

Building biosecurity capacity in the British Overseas Territories: 3.5 years of progress



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Executive summary

Through this project the GB Non-native Species Secretariat (GBNNSS) successfully mobilised UK Government expertise to substantially improve the capacity of British Overseas Territories (OTs) to prevent the introduction of invasive non-native species. Costing just £20k per year per OT, the project helped improve the level of protection from new invasive species to over 90% of the UKs endemic biodiversity. Key outcomes include improved management of priority pathways of introduction, development of biosecurity legislation, improved capacity of biosecurity staff, access to individual OT specific guidance and resources, and established channels of communication to UK expertise.

The need

The 16 British OTs together account for 94% of the UKs unique endemic biodiversity. Being predominantly islands, the OTs are very vulnerable to the introduction of potentially harmful invasive non-native species, recognised as the biggest threat to island biodiversity, as well as to food security and sustainable development. Biosecurity is acknowledged as the most cost-effective means of addressing invasive species threats for small islands.

The OTs have little specialist capacity to combat invasive species and lack access to the wealth of expertise in the UK. An initial gap analysis in 2017 identified prevention and border controls as the weakest area across the OTs. Most project work was targeted at this area and the greatest increase in capacity was recorded here: for example, 15 OTs had completed a pathway analysis and horizon scanning exercise by 2019, prioritising the top 10 threats to biodiversity, the economy and human health, and the top 50 threats to all sectors.

Project objectives

A 3.5-year project run by the GBNNSS, and funded by FCO's Conflict, Stability and Security Fund (CSSF) was carried out between 2016 and 2020 to improve the biosecurity of the OTs against invasive non-native species.

The initial funding was £1m over 4 years and an additional £260k was secured for the final year.

Major outputs

A total of 343 people within the OTs were involved in the project: horizon scanning exercise (71), pathway action planning (142), workshops (67) and training courses (63). More than 150 external experts from 54 entities in the UK, Europe and USA were involved.

The project was divided into underpinning, one-off core activities, and ongoing support activities.

Core activities:

Pathways of entry for invasive species were analysed, and more than 2,500 species were screened in the horizon scanning exercise for their likelihood to arrive and impact the OTs in the next 10 years.

Pathway action plans were developed for the priority species for 15 OTs, aimed at reducing the risk of arrival of new invasive species.

A model biosecurity bill with subsidiary legislation was drafted, together with 5 guidance documents, in 2 formats: (i) fully comprehensive and (ii) simplified for smaller jurisdictions. Support was given to 7 OTs to adapt the model and develop new biosecurity legislation.

Support activities:

- ✓ A biosecurity toolkit was developed, covering border and post-border control procedures and marine biosecurity, producing a total of 77 guides, manuals, posters, protocols and templates, including:
 - 212 factsheets;
 - 4 pest risk assessment templates and a guidance document;
 - Marine toolkit with 25 identification guides and 5 separate tools.
- ✓ Training was carried out in basic entomology, rodent biology and control, biosecurity, pest risk assessment, and contingency planning for wildlife diseases.
- ✓ Prioritisation exercise of established invasive species was carried out for Anguilla and the Turks & Caicos Islands, identifying 22 priority species for (i) cost-effective eradication and (ii) internal biosecurity.
- ✓ Two e-learning modules were developed for front-line biosecurity staff, as well 3 education packs for schools and pre-school children.
- ✓ Three OTs received specific technical assistance visits, following hurricanes Maria and Irma in the British Virgin Islands, South Georgia to protect the £12 million rat eradication, and the Falkland Islands to support implementation of a new biosecurity framework. All OTs received technical advice remotely.

Key outcomes

Between 2017 and 2020 the OTs made substantial improvements in their biosecurity provisions. The project met all outcome and output indicators, and met or exceeded all activity indicators except one, which was borderline.

The project mobilised over £1m in co-finance, primarily in expertise time, in effect almost doubling the project budget. At under £20k per OT per annum the project has delivered excellent value for money across the OTs, delivering cost-effective capacity building tailored to the needs of individual territories.

A key aim of the project was to provide access to UK Government expertise and this was highly successful, with seven government and two part-government bodies actively involved in the work.

Future work

The 16 OTs have made substantial progress towards strengthening their biosecurity to reduce the risk of introduction of new invasive species. Consolidation of the progress achieved is key to ensure sustainability of the work, particularly for the activities delivered late in the project, namely risk assessment, prioritisation and legislative support. Eight recommendations for further work are given. The project continues in 2020 to 2021 with limited funding, primarily to provide technical support for biosecurity and invasive species management.

Summary of changes in capacity between 2017 and 2020, assessed as weak, moderate or strong, based on the results of the 2020 gap analysis in the areas of *Prevention, Early Warning & Rapid Response (EWRR)*, and *Management, Prioritisation & Frameworks (MPF)*. The direction of arrows indicate the direction of change since 2017.

OT	Prevention	EWRR	MPF
Anguilla	Weak / moderate 	Weak	Moderate
Ascension	Moderate 	Moderate 	Strong 
Bermuda	Moderate 	Moderate 	Moderate / strong
BAT	Strong	Moderate	Strong
BIOT	Moderate 	Weak / moderate 	Strong 
BVI	Moderate 	Moderate 	Moderate 
Cayman Islands	Moderate 	Moderate 	Strong 
CSBA	Weak	Weak	Moderate
Falkland Islands	Strong 	Moderate 	Moderate
Gibraltar	Moderate 	Strong 	Strong
Montserrat	Moderate 	Moderate 	Moderate / strong 
Pitcairn	Moderate 	Moderate	Moderate 
SGSSI	Strong 	Strong 	Strong
St Helena	Strong 	Strong	Strong 
Tristan da Cunha	Moderate 	Moderate 	Strong 
Turks & Caicos Islands	Moderate 	Moderate 	Strong

BAT = British Antarctic Territory; BIOT = British Indian Ocean Territory; BVI = British Virgin Islands; CSBA = Cyprus Sovereign Base Areas; SGSSI = South Georgia & the South Sandwich Islands.

1. Background

The 16 British Overseas Territories (OTs) together account for 94% of the UK's unique biodiversity and as such make a significant contribution to global biodiversity (Churchyard et al, 2014). Being predominantly islands, the OTs are very vulnerable to the introduction of potentially harmful invasive non-native species (INNS), recognised as the biggest threat to island biodiversity, as well as to food security and sustainable development. However, most of them have limited capacity to act and need urgent support to develop measures to reduce the risk of future invasions as well as to manage existing ones.

In 2016 the GB Non-native Species Secretariat (NNSS) secured funding over four years (2016-2020) under the FCO's Conflict, Stability and Security Fund (CSSF) to develop comprehensive biosecurity for the OTs by providing them with access to UK expertise on risk analysis, pathway management, pest identification, horizon scanning, contingency planning, rapid response capability and species management.

The CSSF project *Tackling Invasive Non-Native Species in the UK Overseas Territories* is part of the UK government's response to the International Union for Conservation of Nature's (IUCN) Honolulu Challenge of 2016, calling for greater action to tackle the issue of invasive non-native species across the globe, with particular attention to preventative action and the development of effective biosecurity policies. Through this, it also contributes to the UK's obligations towards the UN Sustainable Development Goal 15.8, and under the Convention of Biological Diversity to meet Aichi Target 9: invasive alien species prevented and controlled. It is part of the UK government's obligations to the OTs under the Global Britain Strategy (Anon., 2019a), and speaks to the findings of the House of Commons Foreign Affairs Select Committee on the Overseas Territories by providing access to a range of UK agencies outside the FCO (Anon, 2019b).

The project objective was "to improve the biosecurity of the OTs against invasive non-native species to improve their environmental resilience and food security; achieved through reducing the risk and impact of invasion and natural hazards via technical assistance and capacity building". Biosecurity, defined as measures to reduce the risk of introducing or spreading invasive non-native species (and other harmful organisms such as diseases) in the wild, has long been acknowledged as the most cost-effective means of addressing invasive species threats for small islands (e.g. Tye, 2009).

The initial funding was £1m over 4 years, which amounts to less than £16,000 per OT per year of the project. An additional £260k was secured for the final year, 2019 to 2020. Due to these relatively small sums the project was designed to be very strategic, tackling key issues identified from an initial gap analysis of biosecurity capacity undertaken in 2017.

2. Project oversight

The project started in the autumn of 2016 and was managed by the NNSS. A Steering Group was established in June 2017, comprising the Royal Society for the Protection of Birds (RSPB), International Union for Conservation of Nature (IUCN), Defra, and the UK Overseas Territories Association (UKOTA). The steering group had a total of 14 teleconferences and one face-to-face meeting during the life of the project.

The steering group's overall aim was to ensure that the project achieved its aims within budget and on time. Specifically it was tasked to:

- Review and comment on reports and proposals;
- Agree priorities for future work;
- Help identify biosecurity gaps and needs in the OTs;
- Ensure the project was aware of and interacted with wider initiatives on invasive non-native species;
- Help identify relevant UK Government and Agency expertise.



South Georgia is protected by its relative isolation and stringent biosecurity protocols.

3. Project initiation

3.1 Initial gap analysis

In order to plan the appropriate capacity building activities a gap analysis was carried out between January and March 2017 on biosecurity practices and capacity in all 16 OTs:

- Anguilla
- Ascension Island
- Bermuda
- British Antarctic Territory (BAT)
- British Indian Ocean Territory (BIOT)
- British Virgin Islands (BVI)
- Cayman Islands
- Cyprus Sovereign Base Areas (CSBA)
- Falkland Islands
- Gibraltar
- Montserrat
- Pitcairn Islands
- St Helena Island
- South Georgia & the South Sandwich Islands (SGSSI)
- Tristan da Cunha
- Turks & Caicos Islands (TCI)

Twenty two components were identified which are required for effective biosecurity along the biosecurity continuum, grouped in three areas: (i) *Prevention*, (ii) *Early Warning & Rapid Response*, and (iii) *Management, Prioritisation & Frameworks*. Capacity was scored by each OT for each component as 0 (none, or nothing in place), 1 (basic framework or actions in place), 2 (some substantial advances while other actions remain to be done) or 3 (good, or substantive actions taken or action achieved).

Responses were ground-truthed where possible by the RSPB, IUCN, Animal and Plant Health Agency (APHA) and South Georgia Heritage Trust to ensure that the text and ratings matched recent experience of the relevant territory. The text and ratings assigned to the components were in all cases agreed and approved by the contacts in-country for each territory. See the [gap analysis report](#) for further details.

3.1.1 Gap analysis results

Overall, scores for capacity varied from 19 to 51 out of a total possible score of 66. The UK was also scored for comparison and received a score of 58. The weakest area was that of *Prevention* with a mean territory score of 8.1 (out of a total possible score of 24), and strongest was *Management, Prioritisation & Frameworks (MPF)* with a mean score of 11.9 (out of a total possible score of 18). *Early Warning & Rapid Response (EWRR)* was intermediate, with a mean score of 10.3 (out of a total possible score of 24). Capacity in each component is summarised in Table 1 for the 16 OTs.

Table 1. Overall scores in the three areas and total score for the 16 OTs. The overall mean score excludes that for the UK.

Territory	Prevention	EWRR	MPF	Overall score
Turks and Caicos	4	8	7	19
BIOT	3	5	12	20
CSBA	3	7	11	21
Montserrat	5	8	9	22
Ascension	5	8	10	23
Anguilla	8	4	12	24
Bermuda	5	9	12	26
Tristan da Cunha	7	7	12	26
Pitcairn	9	10	7	26
Falkland Islands	11	10	10	31
Cayman	11	9	13	33
BVI	10	14	10	34
Gibraltar	3	17	17	37
BAT	17	11	17	45
St Helena	14	18	13	45
SGSSI	14	19	18	51
UK	21	20	17	58
Overall mean score for the OTs	8.1	10.3	11.9	

The OTs with the highest capacity were the sub-Antarctic territories of SGSSI (score of 51), BAT and St Helena Island (both with scores of 45). A group of four territories had total scores between 31 and 36: Falkland Islands, BVI, Cayman Islands and Gibraltar. A group of nine OTs had the lowest capacity with scores between 19 and 26 with only one or two points between each: TCI, BIOT, CSBA, Montserrat, Ascension Island, Anguilla, Bermuda, Tristan da Cunha, and Pitcairn.

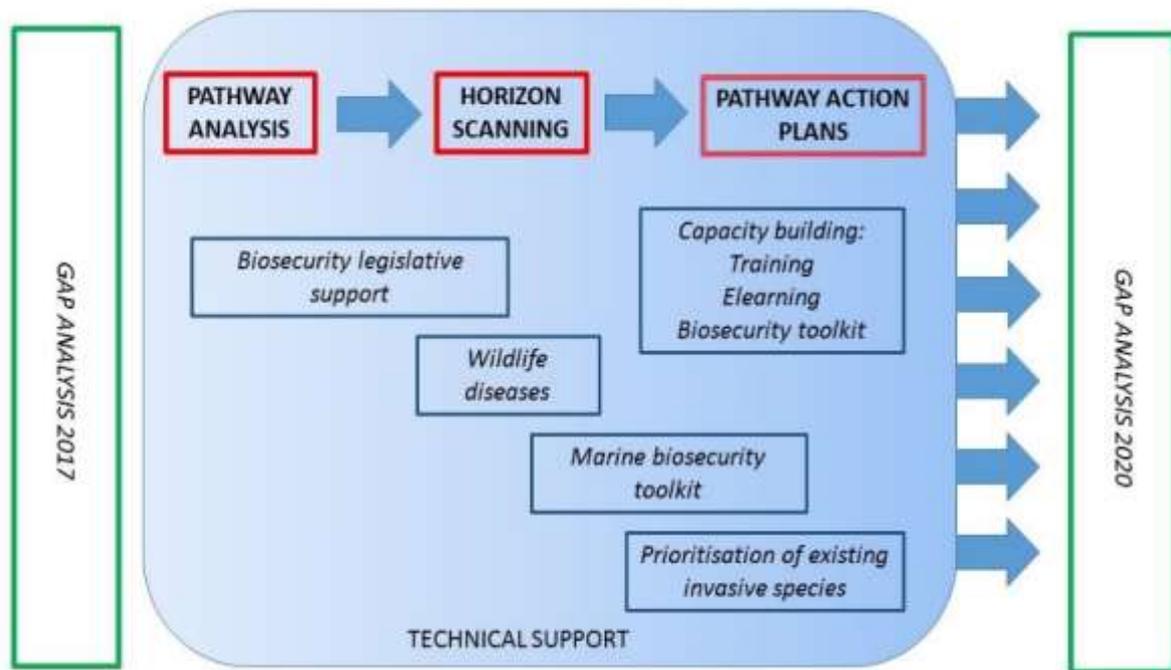
Biosecurity practices tended to be based on historic legislation and procedures aimed at protecting agriculture and production, with limited extension to INNS of wider environmental concern. Capacity to detect and manage invasive species in the marine environment was particularly weak.

3.2 Designing the project activities

Based on the gap analysis findings, project activities were designed to address the main gaps, particularly in relation to prevention. We divided activities into (i) core activities such as horizon scanning and pathway analysis that will only be needed once; and (ii) support activities which are mostly on-going and support the implementation of the core activities. Continuous technical assistance underpinned all the activities. The project design is illustrated in Figure 1.

A summary of activities carried out in each OT is given in **Annex 1. Summary table of project activities.**

Figure 1. Summary of project activities. One-off core activities in red boxes, supporting and additional activities in blue boxes.



Entomology training in Montserrat

4. Core Activities

There were four core activities: **pathway analysis** which informed a large-scale **horizon scanning** exercise, from which **pathway action plans** were developed, and strengthening of **biosecurity legislation**. These were one-off actions which, once completed, did not require further input.

4.1 Pathway analysis

A pathway analysis was carried out by the NNSS to provide input to the horizon scanning exercises, aimed at identifying the key routes (pathways) of entry for new non-native species for each OT. 'Pathway' is defined as the route and mechanism of the introduction and spread of invasive non-native species. The analysis was a desk study and had three elements:

- Connectivity of the OT: volume, frequency, relative importance and origin of sea and air transport networks;
- Exotic animal and plant ownership;
- Historic pathways of introduction were inferred for existing non-native invasive species, using the pathway classification adopted by the Convention on Biological Diversity SBSTTA 18 (Anon., 2014), distinguishing intentional and unintentional introductions at the category and subcategory level.

Further details can be found in the [pathway analysis report](#).

4.1.1 Results

We assessed a total of 2,629 introductions across 15 OTs (it was not done for the CSBAs this was covered as part of two separate Darwin Plus projects (DPLUS056 and DPLUS088), and results were factored into the project work). The greatest number of introductions was of plants (1,515, 58%) then invertebrates (1,030, 39%) and finally vertebrates (84, 3%).

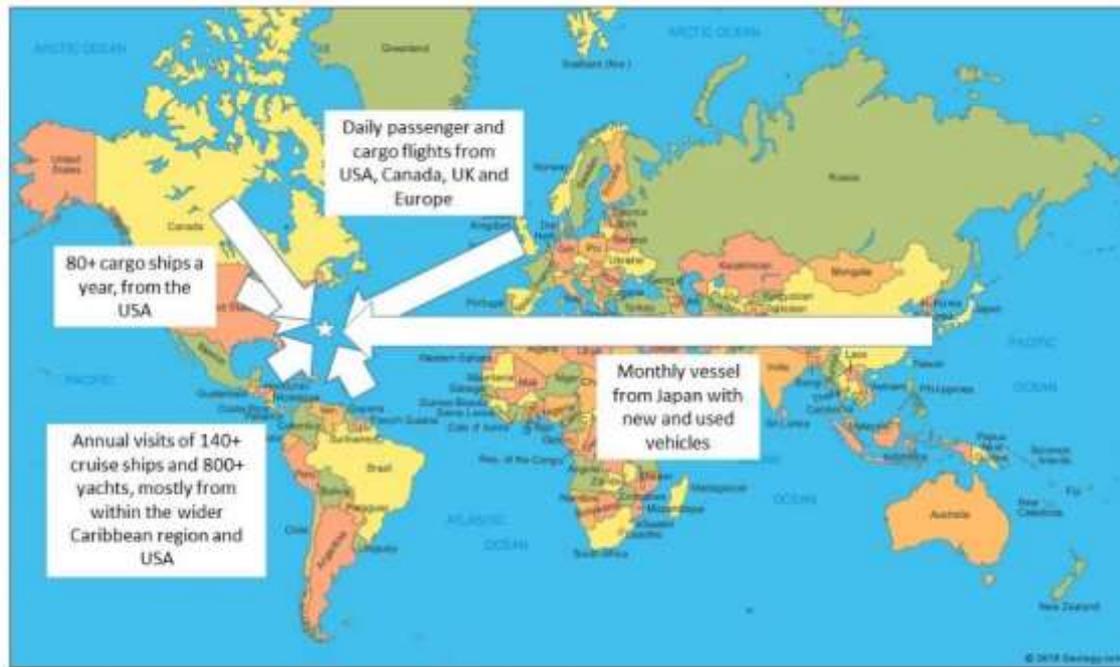
Overall:

- 71% of non-native plant species resulted from intentional introductions, primarily introduced through the horticulture trade as garden plants.
- 97% of non-native invertebrate species resulted from unintentional introductions. The commonest way of arrival was hitchhiking on live plants.
- 58% of non-native vertebrate species resulted from intentional introductions (release in the wild plus escape from confinement), primarily through the pet trade.

In conclusion, the most risky pathway for introducing new species of non-native plant and invertebrate species is the intentional importation of live plants, from the point of view of the plant itself as a potential weed, and as a vector for contaminants such as invertebrates.

Associated material such as soil and plant pots with imported garden plants increase the risk posed by the horticulture pathway. For vertebrates, the pet trade stands out as the most risky pathway of introduction. Two examples of contrasting patterns of pathways of entry are shown in Figure 2, for Bermuda with its many pathways both land and sea, and Tristan da Cunha which is relatively isolated.

Figure 2. Examples of the potential pathways of entry for invasive non-native species in two OTs: Bermuda (upper map), and Tristan da Cunha (lower map).



4.2 Horizon scanning

A comprehensive horizon scanning exercise was carried out between February 2018 and March 2019. The aim of the horizon scanning exercise was to predict which new INNS were most likely to arrive and establish in the next 10 years for each OT. This prediction is key to the cost-effective targeting of resources at those pathways posing most risk and for which risk management is most feasible.

The programme of horizon scanning was led by the Centre for Ecology and Hydrology (CEH) with NNS providing oversight, logistical support, and technical input.

A stepwise approach to horizon scanning for new non-native species was adopted, focusing on species not present in each OT but occurring elsewhere in the region or at the sources of the pathways. Preliminary species lists were compiled by selected taxonomic experts by systematic searches of existing lists and databases. Species were scored and ranked on the likelihood of (i) arrival, (ii) establishment, and (iii) impact on the environment, the economy (agriculture, fisheries, etc.) and public health. The top priority species for each OT were then identified at a consensus workshop involving global, regional and local experts. Consensus workshops were held as far as possible in the OTs; see Table 2.

A total of 147 experts from 52 organisations were involved during the study, and an estimated 10 days per OT per external expert was given as time in-kind. Assuming an average daily rate of £600 (likely an underestimate) per day, this is equivalent to £990K leveraged in co-funding.

Table 2. Programme of horizon scanning exercises.

Date	Location	Territories covered
May 2018	Cayman Islands	Anguilla, Bermuda, BVI, Cayman Islands, Montserrat, Turks & Caicos Islands
August 2018	Diego Garcia	BIOT
October 2018	Cambridge, UK	BAT, Falklands, SGSSI
November 2018	St Helena	Ascension, St Helena, Tristan da Cunha
January 2019	Gibraltar	Gibraltar
February 2019	UK (skype)	Pitcairn

In addition to developing priority species lists for each OT, overall priority lists of the species were identified on the basis of their likely impact across different territories for each impact category. Three “top 10” lists were developed for each impact category (environment, economy, human health), as well as for the Caribbean region overall (across all impact categories) as the Caribbean OTs form a coherent group, united by many shared pathways. A “top 50” list across all impact categories and OTs was also developed.

The criteria for selecting the species for the top 10 and 50 lists was as follows:

1. The number of OTs identifying the species as posing high risk;
2. Where there was no neat cut-off point at 10 or 50 species, the second criterion used was the impact scores from the horizon scanning exercise;
3. Where the line had to be drawn between two species scoring less than 1 point between them, the confidence levels assigned to the scores were used, selecting the species with higher confidence.

4.2.1 Horizon scanning results

A summary of each workshop can be found on the OT Biosecurity project webpage [here](#), lists of the priority species identified for each OT [here](#), and the [CEH report](#).

More than 2,500 potential invasive non-native species were assessed. A total of 209 species were considered of sufficient threat to the environment, human health or economies to be included in at least one of the OT priority lists. Almost half only appeared on one OT list and very few species had multiple impacts. Some commonalities were identified:

Mosquitoes: 8 mosquito species were prioritised by 11 OTs

- Example: Tiger mosquito *Aedes albopictus* on 9 OTs lists

Marine mussels: 5 species of mussel were prioritised by 15 OTs

- Example: Asian green mussel *Perna viridis* on 12 OTs lists

Ants: 12 species of ant were prioritised by 9 OTs

- Example: Little fire ant *Wasmannia auropunctata* on 8 OTs lists.

For biodiversity impact, the “top 10” comprised five marine species, the brown rat, three invertebrate species (including a fire ant and the Giant African snail), and one plant, with the Asian green mussel *Perna viridis* being the species identified by the highest number of OTs (12) in the horizon scanning exercise; see Table 3. For economic impact, the “top 10” comprised eight invertebrates and two parakeets; see Table 4. For human health impacts, the “top 10” comprised six invertebrates (three of them mosquitoes), the Brown rat and three marine species; see Table 5.



The Brown rat would be a major threat to biodiversity if it arrives in a territory.

Table 3. Top 10 list for biodiversity impacts.

Scientific name	Common name	Number of OTs with a risk of impact
<i>Perna viridis</i>	Asian green mussel	12
<i>Mytilus galloprovincialis</i>	Mediterranean mussel	8
<i>Rattus norvegicus</i>	Brown rat	6
<i>Wasmannia auropunctata</i>	Little fire ant	5
<i>Scyphophorus acupunctatus</i>	Agave snout weevil	5
<i>Lissachatina fulica</i>	Giant African snail	5
<i>Pterois miles / volitans</i>	Devil firefish / lionfish	5
<i>Carcinus maenas</i>	European shore crab	5
<i>Mytilus edulis</i>	Blue mussel	5
<i>Prosopis juliflora</i>	Mesquite	4

Table 4. Top 10 list for economic impacts.

Scientific name	Common name	Number of OTs with a risk of impact
<i>Coptotermes formosanus</i>	Formosan subterranean termite	7
<i>Tuta absoluta</i>	Tomato leaf miner	7
<i>Psittacula krameri</i>	Rose-ringed parakeet	7
<i>Wasmannia auropunctata</i>	Little fire ant	6
<i>Ceratitis capitata</i>	Mediterranean fruit fly	6
<i>Aedes aegypti</i>	Yellow fever mosquito	6
<i>Aratinga erythrogenys</i>	Red-masked conure	5
<i>Coptotermes gestroi</i>	Asian subterranean termite	5
<i>Diaphorina citri</i>	Asiatic citrus psyllid	4
<i>Varroa destructor</i>	Varroa mite	4

Table 5. Top 10 list for human health impacts.

Scientific name	Common name	Number of OTs with a risk of impact
<i>Aedes albopictus</i>	Tiger mosquito	9
<i>Wasmannia auropunctata</i>	Little fire ant	7
<i>Perna viridis</i>	Asian green mussel	6
<i>Aedes aegypti</i>	Yellow fever mosquito	6
<i>Lissachatina fulica</i>	Giant African snail	5
<i>Anopheles gambiae</i>	Mosquito	5
<i>Amblyomma cajennense</i>	Cayenne tick	5
<i>Rattus norvegicus</i>	Brown rat	4
<i>Magallana gigas</i>	Pacific oyster	4
<i>Pterois miles / volitans</i>	Devil firefish / lionfish	4

A list was also developed for species which appeared in the priority lists for all three impact categories across the OTs. The overall “top 10” comprises four marine species (including a lionfish), and single representatives of a range of taxa, including a plant species; see Table 6.

The Caribbean OTs comprise a relatively unified group in terms of geographic proximity and shared pathways. The “top 10” list for the Caribbean OTs consists of one marine species (the Asian green mussel), three vertebrates and five invertebrates. No plants species made it onto the list; see Table 7.



South Dock, Providenciales, TCI. The main port of entry for cargo to the territory.

Table 6. Top 10 list across all three impact categories.

Scientific name	Common name	Bio-diversity	Economy	Public Health
<i>Perna viridis</i>	Asian green mussel	12	3	6
<i>Wasmannia auropunctata</i>	Little fire ant	5	6	7
<i>Lissachatina fulica</i>	Giant African snail	5	4	5
<i>Rattus norvegicus</i>	Brown rat	7	4	4
<i>Pterois miles</i>	Lionfish	5	4	4
<i>Magallana gigas</i>	Pacific oyster	4	3	4
<i>Psittacula krameri</i>	Rose-ringed parakeet	4	7	1
<i>Mytilus galloprovincialis</i>	Mediterranean mussel	8	2	1
<i>Boa constrictor imperator</i>	Boa constrictor	4	1	3
<i>Prosopis juliflora</i>	Mesquite	4	1	2

Table 7. Top 10 list for the wider Caribbean region.

Scientific name	Common name	No. OTs
<i>Perna viridis</i>	Asian green mussel	6
<i>Amblyomma cajennense</i>	Cayenne tick	5
<i>Lissachatina fulica</i>	Giant African snail	5
<i>Tuta absoluta</i>	Tomato leaf miner	5
<i>Ceratitis capitata</i>	Mediterranean fruit fly	5
<i>Coptotermes formosanus</i>	Formosan subterranean termite	5
<i>Coptotermes gestroi</i>	Asian subterranean termite	5
<i>Boa constrictor imperator</i>	Common boa constrictor	5
<i>Psittacula krameri</i>	Rose-ringed parakeet	5
<i>Aratinga erythroga</i>	Red-masked conure	5

A list was also drawn up of the top 50 species identified as priority by at least three of the 16 OTs, see **Annex 2. Top 50 priority species identified in the horizon scanning exercise.** The list includes 13 marine, 8 vertebrate (4 birds, 3 reptiles and the Brown rat), 22 invertebrate (19 insects – including 5 ant and 3 mosquito species - 1 tick, the Varroa mite, and the Giant African snail) and 7 plant species.

4.3 Pathway action planning

The horizon scanning exercise provided a list of priority invasive species likely to arrive in the next 5 to 10 years. The most cost-effective way to reduce the risk of their introduction is to focus biosecurity measures on the pathways of arrival, and these measures can be applied at any point along the biosecurity continuum: (i) pre-border (ii) border and (iii) post-border. Pathway action planning was initiated for each OT at the horizon scanning workshops or shortly thereafter through follow-up visits, email and teleconferences.

In each case, a multi-sector stakeholder workshop was held to identify cost-effective actions pre-border, border and post-border to reduce the risk of arrival of the key species identified in the horizon scanning exercise via their associated pathways, using a guidance document developed by the NNS to guide the pathway action planning process; see **Annex 3. Guidance for pathway action planning**. Sectors involved typically included agriculture, fisheries, environment (government and NGO), customs, port authority, importers, farmers association and public health, allowing a One-Health approach to be adopted. Participants flagged the status of current actions for each pathway and noted gaps, actions and priorities. The multi-sector involvement was a great strength of the approach as it is often rare for different sectors to meet and discuss shared interests and concerns for biosecurity. A total of 142 local and locally-based participants were involved in the pathway action planning workshops in 15 OTs (excluding CSBA).

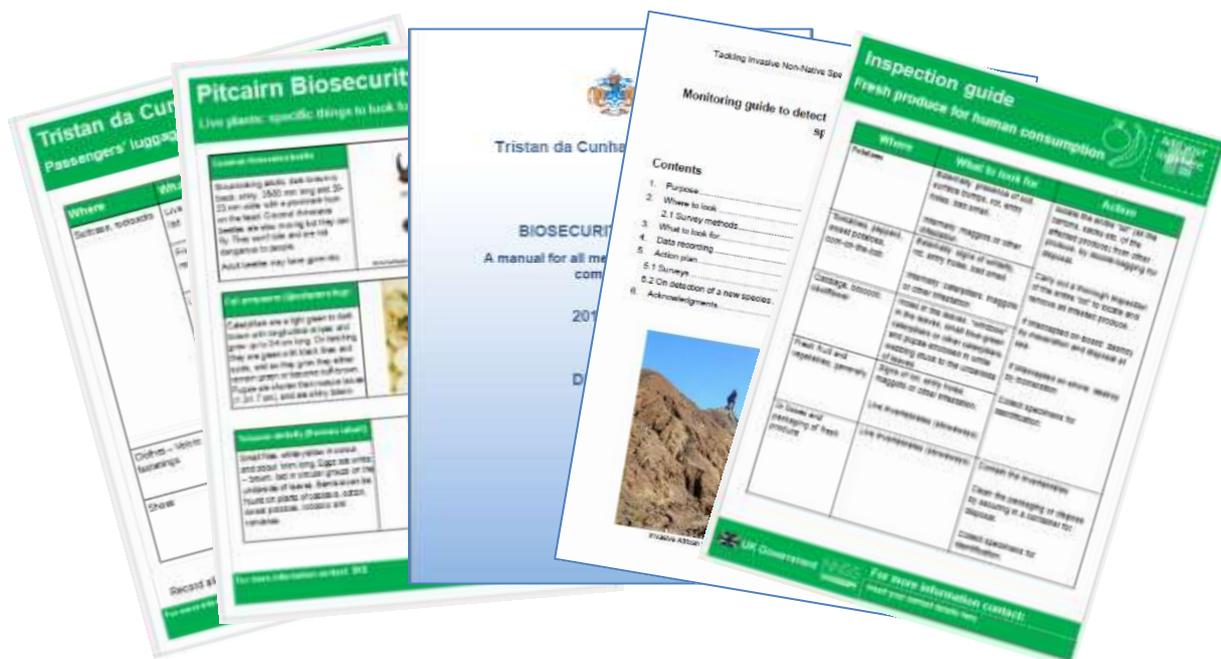


Common issues found across the territories include: lack of facilities, limited staffing and resources, and weak legislation. Front-line biosecurity inspections are often carried out by non-technical or junior officers from customs, pest control, agriculture or environment, and their level of biosecurity training is variable. Common priority pathways in terms of biosecurity risk include: fresh produce for human consumption, live plants for planting, live animals, shipping containers, construction materials (including aggregate and lumber), and hull fouling and floating plastic. Common actions identified during the workshops include biosecurity training or briefing to partner agencies such as customs and port authority, and public awareness and education, including the need to put adequate signage at ports of entry.

Technical materials developed by the NNSS to assist pathway actions include:

- **Inspection guides** for a range of pathways and commodities, noting where to inspect, what to look out for in terms of the species identified in the horizon scanning, and who to call or what to do if species are found. Versions of these have been produced for Anguilla, Ascension, BIOT, BVI, Pitcairn and Tristan da Cunha. A generic editable version of these guides covering six pathways and commodities is available in the [Biosecurity Toolkit](#) for adaptation by any OTs.
- **Post-border weed surveillance protocol** for St Helena, including 21 summary factsheets for the priority plant species and associated plant pests.
- Comprehensive **Biosecurity Manuals** have been drafted for Pitcairn and Tristan da Cunha, which include: biosecurity policy, import health standards, protocols, guidelines and inspection guides. A complementary manual was also drafted for the South African National Antarctic Programme (SANAP) to support actions in the Tristan Manual and the proposed Gough island mouse eradication programme.

Other materials produced are detailed in section [5.2.5 Biosecurity tools](#)



4.4 Biosecurity legislation

Strengthening biosecurity legislation was not in the original project specification. It was included as a project activity as it was recognised that there is a need for comprehensive legislation to underpin biosecurity but existing biosecurity legislation in the OTs was found to be generally weak in the 2017 gap analysis. It was specifically identified as top priority by three OTs (Falkland Islands, St Helena and TCI). Legislative support was also identified as a key deliverable by the project Steering Group.

A specialist legal drafter was contracted through Public Administration International to develop model legislation and adapt it for participating OTs, as requested.

A fully comprehensive model Biosecurity Bill was drafted for the OTs, consisting of 13 clauses:

Preliminary
Biosecurity Border Control
Vessels and Aircraft
Biosecurity Import Procedures
Biosecurity Export Procedures
Biosecurity Quarantine
Powers of Biosecurity Officers
Biosecurity Internal Control
Biosecurity Emergencies
The Director of Biosecurity
Administration of the Ordinance
Offences and Penalties
Miscellaneous Provisions

In addition to the Bill itself, a set of five supporting documents were developed to provide guidance to any OT (or other jurisdiction) to analyse existing legal provisions pertaining to biosecurity and adapt the model text to develop their own draft Bill and subsidiary legislation, independent of further outside help.

The model Bill is available [here](#) in two formats, complete and simplified for smaller jurisdictions. It includes the following components:

1. Generic Biosecurity Bill, annotated
2. Short summary of the generic Biosecurity Bill
3. Biosecurity Bill Explanatory Notes – background to the generic Bill.
4. Generic Subsidiary Legislation – outlines for six subsidiary Regulations
5. Biosecurity Legal Checklist – a tool to analyse gaps in the existing legislation with references to the relevant model text to facilitate use of the model as a resource.
6. Guidance on drafting biosecurity legislation – drawing from the experience of St Helena, this outlines the commitments and work expected from an OT receiving project help in drafting biosecurity legislation.

Nine OTs requested legal assistance, and St Helena and Ascension were accepted as the first OTs for adaptation of the model, with work commencing in January 2019. Work was mainly done remotely, the project drafter working in collaboration with local Attorney General Offices and relevant government departments to produce draft text modified appropriately for

each OT. Visits were also made by the drafter to Montserrat and TCI to discuss needs. Work was completed for seven OTs, and the status of work is given for each of the participating OTs in Table 10.

Table 10. Status of support to develop biosecurity legislation.

Territory	Status	Notes
St Helena	Drafts completed but not yet enacted	A final draft for St Helena was submitted after seven rounds of revision, including subsidiary legislation. At the request of the Attorney General for St Helena, work will be finalised by the Crown Council.
Ascension	Drafts completed but not yet enacted	Second drafts were submitted. At the request of the Attorney General for St Helena, work will be finalised by the Crown Council.
Tristan da Cunha	Drafts completed but not yet enacted	Second drafts were submitted At the request of the Attorney General for St Helena, work will be finalised by the Crown Council.
Falklands	Draft completed but not yet enacted	A second draft was submitted, and work will be finalised locally once the biosecurity policy has been approved.
GSGSSI	Not completed	Drafting was not completed due to lack of information on existing legislation from the GSGSSI.
Pitcairn	Draft completed but not yet enacted	A third draft was submitted, and work will be finalised by the AGs office.
Montserrat	Not completed	Two drafts were submitted to Montserrat, after meeting with the drafter to agree needs. The drafter was unable to complete a full text as further work requires a policy decision on the new OECS legislation.
TCI	Draft completed but not yet enacted	A final draft was submitted after meeting with the drafter to agree needs.
BIOT	Completed	Review of existing legislation only, no drafting requested at this time.

5. Supporting activities

A wide range of on-going supporting activities were carried out which took place continuously throughout the life of the project. Strengthening capacity through **training** and development of **biosecurity tools** were included in the initial project allocation and work on all began in 2017. All the supporting activities were underpinned by **technical assistance**, provided to all the OTs.

5.1 Technical assistance

NNSS staff visited 13 of the 16 OTs during the course of the project (the exceptions, for logistical reasons, were Ascension, Tristan da Cunha and BAT). Biosecurity officers in the Territories received specific technical advice during visits or remotely on a range of issues, including:

- Risk assessment for importing bumble bees to Montserrat
- Treatment and procedures for clearing a rat-infested fishing vessel
- Using urine odours for training rodent detector dogs
- Cleaning procedures for ballast water tanks
- Pre-border treatment of potato tubers for nematodes
- Disposal of cooked bones and shells in Gough before disposal
- Building an evidence base for strengthening biosecurity to present to elected representatives
- Treatment of spider-infested imported building bricks
- Fungus and plant identification
- Biosecurity recommendations for a runway reparation project
- Biosecurity inspection techniques

In addition, regional support was delivered in the form of attendance by the NNSS at the Convention of Biological Diversity Secretariat “Capacity-building workshop for Caribbean Small Island Developing States towards achieving Aichi Biodiversity Target 9”, Jamaica 18 - 22 September 2017. The project funded two OT participants, from Bermuda and TCI.

Three OTs requested field visits for specific support: BVI on reducing biosecurity risks of the post-hurricane recovery programme, South Georgia to assess the risk of reinvasion following an island-wide rat eradication programme, and the Falklands to advise on strengthening and implementing the biosecurity framework.

5.1.1 BVI – Post Hurricane

BVI was hit by two hurricanes, Maria and Irma, in autumn 2017, resulting in extensive damage to property, infrastructure and the environment, and its efforts to rebuild posed a serious risk of the introduction on invasive species. Accordingly advice was requested on biosecurity following hurricanes, and a visit was made from 19 to 23 February 2018 by NNSS and Fera.



Hurricane damage in BVI

Recovery in BVI post-hurricane required the importation of large quantities of a wide range of goods, including construction materials, vehicles, live plant material, and fresh produce for human consumption, all of which are known high risk pathways for the introduction of invasive non-native species. There was a big demand for the importation of ornamental plants, including large feature specimens, for landscaping as part of the recovery process in the tourism industry. The BVI pathway analysis found that live plants were a primary pathway of introduction for new species, especially new plant pests. The Department of Agriculture (DoA) was actively promoting the agricultural industry in part based on greenhouse production. It was therefore essential to ensure that no new pests of agricultural concern are introduced to BVI which would compromise this activity.

A half-day multi-stakeholder meeting was held to discuss the main issues and concerns, at which 22 participants attended from nine organisations. This was followed by a series of field visits to assess the biosecurity risks of current sea and airport operations, and the nursery trade. Pest surveys were made at three plant nurseries, the Botanic Gardens, Queen Elizabeth II Garden, and Sage Mountain National Park, as well as around Tortola as opportunity arose. At the end of the visit the same group met to discuss the visit conclusions.



Imported palm trees

The biosecurity system was found to be stronger than expected by the stakeholders, particularly with regards the importation of live plant material. The nurseries were importing plant material in a responsible manner; and many of the off-shore suppliers of plant material were known and trusted. Strengths of the current system included: a good working relationship between the Department of Agriculture and stakeholders; basic resources and legislation existed; and data on confiscations and interceptions was kept.



Invertebrate survey on native agave

However, there were a number of critical gaps and weaknesses which included: a lack of biosecurity

facilities and equipment at the ports of entry; a lack of detailed protocols and procedures; lack of awareness among the general population of the biosecurity risks associated with importing many commodities; inspections were limited to live plant material; there was a dependence on action at the border, with no post-border surveillance for new invasive species; and biosecurity was limited to consideration of agricultural plant health pests.

Three species of economically and socially harmful pests were identified which may have been introduced on plant material post-hurricane: the soft scale insect *Philephedra tuberculosa*, croton scale *Phalacroccoccus howertoni* and Cardin's whitefly *Metaleurodicus cardini*.

In order to strengthen the system and increase the capacity of BVI to reduce the risk of introduction of new invasive non-native species, 19 recommendations for immediate application were made, and a further eight for longer term consideration. A relatively small investment in simple biosecurity facilities and equipment would result in a large reduction in risk and increase in capacity. BVI government was briefed on these findings.

See the BVI visit [report](#) for further details.

5.1.2 South Georgia

Rodents were successfully eradicated from South Georgia in a project led by the South Georgia Heritage Trust (SGHT) at a cost of £12 million – the biggest island rodent eradication ever at that time. However, concerns were raised about biosecurity following this, and the risk of re-invasion, threatening the recovery programme. The GSGSSI requested advice on minimising biosecurity risks to South Georgia in order to protect the £12 million investment made by the SGHT in the rat eradication programme of 2011 to 2015, as well as to support GSGSSI ongoing weed eradication work. A visit was made by the NNSS in March 2018.

Biosecurity practices on-board the government supply vessel *MV Pharos SG* were observed, the new biosecurity facility on Bird Island was inspected, and biosecurity facilities and procedures at King Edward Point (KEP) on South Georgia were checked over a 3-day visit. In addition, the ports of departure for vessels from the Falkland Islands were visited and the rodent detector dog trial observed at two of them.



Boot cleaning station on the
MV Pharos SG

On the whole, the actions being undertaken to reduce the risk of a new rodent incursion to South Georgia were considered good. There was a mix of detection devices being used, people were enthusiastic and aware, and rodent presence was being tackled across the biosecurity continuum: pre-border, border and post-border. A key gap identified was the risk of rodents entering the pathway in the Falklands. This could occur via both cargo (from any source) and vessels (for

example, yachts depart from rodent infested ports in Stanley and then moor alongside jetties at Grytviken and KEP). Rat guards on the supply vessels were ineffective in the challenging weather conditions of the South Atlantic.



Reviewing post-border monitoring

Incorporation of the rodent detection dogs on a long-term basis would mitigate this risk substantially. Dogs should routinely check vessels, ports, cargo and equipment in the Falklands before departure to South Georgia. Biosecurity actions should be moved pre-border as much as possible. Vessels mooring alongside jetties at KEP and Grytviken should also be kept to a minimum consistent with cargo handling and health and safety considerations.

The primary biosecurity focus was on reducing the risk of rodent incursion on South Georgia post-rat eradication, and quite rightly. There was more limited attention to the risk of introducing non-native invertebrate or plant species. Both were broadly covered within the existing procedures but some recommendations were made specifically to reduce these risks.

The visit [report](#) included 27 recommendations to strengthen the biosecurity system, which are summarised in Tables 8 and 9.

Table 8. Main observations and recommended actions for ports, cargo and visitors.

Pathway	Main risks	Risk level	Recommended actions
Gateway ports in the Falklands	<ul style="list-style-type: none"> Rodent presence 	High	<ul style="list-style-type: none"> Use rodent detector dogs to assist rodent control and confirm absence on vessels
Cargo	<ul style="list-style-type: none"> Risk of infestation with rodents, invertebrates and, to a lesser extent, weeds 	Medium	<ul style="list-style-type: none"> Establish a heat treatment facility in the Falklands, together with FIG New biosecurity facility at KEP to check in-bound cargo and baggage
Visitors	<ul style="list-style-type: none"> Limited biosecurity information before arrival Weak biosecurity briefing video Risk of spread of invertebrates and weeds 	Low	<ul style="list-style-type: none"> Improve signage at UK airport Revise biosecurity briefing video and ensure it is followed Improve facilities for baggage checks



Invertebrate monitoring on the *MV Pharos SG*; Bird Island: construction materials and the new biosecurity room

Table 9. Main observations and recommended actions for vessels. Frequency data is from 2015/2016.

Vessel	Frequency	Main risks	Risk level	Recommended actions
Supply vessels	2 – 4	<ul style="list-style-type: none"> Rat guards ineffective due to the weather conditions Moor alongside the jetty at KEP 	Medium	<ul style="list-style-type: none"> Develop protocols Use rodent detector dogs to assist rodent control at the gateway ports in the Falklands and confirm absence on vessels
Yachts	22 vessels	<ul style="list-style-type: none"> Moor alongside the jetties at KEP and Grytviken 	Low	<ul style="list-style-type: none"> Minimise presence of vessels alongside the jetties. Use rodent detector dogs to assist rodent control at the gateway ports in the Falklands and confirm absence on vessels
Military vessels	4 – 6	<ul style="list-style-type: none"> Moor alongside the jetty at KEP 	Low	<ul style="list-style-type: none"> Minimise presence of vessels alongside the jetties. Use rodent detector dogs to assist rodent control at the gateway ports in the Falklands and confirm absence on vessels
Fishing vessels	No data	<ul style="list-style-type: none"> Shipwreck of infested vessels (they do not moor alongside) 	Low	<ul style="list-style-type: none"> Maintain de-ratting and presence of rodent boxes
Cruise ships	68 vessels, with 8,780 passengers	<ul style="list-style-type: none"> Baggage checks by passengers between sites can be poor. 	Low	<ul style="list-style-type: none"> Expedition Leaders have assistance GSGSSI to carry out more spot-checks

5.1.3 Falkland Islands

The Falkland Islands are an important gateway for two other territories, South Georgia and BAT, both very vulnerable to the introduction of new invasive species. Consequently biosecurity is of particular concern. As the NNS was already undertaking a review of biosecurity for South Georgia, advantage was taken of the opportunity to provide assistance which would be of benefit to all three OTs.

The Falkland Island government requested advice on strengthening and implementing the biosecurity framework and strategy actions through a review of existing procedures and provision of practical recommendations. A visit was made from 4 to 16 April 2018.

Field visits were made to ports of entry, a weed control site at Port Sussex, and fresh produce inspections at two importers premises. A trial of rodent detector dogs checking a rat-free off-shore island (Kidney Island) was also observed. Meetings were held with key personnel in Falkland Islands Government, Falklands Conservation, South Atlantic Environment Research Institute, Government of South Georgia & the South Sandwich Islands, and Members of the Legislative Assembly.

Current levels of biosecurity were considered satisfactory in that no new non-native species had established in the last few years in the Falkland Islands, as far as is known. Key strengths of the biosecurity system were considered to be the good interagency and inter department cooperation, and high level of support from importers and members of the legislative assembly. As well as the border controls, some post-border actions were also in place with regards post-border monitoring and the development of the first emergency response plan, working collaboratively with the Environment Department.

The biggest weakness was considered to be the small size of the biosecurity team. Existing staffing of one full time and one part time officer only allowed for the day-to-day operation of a basic biosecurity programme, and additional staff would be required in order to grow the system. The Falkland Islands had one of the smallest provisions of biosecurity staffing amongst the Overseas Territories. Other key weaknesses of the biosecurity system were considered to be lack of detailed protocols and procedures, and lack of an overarching biosecurity policy framework. Biosecurity legislation was out-of-date and inadequate. Training was limited, and there were no in-house training tools to assist new staff. In addition, data collection was poor overall, making it difficult to evidence successes and failures.



Inspecting fresh produce



Rodent detector dog on Kidney Island

There were mutual benefits to be gained from a joint approach between the Governments of the Falkland Islands and South Georgia & the South Sandwich Islands through a number of biosecurity actions, including:

- Messaging for in-bound travellers
- Rodent control at ports in the Falklands
- Provision of a heat treatment facility in Stanley

In addition to the meetings and field visits, a joint public presentation was given by NNSS, FIG and GSGSSI at the Chamber of Commerce on “Biosecurity: protecting our islands” attended by 24 members of the public.



Rodents could enter vessels at the yacht harbours in the Falklands

Seventeen recommendations were made for short-term technical improvements, and a further 10 for longer-term strengthening of the biosecurity system. See the Falkland Islands visit [report](#) for further details.

5.2 Training

Lack of capacity is the most important issue for biosecurity for most of the OTs. In order to determine the immediate priorities and best approach to be used, an initial survey of training needs was carried out among the 16 OTs.

5.2.1 Survey of training needs

A short (10 question) survey was carried out through [surveymonkey.com](#). The survey was sent to 67 people, with a response rate of 37.3%, and a further 15 people completed the survey during workshops and visits. Respondents were from nine OTs (Ascension, Anguilla, Bermuda, Falklands, Gibraltar, Montserrat, St Helena, South Georgia, and Tristan).

In terms of how people want to receive training, the results indicate how hard it is for people working in biosecurity or invasive species management in the OTs to leave their posts for long periods to do training. A workshop was the preferred option, with online learning second. The ideal time period for training was seen as 1 to 2 weeks, and a UK-based 1-week invasive species management course was preferred. Job shadowing, either in the UK or in another OT, came bottom, possibly due to the time required and also possibly seen as the less formal and therefore less prestigious option.

Based on these and the gap analysis results we produced the following training.

5.2.2 Biosecurity training courses

Three basic biosecurity training courses have been held, for a total of 33 participants, two in-territory and one in the UK:

- April 2019 South Georgia: 1-day training course on invasive rodents, entomology and biosecurity, 2 participants;
- October 2019 Montserrat: 3-day training course entomology and biosecurity, 21 participants;
- September 2019 UK: 5-day training course held by Fera Science Ltd in September 2019 on entomology and biosecurity, for 11 participants from the six Caribbean OTs. Course content covered entomology (main taxonomic groups, symptoms and signs of damage), other damaging invertebrate groups, international standards, basic virology, bacteriology, nematology and mycology, the work of PHSI in the UK, and an introduction to the Fera diagnostic service. Participants were all given USB microscopes and given an opportunity to learn how to use them through field collection of invertebrates.

5.2.3. Pest risk assessment

One of the many functions of biosecurity staff in the OTs is that of carrying out risk assessments of new species, pathways and commodities, but staff lack access to specialist risk assessment teams, as well as both capacity and confidence to effectively assess risk. Under a Darwin Plus project (DPLUS074) CABI worked with St Helena and the Falklands to develop appropriate risk assessment templates and build capacity in their use. The project built on this experience by rolling-out the resulting outputs to the Caribbean OTs through a training workshop held jointly with CABI, together with follow-on help and advice.

The workshop was held in Antigua in January 2020, with nine participants from four Caribbean OTs: Anguilla, Cayman Islands, Montserrat and TCI. Training was given in completing pest risk assessments (PRAs) as well as in the CABI on-line horizon scanning and risk assessment tools. A flow chart was developed to guide biosecurity officers through deciding when a rapid or full pest risk assessment is required, as well as the use of a simple screening procedure. A guidance document and four simplified risk assessment templates are available [here](#), and consist of:

- General guidelines for planned introductions of biological material, horticultural products and other commodities.
- PRA template 1. Planned introduction of plants, animals, commodities or other biological material.
- PRA template 2. Planned introduction of a biological control agent.
- PRA template 3. Risk of accidental introduction of an invasive alien species.
- PRA template 4. Risk assessment for an invasive species already present in the territory.

The following examples of completed PRAs are also available:

- Tomato leaf miner *Tuta absoluta* for Anguilla
- West Indian fruit fly *Anastrepha obliqua* for TCI
- Red palm weevil *Rhynchophorus ferrugineus* for Cayman Islands
- Giant African snail *Lissachatina fulica* for the Cayman Islands

CABI also created a closed repository on their webpage for participants to share PRAs under development.

5.2.4 E-learning modules

At the request of the territories we developed an e-learning module [Better Biosecurity for the OTs](#) to provide online training in the theory of invasive species, their impacts, basic biosecurity, risk assessment, pathway analysis and horizon scanning. It takes 15 to 30 minutes to complete the module, and there is a short optional test at the end for which the trainee gets a certificate which can be used to support Continuous Professional Development.

A total of 262 people have taken the online assessment, with an average grade of 87%, from at least five OTs (as many people enrol with gmail or Hotmail accounts their affiliation isn't clear). The number of people in the OTs using the off-line version isn't known. The informal feedback received to date has been very positive, with people reporting that it is simple, easy to use and very useful.

A second module was also developed, called [Biosecurity inspections](#), which provides guidance on carrying out border biosecurity inspections for a range of commodities, including sampling rates, data collection and handling interceptions. Content of this module complements the standardised import health standards and inspection protocols available as part of the Biosecurity toolkit, see below.



5.2.5 Biosecurity tools

To support the training and implementation of the pathway action plans, a number of biosecurity tools were developed. Overall, a total of 46 guides, posters, protocols, templates and manuals were developed, which included 212 species factsheets. These can be found [here](#) and further details are given below.

Field guides

A set of field guides were developed by Fera to assist detection of the priority species identified during the horizon scanning, as these will be species which by definition do not occur in the territory and will therefore be unfamiliar to the biosecurity officers:

- Invasive alien plant pests in the Caribbean UK Overseas Territories, with factsheets for 48 species.
- Invasive alien plant pests in the South Atlantic UK Overseas Territories, with factsheets for 31 species.
- Invasive alien pests of Pitcairn, with factsheets for 29 species.
- Factsheets for 21 established invasive species of common concern for Anguilla and TCI.
- Early detection of potentially invasive non-native invertebrates in South Georgia.
- Guide to taking digital photos of suspect invasive alien invertebrates in the UK Overseas Territories for identification purposes.

In addition, the NNSS developed a further 58 factsheets for the priority species identified in the horizon scanning exercise for BIOT (17), Falkland Islands (12), St Helena (21) and South Georgia (8).



Public awareness

The NNSS, working with colleagues in Montserrat, produced nine Biosecurity Alert posters for the priority species identified through the horizon scanning exercise:

- Border biosecurity poster
- Multi species alert poster
- Fold out multi species ID guide (pocket size)
- Single species alert posters, with completed examples for 4 species

Materials are available both as ready-to-print pdf files and original Publisher files which can be adapted for other species.

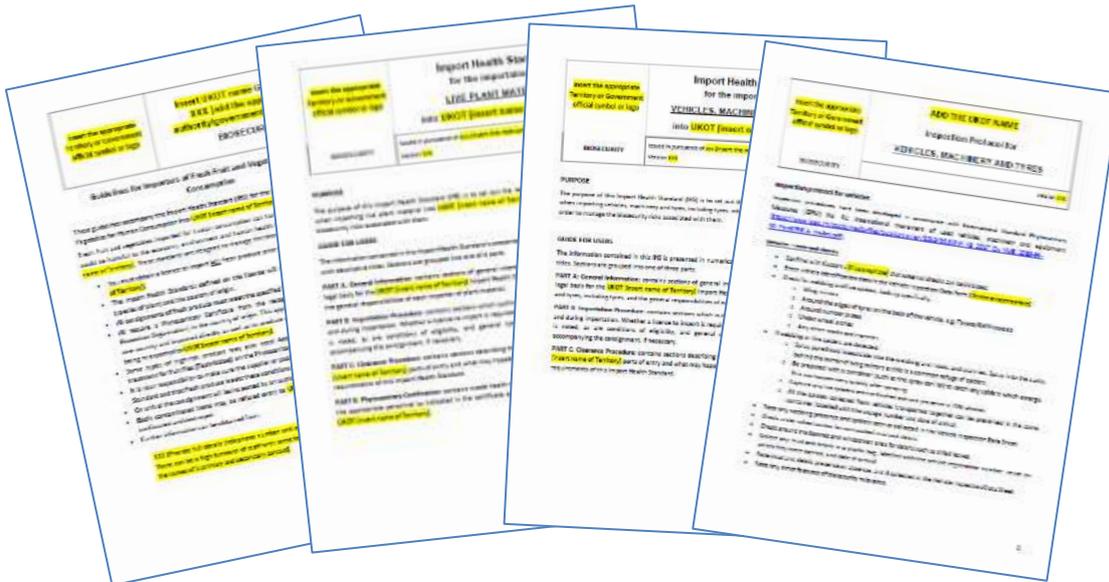
In addition, biosecurity travel advice for the OTs has been collated in a page on the [NNSS website](#), eventually to be linked to the UK government Foreign and Commonwealth Office [Foreign Travel Advice](#) which provides information for travellers to 225 countries and territories around the world.



Standardised biosecurity templates

The tools also include a set of seven standardised templates for import health standards and three inspection protocols developed by Fera and NNSS for the following commodities:

- Fresh produce for human consumption
- Plant material for propagation
- Vehicles and machinery
- Aggregate, sand and gravel
- Composts and peat
- Sawdust and wood chippings
- Shipping containers



In addition, inspection guides for three commodities were developed to assist new front-line biosecurity inspectors and to complement the package of import health standards:

- Fresh produce for human consumption
- Live plants
- Vehicles and machinery

Post-border, generic monitoring and rapid response protocols have been developed for:

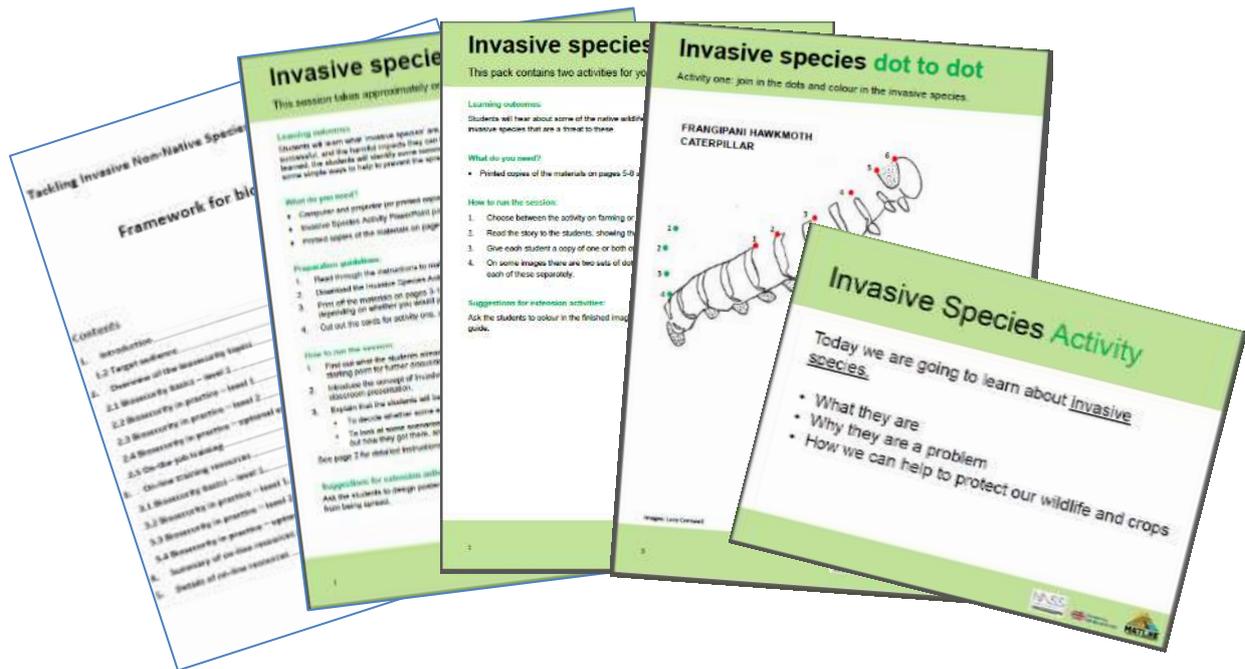
- Fire ants
- Invasive plants

Education and training materials

At the request of Montserrat, the NNSS produced education materials for 7 – 13 year olds and pre-school children, populated with species relevant to Montserrat and the Caribbean and the documents can be used as templates, changing the species information to suit any OT.

The gap analysis in 2017 identified access to specialist training as an issue for many staff involved in delivering or supporting biosecurity actions. For new biosecurity officers, there is no one-stop-shop which delivers a full training package, but there is a wealth of material available on-line, mostly free, designed for various different sectors and purposes.

A training framework was developed which (i) identifies 17 topics on biosecurity principles and practices which together comprise a comprehensive training package appropriate for new biosecurity officers, and (ii) provides links to on-line training tools available for each topic.



5.3 Ballast water

Ballast water has been identified as a major route for the introduction of marine invasive species. The Ballast Water Management Convention's (BWMC) and associated framework offers what is likely to be the most effective and comprehensive means of managing introductions of non-native species and pathogens via ballast water. We contracted the Centre for Environment, Fisheries and Aquaculture Science (Cefas) to review the BWMC applicability to the OTs, and assess the OTs capacity to implement the BWMC.

Although it was not definitively confirmed at the administration level, most of the OTs are not currently working towards the implementation of the BWMC or other ballast water policy, although ballast water is identified as a major threat in many associated action plans. In many cases there is currently limited capacity regarding ballast water management in the OTs, suggesting that implementation under the current situation would be difficult. The report can be found [here](#).

6. Additional activities

Four additional activities were funded from the additional allocation secured for the final year (2019 – 2020) and are detailed below. Like the supporting activities, the additional activities were underpinned by technical assistance, provided to all the OTs.

6.1 Marine biosecurity toolkit

A number of invasive non-native marine species have been identified through the horizon scanning exercise as having a high risk of introduction within the next 10 years. Managing established marine invasive species is technically challenging, and effort needs to be focused on the prevention of arrival, together with early detection and rapid response. However, capacity in the OTs is particularly weak with regards actions in the marine environment and their ability to monitor or respond to marine invasive species incursions.

We contracted the Joint Nature Conservation Committee (JNCC) to develop a basic marine biosecurity toolkit, working in collaboration with three OTs (BVI, Falkland Islands and South Georgia) to ensure that the content was appropriate for OT capacity and needs. The toolkit consisted of five elements, as shown below:

- Field guides for a total of 25 horizon scanned and other high risk species, consisting of pictures, brief facts (preferred habitat, distribution, how it's spread, impacts caused etc.), key identification features, and similar species to avoid confusion/mis-identification, where appropriate.
- Sampling. Overview of the sampling strategies and an indicative sampling regime, following generic guidance.
- Contingency plans. Practical guidance for priority species where strategies have proven effective in the past.
- Hull fouling. Assessment tool, with guidance document on its use and datasheet
- Ballast water management. Four documents:
 - Simple guide to what the IMO regulations mean
 - Simple guide on how to check ballast water log books
 - Rapid status assessment for determining ballast water issues and advice on drafting an appropriate ballast water management policy / ballast water management plan / guidance notes for visiting vessels, as appropriate, based on the outcomes of the rapid assessment.
 - Recommendations for the operation of UK warships in the OTs: education and adopting best practice/ guidelines/ recommendations to reduce the risk to the OTs until vessels are fully compliant with the Ballast Water Management Convention by 2024.
- References and further information.

These documents are available [here](#).

6.2 Wildlife diseases

The horizon scanning exercise carried out in 2018 / 19 did not include the identification of new pathogens (disease causing organisms) as this is a highly specialist area. However, the risk of introduction of wildlife and animal diseases is a concern for a number of OTs, such as the Falklands Islands and St Helena.

The Falklands were concerned about pathogens which can affect both livestock production, specifically sheep as wool production is a mainstay of the agricultural economy, and also wildlife through the spread of diseases to important populations of several species of penguin, seals and sea lions. St Helena is concerned about disease impacting their endemic wirebird (*Charadrius sanctaehelena*), as well as pathogens which might affect their endemic invertebrates.

An issue for all the OTs is their listing as part of the UK for international disease reporting status, which means all regions would be considered to have the same official disease (free) status. Any disease outbreak in an OT affects the UK, and vice versa.

Working with Dr Helen Roberts, one of Defra's animal health risk advisers, workshops were held in Falklands (April 2019, with 9 participants) and St Helena (December 2019, with 10 participants). Participants in the workshops identified and ranked the target species to be protected in order of priority, and then considered the diseases of concern, and pathways of entry, as well as pathways of transmission within each OT. Practical sampling protocols have been developed, to allow samples to be collected and safely sent to the UK for analysis.

The results from the St Helena workshop are still being processed. For the Falklands, nine livestock species or species groups were ranked, of which the top three to protect from incoming diseases were sheep, cattle and working dogs, see Table 11. For wildlife 17 species or species groups were ranked, of which the top three to protect from incoming diseases were penguins, pinnipeds and cetaceans (all species within each taxon), see Table 12. Negative impacts were subjective, for example, invertebrates were noted as having a negative impact on food as they damage local food crops, and Gentoo eggs were noted as a negative impact on tourism as the idea of eating penguin eggs may not be palatable to all visitors to the Islands. Over-fishing may have led or could lead to impacts on other species.

These workshops provided input to the Falkland's Wildlife Health Strategy which includes risk levels and sampling protocols, as well as how to easily and safely take and send samples to Defra for analysis.

Table 11. Ranked livestock for protection from disease.

Species	Food / products of animal origin	Tourism	Biodiversity	Negative biodiversity impact?	Social / Cultural	Employment	Overall score
Sheep	3	1	1	Y	3	3	11
Cattle	3	1	1	y	3	3	11
Working dogs	3	1	1	-	3	2	10
Poultry (commercial and backyard)	2	1	1	-	3	2	9
Trout (farmed)	2	1	1	Y	3	2	9
Horses	1	2	1	y	3	1	8
Pigs	2	1	1	n	2	1	7
Reindeer	1	2	1	Y	2	1	7
Companion animals	1	1	1	-	3	1	7



There are five species of penguin in the Falkland Islands, with over 1 million birds overall.

Table 12. Ranked wildlife for protection from disease.

Species	Food			Tourism			Biodiversity			Overall score
	£	Cultural	Negative Impact	£	Cultural	Negative Impact	National	International	Negative Impact	
Penguins	0	0	-	3	3	-	3	3	-	12
Pinnipeds	0	0	-	3	3	-	3	3	-	12
Cetaceans	0	0	-	3	3	-	3	3	-	12
Trout	2	3	-	2	2	-	1	1	Y	11
Commercial / offshore fisheries	3	2	Y	1	1	-	3	1	Y	11
Albatross	0	0	-	3	3	-	3	2	-	11
Upland goose	1	3	-	2	2	-	1	1	-	10
Other flying sea birds	0	0	-	2	2	-	3	2	-	9
Passerines	0	0	-	2	2	-	3	2	-	9
Birds of Prey	0	0	Y	2	2	-	3	2	-	9
Mullet	1	2	-	1	2	-	1	1	-	8
Teal duck	1	1	-	2	2	-	1	1	-	8
Waterfowl and shore birds	0	0	-	2	2	-	3	1	-	8
Inshore inverts	2	2	y	1	1	-	1	1	?	8
Crab	1	1	-	1	1	-	1	1	-	6
Gentoo eggs	1	2	-	0	0	Y	1	1	-	5
Inverts	0	0	y	1	1	-	1	1	-	4

6.3 Prioritisation of existing invasive species

In addition to the risks of introduction of new invasive non-native species, OTs also face the issue of tackling established invasive species, both in terms of identifying the priority species for cost-effective action, and of internal biosecurity, namely reducing the risk of spread of harmful species within the territory to areas or islands of high biodiversity value. The issue of internal biosecurity is one of high concern for the eight OTs which consist of archipelagos or which have off-shore islets functioning as wildlife refuges, for example with breeding seabirds or endemic reptiles.

The prioritisation work involved the development of a framework for the prioritisation of established invasive species for eradication or control (to reduce the risk of in-territory spread) based on global risk management best practice, using consensus methods similar to those employed for the horizon scanning exercise. For the eradication exercise, species were scored against a range of criteria, with overall feasibility of eradication rated from very high to very low. For the control exercise, species were scored similarly for different criteria, noting where they were present or absent in the territory, together with pathways of spread. Full details of the methodology used can be found [here](#).

Only terrestrial species were prioritised, considering plants, vertebrates and invertebrate species separately in the development of long lists, before combining the taxonomic groups to agree a final short list in a consensus workshop. Two OTs, Anguilla and TCI, requested this assistance. Twenty one local participants attended the Anguilla workshop, and 12 attended the TCI workshop.

A total of 14 worldwide experts from 10 organisations in five countries were involved in the exercise, contributing their time in-kind, equivalent to approximately £53.5k.

Results for Anguilla

A total of 40 species were assessed for eradication, and nine species were listed as having a high or very high feasibility for OT-wide eradication, two vertebrates, three plants and four invertebrates, see Table 13. These are likely to spread rapidly in coming years and so rapid eradication action would likely prevent more serious and intractable problems developing in future. The total cost of eradicating all nine priority species was estimated to range from \$590k to \$2.8 million USD, based on the individual cost estimates for each species (the wide range reflects the broad bands used to score potential cost).

Table 13. Invasive species identified as having a high or very high feasibility of territory-wide eradication in Anguilla.

Scientific name	Common name
<i>Chlorocebus aethiops</i>	Vervet monkey
<i>Passer domesticus</i>	House sparrow
<i>Wasmannia auropunctata</i>	Little fire ant
<i>Plutella xylostella</i>	Diamond-back moth
<i>Papilio demoleus</i>	Lime swallowtail
<i>Diaphorina citri</i>	Citrus psyllid
<i>Tribulus cistoides</i>	False puncture vine
<i>Jasminum fluminense</i>	Brazilian jasmine
<i>Cryptostegia madagascariensis</i>	Madagascar rubbervine

A total of 308 species / island combinations were assessed for control within Anguilla. The highest threat was from green iguana (*Iguana iguana*) to Prickly Pear Cays, which was considered very likely to arrive and likely to establish in the next ten years. Other priorities included preventing rodents and ants spreading to Prickly Pear, Dog, Scrub and Sombrero Island, as well as false puncture-vine (*Tribulus cistoides*) which could dramatically alter habitats. Prickly Pear and Dog Islands were highlighted as particularly at threat from invasive species established on the main island; a heat map showing the islands at most threat from invasive species established in Anguilla is shown in Figure 3.



Vervet monkeys are candidates for eradication from Anguilla.
Image ©Thomas Shahan CC BY 2.0

Figure 3. Heat map of islands at most threat from invasive species established elsewhere in Anguilla (note island size and position is illustrative and not-to-scale).



Results for TCI

A total of 59 species were assessed for eradication and 13 were listed as having a high or very high feasibility for OT-wide eradication: three vertebrates, five plants and five invertebrates (all ant species), see Table 14. The total cost of eradicating all 13 priority species was estimated to range from \$650k to \$1.7 million USD, based on the individual cost estimates for each species (the wide range reflects the broad bands used to score potential cost).

Table 14. Terrestrial species identified as having a high or very high feasibility of territory-wide eradication in TCI

Scientific name	Common name
<i>Iguana iguana</i>	Green iguana
<i>Bos taurus</i>	Feral cattle
<i>Trachemys scripta</i>	Red-eared slider
<i>Solenopsis invicta</i>	Fire ant
<i>Paratrechina longicornis</i>	Longhorn crazy ant
<i>Pheidole megacephala</i>	Big-headed ant
<i>Wasmannia auropunctata</i>	Little fire ant
<i>Nylanderia fulva</i>	Raspberry crazy ant
<i>Washingtonia robusta</i>	Mexican fan palm
<i>Pennisetum setaceum</i>	Fountain grass
<i>Tamarix canariensis</i>	Tamarisk
<i>Tribulus cistoides</i>	Dandelion (False puncture vine)
<i>Lawsonia inermis</i>	Henna



The green iguana poses a high threat if it spread from the main island to Prickly Pear Cays in Anguilla, and is also a candidate for eradication from TCI.

A total of 297 species / island combinations were assessed for control within TCI. Ambergris Cays were found to be most vulnerable to invasion by the greatest number of species expected to have a high impact if they established, together with some islands from the Leeward Cays and Southern Cays. The list of invasive non-native species was a mix of plants, rodents, green iguana, feral dogs and cats, and ants. A heat map showing the islands at most threat from invasive species established in TCI is shown in Figure 4.

Figure 4. Heat map of islands at most threat from invasive species established elsewhere in TCI, red = most and green = least at threat (note island size and position is illustrative and not-to-scale).



Little Water Cay, TCI, is a refuge for the endemic rock iguana

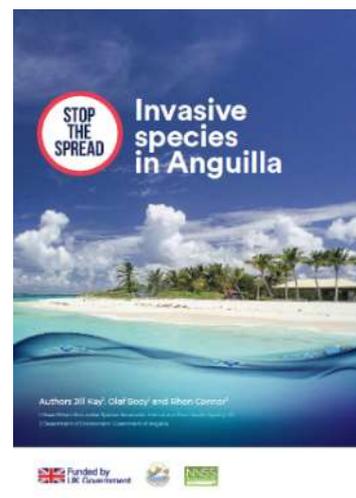
General results

The scoring and ranking methodology used to rapidly screen established invasive species in these two OTs successfully provided manageable short-lists of potential priorities focussed on eradication and spread prevention. In doing so, evidence was compiled to justify management action, as well as to support plans and bids for future work.

Some common issues were identified for both Anguilla and TCI:

- Lack of good baseline information on the distribution and abundance of invasive species in both OTs, especially for the ant species;
- The need for adequate legislation with provision for internal controls on ownership of domestic animals and livestock, sale of pets and plants, and access to private land to carryout controls;
- The importance of awareness and education of the local community about the risks of owning, planting or spreading invasive species;
- The importance of the ornamental plant trade, especially by hotels.

Full results can be found in the report [here](#). Two stickers were produced to support the OTs in their public awareness work, and a summary brochure of both the horizon scanning and proirouitsation exercises for Anguilla.



7. Communications and collaboration

The importance of high visibility and good project communications was flagged by the steering group, and a communications plan was developed in 2018 with the following objectives:

1. To increase awareness of the project in the OTs to engage local support for the project activities and ensure that they are implemented in order to:
 - Increase understanding of the risks of introducing new non-native invasive species
 - Strengthen biosecurity by promoting understanding and compliance
 - Improve management of existing invasive non-native species
2. To raise visibility of the project in the UK to promote support by government and other agencies.

Key audiences, influencers and partners, and channels for dissemination of materials and messages were identified, and a number of actions outlined for project visibility, in-territory communications, and promotion of a network among the OT people involved in the project.

To promote the networking aim of the project, a total of six email updates were sent out to OT contacts and other project stakeholders between January 2019 and March 2020, summarising project activities and OT achievements. Annual reports summarising work carried out over 2017 to 2018, and 2018 to 2019 can be found [here](#).

7.1 Promoting the project

The project was actively promoted through presentations at meetings and conferences, the local media in the OTs, as well as formal meetings with governors, FCO and government officers during OT visits.

Overall, more than nine meetings have been held with governors of Anguilla, Bermuda, Cayman Islands, Falklands / South Georgia, Montserrat, St Helena, Tristan da Cunha and TCI (several more than once), 10 presentations made on the project, two schools or school club presentations, and 12 interviews or articles in the local media in five territories; see Table 15.

Table 15. Summary of activities to promote the project.

Activity	Detail
Project visibility	<p>Presentations at:</p> <ul style="list-style-type: none"> • Island Invasives Conference, Dundee, July 2017: <ul style="list-style-type: none"> ○ Results of the gap analysis presented ○ The activities of the project mentioned in a speech by Lord Gardiner • Falklands public meeting, Stanley, April 2018 • OT governors meeting on CSSF activities UK, May 2018 • Presentation to the US base personnel, Diego Garcia, BIOT, August 2018 • GSGSSI annual meeting, UK, September 2018 • CBD SBSTTA, Montreal, Canada, June 2018 • PHSI Annual Technical Meeting, UK, January 2019 • Natural Capital Assets conference, St Helena, March 2019 • UKOTA meeting, May 2019 • OT Heads of Public Service meeting, UK, July 2019
In-territory communications	<p>Local media:</p> <ul style="list-style-type: none"> • Cayman (TV) • Gibraltar (3 interviews for TV & press) • Falklands (press) • St Helena (4 interviews for 2 radio stations) • Montserrat (radio) • TCI (TV) <p>Schools:</p> <ul style="list-style-type: none"> • St Helena – Pilling Primary School • Falkland Islands – Watch group

In addition, two scientific papers have been published from the horizon scanning work:

Key G. E. and Moore N.P. (2018) Tackling invasive non-native species in the UK Overseas Territories. In: C. R. Veitch, M. N. Clout, A. R. Martin, J. C. Russell and C. J. West, eds. *Island invasives: scaling up to meet the challenge*, Island Invasives 2017 Conference, Dundee, Scotland, 10-14 July 2017, pages 637 – 642. <https://portals.iucn.org/library/node/48358>.

Kevin A. Hughes *et al.* (2020) Invasive non-native species likely to threaten biodiversity and ecosystems in the Antarctic Peninsula region. *Global Change Biology*. <https://onlinelibrary.wiley.com/doi/10.1111/gcb.14938>

7.2 Collaboration with other agencies

Increasing OT access to UK government agency expertise on invasive species was one of the main aims of the project and was actively promoted throughout. This was achieved by negotiating collaborative work with UK agencies, thereby creating professional network of contacts. In total the project worked with six UK government agencies, two part-government owned agencies, and eight other entities from the UK and other countries. This is in addition to the large number of taxonomic experts involved in the horizon scanning and prioritisation work and noted in the relevant sections of this report.

7.2.1 Government Departments / Agencies / NDPBs

Public Health England

Dr Alex Vaux was involved as a taxonomic expert on public health pests in the horizon scanning exercises, listing priority species in anticipation of the workshops. He participated in the Caribbean workshop itself.

Centre for Environment, Fisheries and Aquaculture Science (Cefas)

Cefas was commissioned to carry out a review of the requirements of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWMC) BWMC in the OTs. Summaries of progress made to date have been made with the aim to identify gaps in the process and how Cefas (and wider Defra network) could assist with the effective protection of marine habitats and compliance with the Convention. The report can be found [here](#).

Defra

Dr Helen Roberts, Science and Risk adviser with the Exotic Disease Control team, carried out the wildlife and animal disease work which took place in the Falkland Islands in April 2019 and St Helena in December 2019.

Dr Alan McLeod, Pest Risk Analyst with the Risk and Horizon Scanning Team, has been involved as taxonomic expert on invasive invertebrates in the prioritisation exercises, leading the invertebrate team at the workshops in Anguilla and TCI.

Plant Health and Seeds Inspectorate (APHA)

PHSI have been involved in the UK-based training course run by Fera on entomology and basic biosecurity. PHSI were willing to host OT biosecurity officers on work shadowing placements, but the delays in EU-Exit caused this activity to be put back indefinitely.

Kew Gardens

Kew Gardens have been involved as a taxonomic experts on plant species in the horizon scanning exercises, listing and reviewing priority species.

Environment Agency

Dr Trevor Renals, Senior Technical Adviser on Invasive Species, has been involved as taxonomic expert on invasive plants in the prioritisation exercises, leading the plant team at the workshops in Anguilla and TCI.

JNCC

Prof. Jason Weeks, Head of Business Development & Marketing, led the JNCC team contracted to develop the marine biosecurity toolkit, working in collaboration with the Marine Management Organisation. The kit was developed in consultation with BVI, Falklands and South Georgia to ensure an appropriate fit for the OTs.

7.2.2 Part- government owned bodies

Fera Science Ltd

Dr Chris Malumphy, Plant Health Consultant in Entomology, provided advice on plant pests as part of the BVI technical support visit to provide advice on plant pests. He was also involved as a taxonomic expert on invertebrate plant pests in the horizon scanning exercises, listing priority species in anticipation of the workshops and present at the consensus workshops for the South Atlantic cluster, Mid-Atlantic cluster, Gibraltar and Pitcairn.

Fera were contracted to provide training, and also to produce technical documents such as the Field Guides, and standardised import health standards and inspection protocols which can be found on the Biosecurity toolkit.

Centre for Ecology and Hydrology (formerly part of NERC)

Prof. Helen Roy and her team were commissioned to carry out the horizon scanning exercise across 15 OTs, bringing together the taxonomic experts to review species in anticipation of the workshops and deliver consensus workshops themselves.

7.2.3 Other entities

The following entities were substantially involved in the horizon scanning or prioritisation exercises; CABI was contracted to carry out the pest risk assessment work:

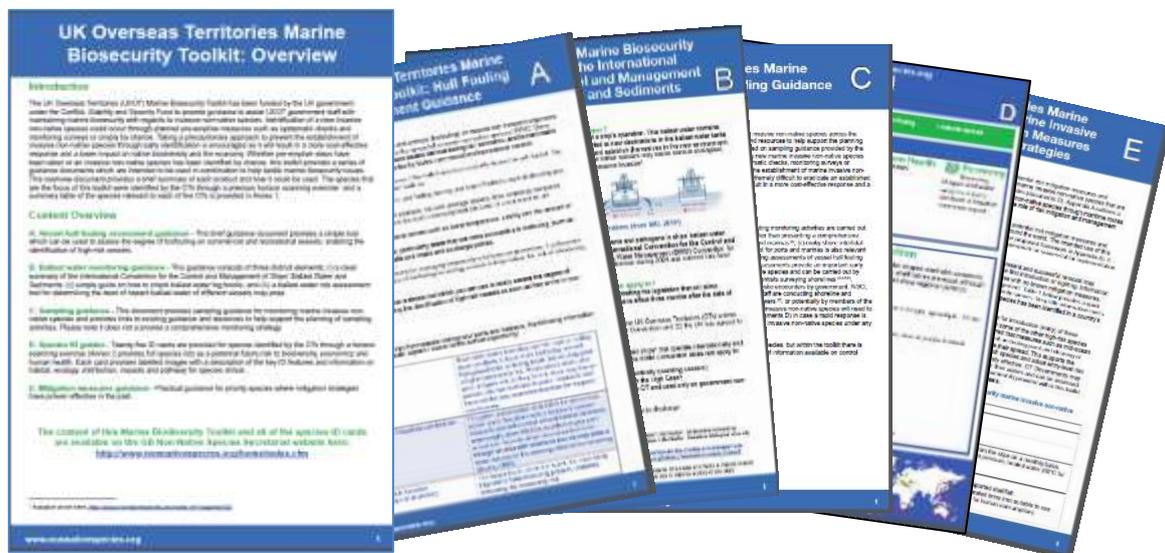
- Centre for Agriculture and Bioscience International (CABI), UK
- Newcastle University, UK
- Durham University, UK
- Research Institute for Nature and Forest (INBO), Belgium
- Scottish Association for Marine Science, UK
- SWCA Environmental Consultants, Honolulu, Hawaii, USA
- Marine Research Institute, Klaipėda University, Lithuania
- University of Florence, Italy
- Environment Agency Austria

7.3 Coordination with other CSSF-funded projects

Coordination with the Blue Belt, Natural Capital Assets, and Gough Island eradication programmes was ensured through periodic teleconferences and meetings with Cefas, MMO, JNCC, RSPB and South Atlantic Environmental Research Institute (SAERI)

A workshop was held in February 2019 between the NNS, Marine Management Organisation (MMO) and CEFAS to discuss common interests and ensure close integration of project activities between Blue Belt and this project. From this, the components of the [marine biosecurity toolkit](#) were identified, as complementing and contributing to the Blue Belt work.

A meeting was held in January 2019 with RSPB and JNCC to discuss biosecurity legislation and technical support for Gough Island mouse eradication and Pitcairn biosecurity.



8. Project impact

The achievements of the project activities were measured in three ways:

1. Repeating the gap analysis close to the end of the project;
2. Output indicators established by FCO;
3. Activity indicators derived from the 2017 gap analysis.

In addition, feedback from the OTs on the various project activities is shown in **Annex 4. Feedback on the project from OTs**. Overall, it was very favourable.

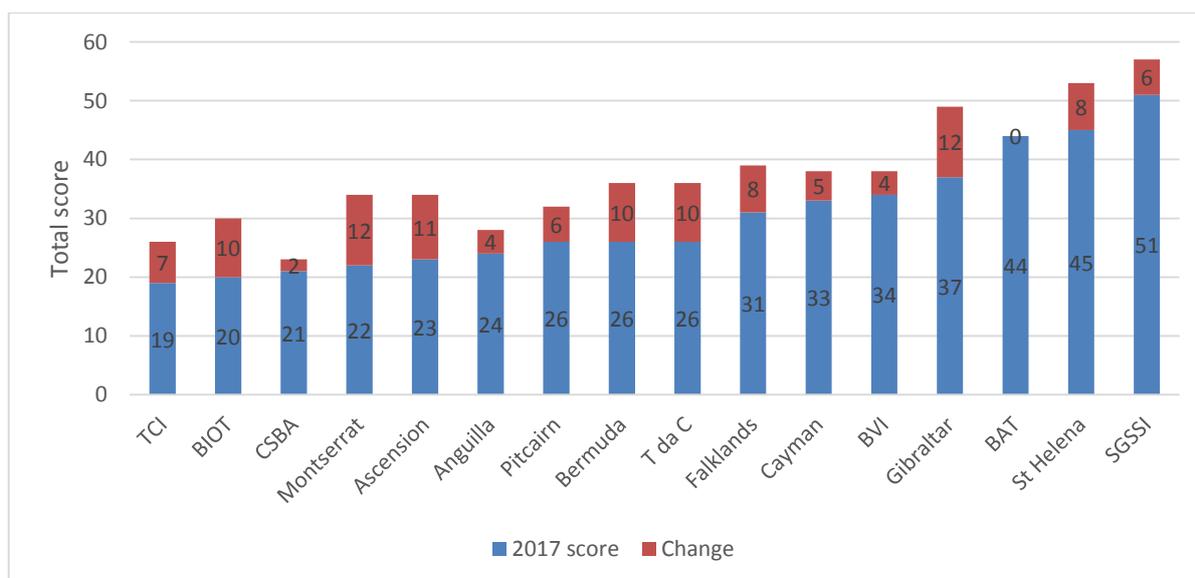
8.1 Second gap analysis

In early 2020 a second gap analysis was carried out, using exactly the same methods as in the first one, scoring each OT against 22 biosecurity components. There were two aims:

1. To measure the impact of the project in terms of changes in the biosecurity scores.
2. To provide guidance for the direction of future work by identifying the existing status and current largest gaps in the biosecurity systems of the OTs.

A substantial improvement in scores was found since the 2017 gap analysis, with the average overall score across the 16 OTs having increased from 30.1 to 37.3. This is statistically highly significant (Wilcoxon test, $p < 0.001$). The score between 2017 and 2020 for individual territories changed by a mean of 7.2, varying from 0 to 12; see Figure 5.

Figure 5. Change in total scores for biosecurity capacity between the 2017 and 2020 gap analyses in the 16 OTs.



Montserrat and Gibraltar had the biggest increase in capacity, closely followed by Ascension, BIOT, Bermuda and Tristan. The lowest increase in capacity was recorded by BAT, with apparently no change since 2017. This was one of the highest scoring OTs in 2017 and biosecurity remains strong, with work having taken place to strengthen biosecurity continuing in a number of areas. The lack of change in BAT's overall score is a result of an adjustment of the previous assessment of capacity of one component (rapid response in animal health) which is now considered to have been over-estimated in 2017.

Two OTs noted a loss in capacity since 2017: the Falklands have reduced capacity for monitoring due to decreased funding, and BVI has reduced capacity for border controls due to the continued impacts of hurricanes Irma and Maria. Anguilla also noted a failure to progress with the Invasive Species Strategy as anticipated, due to staff movements and changes in priorities post-hurricanes Irma and Maria. The national framework component was scored as Some in 2017, but only as Basic in 2020 to reflect this. As all three OTs made increases in capacity in other components the overall result increased.

Capacity in each component across the three areas of (i) *Prevention*, (ii) *Early Warning & Rapid Response*, and (iii) *Management, Prioritisation & Frameworks* is summarised in Tables 16 to 18 for all OTs on a 4-point rating scale: None (score of 0), Basic (score of 1), Some (score of 2) and Good (score of 3). Full responses for each OT are given in Annex 6 (a separate document). The number of components scoring None or Basic capacity fell from a total of 205 to 161 between 2017 and 2020, with a corresponding increase in components scoring Some or Good, and a particular increase for those scoring Good, up from 67 to 98 components. The reduction in the amount of red (None) and increase in yellow (Some) and green (Good) in Tables 16 to 18 is striking.



Sterilising boots during a field trip during the entomology and biosecurity training, York, September 2019.

Table16. Summary of capacity for each component in 2017 and 2020 in the area of *Prevention*. PRA = pest risk assessment; NNRA = non-native species risk assessment.

2017

Territory	Risk Analysis		Pathway Analysis	Horizon Scanning	Contingency Planning			Border Operations
	PRA	NNRA			Plants	Animals	Other	
Anguilla	Basic	Basic	None	Basic	Basic	Basic	Basic	Some
Ascension	None	Basic	Good	None	None	None	None	Basic
Bermuda	Basic	None	None	None	Basic	Basic	None	Some
BAT	Basic	Some	Good	Good	Some	Good	None	Good
BIOT	None	None	Basic	None	None	Basic	None	Basic
BVI	Basic	Basic	None	None	Some	Some	Some	Some
Cayman	Some	Basic	Basic	Some	Basic	Basic	None	Good
CSBA	None	None	None	Basic	None	Some	None	None
Falkland	Some	Good	Good	None	None	Basic	None	Some
Gibraltar	Basic	None	None	None	None	Basic	None	Basic
Montserrat	Basic	None	None	None	Basic	Basic	None	Some
Pitcairn	Basic	Basic	Basic	Basic	Basic	Some	None	Some
St Helena	Basic	None	Some	None	Good	Good	Some	Good
SGSSI	Basic	Some	Some	None	Some	Good	Some	Some
Tristan	Basic	None	Basic	None	Basic	Basic	Basic	Some
TCI	Some	None	None	None	None	None	None	Some
Scores	16	12	17	8	15	23	8	30

2020

Territory	Risk Analysis		Pathway Analysis	Horizon Scanning	Contingency Planning			Border Operations
	PRA	NNRA			Plants	Animals	Other	
Anguilla	Basic	Basic	Good	Good	Basic	Basic	Basic	Some
Ascension	None	Basic	Good	Good	None	None	None	Some
Bermuda	Basic	Basic	Good	Good	Some	Basic	None	Some
BAT	Basic	Some	Good	Good	Some	Good	None	Good
BIOT	None	None	Good	Good	None	Basic	None	Some
BVI	Basic	Basic	Good	Good	Some	Some	Some	Basic
Cayman	Some	Basic	Good	Good	Basic	Basic	None	Good
CSBA	None	None	None	Good	None	Some	None	Basic
Falkland	Good	Good	Good	Good	None	Some	None	Some
Gibraltar	Basic	Basic	Good	Good	Some	Basic	Basic	Basic
Montserrat	Basic	None	Good	Good	Basic	Basic	None	Some
Pitcairn	Basic	Basic	Good	Good	Basic	Some	None	Some
St Helena	Some	Basic	Good	Good	Good	Good	Some	Good
SGSSI	Basic	Some	Good	Good	Some	Good	Some	Good
Tristan	Basic	Basic	Good	Good	Basic	Some	Basic	Some
TCI	Some	None	Good	Good	None	None	None	Some
Scores	18	16	45	48	20	25	9	33

Table17. Summary of capacity for each component in 2017 and 2020 in the area of *Early Warning & Rapid Response*.

2017

Territory	Alert System	Surveillance			Monitoring	Rapid Response		
		Plants	Animals	Other		Plants	Animals	Other
Anguilla	Basic	None	None	None	Basic	Basic	Basic	None
Ascension	Some	Basic	Basic	Basic	Some	Basic	None	None
Bermuda	Some	Basic	Basic	Some	Basic	Basic	Basic	None
BAT	Good	Basic	Basic	Basic	Basic	Basic	Some	Basic
BIOT	Some	None	None	None	Some	None	Basic	None
BVI	Basic	Good	Basic	Basic	Good	Some	Basic	Some
Cayman	Some	Some	Basic	None	Basic	Some	Basic	None
CSBA	Basic	None	Some	None	Some	None	Some	None
Falkland	Basic	Basic	Basic	Basic	Some	Basic	Some	Basic
Gibraltar	Good	Good	Some	Basic	Good	Good	Some	None
Montserrat	Some	None	None	None	None	Some	Some	Some
Pitcairn	Good	Some	None	Basic	Basic	Some	Basic	None
St Helena	Some	Good	Some	Basic	Basic	Good	Good	Good
SGSSI	Good	Good	Some	Good	Some	Some	Some	Some
Tristan	Some	Basic	Basic	None	None	Basic	Basic	Basic
TCI	None	Some	Some	None	Basic	Basic	Some	None
Score	30	23	17	12	23	23	24	12

2020

Territory	Alert System	Surveillance			Monitoring	Rapid Response		
		Plants	Animals	Other		Plants	Animals	Other
Anguilla	Basic	None	None	None	Basic	Basic	Basic	None
Ascension	Some	Basic	Basic	Some	Some	Some	Some	None
Bermuda	Some	Basic	Basic	Some	Basic	Some	Basic	Basic
BAT	Good	Basic	Basic	Basic	Basic	Basic	Basic	Basic
BIOT	Some	Basic	Some	None	Some	None	Basic	None
BVI	Basic	Good	Basic	Basic	Good	Some	Basic	Some
Cayman	Some	Good	Basic	None	Basic	Some	Basic	None
CSBA	Basic	None	Some	None	Basic	None	Some	None
Falkland	Some	Basic	Some	Basic	Some	Basic	Some	Basic
Gibraltar	Good	Good	Some	Basic	Good	Good	Some	Basic
Montserrat	Some	Basic	Basic	None	Basic	Some	Some	Some
Pitcairn	Good	Some	None	Basic	Basic	Some	Basic	None
St Helena	Some	Good	Some	Basic	Basic	Good	Good	Good
SGSSI	Good	Good	Good	Some	Some	Good	Some	Some
Tristan	Some	Basic	Basic	Basic	Basic	Basic	Basic	Basic
TCI	Basic	Some	Some	None	Basic	Basic	Some	None
Score	32	26	22	14	23	26	25	14

Table18. Summary of capacity for each component in 2017 and 2020 in the area of *Management, Prioritisation & Frameworks*.

2017

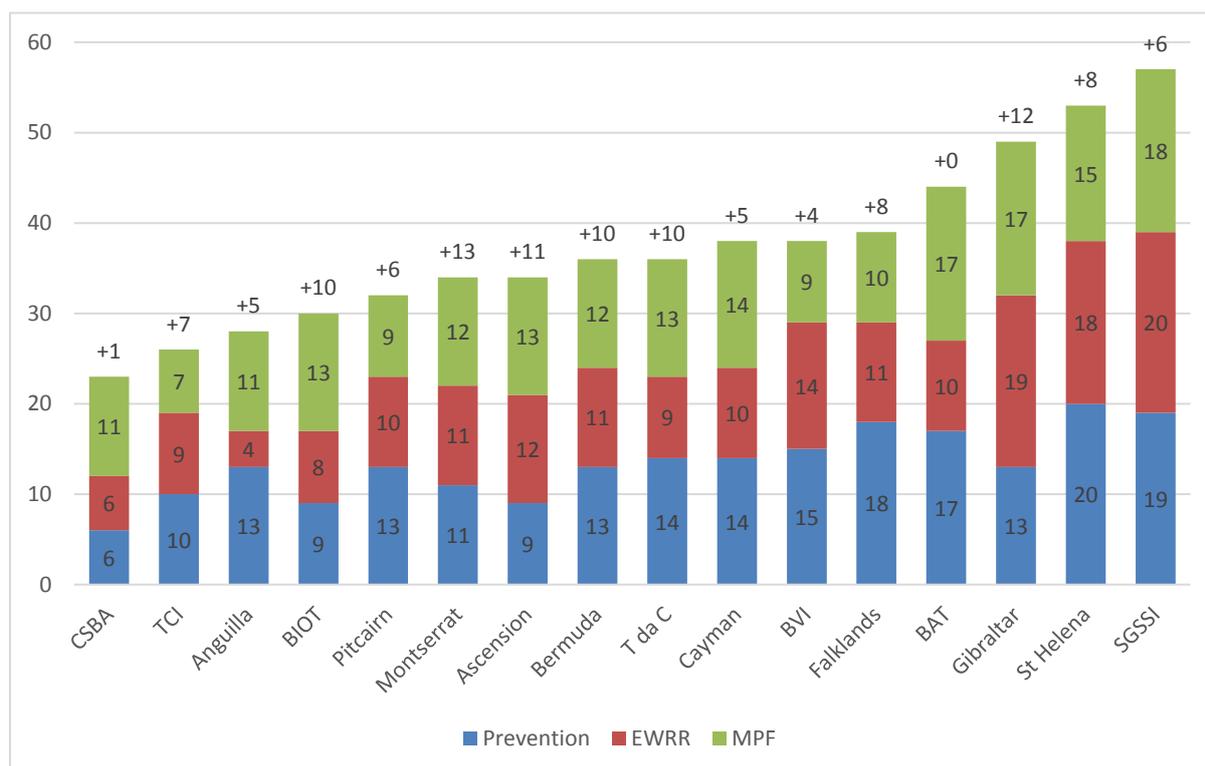
Territory	Prioritisation	Baseline Information			Framework	
		Plants	Animals	Other	Legal	National
Anguilla	Good	Some	Some	Basic	Some	Some
Ascension	Basic	Good	Basic	Good	Basic	Basic
Bermuda	Basic	Good	Good	Good	Basic	Basic
BAT	Good	Good	Good	Some	Good	Good
BIOT	Basic	Good	Good	Good	Some	None
BVI	Good	Good	Basic	Basic	Some	None
Cayman	Some	Good	Good	Some	Some	Basic
CSBA	Basic	Good	Good	Some	Basic	Basic
Falkland	Basic	Good	Good	Basic	Basic	Basic
Gibraltar	Good	Good	Good	Good	Good	Some
Montserrat	Basic	Good	Some	Some	Basic	None
Pitcairn	Basic	Basic	None	Good	Some	None
St Helena	Basic	Good	Good	Some	Basic	Good
SGSSI	Good	Good	Good	Good	Good	Good
Tristan	Some	Good	Basic	Good	Basic	Some
TCI	Some	Basic	Basic	Basic	Some	None
Score	29	43	35	35	28	20

2020

Territory	Prioritisation	Baseline Information			Framework	
		Plants	Animals	Other	Legal	National
Anguilla	Good	Some	Some	Basic	Some	Basic
Ascension	Some	Good	Basic	Good	Some	Some
Bermuda	Basic	Good	Good	Good	Basic	Basic
BAT	Good	Good	Good	Some	Good	Good
BIOT	Basic	Good	Good	Good	Some	Basic
BVI	Good	Some	Basic	Basic	Some	None
Cayman	Good	Good	Good	Some	Some	Basic
CSBA	Basic	Good	Good	Some	Basic	Basic
Falkland	Basic	Good	Good	Basic	Basic	Basic
Gibraltar	Good	Good	Good	Good	Good	Some
Montserrat	Basic	Good	Some	Some	Some	Basic
Pitcairn	Some	Basic	None	Good	Some	Basic
St Helena	Some	Good	Good	Some	Some	Good
SGSSI	Good	Good	Good	Good	Good	Good
Tristan	Some	Good	Basic	Good	Some	Some
TCI	Some	Basic	Basic	Basic	Some	None
Score	33	42	35	35	33	23

Scores for each territory in the three categories of (i) *Prevention*, (ii) *Early Warning & Rapid Response (EWRR)* and (iii) *Management, Prioritisation and Frameworks (MPF)* are shown in Figure 6, with the territories listed from the lowest overall score (weakest practices and capacity) to the highest (strongest practices and capacity). The strongest OTs are still SGSSI, St Helena, BAT and Gibraltar, while CSBA and TCI remain the weakest.

Figure 6. Overall scores in 2020 in the three areas, with change in scores between 2017 and 2020 noted for each OT above the bars.

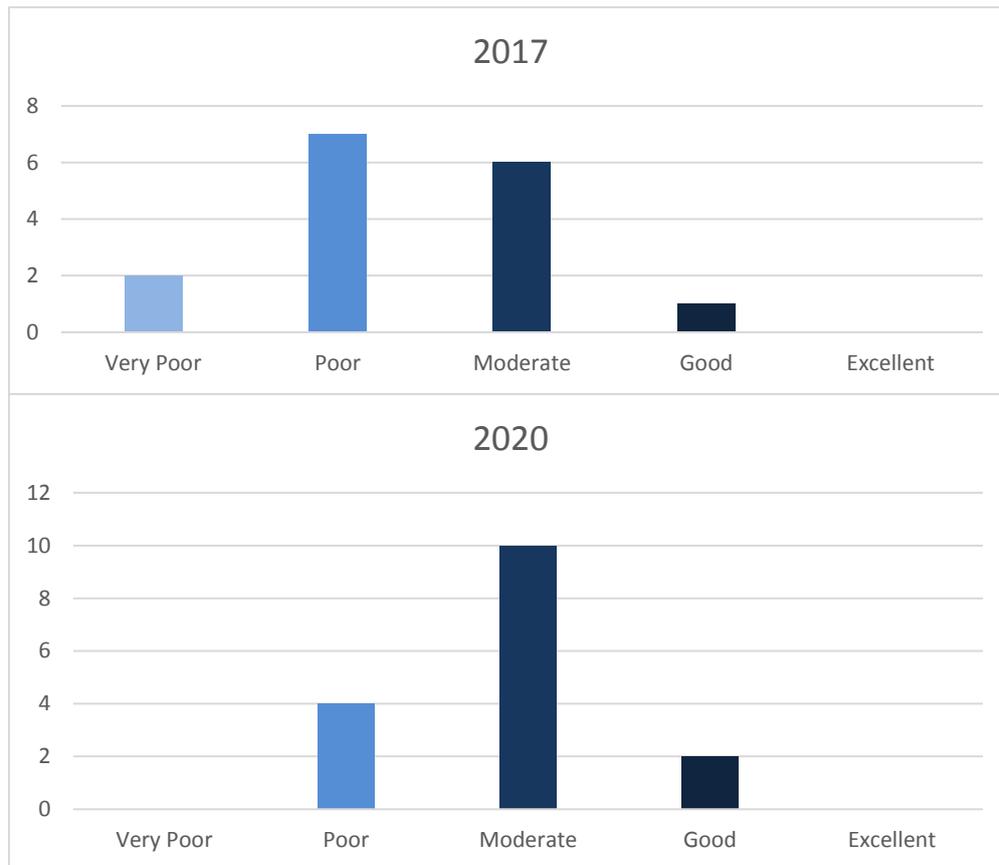


Biosecurity capacity in the OTs was ranked as follows:

- Very Poor: overall score of 20 or less
- Poor: overall score of 21 to 30
- Moderate: overall score of 31 to 50
- Good: overall score of 51 to 60
- Excellent: overall score of 61 or more.

In 2017 two OTs ranked as Very Poor and only one as Good, while in 2020 there were no Very Poor territories, two ranked as Good and a substantial movement from Poor to Moderate; no OTs were ranked as Excellent in either year; see Figure 7.

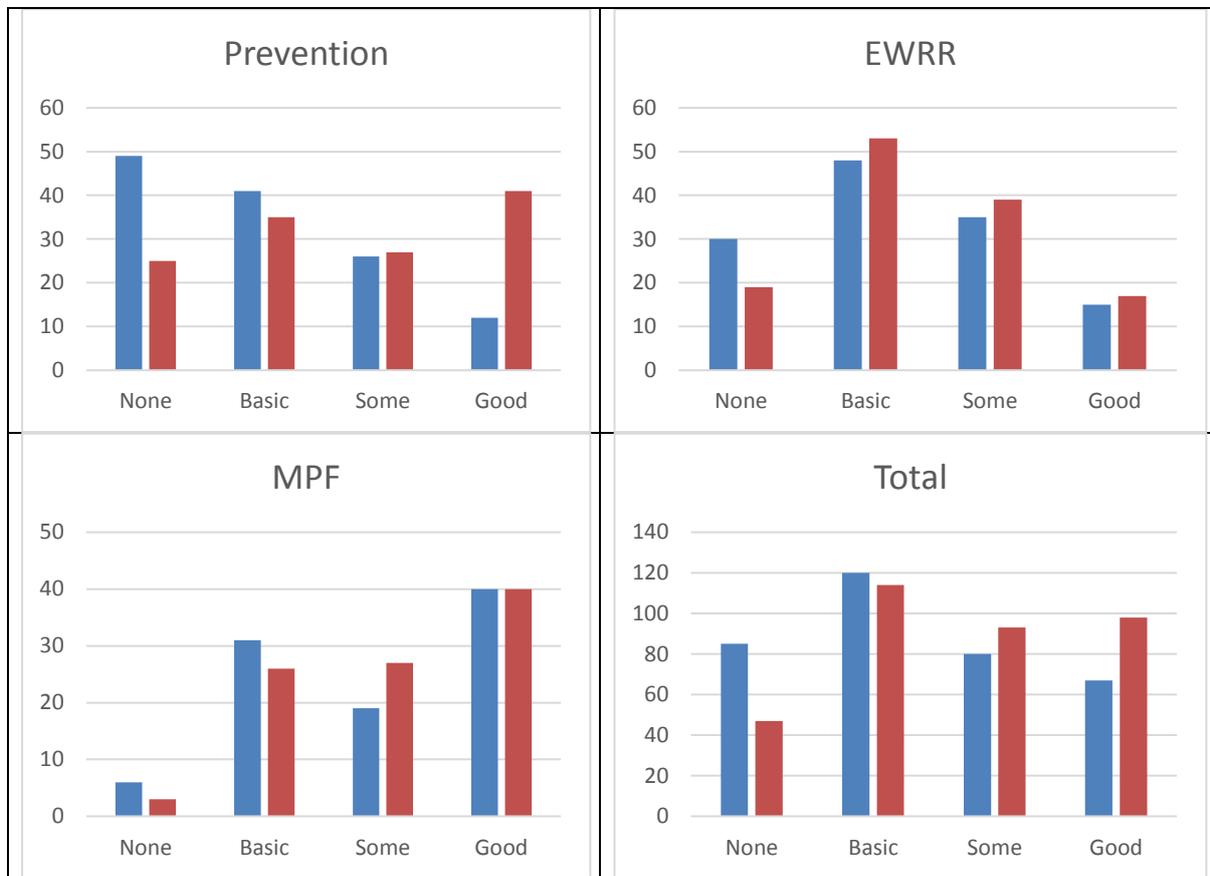
Figure 7. Number of OTs ranked by biosecurity capacity in 2017 and 2020.



Most effort was directed at activities in the area of *Prevention* between 2017 and 2020, and this is reflected in the large improvement in scores for this area between the 2017 and 2020 gap analyses, which is statistically significant (Wilcoxon test, $p < 0.001$); see Figure 8.

OTs also made a number of advances in components of the other two areas, and this was significant for EWRR (Wilcoxon test, $p < 0.01$) but not for MPF (Wilcoxon test, $p > 0.05$).

Figure 8. Numbers of None, Basic, Some and Good scored in 2017 (blue) and 2020 (red), in the three areas and in total.



Components of biosecurity

Overall capacity is now weakest in the area of EWRR which has a mean score of 11.4, and strongest in the area of Prevention, with a mean score of 13.4, as a result of the project targeting this area over the last 3 years. The area of MPF is intermediate, with a mean score of 12.6. It is notable that the weakest area in 2020 has a mean score (11.4) close to that of the strongest area in 2017 (11.8).

Table 19 shows total scores in 2020 by component out of a maximum possible score of 48.

Table 19. Total scores in 2020 for each component; the maximum possible score is 48. Scores 0 -16 are shown in red; 17- 32 in amber, and 33 - 48 in green.

Component		Total score
Prevention		
Pest Risk Analysis		18
Non-native Species Risk Analysis		16
Pathway Analysis		45
Horizon scanning		48
Contingency Planning	Plants and plant health risks	20
	Animals and animal health risks	25
	Other risks	9
Border operations		33
Early Warning and Rapid Response		
Alert System in Place		32
Surveillance	Plants and plant health risks	26
	Animals and animal health risks	22
	Other risks	14
Monitoring		23
Rapid response Capacity	Plants and plant health risks	26
	Animals and animal health risks	25
	Other risks	14
Management, Prioritisation and Frameworks		
Prioritisation		33
Baseline	Plants	42
	Animals	35
	Other	35
Framework	Legal	33
	National policy or strategy	23

8.2 Outputs

Six project outputs were defined at the start of the project, and a further five outputs were identified for the additional activities in the final year of the project, 2019-2020. A summary of project outputs with RAG (red, amber, green) status is shown in **Annex 5. Project outputs with RAG status**. By the end of the project, all the outputs were either achieved (6) or partly achieved (5), and none had failed. The partial achievement was in all cases due to the limited capability of the OTs to engage fully in the time of the project (staffing in the OTs is limited, often with a variety of functions not just those related to biosecurity, and priorities vary).

Four output indicators were established in agreement with the FCO, against which activities were reported:

1. Horizon scanning and pathway analysis have been completed for marine and terrestrial invasive species to allow OTs to focus resources on the highest-risk species / pathways;
2. Development of pathway action plans for terrestrial and marine invasive species;
3. Model biosecurity legislation has been
 - (i) developed, and
 - (ii) adapted for use by OTs;
4. Protocols developed for use by OTs to prioritise established invasive species

The output indicators were all achieved; target and status are shown in Table 20.

Table 20. Status of the output indicators.

Output indicator	Baseline	Target	Status in 2020
Horizon scanning and pathway analysis	1 OT	15 OTs	15 OTs
Pathway action planning	0 OT	16 OTs	16 OTs
Model biosecurity legislation developed	no model	1 model	1 model
Model biosecurity legislation adapted	0 OTs	3 OTs	7 OTs
Prioritisation workshops carried out	0 OTs	2 OTs	2 OTs

One overarching outcome indicator was also established in agreement with the FCO. The outcome indicator target was achieved by the project: *“OTs have necessary information and skills to put effective biosecurity measures in place. Model legislation provided for those that need it.”*

8.3 Activity indicators

In addition to the output indicators a set of activity indicators for the project were established, based on the result of the initial gap analysis in 2017:

1. The number of components scored as None in the area of Prevention decrease by 50% by the end of the project as measured by a desk-based gap analysis completed during the first year of the project and repeated at the end;
2. The number of components scored as Good in the area of Prevention increase by 50% by the end of the project as measured by a desk-based gap analysis completed during the first year of the project and repeated at the end;
3. The change in overall average score as measured by a desk-based gap analysis completed during the first year of the project and repeated at the end;
4. The number of OTs using the e-learning module, measured based on consultations with local biosecurity and customs staff.

Results are shown in Table 21. It can be seen that the project did not meet activity indicator (1) where the decrease in components scored as None came very close but did not quite meet the target. Activity indicator (2), however, greatly exceeded the target (by more than double), and all the others were met.

Table 21. Status of the activity indicators in 2020.

Indicator	Baseline in 2017	Target	Status in 2020
1. Decrease in the number of components scored as None in the area of Prevention	49 components	24.5 components	25 components
2. Increase in the number of components scored as Good in the area of Prevention	12 components	18 components	41 components
3. Change in overall average score in the gap analysis between 2017 and 2020	Average score 30.1	Average score 36	Average score 37.3
4. Number of OTs using the e-learning module	0 OTs	5 OTs	5 OTs



9. Discussion

Through this project the NNS successfully mobilised significant UK Government expertise to substantially improve the capacity of UK Overseas Territories (OTs) to prevent the introduction of invasive non-native species. Costing just £20K per year per OT, the project helped OTs to improve the level of protection from new invasive species to over 90% of the UKs biodiversity. Key outcomes included improved management of priority pathways of introduction, development of biosecurity legislation, improved capacity of biosecurity staff, access to individual UKOT specific guidance and resources, and established channels of communication to UK expertise.

The project was targeted at the biosecurity components identified as the weakest in the 2017 gap analysis, to ensure that the relatively limited funds were used as cost-effectively as possible. Project indicators clearly demonstrate that the project has had a high impact on the capacity of the OTs to reduce the risk of arrival of invasive species. As well as the obvious increase in scores due to blocks of activities led by the project (such as pathway analysis and horizon scanning), there was also a general improvement across the board, with most territories making advances in other areas of biosecurity. The project also facilitated synergy between territories. For example, Bermuda adapted the fire ant monitoring guide and rapid response protocol developed for BIOT, and used the same format to develop the same for the Giant African snail. Similarly, work is in progress in Montserrat to develop contingency plans for key horizon scanned pests, such as the Giant African snail. This general improvement is considered to be due to a raised awareness of the issue of INNS, biosecurity and the need to strengthen procedures resulting from the project presence and involvement of high level officials within territory. It also reflects an increase in confidence of the biosecurity officers to make advances in other areas of their work. This was achieved through capacity building and also through the professional networks developed in the course of the project, both within the cadre of OT biosecurity and environmental officers, and to the external experts met during some activities. The positive effect of feeling a part of something bigger, valued and appreciated, is one of the large but intangible benefits of peer-learning networks.

Project outputs were very realistic and applied, providing practical tools which biosecurity officers in the OTs can apply without the need for additional resources or continual training. Outputs also take into account that delivering biosecurity in the OTs involves partnerships with agencies such as Customs and Port Authority, who have their own agendas and need simple clear tools to hand. Staff turnover tends to be high, and sustainability of the outputs is ensured by promoting standard operating procedures and guides which can be adapted for each OT, adopted into use, and covered by modern biosecurity legislation.

One of the projects specific aims was to improve access to the expertise available in UK agencies. This was achieved by involving representatives of seven government or part government agencies in the main areas of work, namely horizon scanning and prioritisation, as well as involving two, Fera and APHA's Plant Health and Seeds Inspectorate, with technical support and training.

The House of Commons Environmental Audit Committee report on invasive species in 2019 noted for the OTs: *"We welcome the work carried out by the GB Non-Native Species Secretariat supporting the OTs with pathway analysis and biosecurity legislation. This must be scaled up and fully resourced to ensure that each OT has up to date biosecurity legislation*

and adequate powers of enforcement and resources and expertise to carry it out by the end of 2020" (EAC, 2019). The project has gone a long way towards this goal by drafting a model Biosecurity Bill and engaging with seven OTs to tailor this to their own needs, having identified in the 2017 gap analysis that specialist drafting was the biggest bottleneck in the development of new legislation. However, this is only the first step towards having the legislation enacted, and further support is required to get all OTs on board with this particular activity. Other project activities delivered in the final year of the project also require further work to ensure their up-take. This includes marine biosecurity, pest risk assessment, and prioritisation of existing invasive species.

In conclusion, the project has delivered excellent value for money across the OTs, delivering cost-effective capacity building tailored to the limited resources and needs of individual territories.



10. Next Steps and recommendations

The 16 OTs made substantial progress between 2016 and 2020 towards strengthening their biosecurity to reduce the risk of introduction of new invasive species, but inevitably gaps in their capacity remain. Considerable traction has been made under the project, but further support is required to ensure that OTs are able to sustain these achievements, and continue to consolidate their capacity. No OTs ranked as Excellent and only two ranked as Good in terms of their biosecurity capacity in the second gap analysis, and results indicate that biosecurity in the OTs is now weakest for contingency planning, surveillance and rapid response. The project continues in 2020 to 2021 with limited funding, primarily to provide technical support for biosecurity and invasive species management.

The following recommendations are made for further work:

1. Access to biosecurity expertise and technical support (all OTs):

- a) On biosecurity risks and appropriate mitigation measures in the event of a hurricane or other environmental disaster;
- b) To support investments in territory-wide restoration projects, such as the rodent eradication project on Gough Island;
- c) On major infrastructure projects, such as new wharf or airport constructions or repair projects.

2. Biosecurity legislation:

- a) Support the OTs with draft Biosecurity Bills towards enacting comprehensive biosecurity legislation (7 OTs);
- b) Promote and encourage the remaining OTs to take-up the model legislation to ensure harmonisation of biosecurity legislative provisions across the OTs (7 OTs).

3. Post-border management of invasive species (all OTs):

- a) Develop simple and cost-effective surveillance techniques for different taxa identified as priorities during the horizon scanning exercise;
- b) Develop contingency and rapid response plans for all priority species;
- c) Research and training in invasive species control techniques, including eradication, containment and long-term control;
- d) Develop an Alert list of priority species to prevent establishment;
- e) Implement a programme of community engagement, including using citizen science.

4. Prioritisation of established invasive species for action:

- a) Identify the species for which eradication from the territory is feasible and cost-effective (14 OTs);
- b) Identify the species of concern for spread within the territory (14 OTs);

- c) Develop simple and pragmatic management plans for all priority species (all OTs).

5. Biosecurity-related training on border and post-border biosecurity (all OTs)::

- a) Deliver appropriate workshops and courses, in-territory and regionally;
- b) Prepare on-line resources and e-learning modules in key areas;
- c) Develop further biosecurity tools and templates;
- d) Promote networking & professional exchanges.

6. Public awareness and education strategies (all OTs)::

- a) Develop regional and territory-specific strategies;
- b) Develop and promote education materials for children of pre-school to collage age;
- c) Develop communication and awareness raising materials.

7. Marine biosecurity (all OTs)::

- a) Evaluate and expand the marine biosecurity toolkit;
- b) Assess the risk of hull fouling to the OTs;
- c) Evaluate the risk of ballast water for the OTs.

8. Facilities and equipment (all OTs)::

- a) Provide appropriate equipment to carry out biosecurity inspections, post-border monitoring and any treatment required;
- b) Provide adequate facilities for border security and quarantine (animal and plants).

The costs of doing nothing further are very high. Sustainable development, food security and environmental management of the OTs will remain under imminent threat of introductions of harmful species such as mosquitoes, crop pests, and fire ants. OT biodiversity will similarly remain under imminent threat: over 200 invasive species have been identified as likely to arrive in the OTs in the next 5 to 10 years. These would negatively affect tourism, the main industry of most of the OTs, further weakening sustainable development.

11. Acknowledgements

We would like to acknowledge with grateful thanks all friends and colleagues in the OTs who have been involved in this work for their hard work, participation, and making me and the team so welcome. A particular thank you goes to all the external experts, particularly Helen Roy, who gave their valuable time for free, to all the members of the steering group for their time and advice, and for being so helpful and encouraging. Finally, a big thank you to the UK government for funding the project.

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TV interview on the prioritisation workshop, TCI

Annex 1. Summary table of project activities

Territories: Anguilla (ANG), Ascension (ASC), British Antarctic Territory (BAT), Bermuda (BER), British Indian Ocean Territory (BIO), British Virgin Islands (BVI), Cayman Islands (CAY), Cyprus Sovereign Base Areas (CSB), Falkland Islands (FAL), Gibraltar (GIB), Montserrat (MON), Pitcairn (PIT), South Georgia & the South Sandwich Islands (SGS), St Helena (STH), Tristan da Cunha (TDC), Turks & Caicos Islands (TCI).

Activity	Overseas Territory															
	ANG	ASC	BAT	BER	BIO	BVI	CAY	CSB	FAL	GIB	MON	PIT	SGS	STH	TDC	TCI
Gap analysis – 2017	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gap analysis – 2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pathway analysis	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Horizon scanning	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Pathway action planning	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Legislative support		✓			✓				✓		✓	✓	✓	✓	✓	✓
Marine biosecurity tool kit development						✓			✓				✓			
Marine biosecurity toolkit hard copies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Wildlife disease management									✓					✓		
Prioritisation of existing invasive species	✓															✓
Technical assistance - visit						✓			✓				✓			
Technical support - remote	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
In-territory training - entomology and biosecurity											✓					
In-territory training – rodent control and biosecurity inspections													✓			
External training – entomology and biosecurity	✓			✓		✓	✓				✓					✓
External training – risk assessment	✓						✓				✓					✓

Annex 2. Top 50 priority species identified in the horizon scanning exercise.

Scientific name	Common name	No. OTs with a risk of impact
INVERTEBRATES		
<i>Aedes albopictus</i>	Tiger mosquito	8
<i>Wasmannia auropunctata</i>	Little fire ant	8
<i>Tuta absoluta</i>	Tomato leaf miner	7
<i>Coptotermes formosanus</i>	Formosan subterranean termite	7
<i>Lissachatina fulica</i>	Giant African snail	6
<i>Ceratitis capitata</i>	Mediterranean fruit fly	6
<i>Aedes aegypti</i>	Yellow fever mosquito	5
<i>Anopheles gambiae</i>	House mosquito	5
<i>Spodoptera frugiperda</i>	Fall armyworm	5
<i>Scyphophorus acupunctatus</i>	Agave snout weevil	5
<i>Diaphorina citri</i>	Asiatic citrus psyllid	5
<i>Coptotermes gestroi</i>	Asian subterranean termite	5
<i>Amblyomma cajennense</i>	Cayenne tick	5
<i>Linepithema humile</i>	Argentine ant	4
<i>Monomorium destructor</i>	Singapore ant	4
<i>Solenopsis invicta</i>	Red imported fire ant	4
<i>Bactrocera carambolae</i>	Carambola fruit fly	4
<i>Harmonia axyridis</i>	Harlequin ladybird	4
<i>Varroa destructor</i>	Varroa mite	4
<i>Anoplolepis gracilipes</i>	Yellow crazy ant	3
<i>Vespa velutina</i>	Asian hornet	3
<i>Vespula germanica</i>	German wasp	3
VERTEBRATES		
<i>Psittacula krameri</i>	Rose-ringed parakeet	7
<i>Rattus norvegicus</i>	Brown rat	6
<i>Aratinga erythrogenys</i>	Red-masked conure	5
<i>Corvus splendens</i>	House crow	5
<i>Boa constrictor imperator</i>	Common boa constrictor	5
<i>Acridotheres tristis</i>	Common myna	3
<i>Anolis equestris</i>	Knight anole	3
<i>Hemidactylus mabouia</i>	Tropical house gecko	3
PLANTS		
<i>Prosopis juliflora</i>	Mesquite	5
<i>Colubrina asiatica</i>	Asian snakewood	4
<i>Cortaderia selloana</i>	Pampas grass	4

<i>Imperata cylindrica</i>	Cogon grass	3
<i>Leptinella plumosa</i>	Feather leaf	3
<i>Mimosa pigra</i>	Cat's claw mimosa	3
<i>Neyraudia reynaudiana</i>	Burma reed	3
MARINE SPECIES		
<i>Perna viridis</i>	Asian green mussel	12
<i>Magallana gigas</i>	Pacific oyster	9
<i>Mytilus galloprovincialis</i>	Mediterranean Mussel	9
<i>Pterois miles / volitans</i>	Devil firefish / lionfish	6
<i>Carcinus maenas</i>	European shore crab	5
<i>Mytilus edulis</i>	Blue mussel	5
<i>Botryllus schlosseri</i>	Ascidian	4
<i>Ciona intestinalis</i>	Ascidian	4
<i>Halophila stipulacea</i>	Seagrass	4
<i>Undaria pinnatifida</i>	Alga	4
<i>Ascidiella aspersa</i>	European sea squirt	3
<i>Mytilus chilensis</i>	Chilean mussel	3
<i>Semimytilus algosus</i>	Bivalve	3

Annex 3. Guidance for pathway action planning

Use the information from the **pathway analysis report** and the results of the **horizon scanning exercise** to develop action plans for the pathways identified. The aim of the action plans is to reduce the risk of introduction of the identified non-native species.

A pathway action plan should be developed for each pathway implicated as a means of entry to the wild for non-native species identified in the horizon scanning exercise. Some pathways may be implicated for a number of species while for others it may be only one.

The process is as follows:

- For the short lists of priority species, identify the pathway or pathways of entry in each case; this will have been done for most if not all species as part of the horizon scanning exercise. There may be more than 1 possible pathway of entry and it is important to note if there is a primary pathway.
 - Put the short listed species identified for biodiversity, economic and public health risk into one spreadsheet, as some species and pathways will appear in two or all of the lists.
- Group the species according to their pathways of entry.
- Consider all the options available for your territory to reduce the risk of arrival into the wild along each pathway.
 - Take into account the considerations for developing pathway action plans and the checklist of mitigation options, both below.
 - Wherever possible, look at what you can do pre-border, before the species enter the pathway.
 - Note where you have existing procedures, policy or legislation to support actions.
- Identify the most cost-effective mitigation actions for the pathway action plan.
 - Which actions will result in most risk reduction?
 - Which actions can be immediately implemented?
 - Where do you need more resources, and how can you get them?
 - What legislative support do you have for the required actions?

Possible sources of information for pathways and mitigation actions include:

- Colleagues and experts, both in-country and international
- CABI Invasive Species Compendium <http://www.cabi.org/isc/>
- Global Invasive Species Database <http://www.iucngisd.org/gisd/>
- Padil datasheets from the Australian government, including commodities on which specimens have been intercepted <http://www.padil.gov.au/>

Considerations for developing pathway action plans

Consider the following points for each pathway.

1. Description of the pathway and species

- What quantitative or qualitative data do you have for this pathway? For example:
 - The volume of entry over time
 - Seasonal variations
 - Countries or regions of origin
- What do you know about each of the species implicated along this pathway? For example:
 - Life cycle
 - Behaviour
 - Hosts / habitats etc.
 - Visibility / detectability
 - Any other relevant traits

2. Policy and legal background

- How comprehensive is the existing legislation?
- Does it cover actions implemented pre-border, border and post-border?
- Who is responsible for enforcing the different regulations? Considerations include:
 - Which agency is leading on biosecurity?
 - What other agencies are involved? Biosecurity is a cross-sectoral issue typically delivered through coordinated effort by the agencies responsible for agriculture, environment, public health and customs.
 - How will cross-sectoral actions be coordinated?

3. Mitigation actions

- How many species can be stopped by actions taken pre-border? Generally, it is recommended to do as much as possible pre-border to stop new non-native species entering the Territory in the first place.
- Are any mitigation actions particularly effective in that they can be taken against a number of species?
- What are the remaining risks which can't be addressed with existing resources?
 - What will you need to address them?

4. Identification of key stakeholders

- Who are the main stakeholders for this pathway?
- How will they be involved in implementing the pathway action plan?
- Consider regional, national and global stakeholders.

5. Time schedule

- The plan should have a defined time limit to achieve the aim.
- In addition, the timeframe of each action should be defined.

6. Financial planning

- Can the responsible agencies deliver the plan with existing resources?
- What are the main gaps in resources and capacity (staffing, facilities, equipment, materials, etc)?
- What additional resources will they need to deliver the pathway action plan?
- Where will the additional resources come from?
 - Can you collaborate with other agencies?

7. Monitoring and updating action plan

- How will the progress and effectiveness (or otherwise) of the actions be monitored (including responsibilities for monitoring and reporting on success)?
- How will the plan be regularly updated?
- Considerations include:
 - How will you know how effective the biosecurity system is?
 - Can you identify where there are weaknesses or gaps in procedures?
 - Can you identify success to government and the public

Checklist of mitigation options

Pre-border	Border	Post-border
For pathways such as live plants, nursery material, habitat material, fresh produce, biocontrol agents (intentional introduction plus contaminants)		
Ban importation	Fumigation	Surveillance: visual surveys
Fumigation	Inspection	Surveillance: pheromone traps
Import licence system	Quarantine	Surveillance: other devices
Import health standards	Pesticide treatment	Rapid response
Inspection: health checks	Destruction	Ban release into the wild
Inspection: identification		Codes of practice
For pathway of live animals (intentional introduction plus contaminants)		
Ban importation	Inspection	Surveillance: vet team
Vaccination	Quarantine	Rapid response
Import licence system	Destruction	Ban release into the wild
Import health standards		Impounding
Inspection: health checks		Codes of practice
Inspection: identification		
For pathways such as stone etc., sand, aggregate, general commodities (contaminants)		
Ban importation	Fumigation	Surveillance at point of use
Fumigation	Freezing	Rapid response
Freezing	Bleach	Codes of practice
Bleach	Inspection	
Pesticide spray	Quarantine	
Import health standards	Pesticide treatment	
	Destruction	
For pathways such as shipping containers (stowaways)		
Import health standards	Fumigation	Surveillance: ports
Pressure washing	Inspection	Surveillance: other areas
Cleaning (other)	Pesticide treatment	Rapid response
Fumigation		
Inspection		
For pathways such as hull fouling, ballast water		
Compliance with BWC	Check compliance with BWS	Surveillance
Prohibit haul-out of yachts		
Prohibit hull cleaning of yachts		
Refuse entry of vessel		
For the natural spread pathway		
		Surveillance
		Rapid response

Annex 4. Feedback on the project from OTs

Activity	Feedback
The project generally	<ul style="list-style-type: none"> • Support has been very well tailored to the needs of each OT. We have benefitted from the project in a number of ways, gaining access to UK expertise and resources being a major one. (South Georgia) • Support has been critical to assisting our Department to improve existing Biosecurity programmes. (TCI) • Ascension has benefited from this project massively and will continue to for a long time. (Ascension)
Horizon scanning and pathway action planning	<p>What did you most like about the work:</p> <ul style="list-style-type: none"> • The horizon scanning exercise has given us a much clearer picture of where we need to focus our efforts to ‘work smarter and not harder’, without compromising the biosecurity of these Islands. Already as a result, we have been able to direct resources and prioritise our support of other funding bids, which seek to address our highest risks – marine invasive species and rodents. (South Georgia) • It was an excellent workshop and a great capacity builder. It was also a pleasure meeting and interacting with the participants of the various territories and countries who attended the workshop as well. (Anguilla) • I think the approach that you used with us is very useful as it provides a relatively simple and rapid method for identifying and ranking potentially invasive species that countries need to have on their radar and especially brings into focus those species that may impact the environment which most quarantine and border protection services may not be thinking about, as they are usually located in Ministries of Agriculture and hence have an agricultural bias.(Cayman Islands) • The workshop exceeded expectations. (Gibraltar) • All the organisation and opportunity to discuss with all working groups during all the social moments. It is a really learning process. (Gibraltar) • I truly enjoyed the scoring and ranking of the various invasive species. Focussing on the list methodology is ideal and useful. The negotiations and consensus building utilised in the ranking exercise created a balance, led to prioritising and the top overall species. (Caribbean workshop) • The (full) output from the HS is going to be fundamental to building out formal blacklist/whitelist for imports. We have

	<p>strengthened our collaboration with DoA by working through this with them. (Caribbean workshop)</p> <ul style="list-style-type: none"> • The overall list of plants is a big jump for plans that were in the preparation before the start of the workshop; experts actually communicating useful information, even before they arrived. (Caribbean workshop) • It was really nice to meet and mingle with a range of experts and have the time discussing different species, their requirements etc. It was good that the expertise on island was recognised and utilised. (Caribbean workshop) • I mostly like the pathway action plan because this is an integral part of moving forward and protecting our borders. (Caribbean workshop) • We truly enjoyed [the pathway action planning] session, and thus hope to further build capacity in that area. (Anguilla) • That it was output driven, relevant, and the expertise was awesome. (Mid-Atlantic workshop) • Involvement of OT stakeholders to ensure a good implementation of the work done. (South Atlantic workshop)
<p>Prioritisation workshops</p>	<p>What did you most like about the work:</p> <ul style="list-style-type: none"> • The breakout group where we discussed feasibility of eradication was great. It provided an opportunity to see what impacts, effectiveness and acceptability of eradicating non-native species. (TCI) • I really enjoyed the little debates that arose when we were discussing which species had had a more significant effect on the grouped islands. (TCI) • Broad based attendance / participation, open discussions in breakout and whole groups. Well-timed and managed / organised. (TCI) • Good engagement of local experts. (Anguilla) • I really enjoyed the opportunity to discuss conservation issues particular to Anguilla. Having the farmers' perspective on species was interesting. (Anguilla) • It brought the importance of invasive species into perspective. (Anguilla) • We have received high praise from the participants about the organization and delivery of the workshop, as well as their appreciation for the knowledge gain over the 3 days. (Anguilla)
<p>Elearning module</p>	<ul style="list-style-type: none"> • The e-learning module 'Biosecurity for the Overseas Territories' has been an extremely helpful tool, explaining the basics and importance of biosecurity to the wider staff within Government. (Ascension)

Entomology and biosecurity training, November 2019	<ul style="list-style-type: none"> The workshop was timely, useful and interesting. (Montserrat)
Legislative support	<ul style="list-style-type: none"> I'd like to pass on my grateful thanks to you and your team for the help and support you have provided in this matter. I sincerely trust that this work will be completed in the not too distant future and our respective OT's can reap the benefits of having specific biosecurity legislation in place. (St Helena)
Field guide to invasive invertebrate for South Georgia	<ul style="list-style-type: none"> This piece of work is really valuable; finally, we have an idea of what we are seeing in the traps, and what to look out for. That makes our monitoring useful, rather than just blundering around in the dark! The report is clear and concise, and with some recommendations that we will act on. (South Georgia)
Marine biosecurity toolkit	<ul style="list-style-type: none"> It's great to see many of the things we talked about during the horizon scanning process developed into a very practical and useful guide. (Tristan da Cunha)
Fera training course, November 2019	<p>What did you most like about the course:</p> <ul style="list-style-type: none"> The lab visits were very educative and exposed us to various techniques of plant quarantine and surveillance. (Caribbean) The information given in each presentation was spot-on to the roles of plant health inspectors. (Caribbean) The bringing together of participants with various experiences to share knowledge among themselves and with presenters. (Caribbean)

Annex 5. Project outputs with RAG status

Six project outputs were defined at the start of the project, and a further five outputs were identified for the additional activities in the final year of the project, 2019-2020. Project delivery with regards the outputs scored as:

Red	Output not achieved
Amber	Output partly achieved
Green	Output achieved

Output	Achievement	Status
Ballast water plans. All affected OTs will have plans appropriate in place by 2020	Achieved in part. UK has not yet signed up to the BWC. A package of guidance documents was completed with the JNCC and MMO as part of the Marine Biosecurity toolkit (see additional activity below).	
Horizon scanning. All OTs will have prioritised the pathways of entry and carried out horizon scanning to identify the invasive species most likely to invade and cause negative impact by 2020.	Achieved for all OTs. All 16 OTs have carried out horizon scanning based on a pathway analysis, and identified the priority non-native species. Pathway action plans have been developed, with technical support from the NNS and are being actively implemented.	
Risk assessment. All OTs will have comprehensive risk assessment frameworks for invasive species by 2020.	Achieved in part. Training in this area was achieved for four OTs in February 2020 through collaborative work with CABI, training in the use of the Atlantic OTs templates for four Caribbean Territories (Anguilla, Cayman Islands, Montserrat and TCI).	
Contingency plans. All OTs will have contingency plans in place to deal with priority invasive species that are likely to arrive.	Achieved in part. Achieved for at least some priority species for all OTs by March 2020 as part of the PAPs, post-border mitigation, and specifically: <ul style="list-style-type: none"> • Fire ants – BIOT, Bermuda, Ascension, Pitcairn • Giant African snail – Bermuda, Montserrat • Animal disease – Falklands, GSGSSI, St Helena • Weeds – St Helena 	
Rapid identification service. All OTs will have access to this service to identify novel invasive species, including pests and diseases of crops and trees.	Achieved for all OTs. Achieved, through Defra funding for Fera, greatly expanded by CSSF.	

Prioritisation system for established invasive species. All OTs will have prioritised species for control/eradication based on global risk management best practice.	Achieved in part. Achieved for two OTs. This activity was offered to all OTs, but only Anguilla and TCI considered it useful at this time.	
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Additional activities 2019 - 2020

Biosecurity legislation. At least 5 OTs will have biosecurity legislation drafted.	Achieved in part. Model legislation has been drafted and is available on-line. Adapted text was developed for six OTs, and a seventh received a legislation review.	
Technical support. All OTs will have access to technical support on request, as advice, materials or visit.	Achieved Three visits have been made with reports and recommendations: to BVI post-hurricane, South Georgia, and Falklands. In addition, advice has been given by phone and email to other OTs on a range of subjects. A "Biosecurity toolkit" web page has been set up, with a range of technical documents.	
Training. All OTs will have access to on-line and face-to-face training materials	Achieved. Two elearning modules and three Field Guides on-line. Two courses have been delivered in-territory and one in the UK. In addition, training has been given on wildlife disease risk assessment to two OTs, and regionally on risk assessment for four OTs.	
Marine invasive species. All OTs will have access to a basic toolkit of resources.	Achieved. A Marine Biosecurity Toolkit was developed in consultation with three OTs to ensure relevance and suitability.	
Communications and education. All OTs will have access to biosecurity communication and education materials.	Achieved. A range of communication materials (posters and leaflets) have been developed and are on-line, as printable and editable versions. Two activity kits for 7 – 13 year olds and for pre-school children have been developed, and are on line as printable and editable versions.	