane Irma. Eleven (11) cameras are currently in place on Seal Dog Islands, and a card reader is used to check cameras in the field using a smart phone plug in.



Figure 5. JVDPS field assistant (R Isaac) setting bait stations at the Seal Dog Islands, R: Temporary bait station made from discarded water bottle. This one has a wax and chocolate chew block inside of it.

The risks associated with secondary poisoning of species was anticipated and when there was an early arrival of laughing gulls (*Larus atricilla*) to Green Cay in March 2017, which have been identified as one of the few animals that might be susceptible to secondary poisoning, JVDPS delayed the use of Brodifacoum rat bait until these seabirds departed the BVI in the late summer. Instead, the A24 rat traps were deployed and used throughout the summer months.

JVDPS were very conscious of the safety risks associated with the use of the A24 rat traps as all the islands in this DPLUS project are visited by tourists on charter vessels. However, it should be noted that the vast majority of tourists visit adjacent Sandy Spit and never land on Green Cay where A24s had been installed. To address safety issues, warning labels were purchased and affixed to each A24 rat trap. Signage explaining the DPLUS project and the dangers associated with people inserting fingers into the A24 rat traps was also erected on both Seal Dog Islands and Green Cay. At the onset of this project, JVDPS felt as if the A24s were a simple cure-all for carrying out rat eradications. However, despite their automated features, there is still a great deal of human involvement and fine tuning that needs to go into using A24s as a control method.



Figure 6. Warning labels fixed to individual A24s and (Right): Sample of signs fixed in the field to warn potential visitors of any hazards

Rat Control at Green Cay



Figure 7. JVDPS and team conducted May 2017 visits to Green Cay to determine rat densities and to develop a grid for the project. We recorded nearly 100% tracking of rats. Top Right; JVDPS deployed snap traps to collect rat specimens, but in all cases, the traps were snapped and empty.



Figure 8. March 2018 Field Assistants Tate Hempel and Yasmin Jones help to put out chew blocks to determine density of rats on Green Cay following the destructive year with hurricane Irma. The density was again 100%. During this field period, 28 A24s were installed.

On Green Cay, JVDPS laid out an initial grid of the island, modified slightly from the original plan, to place more traps or bait stations on the side of the island closest to Little Jost Van Dyke, where incursions were more prone to happen. Initially chew block and snap traps revealed that Green Cay has an extremely high density of rats, with nearly 100% tracking across the islands.

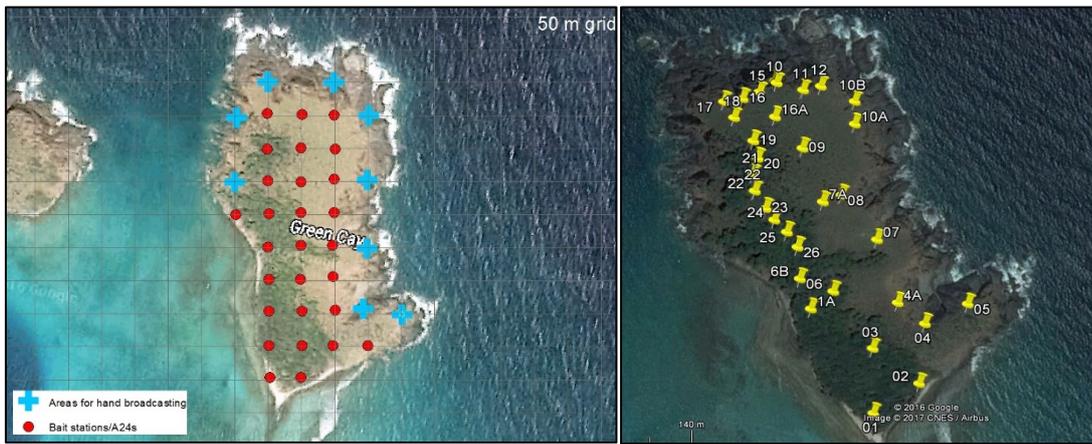


Figure 9. Map showing locations for hand broadcasting of rat bait and A24 stations

Point	Lat	Lon	Survey Date	Type	Rat?	Rat Date
9	18.45413	-64.70875	5/2/17	cam/chew	Y	5/3/17
10	18.45468	-64.70886	5/2/17	chew	Y	5/3/17
10A	18.45426	-64.70832	NA	NA	NA	NA
10B	18.45444	-64.70829	5/20/17	chew	Y	5/21/17
11	18.45459	-64.70867	5/20/17	chew	Y	5/21/17
12	18.45460	-64.70853	5/3/17	chew	Y	5/20/17
13	18.45470	-64.70888	5/3/17	cam/chew	Y	5/21/17
14	18.45470	-64.70888	NA	chew	Y	5/21/17
15	18.45463	-64.70901	NA	NA	NA	NA
16	18.45460	-64.70915	5/20/17	chew	Y	5/21/17
16A	18.45441	-64.70892	5/20/17	chew	Y	5/21/17
17	18.45460	-64.70930	NA	NA	NA	NA
18	18.45446	-64.70924	NA	NA	NA	NA
19	18.45425	-64.70912	5/3/17	cam/chew	Y	NA
20	18.45411	-64.70911	NA	NA	NA	NA
21	18.45399	-64.70917	5/20/17	chew	Y	5/21/17
22	18.45386	-64.70918	5/3/17	chew	Y	NA
23	18.45371	-64.70912	NA	NA	NA	NA
24	18.45361	-64.70907	5/20/17	chew	Y	5/21/17
25	18.45350	-64.70899	NA	NA	NA	NA
26	18.45337	-64.70893	5/20/17	chew	Y	5/21/17

Figure 10. Initial Record in May 2017 of Rat presence on Green Cay.

Rats were observed during the day in the understory of the small forest of the island, and some cameras, like the one below picked up more than one rat at a time, indicating high-density populations.



Figure 11. Game Camera Footage picks up 2 rats on Green Cay, May 2017

Soldiers crabs proved to be a never-ending problem at every stage of project work and were particularly problematic for the A24s.



Figure 12. The density of soldier crabs at Green Cay was staggering and they seemed to infiltrate every part of the project. Here they are crowding over a check black.

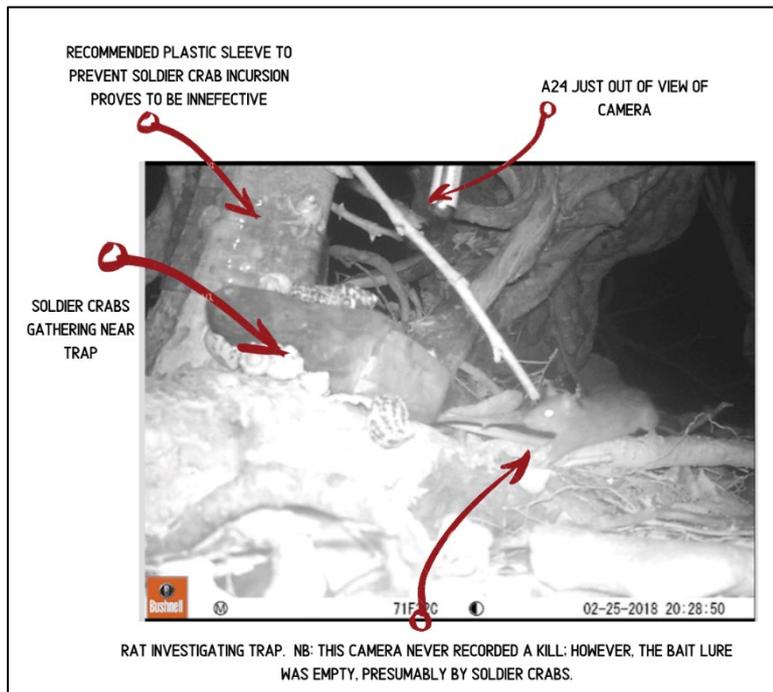


Figure 13. Figure shows a rat investigating an A24, but no kills were captured on camera. The bait lure was completely empty and swarming with soldier crabs the next morning, despite following recommendations by HR Reefscaping to use plastic sleeves as shown in picture. Project leaders have developed a system that uses PVC pipes. Learn more in our “Lessons learnt” synopsis.

Output 3: Published paper on the lessons learnt and best management practices for a locally led invasives project

Rather than a journal article, NPTVI and JVDPS decided that a more practical output would be a step by step guide on how to plan an eradication project based upon the lessons learnt so that valuable time and resources are not wasted. It is more efficient to use in country personnel as work must be ongoing and flexible when weather conditions are not suitable, especially if work is on offshore islands.

This step by step guide has been shared in various formats, including a powerpoint presentation that was given by N. Pascoe of NPTVI at a regional meeting on invasive alien species in Montserrat in 2016 hosted by RSPB and attended by 37 participants from 14 different countries, including UKOTs and the wider Caribbean islands as part of the EU BEST 2.0 project (2016-2019) described in Section 3.1, output 1 (see Annex). The guide was also formatted into a working document that will be shared amongst the UKOT’s Caribbean Conservation Network (CCN) that is comprised of the Caribbean UKOT Directors.

An associated publication was produced by Kew as the lead partner on the vegetation monitoring work that took place at Great Tobago National Park under the EU BEST 2.0 funded project, described in Section 3.1. See citation in Annex 4. In 2018, project team members were able to publish results of seabird surveys, which were a driving force behind invasive species eradication activities entitled “*Seabird Surveys of Globally Important Populations in the BVI*” in The Journal of Caribbean Ornithology. See Annex 4.

Paige Byerly, a field assistant with JVDPS and a PhD candidate has developed a short draft paper entitled “**Roseate tern (*Sterna Dougali*) colony monitoring in the British Virgin Islands**”, which discusses observations of nest predations by rats in BVI offshore seabird colonies and evaluates the effectiveness of using game cameras. Since the original objective was to eliminate rats as a threat to seabirds (especially the Roseate tern), Paige’s work makes up for some of the gaps in this project.



Figure 14. Game camera footage in P. Byerly's paper shows footage of Black Rats (*Rattus rattus*) on Cockroach Cay in the BVI. While the cameras did show predation of eggs by rats, the paper makes interesting observations about the rats passing chicks. Paper is available in the DPLUS dropbox folder:



Figure 15. P. Byerly also drafted a protocol for using game cameras to monitor seabirds. (Image below from document, which can also be found in the drop box folder “Publications and lessons learnt”). In addition to Byerly's papers, JVDPS has drafted a short “Lessons Learnt” report on rat eradication from this DPLUS project.

3.2 Outcome

The project outcome statement was: “Restored habitats for endangered species of fauna and flora on six islands through eradication or control of alien species, using local capacity to develop sustainable protected area management.” This outcome was achieved as this DPLUS project's primary aim was to demonstrate that control of alien invasive species is just as important as eradication, in that small island conservation management organisations such as NPTVI and JVDPS may not always have the financial or human resource capacity to engage in complete eradication projects but that does not mean that no action should be taken at all in order to reduce the pressure on biodiversity.

The goal of Output 1 was the complete eradication of goats from four ecologically sensitive islands and though this was not achieved within the project timeframe, activity is still ongoing and will continue until this is achieved. However, this DPLUS project enabled culling work to continue, thereby prevention the uncontrolled reproduction of existing goats on the islands and reducing the level of grazing on native vegetation, allowing reforestation to occur.

Evidence for native plant recovery at Great Tobago and Prickly Pear National Parks has been gathered as part of the EU BEST 2.0 funded project (2016-2019), described in Section 3.1.

As the two projects ran in tandem the impact of vegetation recovery as goat removal continued was observed over time, as five monitoring plots (10x10m²) were established on each island and surveyed annually from 2016 to 2019 by NPTVI and Kew staff. In summary the number of species increased over time but then the impact of hurricane Irma in 2017 resulted in major vegetation loss. The recovery of vegetation post hurricane has been and will continue to be monitored, but it will now be more difficult to separate the impacts of goat grazing and hurricane impact. A link to the final report from this BEST 2.0 project can be found in section 3.1, under Output 3.

Output 2: System of long-term control of rats implemented on Green Cay and the Seal Dogs. This was successfully achieved as JVDPS developed an operational plan that was tested and implemented over this three-year project to control rats at these two sites. The successful eradication of rats from the Seal Dogs is a great achievement and continued monitoring will take place to ensure the Seal Dogs remain free of rats. The control of rats leading to eradication on Green Cay will continue beyond this DPLUS project now that the necessary skills and equipment are available locally. Further, during the project, Roseate terns nested on Cockroach Island allowing the JVDPS team to spend time on the small cay. Game cameras on the island used to monitor nesting Roseate Terns detected nearly 100% infestation by rats, and an additional basic operational plan for the removal of black rats from Cockroach Island has been developed (See Drop Box folder: The very small size of Cockroach Island and its close proximity to the Seal Dog Islands, means that this will be the next site for rat eradication activities to take place as part of the continued rat control efforts.

For JVDPS the most significant setback to this project was the catastrophic impact of hurricane Irma, as it destroyed approximately 80% of Jost Van Dyke Island’s built infrastructure, including JVDPS’ administrative office with backup computers housing files and footage for this DPLUS project. JVDPS had to hobble along in 2018 in extremely adverse conditions. Despite this, the DPLUS funded project has been largely successful in building local capacity for invasive species management in the BVI and developing long-term site and species management for seabird breeding islands and the threatened species that inhabit them.

The return of nesting Roseate terns was cited as an indicator of success in the original DPLUS application for the successful control of black rats on target islands in this project. While this is an optimistic goal, it is now realised that this was a very poor indicator for project success. Virgin Islands Roseate terns use a network of approximately 30 small cays across the USVI and BVI each year, typically choosing 3-5 islands in a given breeding season. The table below shows site location of BVI breeding sites over the last 5 years. The site selection of these threatened birds seems much more complex than the presence alone, and our partnership with PhD student Paige Byerly proved to be invaluable during the life of this DPLUS project. Byerly supported the project as a field assistant at selected project sites and worked collaboratively to carry out surveys for summer breeding surveys to ensure that she could reach nesting sites. Whilst it is important to minimise threats at breeding sites, there appears to be a lot more to site selection than just the presence or absence of invasive species. P.Byerly’s work did help to confirm that predation by black rats of Roseate terns is occurring and this was documented on Cockroach Island for summer 2018 (See Drop Box folder:

	2014	2015	2016	2017	2018	2019
BROKEN JERUSALEM	X					
CISTERN PT (COOPER)		X		X		X
COCKROACH			X		X	X
EAST SEAL DOG		X				X
GREEN CAY	X					
GUANA				X		
SANDY CAY						X
WEST SEAL DOG	X	X				

Figure 16. Breeding site location for Roseate terns in the BVI 2014-2019.

Whilst Roseate terns did return to nest on East Seal Dog in 2019, JVDPS does not believe this is an actual indicator of success for black rat eradication. Roseate terns were last seen nesting on Green Cay in 2014; however, in that year JVDPS observed predation of Roseate tern eggs and when the colony was abandoned, it was assumed that rats were the main cause.



Figure 17. 2014 Social Media posting by JVDPS about Roseate terns and disturbance by rats.

While rats are obviously a breeding deterrent for Roseate terns, the JVDPS project team collected game camera imagery of goats in the rocky outcroppings where the Roseate terns nest. Goats do not stay only within forested areas on small islands like Green Cay and JVDPS now realise that they may have been the actual cause of the collapse of the Green Cay Roseate tern colony, which favoured the island for several consecutive years in large numbers. Local reports suggest that goats were introduced in the early to mid-2000's, which coincides with the disappearance of the Roseate terns nesting in large numbers.

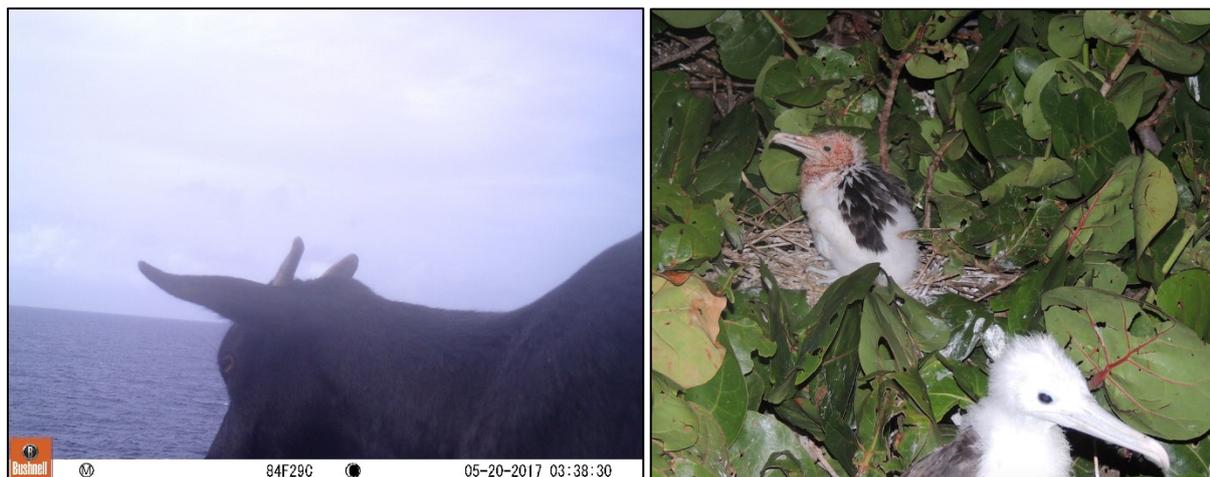


Figure 18. Left: Game camera footage of goat caught on the rocky outcroppings where Roseate terns historically nested. Right: A bloody Frigatebird chick on Great Tobago Island, where NPTVI and JVDPS have also regarded goats as the primary threat to the frigatebird colony. During field work in 2016 and 2017, rats were observed crawling throughout the seagrape trees where these birds nest. It is unknown whether the bloody head of this chick is caused by something else (previously assumed to have been pecked by another frigatebird); however, the disturbance by rats should not be ruled out as multiple invasive species may impact the target species.

JVDPS is developing simple long-term monitoring plans that involve vegetation surveys and surveys of surrounding coral communities, as recent research has shown that rat eradications also correlate to increase in abundance of adjacent reef fish communities surrounding restored cays. Capacity to carry out these surveys is being strengthened via another DPlus funded project involving JVDPS (DPLUS 073) focused on coastal and marine resilience and habitat monitoring.

JVDPS conducted repeat surveys of landbirds and reptiles at each DPLUS project site and this will be part of the long-term monitoring plan for these islands. During fieldwork at the Seal Dogs, JVDPS field workers observed a perceived increase in fruits present on the Turks head cactus (*Melocactus intortus*). Continued observations of mature fruits should also be tracked to help determine whether this could be another useful biodiversity indicator for Caribbean offshore cays once rats are eradicated. Unfortunately, nearly all of the Turk's Head cactus on Seal Dog Islands were destroyed during Hurricane Irma. During the summer of 2017 (June and July), White Cheeked pintails (*Anas bahamensis*) were observed nesting on the island of East Seal Dog.

3.3 Long-term strategic outcome(s)

The BVI Environment Charter Principle 7 has a goal 'to safeguard and restore native species, habitats and landscape features, and control or eradicate invasive species.' This DPLUS Project has directly contributed to this and will continue to do so beyond the project's completion due to the capacity building and knowledge gained through project implementation, in addition to the equipment that has been acquired and can be re-used, such as the A24 traps.

From a conservation management perspective NPTVI has added invasive species control to its biodiversity conservation programme recurrent activities and will begin to budget internally and seek donor support for continued removal of goats from these sites. JVDPS and NPTVI will continue to partner on rat removal or control at important seabird nesting sites, with the frigatebird colony at Great Tobago National Park identified as the next site to be addressed. A realistic approach will be taken that rat eradication will not be financially possible, but an ongoing reduction of rat numbers in a designated zone around the colony will be trialled, with the assumption that it is better to at least reduce rat numbers then do nothing and let them continue to increase.

The greatest expenses are boat fuel and staff time, but this project represented huge value for money as all project staff were in country and the funding was used directly on invasive species control and not international travel and accommodation.

NPTVI and JVDPS saw the benefit of partnering with RSPB and Kew on a parallel EU BEST 2.0 project (2016-2019) meant that complimentary work could take place that would benefit the larger strategic outcome. For small organisations with limited staffing it has always been necessary to think strategically about how projects can complement each other and enable direct conservation action from different angles.

The fact that NPTVI came into the project with all necessary firearms and ammunition purchased in the previous EU BEST 1.0 project and will leave this DPLUS project with an inventory of ammunition for continued use also contributes to value for money.

4 Sustainability and Legacy

The goal of this DPLUS project was to provide the funding to continue the goat removal at the Tobagos National Parks and to begin removal at two new sites, whilst beginning rat control at two important seabird nesting sites. As discussed in detail in Section 3.3 this goat and rat control will continue as part of the NPTVI and JVDPS programme activities.

Recognition that invasive species management and continued public awareness should be an integral part of park management and cannot just be a one-off project as the issues surrounding invasive species are not finite and re-introduction is always a risk. Also noting that islands such as the BVI with steep slopes and cliffs provide more hiding places for invasive species and eradication activities take longer due to access to the different terrain. The use of helicopters and very expensive equipment is short lived and does not address the long-term management and is not a feasible financial option for small island organisations, as it cannot be easily replicated should re-introduction occur. It is therefore better to approach it as IAS control with a goal to long term eradication, with continued monitoring part of park management activities.

Beyond the DPLUS043 project a monitoring schedule will be established so that reintroduction does not occur.

5 Lessons learned

At the project development phase the firearm legislation required a Royal Virgin Islands Police Force (RVIPF) Officer to supervise NPTVI use of the Tikka rifles purchased under the EU BEST 1.0 project due to their high calibre. NPTVI was expected to pay for the presence of this RVIPF Officer and so there was a budget line for staff costs inserted into the DPLUS budget, this RVIPF Officer was also expected to utilise the second Tikka rifle and assist with shooting goats. However, in October 2016 NPTVI was informed by the RVIPF that the permit to use the Tikka rifles would no longer be granted due to new legislation and NPTVI was told that a shotgun had to be used instead, which did not require supervised use by a RVIPF Officer.

Through this DPLUS project NPTVI have learnt that total eradication can take years and evidence to guarantee this can only be generated through years of visual and game camera monitoring as there are so many places for goats to hide due to the steep terrain and gun-shy reaction that results with long -term removal projects. If NPTVI had more trained staff available then progress would have been faster. Understanding these factors beforehand would have meant that perhaps it was too ambitious to expect in the timeframe and with the available human resources that so many islands could be successfully eradicated of goats.

The lessons learnt on this DPLUS project mean that this can be replicated elsewhere in the BVI using local capacity as the equipment is re-useable and there is adequate inventory.

Due to the catastrophic damage caused by hurricane Irma NPTVI and the BVI overall has new respect and foresight on potential hurricane impact. The priorities in the aftermath period become about human survival and safety and park management activities must shift to damage assessment, recovery of capital equipment and securing structures due to the looting that took place. NPTVI was fortunate not to have lost any project equipment as the firearms were securely stored at the RVIPF Armory. Not all A24 traps had been deployed into the field and the second order of A24 traps were stored in a secure concrete storeroom and were available for use once project activities could resume.

The resilience of invasives was proven by the number of rats and goats that survived hurricane Irma, even with the complete loss of vegetation caused by defoliation and tree damage.

The decision to work with Puerto Rico consultants HR Reefscaping was a sensible choice as they shared hands-on experience of working in similar geographic locations and could share their experiences. Due to their close proximity their travel time was only one hour and travel expenses were very affordable and could easily be replicated within a limited budget if needed. This is in contrast to international airfares and extended stay international colleagues. Overall it was more cost effective to collaborate with our neighbours in Puerto Rico and the lessons learnt can benefit others working in the region, with more regional capacity available for rat eradication projects.

Another lesson was learnt on purchasing specialist equipment from geographically distant countries such as New Zealand. The time it took to order these and have them delivered to the BVI was extremely long, taking up to six months for the second order, as the supplier GoodNature in New Zealand tried using a new distributor in the USA believing that it would be quicker than shipping from New Zealand. However there were issues at the New York FedEx office with the required EPA paperwork and the order was returned to the US distributor. In future more time should be anticipated for international shipping, but this was reliant on the arrival of DPLUS project funds, which was delayed in Year 1.

JVDPS was able to secure a donation of replacement game cameras to replace what was lost as a result of hurricane Irma, going forward extra game cameras should be sourced and stored in a location that is proven to be secure during hurricane season.

Other important lessons learnt include storing electronic data in the Cloud on a computer as there was no electricity or internet for up to six months in certain parts of the BVI and physical computers and servers were either damaged or inaccessible due to mould filled offices. Having

DPLUS project information available remotely is important to be able to work remotely if evacuating the island.

5.1 Monitoring and evaluation

There were no major changes in the project design, only in the project duration due to the impact of hurricane Irma in September 2017 which resulted in a one-year extension being granted for this DPLUS project.

Monitoring and evaluation were conducted by NPTVI and JVDPS on project activities. NPTVI created a goat removal log which was the basis for directing which islands took priority based on visual counts of goats observed and this informed the schedule of when islands would be visited. The NPTVI evaluated project success by the actual number of goats killed and when a lull period was experienced with no successful goat kills alternative methods such as feeding and setting nets was conducted.

In terms of external evaluation, it is not immediately apparent who else NPTVI could have contacted to evaluate project progress as no other local entity in the BVI conducts feral animal removal on a large scale on islands. The Environmental Health Department only conduct rat control in specific urban areas and the Department of Agriculture only has experience of livestock (cows) corralling in urban areas where they are a nuisance to communities. There have been two feral goat or sheep removal projects in the BVI on private islands, but these used outside consultants and helicopters (Guana Island), with some assistance from the RVIPF. Therefore, the financial constraints were not the same as NPTVI. The only other successful rat eradication project in the BVI was conducted by the Island Resources Foundation as mentioned in Section 1, and the lessons learnt from that informed the DPLUS design.

5.2 Actions taken in response to annual report reviews

The four comments/queries for the project leader that were listed in the last annual report have been addressed in this final report in the relevant section. NPTVI and JVDPS did discuss the report review when received and sought to address the points raised in the final project year.

6 Darwin Identity

The Darwin identity was publicised in all presentations, such as the presentation on using firearms created by NPTVI and presented in Montserrat under the parallel EU BEST 2.0 project, as described in Section 3.1, Output 3. In addition to the presentation on the use of A24 traps for rat eradication that JVDPS gave during the visit by HR Reefscaping Section 3.1, Output 2.

The Darwin identity has been promoted on all posts on social media. The Darwin Initiative fund and DPLUS are well known names in the BVI as NPTVI and JVDPS have been successful in receiving grants over the years and all of the projects are referred to as the ‘Darwin Project for x,y,z’. As a result the media is very familiar the Darwin identity and members of the community associate it with conservation projects.

The Darwin identity was included in the public signage “Conservation in Action!” that was posted at the Seal Dog Islands and Green Cay.

7 Finance and administration

A project extension was requested and approved by Darwin/Defra in December 2017 with the following budget outline:

Project Spend	2016-17	2017-18	2018-19	2019-20	2020-21	Start/end dates/ Comments
Current						

Proposed						
Difference						

In the last annual report JVDPS was not able to submit financial information, this is now available as seen in the table below. Please note that the report in Section 7.1 only represents the JVDPS spend for 2018-19 as requested in the table.

JVDPS Project Spend	2016-17	2017-18	2018-19	Comments
Staff costs				
Consultancy costs				
Overhead costs				
Travel and subsistence				
Operating costs				
Capital items				
Others				
TOTAL				

7.1 Project expenditure

Project spend (indicative) since last annual report	2018/19 Grant (£)	2018/19 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others				
TOTAL				

The table above reflects the breakdown of costs from 2017-19 as when the extension was granted a new breakdown by category was not requested, so the total funds allocated to Year 2 of the original application have been used for this final annual report as the 2018/19. Overall the DPLUS project spent more than what was budgeted as up six months to one year was lost due to hurricane Irma and work had to be replicated. NPTVI also committed more staff time to this project so that regeneration of goats would not occur in breeding season.

Nb: 27th June exchange rate: 1USD = 0.788917GBP

Staff employed (Name and position)	2018/19 Cost (£)
Israel Bahador, Sr. Marine Warden NPTVI	

Cecil Fraser, Marine Warden NPTVI	
Kevis Thomas, Marine Warden NPTVI	
Susan Zaluski, Director JVDPS	
TOTAL	

Consultancy – description and breakdown of costs	Other items – cost (£)
JVDPS design of A24 warning signs	
TOTAL	

Capital items – description	Capital items – cost (£)
JVDPS purchase of a dinghy instead of vessel rental	
TOTAL	

Other items – description	Other items – cost (£)
TOTAL	

7.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
NPTVI match fund for boat use costs	
JVDPS match fund for equipment and vessel	
NPTVI match fund for firearms equipment and ammunition	
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
NPTVI recurrent budget will cover the cost of NPTVI staff time and boat use/fuel – no fixed amount £	

TOTAL	

7.3 Value for Money

This DPLUS project was great value for money as it essentially provided the base funds to continue the goat removal work, providing NPTVI with the time needed to budget for its long term inclusion in its re-current budget. The fact that the firearms equipment and all ammunition were provided in-kind is additional value for money.

This applies also to JVDPS and the project allowing the purchase of the A24 rat traps that can be re-used. Although some traps were lost in hurricane Irma there are still traps left as not all had been deployed. Challenges in providing value for money can be linked to the high cost of living in the BVI, the shipping costs are very high when purchasing capital equipment.

Annex 1 Project's full current logframe as presented in the application form (unless changes have been agreed)

Please insert your project's logframe (if your project has a logframe), including indicators, means of verification and assumptions. N.B. if your application's logframe is presented in a different format in your application, please transpose into the below template. Please feel free to contact Darwin-Projects@ltsi.co.uk if you have any questions regarding this.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact:			
Outcome:			
Outputs: 1. Add more outputs as necessary	1.1 1.2 1.3 etc.	1.1 1.2 1.3	
2.	2.1 2.2	2.1 2.2	
3.	3.1	3.1	
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)			

Annex 2 Report of progress and achievements against final project logframe for the life of the project (if your project has a logframe)

Project summary	Measurable Indicators	Progress and Achievements for the life of the project
Impact: Insert agreed project Impact statement		Report on any contribution towards positive impact on biodiversity or positive changes in the conditions of human communities associated with biodiversity e.g. steps towards sustainable use or equitable sharing of costs or benefits
Outcome Insert agreed project Outcome statement	Insert agreed Outcome level indicators	Report on progress towards achieving the project purpose, i.e. the sum of the outputs and assumptions
Output 1. Insert agreed Outputs with Activities relevant to that output in lines below	Insert agreed output level indicators)	Report general progress and appropriateness of indicators, and reference where evidence is provided e.g. <i>Evidence provided in section 3.2 of report and Annex X</i>
Activity 1.1 Insert activities relevant to this out put		Report completed or progress on activities that contribute toward achieving this Output
Activity 1.2. Etc.		
Output 2. Insert agreed Output	Insert agreed Output level indicators	Report general progress and appropriateness of indicator
Activity 2.1.		
Activity 2.2. Etc.		
Output 3. Etc.		

Annex 3 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
1	Number of (i) students from the UKOTs; and (ii) other students to receive training (including PhD, masters and other training and receiving a qualification or certificate)	1 PhD
2	Number of (i) people in UKOTs; and (ii) other people receiving other forms of long-term (>1yr) training not leading to formal qualification	4
3a	Number of (i) people in UKOTs; and (ii) other people receiving other forms of short-term education/training (i.e. not categories 1-5 above)	
3b	Number of training weeks (i) in UKOTs; (ii) outside UKOTs not leading to formal qualification	
4	Number of types of training materials produced. Were these materials made available for use by UKOTs?	
5	Number of UKOT citizens who have increased capacity to manage natural resources as a result of the project	4
Research Measures		
9	Number of species/habitat management plans/ strategies (or action plans) produced for/by Governments, public authorities or other implementing agencies in the UKOTs	1
10	Number of formal documents produced to assist work in UKOTs related to species identification, classification and recording.	2
11a	Number of papers published or accepted for publication in peer reviewed journals written by (i) UKOT authors; and (ii) other authors	1
11b	Number of papers published or accepted for publication elsewhere written by (i) UKOT authors; and (ii) other authors	1
12b	Number of computer-based databases enhanced (containing species/genetic information). Were these databases made available for use by UKOTs?	
13a	Number of species reference collections established. Were these collections handed over to UKOTs?	

Code	Description	Totals (plus additional detail as required)
13b	Number of species reference collections enhanced. Were these collections handed over to UKOTs?	
Dissemination Measures		
14a	Number of conferences/seminars/workshops/stakeholder meetings organised to present/disseminate findings from UKOT's Darwin project work	1
14b	Number of conferences/seminars/workshops/stakeholder meetings attended at which findings from the Darwin Plus project work will be presented/ disseminated	1
Physical Measures		
20	Estimated value (£s) of physical assets handed over to UKOT(s)	
21	Number of permanent educational/training/research facilities or organisation established in UKOTs	
22	Number of permanent field plots established in UKOTs	
23	Value of resources raised from other sources (e.g., in addition to Darwin funding) for project work	

Annex 4 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. weblink, contact address, annex etc)
Research Gate	Invasive plant species control and monitoring vegetation plots in Great Tobago National Park, BVI. Year three (final) report for the project " <u><i>Securing Pockets of paradise in the Caribbean</i></u> ". Hamilton, M.A., Barrios, S., Dani Sanchez, M., Clubbe, C., Newton, R., Grant, K., Harrigan, N. and Woodfield-Pascoe, N. (2019)	American	British	Male	Royal Botanic Gardens Kew	https://www.researchgate.net/publication/333105799_Invasive_plant_species_control_and_monitoring_vegetation_plots_in_Great_Tobago_National_Park_BVI_Year_three_final_report_for_the_project_Securing_Pockets_of_paradise_in_the_Caribbean
Journal of Caribbean Ornithology	" <i>Seabird Surveys of Globally Important Populations in the BVI</i> " Zaluski, S; George, A., Petrovic, C., Pierce, J, Woodfield Pascoe, N., Soanes, L. (2018)	American	BVI	Female	JVDPS	http://jco.birdscaribbean.org/index.php/jco/article/view/599

In 2018, project team members were able to publish results of seabird surveys, which were a driving force behind invasive species eradication activities entitled "*Seabird Surveys of Globally Important Populations in the BVI*" in **The Journal of Caribbean Ornithology**.

Annex 5 Darwin Contacts

Ref No	DPLUS 043
Project Title	Consolidating local capacity for sustainable restoration and monitoring of Protected Areas in the Virgin Islands (UK)

Project Leader Details	
Name	Lynda Varlack
Role within Darwin Project	Project Leader
Address	
Phone	
Skype	
Email	
Partner 1	
Name	Susan Zaluski
Organisation	Jost Van Dykes Preservation Society
Role within Darwin Project	Project Partner
Address	
Skype	
Email	
Partner 2 etc.	
Name	
Organisation	
Role within Darwin Project	
Address	
Skype	
Email	

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	x
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	x
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	
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.	