Ascension Island Biosecurity Review

FINAL

Prepared for
AIG with funding from JNCC and RSPB
by Biofume

June 2016

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Biofume Pty Ltd
ACN: 601 115 824

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Client: RSPC and JNCC

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EXECUTIVE SUMMARY

Biofume was contracted by the Ascension Island Government (AIG), with funding from JNCC and RSPB, to review existing legislation, biosecurity practices and risk to Ascension Island and to make pragmatic recommendations on a way forward that will form a sustainable biosecurity system that is commensurate with risk and on Island capability. After spending six weeks on Ascension, liaising with stakeholders, inspecting air and sea freight and reviewing capability it was found that Ascension Island is in urgent need of a complete biosecurity system complete with standalone legislation that applies to all Island users. Based on inspection data biosecurity risk is currently disproportionately associated with freight from the US. Inadequate off-shore storage of freight, combined with a high contamination rate, climate and habitat matching, all contribute to the US's high risk status.

To demonstrate, 50% of inspected US freight, from Florida, were found to have live invertebrates. One container had two *Hemidactylus* geckos. Another container had five dead frogs on the floor, and of particular note were the four flat racks and one GP container that had live ant nests associated with them.

The following recommendations have been made:

Recommendation 1: *Develop AIG Biosecurity policy and legislation that covers* ***all*** *military and non military users of the Island, harmonising where appropriate with St Helena's.*

Recommendation 2: *Employ a dedicated Biosecurity Coordinator to coordinate the below mentioned recommendations and am approved action plan.*

Recommendation 3: *Explore pre-border risk management options for the sea container pathways starting with USAF (US) freight, followed by RMS St Helena Cape Town (Sth Africa) freight and MOD (UK) freight.*

Recommendation 4: *Formulate a 'white list' approach to allowable imports*

Recommendation 5: *Develop the first high priority Import Health Standard for sea containers and implement a targeted inspection regime to determine compliance. A financial incentive must help drive compliance, preferably as an AIG delivered treatment cost for non-comforming imports. Although initially unpopular with exporters/Islanders, it will quickly establish an enhanced level of compliance.*

Recommendation 6: *Enhance detection capability of the under-utilised port workers, container de-vanners, and Customs officers through inspection training. This would dramatically increase border detection rates. All importers would be subject to inspection activities if freight is considered high risk.*

Recommendation 7: *Adopt a precautionary treatment policy for contaminated urgent cargo.*
Recommendation 8: *Enhance and document process for sending specimens for identification. Clarify chain of custody.*

Recommendation 9: *That AIG develops fumigation capability using low-toxicity fumigants such as ethyl formate and nitrogen, subject to approvals.*

Recommendation 10: *That AIG purchase a refrigerated container and a good quality GP that could be used as a cold/heat/fumigation treatment chamber. This would be suitable for some cargo and pest treatments. In some treatment scenarios freezing may not be appropriate in which case a heat or chemical solution is required.*

Recommendation 11: *Review heat treatment capability and chemical approved chemical lists across UK and USAF EHT teams. Each respective party, subject to a cooperative agreement, to pre-emptively order chemicals required for biosecurity response depending on legislative restrictions.*

Recommendation 12: *That an agreed location at the Pier-head (or nearby) is designated as the containment area.*

Recommendation 13*: That a suitably qualified person with the AIG Conservation Department be delegated as the response Coordinator and made aware of the responsibilities associated with this position.*

Recommendation 14*: That the EHT personnel from AIG, Interserve and USAF be temporarily available for high priority response capability. Something as simple as a MoU between AIG and MOD/USAF would formalise any agreement to provide resources in a response emergency.*

Recommendation 15: *Immediate baseline post-border surveillance is conducted for high impact invertebrate species such as mosquitoes (Zika virus vectors) and invasive ants at high risk locations across the island (e.g. USAF base) in case they have already arrived and to provide a potential eradication opportunity.*

Recommendation 16: *A biosecurity communication/awareness strategy is developed, that is appropriate for Island consumption, funded and implemented, focussing on community involvement and reporting. A robust feedback mechanism to reportees is also critical to sustain reporting.*

Three action plan options have been presented which cater to differing funding models and have varying degrees of operational requirements. There is willingness from the Ascension Island Government and Ascension Island Council to progress implementation of biosecurity controls so long as the resources required do not become too onerous. Likewise, the MOD and USAF have expressed a willingness to improve biosecurity outcomes where risk dictates improvements are required.

Given the unmanaged nature of the three main sea pathways and two air pathways it is certain that unless one action plan option, or a variation thereof, is implemented, Ascension Island will continue to see unabated entry and establishment of new organisms, some of which will have irreparable negative impacts on biodiversity, livelihoods and human health.

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1 ACRONYMS AND ABBREVIATIONS

AI	Ascension Island
AIG	Ascension Island Government
AKL	Unit loading device for air freight
AWSML	Andrew Weir Ship Management Limited
EHT	Environmental Health Team
FIRS	Falkland Island Resupply Vessel
GP	General purpose shipping container
JNCC	Joint Nature Conservation Committee
MOD	Ministry of Defence
PAX	Passengers
QRM	Quarantine risk material
RAF	Royal Air Force
RMS	Royal Mail Service St Helena
RSPB	Royal Society for the Protection of Birds
RJI	Richard James International
UKOT	United Kingdom Overseas Territory
USAF	United States Air Force

2 INTRODUCTION

2.1 BACKGROUND

The history of Ascension Island's biological invasions is quite remarkable. The Royal Navy formed a small settlement in 1815 and the Island has been steadily accumulating new species of plants and animals ever since. Approximately 90% of plants and 70% of invertebrates are believed to have been introduced, many intentionally and the remainder accidentally through imports.

The Island has no commercial agricultural, horticultural or silvicultural industry, although a small AIG funded hydroponics system currently being established.. The Island's economy is currently centred on the US and UK military bases, the contractors supporting the military bases and Ascension Island Government employees. There are no local biosecurity practices implemented on people or imported goods that arrive on the Island, with the exception of restrictions on the importation of domestic pets that were introduced following the eradication of feral cats between 2001 and 2004

There has been a recent shift in focus towards preventing further introductions of invasive species, in particular those that have the potential to threaten or impact on the Island's remaining indigenous biodiversity values and public health; or create unnecessary additional economic burden. Ascension Island is well recognised as a significant turtle and seabird nesting site and the marine environment is largely pristine. These environmental assets as well as the unique volcanic landscape attract a small number of tourists each year, and the Ascension Island Government has international obligations to protect them under multilateral environmental agreements.

In the period from 2006-2009 an initiative called the South Atlantic Invasive Species (SAIS) was conducted. An invasive species management strategy and action plan was formulated. As part of the implementation of the action plan a biosecurity consultant was employed to assess Ascension Island biosecurity needs and conduct training. A number of recommendations were made but no further action occurred.

During a recent South Atlantic UK Overseas Territories Regional Biosecurity Workshop, held on Ascension Island during August 2015, it was agreed that a biosecurity action plan should be developed that would address high risk biosecurity threats to the terrestrial and marine ecosystems. The lack of any current significant primary production sectors and the limited resources on Island dictates that a comprehensive biosecurity system is neither warranted nor possible. However, it was determined that the biosecurity system should address high risk pathways and high risk organisms.

Taking into account the largely military and government based economy, a bespoke biosecurity system is required that manages risk associated with these unique pathways.

2.2 PURPOSE

The purpose of this report is to document the results of the biosecurity review that was undertaken to identify high risk pathways onto Ascension Island and any high risk species associated with them. The report also recommends ways to manage these biosecurity threats, with the intent being to reduce the likelihood of further adverse impacts on Ascension Island's biodiversity (marine and terrestrial), livelihoods and/or public health.

2.3 SCOPE

This biosecurity review encompassed an assessment of the biosecurity risk profile of the entire Ascension Island personnel and supply chain continuum as well as reviewing any relevant legislation

and existing biosecurity capability on Island (Appendix 8). Biosecurity Assessment for Ascension Island, TOR 2015)

The biosecurity review was undertaken from 10 Feb 2016 to 26 March 2016 which allowed for a representative snapshot of routine sea and air importation events. Data from these events were collected to:

- identify the main biosecurity risk pathways
- assess the current and potential biosecurity capability on Island
- compare current practises with existing policy or legislation
- develop a plan on how to implement an appropriately resourced biosecurity system.

3 DESKTOP ASSESSMENT

The AIG has no single piece of legislation to conduct comprehensive biosecurity risk management across the biosecurity continuum from pre-border, border and post- border. Any US, UK or Cape Town based shipper has no obligation to perform any specific biosecurity risk management actions and the AIG is currently powerless to manage these risks. If this legislative gap is not resolved, in conjunction with a complimentary biosecurity resource, a constant flow of new organisms will continue to enter Ascension Island unabated, some of which will inevitably impact on the economy, biodiversity and public health.

Review of Existing Information

Relevant documentation relating to biosecurity measures for Ascension Island and the region were reviewed. The key documents included:

- Shine, C. (2009) Introduced species/Biosecurity legislative review for South Atlantic UKOTS. (Appendix 6)
- Ikin, B. (2009) SAIS Biosecurity Presentations and Report
- Biosecurity Policy (MOD) JSP 800, Vol 3- PT2-Leaflet 25 (Appendix 7)
- MOD Movements Biosecurity Certificate (Appendix 7)
- MOD BIO Security Requirements – Imports of Military Vehicles and Equipment (Appendix 9)
- AIG ordinances (as below)
- The United Kingdom Wood packaging material marking program.
- The Bahama's Agreement (1956) and US Final Governing Standards (2002).(Appendix 5)
- St Helena biosecurity policy and draft legislation
- Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species.

3.1 REGULATORY FRAMEWORK AND APPLICABLE LEGISLATION

Any effective and sustainable biosecurity system relies heavily on the legal power of its mandated officials to search and mitigate any biosecurity risk material on any given pathway and at any point along the biosecurity continuum from the border to post-border.

In some cases, countries/territories use Customs legislation as a platform from which to enact biosecurity risk management activities. In reviewing the AIG Customs Ordinance, Cap6 (2007), there is no such inclusion of biosecurity or quarantine powers and there is a strong emphasis on detection of prohibited items and the collection of customs duties and the associated powers of Customs officials.

Ascension Island Customs officials carrying out their duties on the front line are ideally positioned to identify biosecurity risk material or facilitate inspection activities by Biosecurity inspectors in the future, but currently have limited manpower and training to perform this function effectively.

A comprehensive review of Invasive species/Biosecurity legislation has been carried out previously (Shine 2009) which reviewed the following Ascension Island pre-border and border legal instruments:

- Customs legislation revised (2007)
- Dogs and Cats Ordinance (2000)

- Prohibited animals regulations (1967)
- Public Health Ordinance (1967)
- Control of Trade in Endangered Species Control Ordinance (2015)
- Entry Control Ordinance (1990) amended (2001)

No one of these documents places regulatory or policy controls over the introduction or management of all potential invasive species, although the Public Health Ordinance does give the Administrator the power to prevent the landing or importation of anything that is likely to introduce disease. Mosquito species that are known vectors of disease that could potentially be managed under this legislation but it would be a piecemeal approach to a wider issue.

Similarly, the Prohibited animals regulations (1967) does prohibit the importation of primates (Orders of Simiadae, Cepidae, and Lemuridae) and birds of the Order Psittaciformes in order to prevent the importation of disease. New categories of prohibited organisms could theoretically be added as amendments to this regulation, but it is difficult to manage the introduction of new organisms in a piecemeal manner using more than one piece of legislation.

The Dogs and Cats ordinance (2000) prohibits the keeping or importation of un-neutered cats and dogs and aims to prevent the colonisation of the Island with feral populations after the successful feral cat eradication. It does have significant biosecurity benefits but is species specific and does not contribute to wider biosecurity objectives, other than setting a precedent.

The Control of Trade in Endangered Species Control Ordinance (2015) controls the importation or export of endangered species managed under the CITES convention and has little overlap with biosecurity objectives.

3.2 OTHER INVASIVE SPECIES MANAGEMENT AGREEMENTS

The Bahamas agreement is a mutual agreement that was entered into force in 1959 to clarify US obligations whilst operating on Ascension Island for the extension of the Bahamas Long Range Proving Ground. One of the clauses reads:

> *The United States authorities shall afford protection to the fauna and flora of Ascension Island and the waters adjacent thereto and take steps to prohibit the introduction by members of the United States Forces, civilian employees of the United States, contractors of the United States or employees of United States contractors, of animal or vegetable organisms which are in the opinion of the Governor of St. Helena inimical to the growth and existence of living animals or plants or which are likely to become pests.*

This passage is again reflected in the more recent 2002 Final Governing Standards for Environmental Protection by United States Forces when operating on Ascension Island (see Appendix 5) where it states in section C13.3.9.1 that:

> *Installations shall take steps to prohibit the introduction of animal or vegetable organisms which are in the opinion of the Governor of St. Helena harmful to the growth and existence of living animal or plants or which are likely to become pests.*

These passages historically provided the basis to allow the AIG to effectively require the USAF to implement a range of biosecurity measures to prevent the introduction of invasive pests. For this to occur, a list of high risk biosecurity risk material, that the Governor considers detrimental to the Ascension Island terrestrial and marine environments, would need to have been formulated. This has not occurred and nor is it likely to occur, as it is considered unreasonable to require the US base

to perform biosecurity preventative measures that do not apply to the rest of the stakeholders on the Island. However, the intent behind the Bahamas Agreement clearly shows the willingness of the USAF to manage this risk and should new biosecurity legislation be enacted for all Island users, it would seem unreasonable for the USAF to oppose it.

4 PATHWAY RISK ANALYSIS

4.1 INTRODUCTION

Biosecurity risk material can enter a supply chain at any point and understanding the frequency, port of origin, and cargo type can provide useful context to assign relative risk to each commodity. Ascension Island does not have a history of intercept data for biosecurity risk material and only has a record of introduced species that have already established on the Island. Many of these species were deliberately introduced. Accordingly, the use of other intercept data or known pest or hitch hiker associations is the best way to assign risk to cargo types. The association can either be a biological association, for example scale insects on an orange, or it can be a hitch hiker association whereby the organism is simply on a piece of cargo at the time of shipping. A spider on the underside of a timber pallet is a good example. Inferences can also be made with respect to pest survival on any given pathway, based on voyage length and climatic variations between the port of origin versus the final destination port.

4.2 MAIN PATHWAYS CONTRIBUTING TO TERRESTRIAL BIOSECURITY RISK

Ocean vessels and aeroplanes are the two key forms of transport to Ascension Island that provide terrestrial biosecurity risks to Ascension Island. Table 1 below provides a summary description of the potential terrestrial biosecurity risk routes for Ascension Island.

Table 1. Key pathways and volumes that carry potential terrestrial biosecurity risks (2015 estimates)

	Carrier	Point of origin	Description	Frequency per annum	Stats/trip	Biosecurity risk Pathways
Air	US Airforce[1]	Jacksonville, Florida, USA	Passengers and cargo	Information not available	Information not available	Baggage
	RAF (UK) Airtanker[2]	Marchwood (UK) and Falkland Islands (UKOT)	Passengers and cargo	104 flights	Approx 42 pax/flight disembark	Baggage
Vessels freight	RMS St Helena[3]	Cape Town via St Helena	Passengers, military and commercial cargo	15 voyages	6 GPs 80 pax	Containers, packaging, cargo, pax
	FIRS[3]	Marchwood Naval Base, Southampton, UK	Military and commercial cargo	10 voyages	28 GPs 6 Chilled 3 Frozen	Containers, packaging, vehicles
	USAF contracted cargo vessels[3]	Port Canaveral (Florida, USA)	Military and contractor cargo	4 voyages	53 GPs	Containers, packaging, cargo
	Cruise ships[4]	Varied	Passengers	7 voyages	164/vessel	Pax
	Yachts[4]	Varied	Crew	47 yachts	Information not available	Nil terrestrial risk

Footnotes: [1] Information unavailable; [2] Information provided by RAF; [3] Information provided by AIG Customs; Note that schedule for this vessel will change to six voyages/annum. [4] Information provided by AIG Port

4.3 AIR CRAFT / AIR FREIGHT

There are currently only three known air pathways to Ascension Island, MOD RAF flights from Brize Norton and Falklands and USAF flights from Florida, although these are soon to be joined by a monthly passenger/freight service operating between Johannesburg, South Africa and Ascension via the new airport in St Helena.

4.3.1 RAF Air Bridge

Background

The MOD uses Ascension Island as a stop-over location enroute to the Falklands. They allow a proportion of seats and freight space to be used by civilian and commercial shippers. MOD aircraft are maintained and operated by the contractor Air Tanker. Freight is prepared and consolidated at Brize Norton before being shipped to Ascension Island. On the10th February 2016 Biofume visited the pre-border freight consolidation facility at Brize Norton RAF base and was taken on a tour of cargo preparation facilities by Flight Sergeant Gary Jenkin. MOD Movers do not generally clean or decontaminate freight as the responsibility for this lies with the consignor. A "Movements Biosecurity certificate" (see Appendix 7) is provided with all the prepared cargo and is checked off by MOD Movers for compliance. If non-compliant the freight is returned to the consignor for remediation before being re-presented for shipping. Warehouse facilities were generally clean and well maintained although one warehouse showed a slight build-up of accumulated leaves and dust suggesting that house-keeping could be improved.

Origin and schedule

The RAF conducts two flights per week to Ascension Island en route to the Falkland Islands from Brize Norton. 209 flights arrived in onto Ascension in the 2015 calendar year with approximately half arriving from Brize Norton and the other half from the Falklands. One of the 209 flights was logged as originating from Cape Town which was likely a Medevac flight. Table 2 below shows the annual total for passengers and goods unloaded onto Ascension Island. No information was available on cargo types.

Table 2. Ministry of Defence RAF flight statistics for 2015

Passengers disembarking onto Ascension	Baggage unloaded (kg)	Air freight unloaded (kg)	Food unloaded (kg)	Mail unloaded (kg)
4,368	125,750	120,345	50,766	12,757

Passenger (Ascension Island Personnel and Tourists)

The MOD transports up to 290 pax/flight from Brize Norton to Ascension Island. RAF personnel rotate through the base every 4-6 months. A total of 4368 passengers disembarked at Ascension Island during 2015. Approximately 10-15 seats on these flights are allocated to civilians on any given flight.

Baggage

The 125.8 tons of baggage presents some risk in terms of commensal invertebrates inadvertently hitching a ride in niches on baggage, but due to the predominantly commensal nature of these

organisms, the impacts are generally low across biodiversity, livelihoods and human health sectors. For example, Bed bugs (*Cimex lectularius*) are likely to be the highest risk organism from a human health perspective due to the large numbers of bites they can inflict on people and the difficulty associated with effective control and chemical resistance.

Freight

Despite the significant cargo volumes being airfreighted (120t), the type of cargo is likely to be of higher value (newer items) which intrinsically have lower biosecurity risk as they tend to be stored in locations that ensure their preservation and minimise the likelihood of the cargo accumulating biosecurity risk material. Additionally, the cold climate invasive species established in both points of origin (Brize Norton and the Falklands) are also less likely to be an issue on Ascension Island, in terms of a suitable climate match and their ability to establish.

All freight destined for Ascension Island via the RAF Air Bridge must be made Biosecurity Compliant (as per leaflet 25; see Appendix 7) by approved contractors before they transport goods to Brize-Norton for air freighting to Ascension Island. The biosecurity responsibility rests with the consignor and if gross biosecurity contamination is observed by MOD Movers, it is shipped back to the consignor for remediation. It is unclear how robust the MOD Movers inspection for biosecurity material is or what thresholds trigger freight rejection and whether these thresholds align with AIG objectives. Additionally, RJI currently ship about two consignments per month via MOD air craft to Ascension Island. This cargo is not processed according to leaflet 25.

Food

An unknown proportion of the 50.8t of food tends to be perishable food, which based on the Snapshot of biosecurity (Below), is quickly moved into the confines of the kitchen and cold store facilities. The continued and confined cold storage, cooking or consumption and the lack of an agricultural or horticultural industry on Ascension Island results in a low risk being presented from this cargo. Additionally, a significant proportion of this food is likely to have originated from the UK (cool climate) or from the Falklands implying that any pests associated with that produce will have a lower intrinsic risk of establishing on Ascension Island. Only highly phytophagous pests have potential to escape into the wider Ascension Island environment and cause impacts, but the likelihood of this happening is negligible as they would have to survive the cold storage, consumption and or cooking process.

Notwithstanding that, any imported fresh produce from warmer climates does pose a different risk. For example, grapes imported into New Zealand from the US have a higher risk of Brown widow spiders (*Latrodectus spp*) being found within the grape bunches (MOH 2002). Recent border intercept data from Biosecurity St Helena supports this association with a live Brown widow spider detection (18th March 2016) in imported Globe grapes.

Countering these arguments is the short flight time from either destination making surviving the journey more likely. When you combine these factors along with Leaflet 25's biosecurity requirements supported by the findings in the MOD Case Study, it appears this pathway is a relatively low risk for Ascension Island.

Mail

Mail is generally a low risk cargo type, so long as the mail item itself is not a risk good. For example, seeds of a plant not yet recorded on Ascension Island may have the potential to be weedy species and escape into the wild. The packaging, boxes and bags associated with mail are all low risk.

Proposed biosecurity legislation should manage the risk associated with intentional importation of risk organisms.

Existing MOD air pathway biosecurity measures

Military personnel are required (under MOD leaflet 25), to wash their clothing and equipment/baggage before departure from the UK and they are prohibited from moving animals or plants with them. No-one at the Brize Norton or Ascension Island air terminals checks compliance of this.

There are currently no AIG biosecurity requirements for people visiting or living on the island. No legislation is in place requiring any biosecurity compliance by passengers and, as such, there are no biosecurity reporting requirements on declaration cards to allow any official risk assessment of potential biosecurity risk material. AIG Customs inspection of baggage was recently implemented on some flights upon arrival at Ascension Island and is focussed on detection of drugs or goods with dutiable value – not biosecurity risk material. There are currently no restrictions on bringing seeds, plants, cuttings, bulbs, pet fish, vertebrates or invertebrates to Ascension Island, except those stipulated in the Prohibited Animals Regulation (1967) and Dogs and Cats Ordinance (2000).

Snapshot of biosecurity risk

Ascension Island Customs (Catherine Leo) and Biofume observed the unloading of airfreight (25th February 2016) at the Air Head, accompanied by Warrant Officer Vivian Neary-Phillips. The shipment consisted of fresh produce and tyres. The Unit Loading Device (ULD) containing both consignments was clean, the fresh produce was encased inside a brand new cardboard crate sitting on a new and clean plastic pallet, and the wrapped new tyres were on a new and clean ISPM15 compliant timber pallet. This air freight is temporarily stored in a warehouse adjacent to arrivals and departures area before being distributed to its end point. Eg the fresh produce moves quickly to the kitchens for storage and consumption. Inbound or outbound cargo is clearly segregated according to its destination. The storage warehouse was spotlessly clean with no signs of dirt, weeds or pests. Additionally, a recently unloaded Unit Load Device AKE air can was also examined for build-up of biosecurity risk material with minor amounts or detritus observed in the corners on the floor. All the air cans observed were in excellent overall condition with no dents or holes in the aluminium skin. Although these observations are based on a very small sample, they did appear to align with biosecurity requirement as set out in Leaflet 25.

4.3.2 USAF Air Bridge

Background

The USAF has a long history on Ascension and brings both personnel and freight to Ascension Island. Personnel are rotated through the base and are currently bypassing Ascension Island Government customs and immigration checks which complicate enforcement of proposed biosecurity regulations. Currently both the USAF air and sea pathways are unmanaged from a AIG regulatory perspective and this exposes the AIG and Ascension Island to significant customs and biosecurity risk. In order that everyone on Ascension Island is treated fairly with respect to their customs and biosecurity responsibilities, it is vitally important this inconsistency is resolved as soon as possible. Freight originates primarily from Patrick Air Force Base in Jacksonville,Florida but this can vary. Details on freight types, frequency and origin of flights and passengers numbers were not available.

Detailed flight data from the USAF was not available for assessment, however, point of origin analysis identifies that the mild winters and hot summers in Jacksonville provide a greater climatic match

with Ascension Island and implies a greater contamination risk and establishment risk of any organisms entering via this pathway. Flight times are likely to be similar to those from the RAF Brize Norton so this is unlikely to change or reduce the risk any further. Documentation on any pre-border biosecurity risk reduction policies or processes were not available. In the absence of this information and taking these factors into account it is considered the risk of the airfreight/aircraft pathway from the US is considered Medium.

Baggage

Assuming that the USAF model for personnel turnover is similar to that of the MOD, then a broadly similar biosecurity risk can be attributed to personnel baggage with respect to hitch hiker commensal pests. However, the warmer climate associated with the port of origin implies a higher likelihood of contamination via invertebrates and a higher establishment rate due to the greater degree of climatic similarity between Jacksonville and Ascension Island and therefore present a slightly higher risk than similar baggage from the UK.

Freight/spares

If it is assumed the freight/spares re-supply model is similar to that of the MOD, then a similarly low risk can be assigned to high value air freight. The unknown factor in the USAF model is the condition and cleanliness of the air cans, which are a potential vector for another suite of hitchhiker pests. Air cans are frequently stored on the ground outside and are exposed to contamination from invertebrates like ants and spiders. The warmer climate associated with the port of origin implies a higher likelihood of contamination via invertebrates and a higher establishment rate due to the greater degree of climatic similarity between Jacksonville and Ascension Island and therefore present a higher risk than similar air cans from the UK.

Food

If it is assumed the food resupply mechanisms are similar to that of the MOD, then a similarly low risk can assigned to the value of air freight.

Existing USAF air pathway biosecurity measures

There are no AIG restrictions on the material passengers can bring on to the Island from a biosecurity perspective via this pathway, and based on available information, and unlike the MOD, there are no USAF biosecurity restrictions on what USAF personnel can bring to the Island. Clearly, this situation must be addressed as a priority.

4.4 MARINE VESSELS

Five categories of vessels visit Ascension Island. These include:

- military ships
- commercial cargo ships
- yachts
- cruise ships
- adhoc visitors.

Biosecurity risk on a vessel can be broken down into three separate areas:

1. The vessel cargo (including shipping containers, pallets and packaging).

2. The vessel topside (deck areas) and the vessels wet sides (hull).
3. Wet sides (see Section 4.5.1).

4.4.1 RMS ST HELENA

Origin and schedule The commercial cargo/passenger vessel, the RMS St Helena (RMS,) operates from Cape Town. The RMS transports cargo first to St Helena and then on to Ascension Island (2765 miles) before reversing the route and is operated by Andrew Weir Ship Management Ltd. (AWSML).It conducts this voyage 15 times per year. Given the short distance (timeframe) between St Helena and Ascension (approx. 810miles), there exists a significant risk pathway for invasive species not present on Ascension Island and vice versa. This vessel is soon to be retired and to be replaced (late 2016) by another purpose-built vessel with a reduced schedule of one visit per two months to Ascension Island.

Consignees

Freight is imported by:

- RJI
- Private consignees
- Obsidian Hotel
- Solomon's shop[1] and fuel station
- AIG
- Two boats club
- Post Office

[1]Note: Solomon's shop is to be replaced by Seafish Chandlery with supplies probably originating from the UK.

Devanning location

Devanning of RMS St Helena containerised freight occurs anywhere on the Island where the consignors receive the cargo. Devanning occurs as close as practicable to the consignee's facility/house. Vehicles and some break bulk freight are stored in the Pier Head Warehouse.

Freight types

The RMS carries animals, fresh produce, vehicles, break bulk and containerised cargo as well as passengers. It arrives on a monthly basis (approximately) and is a life line to the Islanders who rely heavily on the vessel for cargo and a connection back to family and friends on St Helena.

Vehicles imported or transhipped via the RMS are cleaned and come with a cleaning certificate. The cleaning standard varies from vehicle to vehicle and the quality of some vehicles, particularly 4x4's, undermines this attempt at managing the risk associated with soil. Manifest reports provided by the Ascension Island port indicate that only ten vehicles were actually imported onto Ascension Island during 2015. A much larger proportion of vehicles (60) are trans-shipped to St Helena. These vehicles are stored at the Ascension Island Port Warehouse awaiting the next transfer vessel. Any live invertebrate or vertebrate risk material on these vehicles has the potential to cross contaminate the warehouse.

A total of 70 GP containers (approximately) were also landed during 2015 off the RMS, along with 27 chilled and 19 frozen Reefers. The predominant biosecurity risk with the containers is associated with the GP containers and their associated wooden packaging, although there were six containers of wooden fence panelling. Fence panelling is imported infrequently each year and carries some risk of wood boring pests associated with these panels. The dry containers themselves are rarely considered as a biosecurity risk and tend to be either not cleaned or cleaned poorly and then stored in such a way that re-contamination of cargo occurs. The only risk associated with the frozen reefers is with the exterior of the container, and the risk with the chilled containers is associated with the exterior and any cold tolerant pests on fruit and vegetables. These are generally considered to be a low risk due to a lack of a horticulture industry on Ascension Island.

There were approximately 23 consignments (volume unknown) of household effects and baggage unloaded from the RMS St Helena. Typically, commensal pests can be associated with such cargo and there is some possibility of invasive ants, spiders, cockroaches, bed bugs or seeds that could be interspersed with this cargo. These commensal pests usually present a low biosecurity risk as their impacts are generally low and limited to the built environment.

Break bulk consignments (volume unknown) also featured in cargo offloaded from the RMS and accounted for approximately 18 consignments, two of which contained compost. Compost and other growing media, if not commercially prepared under controlled conditions, can potentially be a vector for seeds, invertebrates and fungal diseases.

Passengers

Significant numbers of St Helena people arrive to Ascension via the RMS St Helena. In 2015 approximately 1200 people disembarked onto Ascension off the RMS. These are generally St Helena people returning to Ascension Island for work, but there are visiting tourists too. Information on the number of each was not available.

Existing Biosecurity policy

The only apparent biosecurity processes in place for importing freight onto Ascension Island via the RMS St Helena was the washing of vehicles as evidenced by their cleanliness and the cleaning declaration attached to each vehicle. Additionally, the checking of dogs and cats being imported occurs to ensure they are identified, registered and females neutered.

Existing Biosecurity actions on Island

Containers are craned off the RMS vessels onto waiting barges which are then moved to the wharf-side for craning the cargo to a waiting forklift or truck trailer. No formal biosecurity inspections occur at any point during this unloading process. Irrespective of the de-vanning location, no formal biosecurity inspections or measures are in place during the unloading or de-vanning process. In an attempt to better qualify the risk profile from this pathway, Biofume was tasked with sampling some freight being unloaded from vessels that were discharging cargo during Biofume's stay on the island.

Snapshot of Biosecurity risk

On the 23rd February 2016 AIG Customs and Conservation Department staff members accompanied Biofume while conducting exterior and interior inspections of the five 20ft containers and their contents, off the RMS St Helena Voyage 222. Barge stands were positioned at the Pier Head and were used to support the containers to enable underside inspections. The top twist lock pockets and the tops of the containers were generally not accessible. Biosecurity risk material (Appendix 2) was observed/collected from the underside and interiors of containers or cargo.

All three reefer containers shipped from Cape Town on the RMS St Helena were inspected. Overall, these containers were generally clean inside and out, and showed minimal contamination levels. Conversely the two GP containers inspected showed high levels of interior contamination, partially as a result of the contaminated pallets that were loaded into them, but also due to what appears to be inadequate container cleaning at the point of departure. In addition, the Andrew Weir Shipping (AWS 1961769) container was in poor condition, which enhances the likelihood of contamination. This container had a live millipede inside crawling around in the inside corner of the container (Figure 1) .

Figure 1. Accumulation of detritus, location of millipede and very old door seals

The freight that was de-vanned from the GPs into the Pier Head Warehouse was generally free of biosecurity risk material except for a pallet of UHT milk that was infested with what appeared to be *Drosophila* flies. The majority of pallets on which cargo was loaded showed signs of poor storage and inadequate cleaning, with most having spiders and webbing attached to the underside and one pallet having many dead *Pheidole* sp. ants attached to the timber.

A small sample of the fresh fruit and vegetable produce that was shipped in the reefers was sampled in the Solomon's cold storage facility after it had been brought up from the Pier Head. The produce appeared to be of high quality and of the 30 pieces of produce (apples, pears, grapes and tomatoes) examined, no live pests were detected. Numerous dead mites were detected on citrus and apples. It should be noted that a previously unloaded proportion of these consignments (sharing the container) is imported into St Helena under strict Import Health Standards and inspected by St Helena biosecurity staff. Phytosanitary certificates are issued in Cape Town and only exported once it has demonstrated that it has met St Helena import requirements. Ascension Island is therefore most likely benefitting from the implementation of the biosecurity system at St Helena, at least around the fresh produce pathways where import health standards exist.

Establishing a formalised intercept data exchange between St Helena and Ascension would provide a good opportunity to risk profile the organisms intercepted by Biosecurity St Helena which is likely to benefit the hydroponics facility.

Table 3. RMS St Helena freight contamination rates

23/2/16	RMS St Helena							
Cargo type	**Shipped**	**Inspected**	**Live QRM%**	**Spiders%**	**Molluscs%**	**Ants%**	**Other inverts%**	**Seeds%**
GPs	5	2	100	100	100	0		50
Vehicles	4	0	-	-	-	-	-	-
Break bulk	7	3		-	0	0	33	
Refrigerated containers	4	3	0	0	0	0		33
Fresh produce	Multiple lines	30 pieces	0	0	0	0	0	0

Table notes: (-) denotes that the cargo type was not inspected, (0) denotes that cargo type was inspected but no contaminants detected.

Based on this random shipment from Cape Town, albeit very small, it is apparent that the biosecurity pathway via containerised freight, particularly dry GPs, is largely unmanaged. There currently exists a high propensity for the introduction of hitch hiker organisms from Cape Town loading facilities or other freight consolidation and loading points, except perhaps pests associated with fresh produce. Much of the live contamination observed is likely to have originated from the second hand pallets used for the loading of the cargo and the inadequate container cleaning.

4.4.2 MOD MILITARY VESSELS

Origin and schedule

The MOD vessels collectively referred to as the FIRS (Falkland Island Resupply Service) carry a combination of military, AIG and small quantities of commercial cargo. All of this freight is shipped out from the Marchwood Naval Base, Southampton (UK) on one of five FIRS vessels. According to Customs data, there were nine FIRS vessel shipments to Ascension Island from Marchwood and one vessel from the Falklands during the 2015 calendar year.

Pre-border commercial freight forwarder

A proportion of the UK originating commercial cargo is consolidated and forwarded by Richard James International (RJI) and is carried on MOD FIRS vessels at their pleasure and averages about 8x20ft GPs per voyage.

Biofume visited the pre-border facility at Avonmouth, Bristol (UK) on 9/2/16 to discuss the movement of freight and assess general biosecurity risk associated with RJI's processes and site. A biosecurity declaration (Appendix 10) is provided by RJI to the consignor for their signature and RJI state that they inspect cargo to ensure it is free from biosecurity risk material. It is unclear as to what degree of effort goes into this inspection. There is no direct treatment of Ascension Island cargo/shipping containers or preventative measures taken to prevent contamination prior to shipment except that RJI does contract Rentokil to conduct rodent baiting in the warehouse, but that is the extent of pest control at their facility. They contract Titan to supply clean, functional shipping containers. The cargo that is shipped from RJI can come from anywhere in the world and can be anything, except live animals, fresh produce and nursery stock.

The RJI yard, where containers are stored prior to and during loading, appeared cramped with various piles of refuse and old pallets scattered around, potentially providing habitat for hitch hiker species. Their yard is surrounded by other industrial facilities with significant *Asteraceae* weed populations, potentially providing a source of parachute seed contamination. At the time of the visit the RJI yard was surprisingly sterile from an invertebrate perspective, due most likely, to the wintery conditions. The warehouse appears cramped with potential little apparent segregation of goods due to a Falkland Island shipment being packed.

Consignees

The small quantities of commercial cargo carried on the FIRS vessels are mainly shipped by Richard James International, Solomon's Shop and at times by various private consignees. See below list of consignees:

- AIG
- Ex Watchkeeper (ARMY)
- Interserve Defence
- NAAFI
- RAF Ration stores
- RAF Supply
- RJI
- Solomon's Shop and various consignees or any other current MOD sub-contractor facility.

Devanning location

MOD and commercial containerised or break-bulk cargo is unloaded from the FIRS by crane and transferred to barges waiting alongside at sea. The barges then steam into the Pier Head where the majority of the cargo is then craned off directly onto waiting trailers and moved directly to destinations around the Island. This can be at any of the consignee locations listed above.

De-vanning occurs at these respective facilities, often on the ground outside the warehouse/storage facilities. Customs attend the de-vanning process or parts thereof. No biosecurity inspection occurs during this process at any location. No MOD manifest data was provided to Biofume so a limited breakdown of military cargo types was conducted. A detailed list of biosecurity inspections of containers from FIRS MOD is contained in Appendix 3.

Freight types

In 2015, approximately 252 dry 20ft GPs, 52 chilled and 30 frozen reefers were unloaded onto Ascension Island from MOD vessels The GP container risk is similar to that discussed for the RMS St Helena above (Section 4.4.1) and this applies to MOD containers as well. Of the 252GP containers, 31 contained foodstuffs and this presents some minimal risk associated with stored product pests. Additionally, there were 5 consignments of personal effects and baggage and the risk of commensal pests associated with these has been previously discussed (Section 4.4.1) and is considered low.

There were 120 consignments (volume data not available) of break bulk and 137 vehicles unloaded from MOD vessels. Cargo manifests were not available so detail on each consignment is lacking but any wooden packaging associated with break bulk potentially presents a higher risk for wood boring pests, hitch hiking invertebrates and seeds. If the break bulk is of UK origin, the biosecurity risk can be considered relatively low, due primarily to a poor climatic match. If from other locations, the cleaning that occurs in line with Leaflet 25, should reduce biosecurity risk to moderate. Inspection

results of MOD shipped freight suggests that this is not occurring consistently or to a standard acceptable for optimal biosecurity risk management.(See Appendix 3)

The vehicles (either second hand or new) that are bound for Ascension Island are checked for road compliance and driven out of the port shortly after unloading. Vehicles that are being transhipped to St Helena are checked for road compliance and stored in the Pier Head Warehouse prior to re-shipping on the RMS St Helena to St Helena. No biosecurity inspection occurs prior to release or transhipment of these vehicles. A Customs narcotics dog inspection does occur. The MOD Snapshot of biosecurity risk demonstrates that the vehicles are commonly contaminated with spiders and some other invertebrates.

Existing Biosecurity policy

For the MOD freight there are clear and comprehensive biosecurity requirements (JSP 800, Vol 3 –Pt 2- Leaflet 25) for the movement of defence vehicles, equipment, clothing and personnel into and out of the UK.

> *All vehicles, equipment and CTU are to be thoroughly cleaned prior to movement across National and International borders, where possible this should be undertaken by the use of pressure or steam washer. The MOD does not have any exemptions from legislation or regulation to comply with Biosecurity policy.*

This policy does not apply to non-MOD cargo. Although policy seems to provide a solid biosecurity platform to manage risks via this pathway there appears to be an inconsistent approach to its implementation based on intercept data associated with this cargo. (See Snapshot of biosecurity risk below)

Existing Biosecurity actions on Island

Containers are craned off the FIRS vessels onto waiting barges which are then moved to the wharf-side for craning the cargo to a waiting forklift or truck trailer. No formal biosecurity inspections occur at any point during this unloading process. Irrespective of the de-vanning location, no formal biosecurity inspections or measures are in place during the unloading or de-vanning process.

Snapshot of biosecurity risk

On the 25/2/16 the FIRS vessel MV HURST POINT arrived and started discharging cargo consisting of 30 containers, 31 vehicles and 8 consignments of break bulk cargo. Biofume inspected as many of the container exteriors as operationally achievable at the Pier Head using barge stands to inspect the undersides and bottom twist locks. The interior of containers were inspected as they became available at consignees premises. Vehicles and break bulk were inspected in the Pier Head warehouse. The results of these inspections are detailed in Appendix 3. FIRS cargo inspection results and summarised in Table 4 below.

Of the 30 GP containers shipped from Marchwood, 13 container exteriors were sampled. Six (46%) of those had live invertebrate contamination present, consisting of spiders and snails. Seven container interiors were inspected and five (71%) of these had live contamination. One RJI container had 11 parachute seeds on the floor.

Of the 31 vehicles (to be transhipped to St Helena), eight were sampled and four (50%) had live spiders, mainly associated with side mirror and front door cavities. Although cleaning had clearly occurred, the cleaning standard was variable across the vehicles sampled, with two of the vehicles (4WDs) showing mud on the underside and in cavities associated with the hollow sub-frame chassis.

The interiors were generally clean and any contamination present here did not pose any biosecurity risk.

Of the 115 bulk bags of aggregate (100) and shingle (15), 50 and 10 were inspected respectively. The bulk bags were new and clean, and appeared to have been very recently filled. The shingle/aggregate was visually clean with no apparent organic matter, except for two recently uprooted grass seedlings in one bag of shingle. The seed loading in the shingle could not be determined due to the high sand content. There was some surface crusting of the sand/soil on approximately 15% of the bags of shingle, associated with having been wet.

Table 4. MV Hurst Point freight contamination rates

25/2/16	MV Hurst Point						
Cargo type	**Shipped**	**Inspected**	**Live QRM%**	**Spiders%**	**Molluscs%**	**Ants%**	**Seeds%**
GPs	22	15	60	40	13	0	20
Vehicles	31	8	50	50	0	0	12
Refrigerated containers	8	3	0	0	0	0	0
Breakbulk	115	60	1.7	0	0	0	1.7

Table notes: (-) denotes that the cargo type was not inspected, (0) denotes that cargo type was inspected but no contaminants detected.

Overall, the containers on the FIRS vessel had poor hygiene, with a build-up of detritus on the floor in the flutes of the side wall corrugations and some rubbish left on the floors. This indicates that only rudimentary floor sweeping occurs, thus allowing this built-up detritus. Much of the detritus material itself is of no biosecurity concern but it can provide food and shelter for invertebrates. It is highly likely that many of the organisms intercepted with the FIRS shipment of containers have arrived on Ascension Island previously. It is possible that some more adaptable commensal species have already established but it is more likely that many organisms have been unable to establish due to the unfavourable climate and lack of suitable habitat. For these reasons the existing risk to public health, biodiversity and peoples' livelihoods appears low but the intercept rate clearly indicates that the sea freight pathway from Marchwood can be managed a lot better.

4.4.3 USAF MILITARY VESSELS

Origin and schedule

According to data provided by the Ascension Island port, USAF freighters arrived four times in the 2015 calendar year and originated from St Johns, Antigua and Cape Canaveral, Florida, USA. The Antigua shipments have ceased as the military base in Antigua has been decommissioned. Information regarding any other ports of origin was not available. The vessels used are commercial freight carriers that are contracted to carry USAF freight and so probably present a higher top side contamination risk than a dedicated military vessel might as they would have carried non-USAF freight destined for other locations.

Consignees

A list of consignees was not available but it is assumed that the USAF and any contractors operating at the time will be the recipients of the cargo.

Devanning location

Containerised GP freight is commonly de-vanned behind the Volcano Club in a lay-down area. Refrigerated freight goes straight to their respective de-vanning locations which is dependent on the contents of the refrigerated container. For example fresh produce will go straight to the kitchen refrigeration facilities.

Freight types

Information regarding freight types was not available.

Existing biosecurity policy

Information regarding existing USAF biosecurity policy was not available except for a statement provided to Biofume,

"Foodstuffs meet USDA requirements. Washing soil and seeds from heavy equipment is a requirement. Everything is inspected prior to being placed in seavans, especially construction pipe and wood."

Existing biosecurity actions on Island

Containers are craned off the USAF vessels onto waiting barges which are then moved to the wharf-side for craning the cargo to a waiting truck trailer. No formal biosecurity inspections occur at any point during this unloading process. Irrespective of the de-vanning location, no formal biosecurity inspections or measures are in place during the unloading or de-vanning process.

Snapshot of biosecurity risk

On the 4th March 2016 the charter vessel MV Corsica arrived carrying the USAF freight from Port Canaveral. It took 25 days to get to Ascension and stopped at Guantanamo Bay en-route. Unloading of the vessel started at Ascension Island on the 6th March and cargo was trucked to the Volcano club lay down yard. It was here Biofume, with help from Conservation Department staff, conducted container/flat-rack under side inspections using the barge stands from the Pier Head. Approximately every second container/ flat rack was inspected to ensure no delays in truck movements occurred. Container internals were inspected opportunistically as they were de-vaned over the coming days. Appendix 4 details the location and type of contamination detected during this exercise.

Significant levels of soil, organic matter and live invertebrates and reptiles were detected. Of particular note were the four flat racks and one GP that had live ant nests associated with them (Table 7 in Section 5 summarises contamination data) which clearly highlights the contamination risk associated with this cargo.

Of the 50 containers discharged from the MV Corsica, 28 were inspected. Of those inspected, 14 (50%) were found to have live invertebrates. One container had two *Hemidactylus* geckos, one of which was alive. Another container was found with five dead frogs on the floor. The live invertebrate figure is likely to be conservative as the viability of the praying mantid egg rafts, case moth pupae, snails and a large number of uncollected spider eggs sacs were not able to be determined. Likewise, viability of seeds was not established.

Table 5. MV Corsica freight contamination rates

4/3/16	MV Corsica							
	Shipped	Inspected	Total QRM%	Live QRM%	Live Spiders%	Live Molluscs%	Live Ants%	Seeds%
GPs	50	28	71	50	39	0	3	0
Flatracks	5	5	75	75	0	0	80	0
Break bulk	6	6	66	50	0	50	0	0
Refrigerated containers	5	0	-	-	-	-	-	-

Table notes: (-) denotes that the cargo type was not inspected, (0) denotes that cargo type was inspected but no contaminants detected.

From inspection results, it appears that a significant proportion (28%) of the examined containers and flat racks had been partly immersed in fresh water at some previous common storage location. The presence of a 'high tide mark' was clearly evident from the presence of organic material left behind when the water levels dropped. See Figure 2.

Additionally, snails were more common on the containers with 'high tide marks', possibly indicating the snails were looking for a dry refuge out of the rising water. Additionally, mosquitoes lay their eggs at or near the water level on solid substrates and eggs of species like *Aedes aegypti* may have been present on these containers. One container exhibited a 'high tide mark' above the floor inside the container. It appeared that most of the containers/flat-racks affected by the flooding had been cleaned to varying degrees prior to the flooding event which had subsequently caused much of the contamination observed

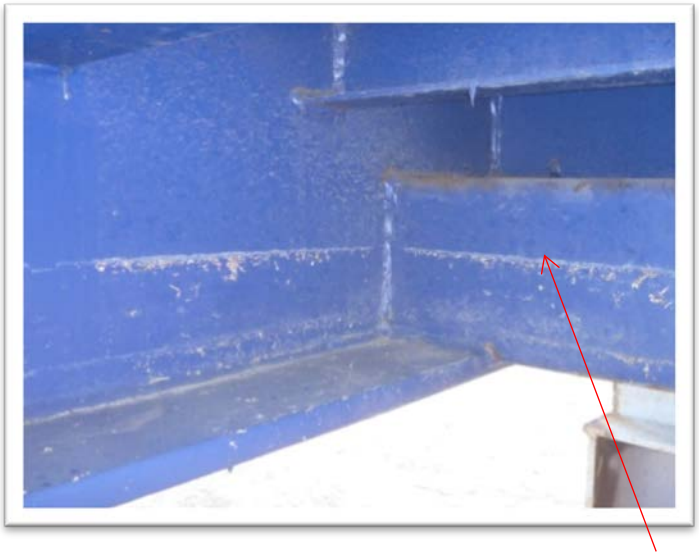

Figure 2. Evidence of organic material from water high tide mark

Six of the containers showed evidence of galleries made from sand and organic material left behind by ants, and this suggests that the flatracks were stored in an area inhabited by tramp-ants (Figure 3).

Figure 3. Evidence of ant galleries

Of note were the four flat racks affected by ant colonies. Based on the inspection results of the underside of the flat racks, it appeared they had been cleaned well, notwithstanding the subsequent high tidemark. It was apparent from soil and grass on the floor of the flat rack and the lower portion of the (non- ISPM15) pallet used to cradle the cargo, that the pallets/cargo had been stored on white sand and grass before being lifted directly onto the flat racks, transferring the sand, grass and the ant nests with them (Figure 4).

Figure 4. Sand, grass and ant nests as evidence of inadequate cargo storage and inspection prior to loading cargo on to the flatrack

The ants could not be identified at the time of the survey so a precautionary approach was taken to ensure they did not escape into the wider Ascension Island environment.

The ant affected flat-racks were immediately isolated into the inhospitable centre of the Volcano Club lay-down yard, away from other cargo and any nearby favourable ant habitat. The USAF pest controller applied a 1m band spray of cypermethrin around the affected assets for safe storage overnight. The following day, each affected pallet was carefully separated from the unaffected cargo and flat racks, encased in plastic and transferred by truck to the USAF incinerator for burning. This was a useful exercise as a first response scenario and effectively dealt with the affected material. The container with the ant nest in the floor could not be treated in the same manner and consequently remains onsite untreated. Fumigation under a tarpaulin or heat treatment would be the only truly effective treatment for the affected container.

With current levels of sand, dried mud, organic material and invertebrate contamination on the exterior of the containers/flat racks, the journey from the Pier Head to the lay-down yard poses an increased risk that some of the biosecurity risk material will fall off on the journey to the yard. It is possible new organisms have already established along the road and at the lay-down yard. Structured surveillance is the only way AIG can determine if this has already occurred and should be conducted as a high priority. In future all freight should be inspected before it leaves the AIG pier-head.

4.4.4 CRUISE VESSELS

Customs data showed seven dedicated cruise ships visited Ascension Island during the 2015 calendar year. No freight is off-loaded but passengers disembark and occasionally stay overnight on Ascension Island. In 2015, 1151 passengers disembarked their various respective cruise vessels onto the Island. If passengers off the multipurpose RMS St Helena were included, then the total number increases to 2346 passengers disembarking. Records of passengers staying overnight were not available. The last port of call for the cruise vessels were Jamestown, St Helena; Praia, Cape Verde and Banjul, Gambia. Unless there are widespread unmanaged infestations of commensal pests on the vessel that are contaminating passengers cabins and personal effects, the risk of transferring new terrestrial organisms to the island is considered very low. This risk increases slightly if they stayed ashore overnight. Those 1195 passengers that disembarked off the RMS St Helena pose a higher risk, as both unintentional commensal hitch hiker species and intentional introductions of plants, cuttings and or seeds can currently be introduced via the St Helena cruise pathway.

There is no visibility on the degree of biofouling or ballast water management for these vessels but they are expected to comply with the International Maritime Organisation Ballast Water Agreement. Biofouling is likely to vary depending on the age and type of antifouling used. No cruise vessels visited Ascension Island during Biofume's visit.

4.4.5 YACHTS

During the 2015 calendar year, 47 yachts visited Ascension Island and 89% of those had arrived after visiting St Helena, with 4% from Cape Town, with just 2%each from other locations such as Rio De Janeiro, St Georgia and Walvis Bay. The majority of the yachts (83%) stayed less than five days, the remaining vessels less than 10 days, with the exception of one which stayed 15 days. Most yachts stop at Ascension Island to take on provisions in which case the likelihood of terrestrial hitch hiker organisms leaving the vessel is considered low, with a greater risk of them being taken on-board their own yachts with provisions from Ascension Island. The short stays present a low risk to Ascension Island from terrestrial pests.

There are no records of yacht biofouling or previous hull anti-fouling applications.

Snapshot of marine biosecurity risk

A dive, conducted by Conservation Department staff member Dr Andrew Richardson, was carried out on two yachts, a monohull and catamaran that were in the Ascension Island harbour during Biofume's visit. Video footage of the hulls was captured and stills taken. Strong currents made filming difficult. Based on this footage Biofouling Solutions viewed the images on both vessels and it appears the general hulls have been in-water cleaned at some stage, although niche areas appear to have been neglected. As a result there appears to be some secondary levels of biofouling (e.g. encrusting bryozoans, acorn barnacles, tubeworms, spirorbids, amphipod tubes, etc) around the skeg, and prop shaft. Generally, such level of biofouling does not pose a significant biosecurity risk (Pers. Comm. Dr A. Coutts). That said, this is clearly a very small sample and other yachts could carry higher risk organisms.

4.4.6 AD HOC VESSEL VISITS

During the course of the consultancy, the anchor handling vessel, the MV Skandi Admiral, was towing a large pipe laying platform that had been towed from Curacao (Southern Caribbean) enroute to Aland, India. It was visiting to conduct a crew change and to pick up provisions. Some AIG officials were unaware the vessel was coming until just before its arrival, but clearly someone on the Island who organised provisions and change-over crew knew of its arrival. Any vessel that is slow moving, as in this case, presents a high opportunity for biofouling organisms to establish and subsequently a higher marine biosecurity risk. Additionally, the Brazilian Navy pulled into port on 29th February 2016 with the crew coming off for rest and recreation.

4.4.7 VESSEL TOP SIDES

Ocean going vessels tend to accumulate a variety of invertebrates and vertebrates either by cross contamination from affected cargo or through these organisms seeking refuge on the vessel whilst at port or enroute. For example, birds will often rest on a vessel and vessels frequently report being descended upon by flying insects, often hundreds of kilometres from shore. Some of these organisms, particularly stored product pests, spiders, ants and cockroaches are frequent inhabitants of vessels and set up permanent populations. In turn, these organisms can potentially cross contaminate cargo on the vessel if not managed adequately.

Vessel top sides represent a potential biosecurity risk to Ascension Island. However, this could not be verified as access to RMS St Helena, FIRS and USAF vessels during the consultancy period was declined by the respective shipping companies/masters so no formal assessment of biosecurity risk material on the vessels was conducted. Aside from routine deck washing, it is highly unlikely that any of the vessels in this study conduct any effective routine top-side pest management.

4.5 MAIN PATHWAYS CONTRIBUTING TO MARINE BIOSECURITY RISKS

The accidental or unintentional movement of marine organisms has probably been occurring since humans first began oceanic navigation for trade and exploration. Today the scale of oceanic transport and trade is now at unprecedented levels. Shipping routes cover much of the globe's oceans and the interconnectedness of trade routes provide the ideal mechanism for transfer of marine organism in both ballast water and on the exterior hull surfaces. Table 6 (below) summarises the pathways, their risk and relative manageability.

4.5.1 Biofouling

There is currently neither AIG legislative requirement nor active management of biosecurity risk associated with biofouling on vessels. This is one of the more significant risks to Ascension Island marine biodiversity and has been proven as a mechanism for transferring many of the world's invasive marine species. From a biofouling perspective, the risk is less certain with Ashton et al (2006) suggesting that yachts surveyed in Scotland presented as high risk vectors for marine biofouling due to the 59% of vessels that had secondary biofouling present, whereas in New Zealand a similar exercise revealed a 15% contamination rate of secondary biofouling. Despite the largely cold water (northern hemisphere) origin of the majority of the yachts, not knowing the previous voyage history, lengths of stays in previous ports and the date of the last hull clean and application of antifouling paints, makes risk assessment highly uncertain. Never the less, if it was assumed that the lower end of the spectrum (15%) of yachts entered Ascension Island waters with secondary biofouling, it clearly represents a biosecurity risk. To support this, Tsiamis et al 2015, suggested that the established marine algal species *Laurencia caduciramulosa* has been recently introduced to Ascension Island waters, potentially via the biofouling route. Additionally, opportunistic inspection of two yachts that were in the harbour during Biofume's visit (See Yacht biofouling Snap shot in 4.4.5) demonstrates that biofouling is potentially very common and that relying on sailors to do the right thing clearly is a risky strategy.

AIG would be wise to capitalise on St Helena's yacht biofouling initiatives and extend an awareness program to sailors for Ascension Island.

-See Risk Assessment in Appendices 1.

4.5.2 Ballast water

Under the yet to be ratified International Maritime Organisations (IMO) ballast water convention of 2004, vessel masters have to be able to provide evidence that a 95% volumetric exchange of ballast water has occurred prior to entering the any port. Until this is ratified, there is no obligation for vessels to comply with the convention. Ratification is likely to occur soon, as one of the two criteria for ratification has been me, and the second criteria is close to being met. There are no additional measures placed on vessels to manage ballast water by the AIG. Once the ballast water convention is entered into force there is a requirement for vessels visiting AIG to present certification or log books on ballast water exchange.
Taken from the IMO Ballast Water Agreement:

> *" (Article 7 Survey and certification) and may be inspected by port State control officers (Article 9 Inspection of Ships) who can verify that the ship has a valid certificate; inspect the Ballast Water Record Book; and/or sample the ballast water. If there are concerns, then a detailed inspection may be carried out and "the Party carrying out the inspection shall take such steps as will ensure that the ship shall not discharge Ballast Water until it can do so without presenting a threat of harm to the environment, human health, property or resources."*

Again, this is a very significant risk pathway for transferring invasive marine organisms and the compliance of visiting vessels is something that should be monitored, after ratification, by warranted Biosecurity officers once Biosecurity legislation is passed.

4.5.3 Flotsam

Flotsam generally travels from the West coast of South Africa and is sporadically detected at sea or on rocks/beaches sometimes with tertiary biofouling attached to it. It is occasionally represented as Fish Aggregating Devices (FADs) or equipment associated with purse seining. This is an impractical pathway to manage due to the randomness of events likely to occur. Where biofouled flotsam is encountered, it should be removed from the sea where practical and dried out before disposing of it in landfill.

4.5.4 Intentional Releases

With the high turn-over of military personnel and contractors on Ascension Island, it is conceivable that a release of tropical salt water aquarium fish could occur into the marine environment when personnel are due to leave the Island. It is not known if this is currently occurs, but given the porous nature of border controls, it should be assumed that it is possible. This risk can be managed both through Biosecurity legislation and awareness material provided to personnel before they are deployed to the island.

4.5.5 Natural spread of invasive marine species

It is conceivable that natural dispersion of invasive marine species could affect the pristine waters of Ascension. A natural result of global warming, sea temperature increases and changes in sea currents will be the changing distribution of established species into novel marine ecosystems. Management of natural dispersion of organisms that are native at their point of origin, is outside the scope of this assessment and is impractical.

Table 6. Marine pathway risk matrix

Marine biosecurity risk pathway	Main risk groups	Risk management	Effectiveness
Biofouling	Encrusting bryozoans, acorn barnacles, tubeworms, spirorbids, amphipod tubes, algae, molluscs, crustaceans, invertebrates	Legislation, inspections and awareness	Moderate-High[1]
Ballast water	Dinoflagellates, crustaceans, algae, invertebrates, fish, jellyfish, kelp, bacteria.	Legislation, compliance checks and awareness	Moderate-High[1]
Flotsam	Encrusting bryozoans, acorn barnacles, tubeworms, spirorbids, amphipod tubes, algae, molluscs, crustaceans, invertebrates	Opportunistic removal	Low
Intentional releases	Aquarium species- fish, crustaceans, molluscs, algae	Legislation, inspections and awareness	High
Natural spread	Fish, jellyfish.	Not practical	Nil

Table notes: [1] denotes that the range of effectiveness will be a function of regulatory compliance monitoring.

5 RISK ASSESSMENT

5.1 METHODOLOGY

Biosecurity risk assessments often rely on a history of intercept data to quantitatively demonstrate the association of a certain pest with a certain pathway. There is no history of border intercepts on Ascension Island so a qualitative approach to pathway risk is taken, besides those conducted during the current freight inspection exercise. Comments on trends in contamination data, relative to the risk assessment results, are made in the detailed species risk assessments.

Qualitative risk is determined by cross referencing the known distribution of the 'risk organism' with known pathways of association, climate and factoring in relevant components of the organism's biology to ascertain the relative likelihood of entry, establishment, and impacts. The relatively short voyage (approx. 2765miles) and temperate climate at Cape Town infers that certain organisms may present as high risk via this pathway. The poor condition of some containers and the lack of appropriate cleaning only exacerbate this risk.

Despite the vast range of cargo types and points of origin, it appears the UK originating cargo has an inherently low risk profile due to voyage length (approx. 4250 miles), poor climatic and habitat match and the low number of potentially invasive high impact pests. That said, clearly organisms are still arriving alive via this pathway at a significant rate and there is a need for improvement in managing the hygiene associated with sea-containers, cargo and vehicles.

The USAF cargo, although having the longest voyage (approx. 5100miles), has a markedly different risk profile due to its port of origin being in sub-tropical Florida. The closer climatic similarity and the elevated contamination risk and rate of high impact groups, such as invasive ants, results in a high risk profile rating. (See Risk Assessment Table 7 below)

The risk assessment estimates the relative likelihood of a pest entering, establishing and their potential impacts. This allows policy writers and decision makers to make informed decisions about the cost/benefit of applying biosecurity risk management activities to high risk supply chains. Predicting what an invasive species will do in any given novel location can be difficult and complex. However, using documented examples of impacts in locations where they have already established, improves the likelihood of making accurate risk assessments.

This risk assessment used the following methodology:

1. Identify an exemplar species within a high risk group, which are most likely to have impacts on Ascension Island's biodiversity, livelihoods or public health, and that are known to be established at ports of origin. Rather than trying to identify all potential high risk organisms, this approach was taken because risk mitigation measures for exemplar species will tend to be effective for all other species in that group that are likely to enter.

2. Use pathway analysis incorporating:
    - the intrinsic hitch hiker contamination risk for a particular commodity;
    - any existing biosecurity mitigation activities applied to the pathway;
    - the organism's propensity to survive the journey,

    To qualify the likelihood of **entry** into Ascension Island as either Low, Medium or High (there is no time frame associated with this risk).

3. Using basic climatic matching or existing modelling data and habitat availability, comment on the likelihood of **establishment** on Ascension Island of the pest, as either Low, Medium or High.

4. Using basic exemplar group/species biology, comment on **potential impacts** on Ascension Island biodiversity, livelihoods and public health, as either Low, Medium or High.

5. Using the highest ranking species for any given pathway, comment on potential effective **risk mitigation strategies**.

There are two high risk categories of organisms. The first are those that are intentionally introduced, which Biofume does not attempt to model as it is too difficult to predict what species of pets, plants or foods people may want to bring to the Island. The second category is those risk species which hitch hike with commodities, containers, packaging or vessels. These are captured in the risk assessment. Modelling what species may be transhipped from other locations into the focus ports of origin is not attempted. Shipping manifest data provided does not provide enough information on original port of departure and as such there is too much uncertainty in trying to predict pest/cargo associations.

The risk assessment screening model (Table 7) is included below which details the species and groups that were screened as part of the assessment. The highest ranking organism within each group is covered in more detail in Appendix 1. The list of groups, or species within a group covered, is by no means exhaustive and the exercise just serves to demonstrate that a suite of highly invasive and high impact organisms could potentially enter and establish on Ascension Island. In order to simplify this process a spreadsheet was developed to rank these potential high risk species in terms of Low, Medium or High risk. Those that ranked as potentially having High impact are explained in further detail. Only ports that are known to be used are included so locations like Antigua where a significant amount of freight has already arrived from is not covered in likely future shipments.

Table 7. Biosecurity Risk Assessment Screening

Exemplar Group	Common name	Species	Port of Loading					Risk of entry	Risk of establishment	Impact potential
			James town	Cape Town	March-wood	Port Canaveral	Houston			
Tramp Ants	Little fire ant	*Wasmannia auropunctata*[1]	Nil	Nil	Nil	Medium	Nil	Nil	Nil	Nil
	Red imported Fire ant	*Solenopsis invicta*[2]	Nil	Nil	Nil	High	High	Medium	Medium	High
	Tawny Crazy ant	*Nylanderia fulva*	Nil	Nil	Nil	High	High	High	High	High
	Argentine ant	*Linepithema humile*	Low	High	Nil	Nil	Nil	Medium	Low	Low
	Singapore ant	*Monomorium destructor*	Nil	Nil	Nil	Low	Nil	Low	High	High
	Yellow crazy ant	Anopolepis gracilipes	Nil	Nil	Nil	Nil	Nil	Nil	High	High
Commensal Spiders	Violin spider	*Loxosceles pillosa & bergeri& reclusa*	Nil	High	Nil	High	High	Medium	High	Low
	Sac spider	*Chiracanthium lawrencei*	Nil	High	Nil	Nil	Nil	Medium	High	Medium
	Black Button spider	*Latrodectus indistinctus and spp*	Low	High	Nil	Nil	Nil	High	High	High
Parachute seed Weeds	Feather grass	*Pennisteum setaceum & villosum*	Nil	High	Nil	Medium	Nil	High	High	High
	Buffel grass	*Cenchrus ciliaris*	Nil	Nil	Nil	Medium	Medium	Medium	High	Medium
	Scotch Thistle	*Onopordum acanthium*	Nil	Nil	High	Medium	Medium	Medium	Medium	Low
Mosquitoes	Tiger mosquitos	*Aedes aegypti and albopictus*	Low	Nil	Nil	Medium	Medium	Medium	Medium	High
Molluscs	Giant African snail	*Achatina fulica*	Nil	Nil	Nil	Low	Nil	Low	Low	Low
Mammals	Norway rat	*Rattus norvegicus*	Medium	Medium	Low	Low	Low	Medium	Medium	High
Reptiles	Brown Anole	*Norops sagrei*	Nil	Nil	Nil	Medium	Nil	Medium	Medium	Medium
	Brown tree snake	*Boiga irregularis*	Nil	Nil	Nil	Nil	NIL	Nil	Nil	Nil
Marine	Brown mussel	*Perna perna*	Nil	Nil	Nil	Low	Nil	Low	Low	Low
	Asian Green mussel	*Perna viridis*	Nil	Nil	Nil	Low	Nil	Low	Low	Low
	Tube coral	*Tubastraea coccinea*	Nil	Nil	Nil	Nil	High	High	Medium	Medium
	Brown bryozoan	*Bugula neritinia*	Nil	Nil	Nil	Low	Nil	Low	Low	Low

Table Notes: [1] Denotes that this species has a strong biological association with nursery stock and cut flowers, neither of which are a feature of Ascension Island freight profile from these locations; [2] This species has strong biological association with damp soil in which a nest can survive, they do not tend to build nests on animate object without soil attached. Based on soil types and quantities attached to containers inspected from Port Canaveral *S.invicta* appears to be a lower risk as compared to *N.fulva* which does not require soil in which to nest.

Ants are a relatively common feature of unmanaged sea freight and, to a lesser degree, air freight pathways. They are opportunistic organisms that take advantage of temporary food sources and transient niches as nest sites. The most successful invasive ant species often have multiple queens, with small sections of a colony budding off to start a new colony. They have caused some of the most spectacular recorded biodiversity impacts in other parts of the world, but similarly, invasive ants can cause significant economic and lifestyle impacts. Their ability to survive long journeys and even set up viable nests on a huge range of freight types and/or vessels, practically ensures they will continue to enter Ascension Island unless pre-border management actions are taken. The Tawny Crazy ant (*Nylanderia fulva*) is one species that is rapidly gaining notoriety and it is examined in more detail in the risk assessment. (Appendix 1)

Spiders are one of the most commonly encountered contaminant on all biosecurity pathways and this is demonstrated by the intercept data gathered from the sea freight pathway. However, the majority are species that have no significant economic or environmental impacts. Occasionally, the habitat niche preferences of poisonous spiders do cross over with human habitation and then there is potential for health impacts. The widow spiders (*Latrodectus* genus) is one such group that are well known for their painful and toxic bite. These are explored further in the detailed risk assessment. (Appendix 1)

Mosquitos are well known for their ability to transmit debilitating diseases as they consume blood meals from humans as part of their lifecycle. These diseases cause much suffering and occasionally, if not treated properly, death. The medical costs for ongoing treatment can be significant as too can be government led spraying programmes that attempt to reduce impacts on humans. Human habitation along coastlines and near estuarine areas ensures that there are many opportunities for interaction, and likewise ports, by their nature, are often in close proximity to mosquito habitat. The Tiger mosquito (*Aedes aegypti*) is one such species and they could arrive on Ascension Island via air or sea pathways. This species of mosquito is of particular concern due to its ability to be vector for the Zika virus which is currently spreading around the globe with dramatic health implications. (Appendix 1)

Invasive weeds are something most Ascension Islanders are familiar with. With much of the vegetation on Ascension Island being introduced, the Island's ecosystem is irreparably under the process of successional transformation. It is difficult to accurately predict invasiveness of any given plant species, as can be seen by the eclectic mix of weedy species that have established on Ascension Island, but one family of weeds, *Asteraceae*, are particularly successful colonisers, due partly to their ability to disperse their seeds long distances. Additionally, the parachute seeds adhere to surfaces such as rough sawn timber and spider webs, both of which are found commonly with wooden packaging associated with trade. Parachute seeds were detected across all sea freight pathways during container/cargo inspections on Ascension Island during this consultancy. Some grasses (*Poaceae*), which are a spectacularly successful invader in their own right, also have a parachute type seed and one genus (*Pennisetum*) is detailed in the plant risk assessment. (Appendix 1) The biosecurity measures for management of parachute seeds will generally manage risks associated with other invasive plant species. For this basic risk assessment exercise no other weed groups are assessed.

One group of reptiles - Geckos -have managed to find their way onto practically every suitable tropical and subtropical location via trade. Ascension Island is no exception and has three gecko species introduced, almost certainly accidentally via trade. They are the Cradock thick toed gecko (*Pachydactylus geitje),* the Java gecko (*Hemidactylus frenatus*) and the Coconut gecko (*H. mercatorius*). Their ability to colonise human structures, gain more insect food from artificial lighting at night, and their cryptic behaviour during the day, ensures that geckos are a common contaminant

on freight leaving from tropical and sub-tropical locations. Another lizard is also demonstrating its ability to be a successful invader and that is the Brown Anole (*Norops sagrei*) which is firmly established and spreading within Florida. This small iguana is explored further in the detailed risk assessment. (Appendix 1)

Rodents (*Rattus* sp) were the earliest reported invasive species causing economic impacts on Ascension Island and they are arguably one of the most successful invasive mammals in the world. The scope of their impacts is far reaching and crosses economic, public health and biodiversity sectors. Their propensity to hitch hike on vessels and cargo has led to their almost global distribution. Ascension Island is so far free of one these successful rodent species, the Norway rat (*Rattus norvegicus*). However, on St Helena, its nearest cultural, economic and geographic neighbour, they are recorded as being established and they could easily be inadvertently transported to Ascension Island. *R.novegicus* is the subject of the detailed risk assessment. (Appendix 1)

Marine pests can cause irreparable damage to marine ecosystems and once established they can quickly become impossible to eradicate. Biofouling and ballast water movement are the two leading causes of marine invasive species movement. The degree of biofouling on any given vessel is affected by a number of factors, including quality and timing of the last hull clean, the type of anti-fouling paint used, speed of the vessel, the history of ports visited and the time spent in high risk port/locations. The pipe laying platform towed by MV Skandi Admiral that visited Ascension Island harbour recently is a slow moving vessel that had spent an unknown period in high risk waters in the Gulf of Mexico. *Tubastraea* is a genus of colonising coral that has colonised many platforms in this region and is the subject of the marine species risk assessment. (Appendix 1)

6 BIOSECURITY FUNCTIONS AND RECOMMENDATIONS

There is currently no formal biosecurity capability on Ascension Island in any form and so a prime opportunity exists to formulate a biosecurity agency that is fit for purpose. The foundation of any formal biosecurity capability must be firmly grounded in legislation. This legislation must apply to everybody on Island with no exceptions. Current USAF exclusions from Customs legislation is incongruent with an Island-wide approach to managing prohibited imports, and likewise any exclusions from regulatory control of biosecurity risks would see the highest risk pathway remain open. This is clearly unacceptable. Likewise, where Biofume was unable to obtain relevant pathway information or data, particularly from the USAF and to a lesser degree from MOD, legislation should empower the AIG regulatory authority to have access to this information for risk profiling purposes.

Any new biosecurity legislation should be comprehensive in terms of the scope, but implemented in manageable sections based on cargo/pathways of highest risk. Once legislative power is granted, biosecurity capability could prevent new high impact organisms. Additionally, if the biosecurity legislation is developed as recommended, it may be possible to supersede the Prohibited Animals Regulations (1967), Dogs and Cats Ordinance (2000) and the Public Health Ordinance (1967). Although St Helena's and Falkland Islands' primary production sector is very different from Ascension Island, it would be worth harmonising policy, legislation, education and awareness programs as much as is appropriate to capitalise on the synergies of a regional approach. Likewise reviewing the EU Regulation No 1143/2014 on prevention and management of the introduction and spread of invasive species, may also enhance the benefits from taking advantage of a cooperative regional approach.

If AIG is to commence biosecurity risk management activities, it is absolutely critical that a stable and skilled biosecurity champion is employed to drive biosecurity awareness and implementation. Without such a role, this report and the previously contracted biosecurity report through the SAIS project, will languish on the shelves in AIG Administrators' offices while new organisms continue to enter and establish.

The pre-border risk management approach is the most desirable outcome for Ascension Island and should be implemented as far as is practicable at high risk off-shore locations. Initially, the adoption of simple sea container cleaning, treatment and storage protocol, for exporters to Ascension Island would significantly reduce the current risk exposure.

In terms of allowable imports, the foundation of a white list approach should be taken, which essentially bans the intentional introduction of any plant or animal, unless otherwise permitted. It can be rolled out incrementally as capability on-Island improves. A list of permitted organisms (including pets and plants) would be formulated for which a permit would be issued upon proof of identity of the organism.

The following recommendations should be viewed as the absolute minimum requirements to setup a functional and effective biosecurity system and are separated into logical functions such as legislation, pre order policy, inspection, identification, response and surveillance . There are many ways these recommendations could be implemented. The actions, as outlined in the Action plans, are three examples of ways that this could be achieved and provide a basic schedule for their implementation.

> ***Recommendation 1:*** *Develop AIG Biosecurity policy and legislation that covers* ***all*** *military and non military users of the Island, harmonising where appropriate with St Helena's.*

Recommendation 2: *Employ a dedicated Biosecurity Coordinator to coordinate the below mentioned recommendations.*

Recommendation 3: *Explore pre-border risk management options for the sea container pathways starting with USAF (US) freight, followed by RMS St Helena Cape Town (Sth Africa) freight and MOD (UK) freight.*

Recommendation 4: *Formulate a 'white list' approach to allowable imports*

Inspection

Without established and functioning Import Health Standards to control biosecurity off-shore, effective border-based risk management relies heavily upon detection of the pest before it escapes into the environment. Based on the container/cargo surveys conducted, it is apparent that shipping containers and pallets pose the highest risk of introducing new organisms to Ascension Island. Therefore, an import health standard developed for shipping containers and a separate one for packaging would likely be high priorities. The New Zealand sea container import health standard provides a good example of what this may look like (see Appendix 11.). There are currently no official biosecurity inspectors on Ascension Island. However, Customs inspect a broad range of cargo arriving and have good coverage across pathways. Anecdotally, numerous AIG employees have made comments about previous notable detections at the Pier Head, the Volcano Club and at other de-vanning locations across the Island. All imported goods, including goods imported by MOD and USAF, would be subject to inspection activities if they are considered high risk.

Recommendation 5: *Develop the first high priority Import Health Standard for sea containers and implement a targeted inspection regime to determine compliance. A financial incentive must help drive compliance, preferably as an AIG delivered treatment cost for non-conforming imports. Although initially unpopular with exporters/Islanders, it will quickly establish an enhanced level of compliance.*

Recommendation 6: *Enhance detection capability of the under-utilised port workers, container de-vanners, and Customs officers through inspection training. This would dramatically increase border detection rates. All importers would be subject to inspection activities if freight is considered high risk.*

Identification - Traditional biosecurity models rely heavily on being able to identify the organism detected at the border or post border to determine if it is new to the Island or an established species. Those that are not established require treatment. Currently on Ascension any invertebrate requiring identification is sent to an entomologist at FERA (UK) for identification, as there is no entomological taxonomic capability on Island. The FERA service is largely agricultural pest centric and is not necessarily the best location to send hitch hiker pests which are most likely to be an issue on Ascension Island. This service is still potentially invaluable, and should be used, but alternative suppliers of identification services for non-agriculture pest are required. Transferring specimens detected at the border back to the UK for identification takes at least 4-5 days but more likely longer. This is clearly unacceptable when a consignment is under quarantine-hold pending identification and treatment. Any Ascension Island biosecurity model would either require precautionary treatments to be conducted immediately, potentially with the identification following to confirm the organisms' status or alternatively an enhancement in remote diagnostic capability to inform treatment

decisions. The latter requires constant capability to take high quality diagnostic images and reliable internet and equipment and a network of competent taxonomists.

Cryptogenic organisms are sometime detected at border or post-border locations. In these cases a quick assessment on the likelihood of the organism being a previously undetected established species needs to be conducted. If it is likely to be a newly introduced species a further risk assessment should be carried out to determine if response action is required.

Recommendation 7: *Adopt a precautionary treatment policy for contaminated urgent cargo.*

Recommendation 8: *Enhance and document process for sending specimens for identification. Clarify chain of custody.*

Treatment - Under traditional biosecurity risk management models, consignors generally have the option, to treat, destroy or reship any commodity affected by a pest of concern. Reshipment is not an option on Ascension Island due to the infrequency of vessels, so any risk mitigation of a newly landed consignment will need to occur on Island. Destruction should generally be avoided on Ascension Island, where there is a close knit community and the significant costs associated with bringing cargo to the Island. Removing these two risk mitigation options places a heavy emphasis on having in-house treatment capability suitable for biosecurity treatments.

There already exists some capability to mitigate biosecurity risk material within the AIG, MOD and USAF Environmental Health Teams (EHT). None of these teams are currently geared to conduct biosecurity eradication treatments like fumigation or cold temperature treatments but all have access to chemicals and application equipment that may be appropriate in some circumstances. USAF EHT has some heat treatment capability but this would need to be looked at in greater detail to determine possible uses in a response situation and an agreement sought for using the equipment.

USAF EHT has previously conducted sulphuryl fluoride (Vikane) fumigations of buildings for termite eradication at the base but these are teams especially mobilised from the US mainland. Routine EHT work is currently commonly geared around pests around or within infrastructure.eg weeds, rodents, ants and cockroaches. The USAF EHT is limited by US regulations around what chemicals they can use which is likely to limit effectiveness of a response to a biosecurity situation. Likewise, the AIG EHT will likely be restricted by the UK approved chemicals list.

Ethyl formate and nitrogen fumigation is a new fumigation technology that uses environmentally friendly fumigant with a relatively low potential human impact. It is non-ozone depleting, non-residual fumigant with ingredients found in common foodstuffs. The carrier gas, nitrogen, is extracted from the atmosphere mitigating the need for compressed gas cylinders. This fumigation technology would be a good fit for Ascension Island.

Recommendation 9: *That AIG develops fumigation capability using low-toxicity fumigants such as ethyl formate and nitrogen, subject to approvals.*

Recommendation 10: *That AIG purchase a refrigerated container and a good quality GP that could be used as a cold/heat/fumigation treatment chamber. This would be suitable for some cargo and pest treatments. In some treatment scenarios freezing may not be appropriate in which case a heat or chemical solution is required.*

Recommendation 11: *Review heat treatment capability and chemical approved chemical lists across UK and USAF EHT teams. Each respective party, subject to a cooperative agreement, to*

pre-emptively order chemicals required for biosecurity response depending on legislative restrictions.

Containment -Whenever a consignment of contaminated cargo is detected it is paramount that a secure place is available to contain the cargo and the associated contaminant. There is currently no identified location for any affected consignments to be secured pending treatment. This could be as simple as a using a suitably sealed and dedicated shipping container at the Pier-head facility. This would also mean that high risk USAF freight would need to be inspected for Customs and biosecurity risk material at the Pier-head, before being moved to post-border lay-down facilities. An area at the Pier-head would need to be identified to contain an affected container/consignment. This can be quite a simple exercise, but needs to be effectively communicated to users of the area.

Recommendation 12: *That an agreed location at the Pier-head (or nearby) is designated as the containment area.*

Response - Critically, AIG needs capability to rapidly respond to new detections of invasive species, whether its first response, at the border, or a pest has been detected post border in the wider Ascension Island environment. Early detection of a new organism at the border or post-border dramatically increases the likelihood of a successful eradication attempt and ensures response costs are minimised. It is therefore critical that the response to the early detection is prompt, and appropriate for the type of organism detected. This requires at least one expert who can lead and coordinate the response, and a number of trained personnel who can be called on at short notice to participate in the response.

Recommendation 13*: That a suitably qualified person with the AIG Conservation Department be delegated as the response Coordinator and made aware of the responsibilities associated with this position.*

Recommendation 14*: That the EHT personnel from AIG, Interserve and USAF be temporarily available for high priority response capability. Something as simple as a MoU between AIG and MOD/USAF would formalise any agreement to provide resources in a response emergency.*

Surveillance- There is currently no invasive organism surveillance conducted in either the marine or terrestrial environments. Some surveillance will be triggered by a response at the border or post border. Other surveillance for high risk organisms like ants and mosquitoes should be conducted routinely. As evidenced by the high risk organism contamination rate on the USAF sea freight pathway, terrestrial surveillance in high risk localities is conducted as a matter of urgency. Surveillance capability potentially already exists with Dept of Conservation staff, as well as with AIG, MOD and USAF Environmental Health Teams. This capability could be readily enhanced with relatively little effort. A willingness to commit a small amount of time and effort for training and operations needs to be secured from each organisation.

Recommendation 15: *Immediate baseline post-border surveillance is conducted for high impact invertebrate species such as mosquitoes (Zika virus vectors) and invasive ants at high risk locations across the island (e.g. USAF base) in case they have already arrived and to provide a potential eradication opportunity.*

Recommendation 16: *A biosecurity communication/awareness strategy is developed, that is appropriate for Island consumption, funded and implemented, focussing on community involvement and reporting. A robust feedback mechanism to reportees is also critical to sustain reporting.*

7 FIVE YEAR ACTION PLAN FOR AIG BIOSECURITY

The following options are presented and vary according to scale and resources required. The implementation of recommendations, as outlined in section 6 above, will be dependent on the level of resourcing received for these priority activities. That said, any limitations in resourcing should not impede implementation of basic biosecurity actions and any improvement in biosecurity outcomes will reduce biosecurity risk and the establishment of new organisms on Ascension Island.

Option 1 requires minimal additional funding (£18,000 over 5 years) and attempts to start a Biosecurity system using existing funding and resources of personnel already on Island only. Without a Biosecurity champion it is considered that the likelihood of establishing a functional and self-sustaining Biosecurity system is considered low. This is considered the least desirable option.

Option 2 requires additional funding for half a FTE to start and sustain a Biosecurity system. This option will only work if a clear cut work plan documents what Biosecurity activities are to occur in any given period. Without a clear work plan the Biosecurity function is likely to be lost while conducting post-border biosecurity/biodiversity works. It still requires a person with enhanced Biosecurity skills to implement this work plan. This option, although considered workable will be slow to implement.

Option 3 relies on receiving external project-funding for two years, and gives the implementation of the Biosecurity system a much needed boost during the start-up phase, after which the model essentially reverts back to option 2 for years 3-5. It would allow for the procurement of capital intensive Biosecurity surveillance and treatment equipment and enable the Biosecurity system to form relatively quickly. This is the preferred option.

See Tables 8, 9 and 10 (below) for further details. ‘Existing funding’, as detailed on the following tables, indicates the use of existing personnel on Island whose role or tasks have been reallocated to perform Biosecurity functions.

Table 8. Action Plan: Option 1 Minimal funding option

Year		Activity	Existing funding (personnel)	New funding (materials[1] and training[2])
1	1.	An unfunded 'Biosecurity Threats' coordinator within the Conservation Dept. is appointed from within existing staffing resources and charged with coordinating and delivering priority biosecurity continuum outcomes. Cost over 5 years.	30,000	
	2.	Develop and enact specific Biosecurity Policy and supporting Legislation, harmonising where appropriate with Falklands and St Helena.	3000	
	3.	Develop locally appropriate Import health standards for the 1st priority commodity, such as shipping containers, in conjunction with a public awareness campaign	500	
2	4.	Develop amalgamated Customs/Biosecurity declaration card including biosecurity requirements and public awareness program to support. Train customs to risk profile for biosecurity focussed baggage inspections		2000[1,2]
	5.	Develop standard operating procedures and provide law enforcement training to implement the newly developed import health standard	250	
	6.	Commence targeted cargo inspections across high priority pathway like shipping containers	3500	
3	7.	Develop biosecurity treatment capability including cleaning, fumigation and freezing or destruction E.g. termite infested timber pallets.		10000[1,2]
	8.	High risk pest surveillance is conducted for high impact organisms such as mosquitos, invasive ants and scheduled appropriately at high risk locations. Only ID 'out of place' organisms		3500[1,2]
4	9.	Repeat high risk terrestrial surveillance (eg mosquitoes and weeds)	3500	
	10.	Develop 2nd priority import health standard eg wood packaging and dissemination of awareness material	500	
5	11.	Develop border-postborder"First response" capability through training, procuring equipment and running exercise for organisms threatening to escape into wider environment or detected early in post border environment	1250	2500[1,2]
	12.	Commence targeted cargo inspections of 2nd priority pathway. Eg wood packaging	2500	
TOTALS			**£45,000**	**£18,000**

Table 9. Action Plan Option 2. Half FTE option

Year	Activity	Existing funding (personnel)	New funding (materials[1] and training[2])
1	1. A core-funded 50% FTE 'Biosecurity Threats Coordinator' is appointed within the Conservation Dept. and charged with coordinating and delivering priority biosecurity continuum outcomes. Cost over 5 years.	30,000	6000[1,2]
	2. Develop and enact Biosecurity Policy & Legislation, harmonising where appropriate with Falklands & St Helena.	3000	
	3. Develop locally appropriate Import health standards for the top two priority commodities, such as shipping containers and wooden packaging in conjunction with a public awareness campaign		3500[1]
	4. Develop amalgamated Customs/Biosecurity declaration card including a public awareness program to support. Train customs to risk profile for biosecurity focussed baggage inspections		2000[1,2]
	5. Develop standard operating procedures and provide law enforcement training to implement the newly developed import health standards	500	
	6. Develop biosecurity treatment capability including cleaning, fumigation and freezing or destruction. eg termite infested timber pallets.		10,000[1]
	7. High risk pest surveillance is conducted for high impact organisms such as mosquitos, invasive ants and plants and scheduled appropriately at high risk locations. Only ID 'out of place organisms'		7000[1,2]
2	8. Commence targeted cargo inspections across high priority pathways.	5000	
	9. Design and seek funding for a marine invasive species surveillance program. To be actively monitored annually with an emphasis on public reporting back to the Biosecurity Threats position. Identifications of 'out of place' organisms through SMEs.		5000[1]
	10. Repeat high risk terrestrial surveillance (e.g. ants, mosquitoes and weeds)	5000	
	11. Develop border-post border "First response" capability through training, procuring equipment and running exercise for organisms threatening to escape into wider environment or detected early in the post border environment	2500	5000[2]
3	1. High risk pest surveillance	2500	1000[1]
	2. A core funded 'Biosecurity Threats Coordinator' resource within the Dept. of Conservation is appointed and charged with coordinating and delivering priority biosecurity continuum outcomes	6000	
	3. Routine cargo inspections	3500	

Year	Activity	Existing funding (personnel)	New funding (materials[1] and training[2])
	4. Response exercise	2500	
4	1. Repeat high risk pest surveillance	2500	1000[1]
	2. Response exercise	1500	
	3. Routine cargo inspections	1000	
5	As per year 3& 4 but expanding conducting QRM surveys into new risk cargo types	3000	1000[1]
TOTALS		**£68,500**	**£41,500**

Table 10. Action Plan Option 3. Externally funded (first 2 years)

Year	Activity	Existing funding (personnel)	New funding (personnel[1], travel[2], materials[3], training[4])
1	1. A full time, externally-funded 'Biosecurity Threats' resource within the Dept. of Conservation is appointed and charged with implementing a fully functioning biosecurity system that can be sustained in the longer term. Cost over 5 years	18000	40,000[1]
	2. Develop and enact specific Biosecurity Legislation, harmonising where appropriate with Falklands and St Helena.	3000	
	3. Purchase ethyl formate/nitrogen fumigation equipment and refrigerated container and provide training in its use.		90,000[3]
	4. Develop locally appropriate Import health standards for the top two priority commodities, such as shipping containers and wooden packaging in conjunction with a public awareness campaign		3500[3,4]
	5. Develop border-post border "First response" capability through training, procuring equipment and running exercise for organisms threatening to escape into wider environment or detected early in the post border environment	1250	2500[3,4]
	6. Develop and implement off-shore risk management in areas of greatest risk return eg sea freight from the US		10,000[2]
	7. High risk pest surveillance programme is designed and conducted for high impact organisms such as mosquitos, invasive ants and scheduled appropriately at high risk locations. Only ID 'out of place organism	1000	7000[3,4]
2	8. Develop amalgamated Customs/Biosecurity declaration card including biosecurity requirements and public awareness program to support. Train customs to risk profile for biosecurity focussed baggage inspections		2000[3,4]
	9. Develop standard operating procedures and provide law enforcement training to implement the newly developed import health standard.	250	
	10. Commence targeted cargo inspections across identified high priority pathway	3500	
	11. Treat all high risk cargo with ethyl formate/nitrogen as required		3000[3]
	12. High risk pest surveillance is conducted for high impact organisms (such as mosquitos, invasive ants and weeds) scheduled appropriately at high risk locations. Only ID 'out of place organisms'	1000	3500[3]
	13. Audit off-shore risk management systems		6500[2]
3	14. Commence risk profiling and baggage inspections of high risk passengers	3000	

Year	Activity	Existing funding (personnel)	New funding (personnel[1], travel[2], materials[3], training[4])
	15. Repeat high risk site surveillance	1000	2000[3]
	16. Commence inspection surveillance activities across other unmanaged pathways/commodities .e.g airfreight	3000	
	17. Review existing biosecurity risk management strategies and recommend improvements	500	3500[1]
4	18. .Audit off-shore risk management systems	3500	6500[2]
	19. Design and seek funding for a marine invasive species surveillance program. To be actively monitored annually with an emphasis on public reporting back to the Biosecurity Threats position. Identifications of 'out of place' organisms through SMEs.		5000[3,4]
	20. Repeat high risk terrestrial surveillance (eg mosquitoes ants and weeds)	3500	
5	21. Implement marine invasive. To be actively monitored annually with an emphasis on public reporting back to the Biosecurity Threats position. Identifications of 'out of place' organisms through SMEs.	1250	
	22. Treat all high risk cargo with ethyl formate/nitrogen as required	1000	2000[3]
	23. Commence targeted cargo inspections across newly identified high priority pathway.	2500	
	24. . Repeat high risk terrestrial surveillance (eg mosquitoes ants and weeds) or target newly identified risk organisms		500[3]
TOTALS		**£47,250**	**£187,500**

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Appendix 1.
Risk Assessments

1 TIGER MOSQUITO (AEDES AEGYPTI)

The Yellow Fever mosquito (*Aedes aegypyti*), is a vector of the Zika virus, yellow fever and dengue fever. There are no known Ascension Island intercepts of *Ae.aegypti* but the following approach has been used to assess their potential biosecurity risk to the Island.

1.1 RISK OF ENTRY

It is established that any cargo that holds or has held a small amount of water (particularly tyres) and has originated from a port where *Ae.aegypti* is known to be present, presents a risk of transporting this mosquito in egg, larvae or adult form. For example, a shipment of tyres from Florida, from where *Ae.aegypti* is established, that has or has had pooled water in them would be high risk. Eggs are very hardy and can survive for months in a desiccated state before being rehydrated again to facilitate hatching. This means of transport has clearly been identified through other border biosecurity agencies intercept data (Calder & Laird 1995) and it is fair to conclude that unless some specific pre-border risk mitigation was applied in Florida, a similar 'risk of entry' would exist for Ascension Island. Break bulk cargo that is exposed to rainfall events or second hand tyres that have been stored outside are two examples of high risk cargo.

1.2 RISK OF ESTABLISHMENT

Combining this clear'risk of entry' with the current lack of a biosecurity system on Ascension Island, the likelihood of future introduction may depend on whether or not a newly arrived mosquito, can find a place to feed and breed i..e the 'risk of establishment'. This mosquito species is commonly established in tropical to sub-tropical climatic zones, so broadly speaking Ascension Island is suitable climatically. See Figure 1 map (below) of potential global distribution of *Ae aegypti*, with red areas showing areas of highest climate match (Kramer eta l 2015). Although Ascension Island is not explicitly mapped it is clear based on this model that. *Ae.aegypti* could establish.

Photo by Muhammad Mahdi Karim (www.micro2macro.net)

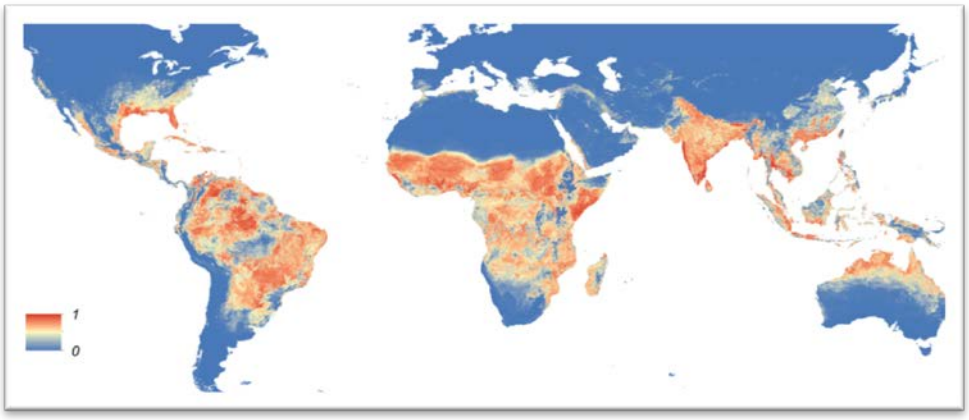


Figure 1. Potential areas of Ae.aegypti distribution based on climatic modelling

Sources of blood meals from humans (their preferred host) or animals to complete the mosquito's life cycle are readily available on Ascension Island. For example, a mosquito could fly from the lay-down yard at the Volcano Club to find a blood meal and then fly to the nearest standing water source, such as a grey water drum,which would suffice for depositing the 100-200 eggs.

1.3 POTENTIAL IMPACTS

Ae.aegypti is a known vector for numerous debilitating arboviruses including Dengue, Yellow fever, Chikungunya and more recently the Zika virus. The potential public health impacts from an outbreak in any one of the known diseases carried by this mosquito is considered High.

1.4 *AE AEGYPTI* RISK MITIGATION

There are various ways the Biosecurity risk of *Ae. aegypti* can be managed, pre-border, border and post border. From a pre-border perspective an Import Health Standard could be developed for high risk cargo from high locations specifically stating that cargo that can hold water needs to be dry, clean and treated with a recognised effective mosquito larvacide.
Border measures should include risk profiling manifests to identify shipments of tyres or similar high risk cargo from known affected ports, conducting inspections of all high risk cargo, if necessary treating affected cargo and collecting suspect biosecurity risk material from them for later identification.
Post border measures should include biannual mosquito surveillance at identified high risk locations around the port, laydown areas and grey ("effluent") water tanks.

2 TAWNY CRAZY ANT (NYLANDERIA FULVA)

This ant is a relative newcomer to the tramp ant world although taxonomic confusion has meant it has gone misidentified for some time. It has been making its presence known in the US where it has demonstrated it can out-compete the once dominant high impact species Fire ant (*Solenopsis invicta*) where their ranges overlap. It is widespread in Florida and Texas and the range is increasing all the time.

Photo by April Noble

2.1 RISK OF ENTRY

As with many successful tramp ant species *N. fulva* shares the following attributes:

- Ability to survive extended periods without food and water,
- Ability to bud as small satellite colonies into vehicles, truck trailers, garbage, timber, and buildings.
- Polygyne- multiple queens and budding
- Synanthropic (organism that lives near and benefits from humans) behaviours (Meyer 2008)
- Widespread in Texas and Florida

Additionally, *N.fulva* appears to dominate the landscape in boom bust cycles in huge numbers, and is attracted to electrical items. Given the above attributes of this tramp ant and based on the high rate (12.8%) of ant contamination on cargo from Port Canaveral (Summarised in Section 4.4.3 & in detail in Appendix 4) it is highly likely that *N.fulva* or other high impact tramp ant species such as the Red imported fire ant *(Solenopsis invicta*) will affect cargo bound for Ascension Island at some point.

2.2 RISK OF ESTABLISHMENT

It is highly likely that N.fulva could establish on Ascension Island. Given the following:

- ability to locate and utilise habitat associated with both cargo and human structures,
- the ability to bud fragments off the main colony facilitating spread to a range of microclimates, and
- its omnivorous foraging behaviour enabling it to adapt to a variety of local food sources, and

- its current distribution in the Caribbean, Florida and Texas, sharing some climatic similarities with Ascension Island

2.3 POTENTIAL IMPACTS

Currently this species impacts are documented as predominantly being economic due to their impacts on electrical equipment, as they are attracted to electrical fields and the associated warmth. This results in electrical shorts and potentially fires as well as significant stress to house holders as the huge numbers overwhelm inhabitants.

Wedge tailed shearwater hatchling with formic acid burns to feet caused by invasive ants. Photo: Sheldon Plentovich

Additionally *N.fulva* out competes all other ant species in its range and tends to remove all invertebrates that were within the foraging range of the colony. They are recorded as using their own formic acid as a chemical shield when they compete against the venom spraying *S.invicta* for territory. Given their use of formic acid as a defence mechanism it is possible that if a colony was accidentally transferred to any sea bird colony either on Ascension or Boatswainbird Island that ant/chick interactions could see physiological damage to webbing on their feet, beaks and eyes as has been recorded with another formic acid spraying ant the Yellow Crazy ant (*Anoplolepis gracilpes*) (Plentovich et al 2008). Additionally, large shored based colonies of *N.fulva* may also attack defenceless young Landcrabs (*Johngarthia lagostoma*) emerging from the ocean to head inland for the first time. The adult Land crabs of Christmas Island (*Gecarcoidea natalis*) have been recorded being blinded by the formic acid spraying *A.gracilpes (*O'Dowd et al 2003*).* The ants spray formic acid onto the crab's eyes and mouthparts causing blindness and subsequently starvation and death.

Given these recorded and potential impacts it is considered the potential impacts of N.fulva are likely to be High.

2.4 N.FULVA RISK MITIGATION

Risk mitigation for invasive ants can be applied at pre-border, border and post-border locations. As with all biosecurity risk management the most strategic location to manage this risk is at the off-shore locations, prior to the contamination occurring. The application of good cargo and shipping container hygiene practices can see ant contamination rates approach zero but it does require a systematic approach and a consistently high standard of housekeeping. Concrete/bitumen or

compacted gravel yards that are not prone to flooding, the use of toxic ant baits and application of residual insecticides onto shipping containers and breakbulk cargo can eliminate ants from the sea freight or air freight pathways. Exporters from high risk areas, most notably the US, should be encouraged to adopt some or all of these mitigation measures. Contractual obligations with suppliers to maintain hygiene practices and/or a strong economic incentive are required for this approach to work sustainably.

It is not always possible to manage the risk offshore due to complexity in the supply chain or a lack of will or economic incentive on the part of the exporter. Risk management then comes down rigorous border based inspection of cargo that is prone to contamination. This can be very effective but is resource intensive and not 100% effective. Once ants are detected an affected commodity/shipping container should be tent fumigated with methyl bromide or a suitable alternative fumigant to ensure 100% mortality, including eggs, pupae and queens. Other treatment options are sometimes viable as demonstrated in Section 4.4.4 where affected pallets were incinerated.

Lastly, a robust post border surveillance program can detect recent introductions if conducted at the right frequency, intensity and most importantly the correct locations. This can be complimented by informed public reports and especially by skilled EHT members across AIG, MOD and USAF. Once new infestations of ants are detected an appropriate eradication plan will need to be developed and actioned. Depending on the timeliness of the detection this can be a cheap and effective treatment of a single nest or a complex, costly and risky eradication attempt spanning many hectares.

3 FEATHER OR FOUNTAIN GRASS (*PENNISETUM SPP*)

Various *Pennisetum* species have exhibited invasive tendencies and impacts across multiple locations around the world. It is often purposely introduced as either a pasture grass or as an ornamental due to the attractive clumping foliage and the feathery seed heads. Unfortunately the traits that make it attractive as a pasture grass also tend to improve its ability to sustain invasive populations as well.

Photo by Forest & Kim Starr, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=6123704

3.1 RISK OF ENTRY

The *Pennisetum* is genus well adapted to disturbed habitats and can be found along coastal areas as well. This habitat tends to align with container cargo storage locations which are often associated with coastal industrial wasteland or poorly managed container yards adjacent to the exporting port. It produces large numbers of wind- blown seeds from the feathery seed head which can disperse large distances via wind, water or animals. Although not a true parachute seed (Asteraceae) it exhibits many of the dispersive characteristics of a parachute seed in its ability to disperse and adhere to things like rough sawn timber, as is frequently used in wood packaging and pallets. Often pallets and packaging are adorned with spider webs and these also tend to accumulate light wind borne seeds like *Pennisetum spp*. Its distribution in St Helena, Cape Town and Florida ensures there is potential for contamination of containers, wooden packaging and freight from these locations. Parachute seeds were detected on all three sea freight pathways and were associated with spider webs, sea container floors and timber pallets.
For these reasons the risk of entry is considered High.

3.2 RISK OF ESTABLISHMENT

A number of the species in the genus Pennisetum are well adapted to harsh environmental conditions namely *P. setaceum, P.villosum* and *P.scrobiculatum,* the latter being already established on Ascension Island. The below distribution map (Figure 2) for *P.setaceum* from CABI shows a wide range of sub-tropical/tropical climatic and habitat tolerance. *P.setaceum* is also known to be invasive

in other young volcanic ecosystems such as St Helena, Hawaii and Mount Pinatubo, in the Philippines (Marler & Morel 2011).

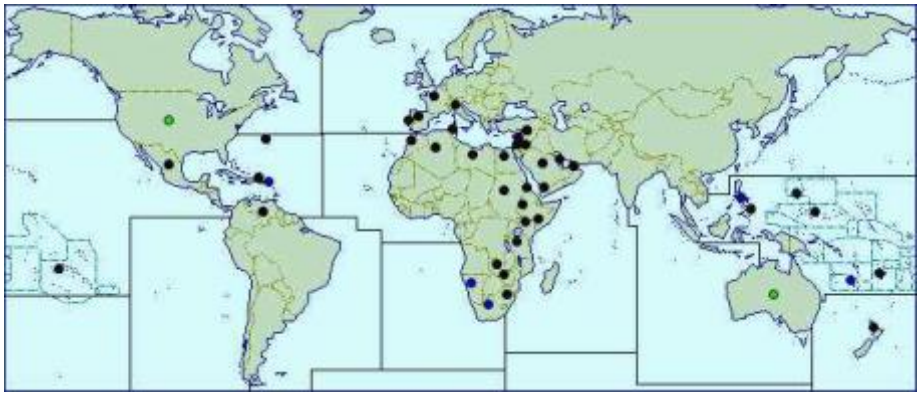


Figure 2: Global distribution map for *P.setacuem* (CABI)

Potential impacts

P.setacuem and *P.villosum* have the potential to form dense monocultures in dry grassland or early successional habitats as can be found in abundance on Ascension Island. In Hawaii, in volcanic landscapes, it displaces and dominates native grasses (Daehler & Carino 1998). Additionally, the increased fuel load from the dense monocultures can cause increased fire risk further increasing disturbance and potential damage to infrastructure and communities. The cost associated with either infrastructure or environmental fires would be significant.

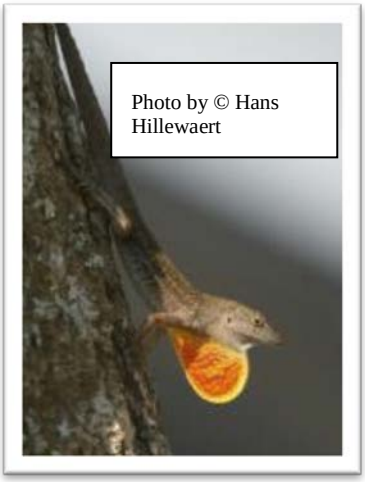
3.3 *PENNISETUM* SPP RISK MITIGATION

Pre-border management of *Pennisteum* spp seed contamination involves minimising the contamination opportunities through control of existing plants in and around pallet, container and freight storage areas. Additionally, shade cloth attached to perimeter fences can significantly reduce heavier parachute seed movement into these storage areas. Keeping container doors shut when they are not being loaded or during windy conditions can reduce movement of seeds into the containers. Using new timber or plastic pallets can significantly reduce the amount of seed attached to these high risk items. A pre-shipment inspection of cargo and containers locating and removing seed (high pressure air) can be very effective at removing contamination which should be included in off-shore risk management processes.

Intensive inspection is really the only effective way of managing risk at the border. This can be very effective but it is resource intensive and will not necessarily locate 100% of seeds as many a very small and practically undetectable. Physical removal of seeds is required to ensure they do not escape into the environment. Heat treatment can kill seeds (85C for 12hrs) but can damage some commodities.

Post- border targeted weed surveillance along roadsides, around lay down areas, devanning locations and any other high risk locations can be very effective but it requires a high degree of vigilance, expertise and the correct frequency and timing to ensure any germinating plants do not seed. Again, this can be complimented by using EHT from AIG, MOD and USAF who with some minimal training can be a valuable surveillance resource.

4 BROWN ANOLE (*NOROPS SAGREI*)



Brown Anoles (*N.sagrei*) have demonstrated their ability to become invasive in the United States, particularly in Florida and Texas. They are a small Iguanidae lizard with generalist feeding habits that include a wide range of invertebrate prey.

4.1 RISK OF ENTRY

N. sagrei have successfully colonised large areas of Florida, Texas, Louisiana, Hawaii and Georgia in the USA and, more recently has been reported in Taiwan. Campbell (2002) states that at least six separate introductions into Florida occurred during the 1940's. They are thought to hitch hike on vehicles along highway networks and with nursery stock (Campbell 1996), although the Hawaiian introduction was thought to be an intentional release. Densities are recorded as high wherever it establishes and it is often recorded as the most abundant reptile in those areas. As such this increases the likelihood of *N.sagrei* contaminating a vehicle or a piece of cargo bound for Ascension Island. Survival of the journey would likely depend on the condition of the individual that was in transit. A healthy *N.sagrei* with fat reserves could potentially survive the trip if no significant delays occurred as demonstrated by a live gecko (already present on Ascension) detected in cargo from Florida. Clearly small reptiles can enter and survive on the sea freight pathway. For these reasons the risk of entry is considered medium.

4.2 RISK OF ESTABLISHMENT

N.sagrei reportedly prefer habitat within 2m (6'6") of the ground including shrubs, small trees and rock piles (Rogowitz 1996). It is thought that one of the reasons they have become a successful invader is their enhanced ability to thermoregulate enabling a wider climatic tolerance in novel environments (Rogowitz 1996). Each breeding season a female lays a total of 15-18 eggs, 1-2 at a time every 1-2 weeks. The female *N.sagrei* has the ability to lay eggs every 1-2 weeks as she can store sperm allowing her to lengthen the laying period, potentially increasing the risk associated with a newly arrived gravid female The hatchlings are independent and develop fast, becoming mature before one year of age. The female *N.sagrei* does require moist soil, high humidity and leaf litter for establishing her nest for laying eggs. This is likely to be limiting resource on the western side of the Island where entry is most likely. For this reason the risk of establishment is considered medium.

4.3 POTENTIAL IMPACTS

N.sagrei is omnivorous and will prey upon a wide range of invertebrates including spiders, grubs, beetles and grasshoppers some of which are present on Ascension. Potentially young land crabs that have recently emerged from the ocean could also be come prey.Additionally they will prey upon other smaller lizards and their eggs so would potentially find a food source in the already established lizard species of *Hemidactylus frenatus* and *H.mercatorious* and the introduced iguana *Liolaemus wingmani.* It is therefore likely that impact to AscensionIsland biodiversity will be limited to preying on indigenous invertebrates. Impact is therefore assessed as medium.

4.4 *NOROPS SAGREI* RISK MITIGATION

Being such a highly mobile species, detection within a container or break bulk being prepared for loading would be difficult and largely come down to chance. However, providing sterile fenced container/ cargo lay down facilities that do not attract lizards or other biota would reduce the risk of contamination.

Detection at the border is likely to be difficult for similar reasons, although may be more likely as the lizard's vigor could be affected by the journey (if containerised). Thorough inspection would be required to detect the lizard and to facilitate capture before it escaped into the wider environment. The use of adhesive paper (MobeMoat) is used elsewhere to great affect for managing reptile ingress but requires practice in its use.

Post border detection is likely to be via public reporting or through skilled observers on agencies respective EHT or via Dept of Conservation staff. Management of *N.sagrei* once it has established is likely to be impossible, especially if it establishes among lava flows and similarity difficult terrain. There has been no documented eradication of any lizard species from any location in the world.

5 NORWAY RAT (RATTUS NORVEGICUS)

5.1 RISK OF ENTRY

R.norvegicus is present around the world (See Figure 3 below)except for a few isolated locations and is present in St Helena, Capetown, Florida, and Texas with transit times of 9 days being shortest from St Helena and Capetown. A rat would most likely need to be contained within a confined space like a crate or a shipping container to prevent it from fleeing during the vessel discharge process onto the landing barges. Break bulk cargo with suitable refuges is also a possible means of translocation to Ascension. Their affinity for urban settings and port environments infers a high degree of exposure to freight awaiting shipment but combined with this the greater awareness of rat risk on vessel, and the associated likelihood of baiting programs around ports in developed countries possibly counters this risk. Given these factors the risk entry is considered Medium.

5.2 RISK OF ESTABLISHMENT

Given the largely worldwide spread of *R.norvegicus* and its long association with human habitation it seems almost certain that *R.norvegicus* could establish on Ascension Island. The harshness of the western side of the island combined with widespread toxic baiting programs in inhabited areas has the potential to kill new arrivals should they encounter them. Countering this is the rat's resourcefulness, omnivorous feeding habits and ability to move large distances (Russel et al 2005) and reproduce quickly.

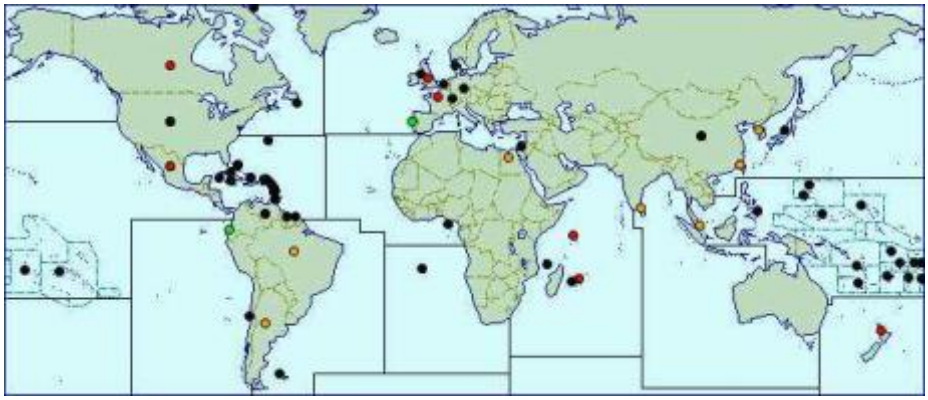


Figure 3: *Rattus norvegicus* current distribution (CABI)

5.3 POTENTIAL IMPACTS

In a natural environmental setting *R.norvegicus* has an apparent affinity for vegetation in damper areas (Harper et al 2005). This implies that should they arrive and establish they are likely to find conditions, in the wider environment, on the west coast of Ascension Island sub-optimal. Should they naturally migrate or be accidentally translocated to Green Mountain or the southern side of the Island, conditions there are likely to be far more favourable. Being omnivorous impacts are not likely be markedly different than *Rattus rattus* already established widely on the Island, but actual dietary

preferences and any associated impacts on birds, plants or invertebrates are difficult to predict with any certainty. In saying that it has been recorded swimming up to 2km across water to get to offshore Islands (Russell et al 2005) so there is clearly a risk if they accessed sea bird colonies off Ascension. Invasions onto novel island environments have seen *R.norvegicus* densities reach 10 animals/ha so there are implications for eggs and hatchlings within any sea bird nesting colonies at these densities.

5.4 RATTUS NORVEGICUS RISK MITIGATION

Preventing *R.norvegicus* from contaminating vessels and cargo is an obviously a preferable strategy rather than trying to eradicate an expanding population. Ensuring all vessels that visit the Island have robust baiting programs and getting them to demonstrate that the crew knows how to use and routinely use rat guards is required. This is difficult to achieve without spending some time on the vessel to talk to the crew and to survey existing rat control efforts and observing rat guard deployment. Toxic baits can also be placed around all relevant off-shore cargo storage facilities and within containers, crates, break-bulk and on the vessels.

Inspecting and locating a rat during border inspections is an unlikely event unless the rat is already experiencing effects from toxic baits as they will actively evade detection. That said, they do leave tell-tale signs of having been on or in cargo via rat droppings or by chew marks on cargo or toxic baits but by this stage, unless cargo is prevented from being unloaded, it is too late. Baits need to be fresh to ensure these indicators are current and not from some historical feeding event.

Post border surveillance is only likely to be effective once numbers build up to detectable levels. Newly arrived rats have the potential to move large distances and to evade trapping and poisoning efforts. The effort to detect and eradicate any newly founded population can be huge and has a low likelihood of success (Russell et al 2005).The costs associated with this could quickly become prohibitive.

6 LATRODECTUS INDISTINCTUS AND SPP

The black button spider, *L.indistinctus* is one of thirty *Latrodectus* species scattered across the globe and one of the six species being present in South Africa and of four species in Florida. They have a global reputation for causing for causing painful neurotoxic bites, although the bites are not common and not all involve injection of venom. When venom is injected and envenomation symptoms evolve the victim are classified as having Latrodectism.


Photo by Shenrich

6.1 RISK OF ENTRY

Each of South Africa's *Latrodectus* species has a mapped distribution with someoverlap. *L.indistinctus* is present in Capetown (Muller 2012) and provides a source of venom for the production of anti-venom. Florida has four other species present. Like all *Latrodectus* they build strong but messy looking 3-dimensional webs, generally in low lying areas that are protected and that go undisturbed. Several of the species are synathropic (Garb et al 2004) and are frequently associated with buildings, sheds and other low lying man-made structures as well logs and stones. In USAF container inspection data (Appendix 4), one active *Latrodectus* web with an egg was collected and two other distinctive *Latrodectus* sp webs were detected on the underside of containers and break bulk from Florida. Due to inspection time constraints and access difficulty the spiders could not be located or collected.

Anecdotally, there have been reports of *Latrodectus* spp on grapes being imported to Ascension. This could not be confirmed but there are many reported intercepts from around the world of this occurring so it is likely to be true and a recent intercept (18th March 2016), on La Rochelle grapes from South Africa by Biosecurity St Helena, reaffirms the likelihood of this occurring. This association with grapes appears to be isolated and there are no records of other fresh produce being affected.

Given the *Latrodectus* genus's propensity for building webs on low lying man-made structures and the records of contamination from freight from Florida and the likely importation via table grapes we can conclude that the risk of entry is High.

6.2 RISK OF ESTABLISHMENT

Latrodectus geometricus is already established on Ascension Island, its direct source is unknown but genetics suggest its original endemic range was in South Africa and possibly South America (Garb et al 2004). The genus has demonstrated that they can move with trade for various representatives of the genus having been translocated across to novel locations around the globe. With Florida having four species, one in St Helena (Ashmole & Ashmole2000) and South Africa another 5 species (Muller 2012) it seems highly likely that other habitat niches may be available on Ascension that have not yet been colonised. The female *Lactrodectus* can store sperm for two years so a fertilised female theoretically could establish a new population with each egg sac holding up to 200 eggs.

The risk of establishment is therefore considered High.

6.3 POTENTIAL IMPACTS

Impacts from *Lactrodectus* spiders are limited to public health. Lactrodectism, the systemic symptoms observed after envenomation by a *Lactodectus* genus spider, are well studied in the

medical literature. The symptoms described below are generalised for the genus with some species being more venomous than others, and the degree of envenomation varies between bites. The *Latrodectus* spider's venom can cause a state of anxiousness, excruciating pain and cramps in muscles and some difficulty in breathing. Weakness of the legs, tightness in the chest and profuse sweating are also common recorded symptoms (Muller et al 2012). People particularly susceptible from the effects of envenomation are children, the elderly or those with cardiovascular or respiratory conditions. Bites from *Latrodectus hasseltii* in Australia are common with approximately 2000 bites per annum being recorded (Nicholson and Graudins 2003) but not all Latrodectus have the same degree of human interaction. Death from Latrodectism is rare and anti-venom is available for some species.

Potential impacts from any new Latrodectus species establishing on Ascension Island are considered High

6.4 RISK MITIGATION

The most effective pre-border strategy is to ensure that during the cargo packing process, all cargo, pallets, flat racks and containers are thoroughly cleaned and treated with a residual insecticide. This will kill almost everything present and provide a period of protection depending on the strength of the residual chemical used. Pallets, packing material or flat-racks or shipping containers that have been inappropriately stored for long time before use are at higher of risk of being contaminated. To that end new pallets or freshly prepared shipping containers or flat-racks are best. Where access to affected surfaces is difficult effective pre-border control of affected (non-foodstuff) cargo can only be achieved by fumigation using methyl bromide, sulphuryl fluoride or equivalents. The gas will penetrate all voids where spiders construct webs and it will kill eggs, spiderlings and adults. This is a relatively costly exercise using a very potent fumigant. The next best treatment is a smoke bomb containing synthetic pyrethroids. It will not penetrate small voids like a fumigant but is still quite effective, is far cheaper and safer. It won't be effective on eggs sacs. It must be conducted in a closed space to retain the smoke or fumigant for maximum effect.

Managing spiders at the border relies on either visual inspection to detect them or routine treatment. Inspection is resource intensive and not 100% effective due to the inaccessible crevices that spiders can use but, where visible, webs and egg sacs are usually very distinctive. Again fumigants or smoke bombs can be used to good effect in enclosed spaces but the former is costly and hazardous and the latter is cheap and not as effective.

Post-border surveillance can be used to pick up newly arrived spider species but identification is highly specialised and problematic especially on immature spiders and males. Additionally by the time they are detected and identified any ballooning spiderlings could be across the other side of the island – making eradication impossible. Pre-border or border management of this threat is therefore by far the preferred option.

7 TUBASTRAEA MICRANTHUS & COCCINEA

*Tubastraea micranthus & coccinea (*Cup corals) are two Indo-Pacific species of scleractinian corals that have been recorded as demonstrating invasive characteristics by forming dense colonies on artificial structures and potentially excluding other native sponges and corals in natural marine environments (Sammarco et al 2010). They have been widely spread to novel locations, have been observed at very high densities and have the potential to arrive at Ascension Island.

Photo by Chaloklum Diving

8.1 RISK OF ENTRY

Both *Tubastraea* species have already demonstrated that they are capable of hitch hiking to new locations as shown by their wide geographic distribution outside of their known native range. They are established in many tropical locations extending from Florida through the Central American and Caribbean regions and down to Brazil as well as some Micronesian islands. *T.coccinea* is well known for its ability to colonise oil and gas platforms in the Gulf of Mexico (Sammarco et al 2010) which are not dissimilar to the pipe laying platform that visited Ascension Island during the consultants visit (see Section 4.4.6). This pipe laying platform was from the Southern Caribbean. The arrival of this high risk type of vessel does not appear to be common occurrence on Ascension Island, therefore the risk of entry of T.coccinea and or micranthus to AI waters is considered to be medium.

8.2 RISK OF ESTABLISHMENT

T.coccinea and *micranthus* have demonstrated their ability to establish in novel environments in areas where it has already been introduced. Reproductive maturity can be achieved in as little as 1.5 years. They can reproduce sexually as well being able to reproduce hermaphroditically.They can also spread through the extension of runners. Planulae larvae are viable for 14 days after emergence but tend to settle close to parents. They have been recorded in both sub-tidal zones as well as deep and shaded vertical surfaces and show a high degree of niche selection plasticity. The risk of establishment is considered to be medium.

8.3 POTENTIAL IMPACTS

The very high densities of T.coccinea that have been recorded on oil platforms infer that niche dominance could occur at the expense of other native benthic invertebrates, sponges and corals. The potential biodiversity impacts are considered to be medium.

8.4 RISK MITIGATION

There is really only one truly effective way to mitigate the risk associated with biofouling marine invasive species and that is to ensure that they do not arrive in Ascension Island waters in the first place. This requires biofouling policy and legislation to be enacted that sufficiently covers the marine environment and allows the implementation of a vessel hull cleaning requirement. Alternatively, certain types of high risk vessels (eg oil and gas platforms) could be prohibited from mooring inshore.

Border management of marine species would entail surveillance of all high risk vessels arriving at Ascension Island including hull inspections. This is unlikely to occur in practiceas they only safe to do this is to have dead vessel and this is costly and dangerous. Border management is therefore not considered practical.

The likelihood of detecting newly arrived individuals in a timely manner to facilitate eradication is extremely remote. Indeed Zibrowius et al.(2014) suggest that a presentation made by Irving (2013) potentially show that *T.micranthus* may already be present on Ascension island. This needs further investigation as it may be an erroneous record. Unless a very effective marine invasive species surveillance program is established to reduce the time between incursion and detection, trying to eradicate new arrivals is problematic and unlikely to succeed.

Appendix 2.
RMS Cargo Inspection Results

Appendix 3.
FIRS Cargo Inspection Results

Appendix 4.
USAF Container Inspection Results

Appendix 5.
USAF 2002 Final Governing Standards for Environmental Protection by US Forces on Ascension Island

Appendix 6.
AIG Legislation excerpt from Shine (2009)

Appendix 7.
Leaflet-25-Biosecurity

Appendix 8. Biosecurity-Assessment-for-Ascension-Island-TOR

Appendix 9. MOD Biosecurity Requirements for Vehicle Imports

Appendix 10.
Richard James
Biosecurity Declaration

Appendix 11.
Sea Container Import Health Standard (MPI)