Pest Abatement Measures for the Outer Islands in the Seychelles

Recommended measures to reduce the risk of introduction of harmful pests to Desroches, Alphonse, Farquhar and Poivre Islands

James Millett, Consultant.

October 2017

Cover Photo:

Clockwise from top left: Spiraling whitefly, Yellow crazy ant, vine *Merremia peltata*, Brown rat and cargo vessel *Spirit of Ton George* at Providence

Recommended Citation

Millett, J, (2017) Pest Abatement Measures for the Outer Islands in the Seychelles. Unpublished report under the GOS-UNDP-GEF project entitled Expansion and strengthening of the Protected Area Subsystem of the Outer Islands of Seychelles and its integration into the broader land and seascape. GOS-UNDP-GEF Programme Coordination Unit, Mahe Seychelles.

Acknowledgements

This document was produced under GOS-UNDP-GEF project: Expansion and strengthening of the Protected Area Subsystem of the Outer Islands of Seychelles and its integration into the broader land and seascape managed by GOS-UNDP-GEF Programme Coordination Unit. I would like to thank the staff and managers of IDC for invaluable inputs and recommendations, in particular Mr Glenny Savy, Mr Ronny Renaud, Mr Brian Camille, Mr David Brown, Mr Barry Laurencine. I would also like to thank Mr Brown for showcasing pest prevention measures already being undertaken by IDC. I would also like to thank Ms Wilna Accouche for advice and review of the document and ensuring complementarity with the objectives of SIF and to thank staff of PCU, Ms Joanna Prosper and Dr Grieser Johns for guidance and review of the documents.

Contents

Introduction

Purpose of Document

This document recommends **Pest Abatement Measures (PAM), which includes the prevention of pathogens and pests that are likely to cause negative economic, social and environmental impacts on islands.**

The best way to prevent pests reaching an island is to have restricted shipping and cargo with containment and fumigation measures. That is to say cargo is sterilized and sealed before departure and contained and searched on arrival. This is suitable for high protection sites with low volumes of cargo but not for the Outer Islands. The Outer Islands must have an effective and practical Pest Abatement Measures.

We can use the mnemonic "PEST"

- ✓ **P**ermanent
- ✓ **E**ffective
- ✓ **S**imple
- ✓ **T**reatments

A prevention strategy should

1. **Place as many barriers as possible to prevent pests reaching the island**: this will reduce the risk of pests reaching the islands at each stage
2. **Should be along the entire pathway, especially the beginning**. It is a lot better to eliminate pests on Mahe where there are only 2 or 3 gateways than on arrival at the islands
3. **Should focus on the biggest risk pathways and pest types**. It makes more sense to sterilize bulk cargo which has big risks than mitigate for rare and low risk pathways such as unauthorised landing
4. **Should be practical and supported by staff and business managers.** If protocols are too difficult complicated and expensive to implement they will not be adopted – a simple model that mitigates the biggest risks is better

The priority Pathways are **bulk cargoes** particularly those being transported on barge or ship from Zone 21

The priority pest to prevent are first and foremost are **ants, insects, snails and invertebrate pests and second rodents**. These groups are the most common stowaways and have the biggest impacts

Identifying Risks from Pest Species

Main groups of Pests Species Posing a Risk to the Outer Islands

A simple grouping of some of the worst types of invasive species is helpful to inform planning, this allows for prioritization of some of the most harmful types of pest.

Rodent and other small mammals (black rat *Rattus rattus*, brown rat *R. norvegicus*, house mouse *Mus musculus,* tenrec *Tenrec ecaudatus,* cats *Felis catus* and rabbits *Oryctolagus cuniculus**):***

Rodents are some of the most harmful invasive species depredating on native species and causing economic and health impacts (e.g. leptospirosis). Three species are abundant in the Seychelles

- Black Rat
- Brown Rat
- House mouse

It's probably that only Black rats and House mice are present on most of the outer islands; brown rats, should they establish may have different impacts and are more likely to swim between islets (such as on Farquhar or Aldabra). It is good practice to prevent further introductions. Rodents are normally introduced as stowaways, especially in bulk cargoes such as hollow goods, building materials, animal feed and bedding.

Cats are often introduced to control rodents or as companion animals. Rabbits, raised for food, have been released on several islands (Cosmoledo, Desnoeufs and Marie Louise). Tenrecs are abundant on Mahe but infrequent on the reclaimed land and lowlands and the risk of accidental introduction is low.

In addition there are a number of other small mammal pests in the Western Indian Ocean Region including Small Indian mongooses *Herpestes javanicus* and Indian musk shrews *Suncus murinus* that could be transshipped from abroad in cargo.

Key actions to prevent Mammal Pests:

Restrict personnel and prevent movement of pets, restrict the release of live stock or animals being kept for food (e.g. rabbits).

Hygiene of cargo, boats and landing points, the use of bait stations and traps will reduce re-introduction risks. Ideally the fumigation of cargoes.

Birds (Indian myna *Acridotheres tristis*, House sparrow *Passer domesticus*, Madagascar fody *Foudia madagascariensis*, Indian House crow *Corvus splendens*, Ring necked parakeet *Psittacula krameri*, Barn owl *Tyto alba*, Wax bill *Estrilda astrild*)

Several species of introduced bird are established in the Seychelles, mostly on Mahe and granitic islands (Mynah, Madagascar fody, barn owl, and waxbill) house sparrows are established on some outer islands.

Introduced birds have been the target of control measures: Red whiskered bulbul and Madagascar fody have been eradicated from Assumption and Aldabra, Indian house crow and ring necked

parakeet from Mahe and house sparrows from Mahe. Mynahs and barn owls have been controlled or eradicated on several islands. This is indicative of the high impact they have as pests, impacting on wildlife and being crop pests and a nuisance to hotels.

In the past birds have been released deliberately or pets (caged birds) have escaped. It's unlikely that this would happen today and the main pathway is from birds riding on boats. House sparrows were ship assisted to Mahe and Mynahs have been documented dispersing on boats elsewhere. Flying between adjacent islands can also occur (e.g. Red whiskered bulbul *Pycnonotus jocosus* and Madagascar fody dispersed 27km to Aldabra from Assumption).

Key actions to prevent bird pests
Vigilance to prevent birds (mynahs and house sparrows riding on ships), and prevent pets being taken to islands, prevent the release of game birds, domestic birds.

Reptiles and Amphibians (mainly geckos *Gehyra Spp, hemidactylus Spp*, crested tree lizard *Calotes versicolor*):

Most of the reptiles introduced in the Seychelles are gecko species, such as the House geckos *Gehyra mutilata, Hemidactylus spp*, which are mostly a nuisance living in houses and fouling paintwork and furnishings. More recently Crested tree lizards and Red eared slider terrapins *Trachemys scripta* have been found in several locations in Mahe and both species may establish.

Future invasion threats include snakes (e.g. corn snakes) introduced as pets or as stowaways to Mahe. Asian common toads *Duttaphrynus melanostictus* are present in the region would also be a substantial threat to biodiversity (Andreone, 2014). Reptiles and amphibians are often stowaways in cargo or may be brought as pets.

Key actions to prevent Reptile and Amphibian introductions

Reptiles and amphibians may be quite resilient to starvation and dehydration and not susceptible to baits in the way rodents are; fumigation and vigilance are effective in reducing import risks. Restrictions on bringing pets is also important.

Invertebrates (ants, snails, whitefly, scale insects, moths)**:**

Invertebrates pests are numerous and several new high profile pests have been imported in recent years, many are crop pests whilst others have nuisance impacts.

Ants are amongst some of the most damaging and costly pests: at least 6 invasive ant pests are in the Seychelles:

- Tiny yellow house ant *Tapinoma melanocephalum*
- Big headed ant *Pheidole megacephala*
- Yellow crazy ant *Anoplolepis gracilipes*
- White tipped ant *Technomyrmex albipes ,*
- Slender crazy ant *Paratrechina longicornis*
- Flower ant *Monomorium floricola*

At this time most ants in the Seychelles are a nuisance and may increase damage from crop pests by protecting aphids, however there are risks that more harmful stinging species (e.g. fire ants *Solenopsis invicta,* Little fire ants *Wasmannia auropunctata*) will arrive in the Seychelles. Ants are able to stow away very easily, in soil, containers, stacked materials, food products.

Other introduced invertebrates (some of which have become high profile recently) include:

- Yellow tailed moth *Euproctis sp* which is a recent introduction, the caterpillars or pupae may be transported in cargo or moths carried in containers or attracted to boat lights. It has reached Desroches. The hairy caterpillar can cause severe irritation.
- Spiraling whitefly *Aleurodicus disperses* and Coconut whitefly *A. atratus* are crop pests, the former attaching a wide range of fruit and vegetables, the latter palms. Spiraling whitefly is reported to have reached Alphonse and Desroches. Presumably import is on living and cut plant material.
- Mosquitoes including Asian Tiger mosquito *Aedes albopictus* (can carry zika virus and dengue) and Anopheles Mosquitos (can carry malaria). Mosquitos are commonly transported in cargo, this may be as adults in containers but more often as larvae or pupae in water trapped in cargo. Tyres, hollow blocks or containers that have gather rainwater are a sure fire way to transport mosquitoes. Inspection of cargo and spraying containers or cabins are sensible precautions.
- Melon fruit fly *Bactrocera cucurbitae* is a tiny fly recently introduced to Mahe, it attacks melons squash and cucumbers laying eggs in immature fruit that destroy the produce. Its mainly transported as larvae in vegetables and inspection and restriction of produce are good counter measures.
- Fungus gnats (unidentified) are presumed to be an imported species became extremely abundant on Mahe in 2016, they are a nuisance species. They appear to breed in compost and care with transport of compost is advisable.
- African land snails *Achatina fulica* the large and well known African land snails are formidable garden pests which can stow away in bulk cargo especially as juveniles.
- The Tomato leafminer *Tuta Absoluta* which has undergone a rapid global expansion is the latest pest which may have colonized the Seychelles.

Key actions to prevent invertebrate pests

Hygiene of cargo is essential. The most effective solution is the transit of cargo in sealed containers and fumigation of high risk cargoes, however this is not practical. An alternative is to ensure sterility of the storage and landing sites, through spraying with long lasting insecticides, maintaining clean loading facilities (removing rubbish), spraying high risk cargo, inspection, ensuring trapped water is not shipped and prohibiting movements of soil and plants.

Weeds (creepers, palms and trees):

There are many harmful weeds and plants a number of ornamental species, in particular creepers and palms that are popular ornamentals. The list of invasive plants or potentially invasive plants is long (see table 5 in Rocamora (2015). Examples of invasive species include:

- Vines and creepers including *Epipremnum aureum* which grow on the trunks of trees and are partly epiphytic (if cut they don't die off) and *Mirremia* which spreads over crowns of trees

- Hard wood trees such as *Adenanthera pavonina* (lagati), *Alstonia macrophylla* (bwazonn) which seed prolifically and are not widespread on outer islands
- Palms including *Licuala spinosa* Mangrove fan palm *Syagrus romanzoffiana* (Queen palm) and Betel palm *Areca catechu* which are widely planted as ornamentals and show signs of being invasive

By and large vegetable crops do not become problem weeds, however plants imported for gardens often show invasive characteristics (i.e. the ornamental plants easy to grow are vigorous, easy to propagate and tolerant of harsh conditions)

The most obvious introduction pathway is when plans are deliberately imported for gardens with secondary pathways with seeds that are accidentally brought, in soil or on wheels or foot wear etc.

Key Actions to Prevent Weeds

A white list of plants that can be used in landscaping is recommended, or native only landscaping. Good hygiene for soil, compost machinery footwear.

Diseases (e.g. takamaka wilt)**:** On a global scale there is a proliferation of plant diseases mostly fungal or fungus like diseases, the Seychelles has experienced two outbreaks, Takamaka wilt and Sandragon wilt and the probability is there will be more. The main pathways for such pathogens is probably with contaminated wood or live plants, possibly insect vectors. The introduction of Chytridiomycosis is an infectious disease that affects amphibians worldwide is a meaningful concern for the Seychelles causing mass mortality and extinction of amphibians. It is caused by the chytrid fungus (*Batrachochytrium dendrobatidis*).

Human and veterinary diseases can also be considered invasive species, a number of potentially quite serious diseases including dengue or malaria may arrive with mosquito vectors, or with human carriers and the transmitted by alien vectors. Zoonotic diseases (diseases transmitted from animals to humans) could potentially arrive with invasive species or naturally dispersing animals: bird flu is an example.

Key Actions to Prevent Diseases

Management can include importing of treated timber only, and restrictions / hygiene on live plant material. Measures to prevent the importation of mosquitoes and biting insects

Simple Pathway Analysis for Pest Risks to the Outer Islands

The means by which pest species are imported or introduced into new environments are called ***pathways***, or ***vectors***. A fairly simple analysis can be undertaken for the Seychelles which identifies main routes that pest may take to the Outer islands. Pathways to the various outer islands are very similar to one another.

The main pathway to the outer islands has three stages

1. One of the 3 main loading areas and stores on Mahe
2. The boat or plane transport
3. Arrival on the island and movement of goods and luggage to final destination

Cargo and passengers are all regulated and pathways to the outer islands almost entirely originate in Mahe, and from only three loading points. Therefore the risk of new species introductions comes firstly from pest species established on Mahe, and to a lesser extent from trans-shipping between islands or cargo from abroad.

Having few controlled entry points is a great advantage when it comes to preventing pest species

The Pathways are:

Air Transport (personal and light cargo) from IDC Aviation: IDC runs light aircraft services to Alphonse, Desroches, Farquhar, Assumption, Coetivy, Marie-Louise, Platte and Remire. IDC also operates a daily flight for the Desroches Island Resort and a weekly flight to Farquhar during the fly-fishing season which runs from October to May. There is a fleet of four light aircraft. IDC also operate flights to D'Arros. Passengers taking air transport to Assumption may proceed on to Aldabra by boat.

Most flights depart from IDC Aviation, a compound on the south side of the airport containing small storage units, offices for IDC and ICS and departure lounge etc.

Supply Boat (Cargo) from Victoria and Area 21: IDC supply boat (Enterprise) normally circuits islands on a 2 monthly basis; it particularly services Assumption and supplies Aldabra. A number of other boats are used including *Spirit of Ton Joe*, *Praslin Wave*, *Vijay 1 and 2*. Charter vessels are used to meet the shipping demands particularly with construction projects on several islands.

There are two loading points: from IDC Port Victoria or Zone 21 (airport site) on Mahe.

Zone 21 is a 1ha compound just to the north of the runway on Providence Reclaimed land, it is fenced and has several large sheds for storage and a carpentry workshop, the area is used as a storage site for bulk materials including aggregates (macadam, sand), timber, pipes, paints as well as animal feeds etc.

Arrival on the Islands

Supply boats either moor offshore and transfer small cargoes by tender, or in the most part beach and unload, at least for heavy cargo.

Additional potential pathways for pests to get to the outer islands include:

Deliberate Introduction: the purposeful introduction of pests or weeds, such as ornamental plants, pets, lose livestock or potentially malicious introductions although the latter seems unlikely.

Trans-shipping Between Islands: potentially invasive species could be picked on one island and be transferred between islands, the risk being greatest where boats land or are moored overnight. This could include the transshipping of rodent pests or where moored off shore bird species such as sparrows or moths attracted to lights on the vessel.

Authorised or Unauthorised Boat Landings from Abroad: direct boat or air transport between the outer islands and other countries is a risk. The frequency and type of vessel and goods carried are not known. Hence unregulated landing such as smugglers or poachers represents a potential route especially as they may come from outside of the Seychelles.

Natural Dispersion: flight or rafting between islands, is probably a rare event given the distances between most islands although quite likely between close by islands or within island groups. It has been proven with birds (fodies and bulbuls) crossing from Assumption to Aldabra.

Rare and Unpredictable Events (Shipwreck etc): from time to time rare events may happen that result in the introduction of species, this could include the wreck of a ship, or invasive species jumping or flying off a passing boat

<u>The main pathway and overwhelming risk of pest introductions to the Outer Islands is from bulk cargo loaded and shipped from Zone 21, additional sea freight from Victoria, airfreight and passenger transports are also potential introduction routes, but the risks are substantially less</u>

Table 1 Pathway Risk Assessment: a simple assessment looking at main pathways or vectors and assessing severity of threat and frequency to estimate overall risk

Pathway	Origin	Transport	Main pest type	Frequency	Threat	Risk
Cargo (heavy)	Zone 21	Boat / barge	Rodent, reptile, invert, (diseases)	3	3	9
Cargo	Victoria Port	Enterprise / charter boat	Rodent, reptile, invert	3	2	6
Cargo	IDC Aviation	Light aircraft	Rodent, reptile, invert	3	2	6
Unauthorised landings	Mahe, Madagascar, unknown	Boat (smugglers / pirates)	Rodent invertebrate reptile	1	2	4
Personnel	IDC Aviation (mostly)	Light aircraft	Invertebrate, rodent weeds	3	1	3
Deliberate introduction	Victoria Port / Zone 21	Boat	Weeds (i.e. ornamental plants), Small animals (pets)	1	3	3
Trans-shipping	Between islands	Boat possibly aircraft	Birds, invertebrate rodent	3	1	3
Charter boats	Mahe, private islands, abroad	Yachts / boats	Rodent invertebrate reptile	3	1	3
Natural dispersion	Unknown	Flying (rafting), migrant birds	Birds, rodents reptiles, diseases			
Stochastic events / Accidents	Unknown	Boat (ship wreck/ groundings)	Rodents	1	1	1

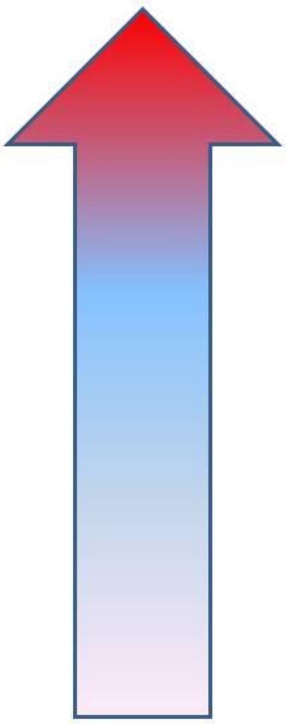
- Frequency = frequency of vector / pathway being used - 3 is very frequent 1 is infrequent
- Threat = threat of pests arriving using vector (3 = high threat, 1 low threat)
- Risk = frequency x threat

Pest Abatement Protocol

A pest Abatement Protocol should:

1. Focus on the greatest risk which is cargo especially from Zone 21 because this has the highest probability of containing stowaway pests
2. Most effort should be on sterilizing loading sites and boats because it's easier to control and destroy pests on a few locations on Mahe than contain pests arriving on islands
3. Interception and monitoring on the island will be the last line of defense
4. A basic knowledge of pests for all staff will be helpful

The Pathway Risk Assessment indicates that the greatest risks of pest introduction are:



High Risk

Bulk Cargoes Area 21 (rodents, reptiles insects)

Cargo Victoria Port (rodents, reptiles insects)

Cargo IDC Aviation (rodents, reptiles insects)

Medium risk

Personnel bringing pets or produce (IDC Aviation)

Illegal (unauthorised) landings

Deliberate introduction (plants for landscaping)

Private (authorised landings)

Transshipping between outer islands (birds, rodents)

Low Risk

Shipwrecks, rafting and natural dispersion

Prevention on Mahe

Zone 21 Very High Risk

The compound is difficult to manage to reduce pests with a large area *c*.1ha, Casuarina trees overhanging storage areas (shedding seeds and providing refuge for pests) workshops and open storage buildings, and a large work force that may not be aware of nor support pest control measures. Invertebrates including several invasive ants are in the compound and rodents are abundant (D. Brown Pers com.).

A *perfect solution* would be to devise a sealed sterile storage unit where all cargoes are loaded in the rear inspected and if needs be fumigated, and when sterile loaded directly on to awaiting craft. However this is not a realistic proposition (at least in the short term) because of costs of construction and difficulty of implementation.

However a number of simple measures are recommended which will greatly reduce the risk of transporting pests:

- As much as possible the entire site should be cleared – any materials not to be transported or used in workshops, rubbish, waste wood should be disposed of safely or burned (e.g. waste wood) to reduce cover for pests
- Territorial dogs should be removed or penned during the day to allow pest controllers safe access
- Place a grid of permanent (commercial locking cover) bait stations roughly 25m apart across the site to control rodents and reduce the risk of them getting in to cargo. Bait stations should be placed in locations where they will not be damaged (e.g. run over). Human interference should be monitored. Bait can be sourced locally – but should be good quality second generation anticoagulant (Brodifacoum, Bromadialone, Difethiolone).
- The entire site should be treated on a 2 monthly basis with a long-lasting insecticide such as Icon. This applications should pay particular attention to dry areas, walls of sheds vertical surfaces and stacked materials (not roads or areas that are exposed to rain). The aim will be to reduce populations of crawling insects in the area
- Bulk cargoes such as timber should be inspected, and sprayed with insecticide following same procedure.
- Ant Bait stations can be maintained in sheds and dry areas
- Cargoes should where possible be maintained in dry conditions (ie in the existing shed). Containers and hollow blocks containing water should be emptied and kept dry to reduce risks of mosquito larvae
- Compost soil, and vegetable matter should be inspected and phyto-sanitary certificates issued
- Potted plants or materials containing soil should be avoided as much as possible – if shipped they should be inspected by a qualified person and phyto-sanitary certificates issued.
- Containers should be cleaned before use, minimal measures of sweeping out or washing or jet washing if heavily contaminated. Ideally containers should be sprayed with a contact insecticide before loading with cargo

IDC Aviation High Risk

The IDC compound is clean and tidy and is treated for pests quiet often, however, big headed ants were noted around the ICS offices and the pest management measures could be strengthened:

- Regular spraying with long lasting insecticide on all external walls, internal walls and floors of store rooms up to and including the boundaries of the compound (in dry conditions). There is no need to spray inside offices or similar closed spaces (unless there is a specific infestation)
- A network of ant bait stations can be maintained in and around buildings and stores
- Rodent bait stations should be maintained in all stores and several places outside of building and in hangers
- Inspection of baggage and removal of plant items, weeds, soil, inspection of foot wear and outside clothing for passengers flying

IDC offices and Stores, Victoria High Risk

- Regular spraying with long lasting insecticide of all external walls, internal walls and floors of store rooms, treatment with long-lasting insecticide up to and including the boundaries of the compound (in dry conditions). There is no need to spray inside offices or similar closed spaces unless there is a specific infestation issue
- A network of ant bait stations can be maintained in and around buildings and stores
- Rodent bait stations should be maintained in all stores and several places outside of building and in hangers
- Inspection of baggage and removal of plant items, weeds soil, inspection of foot wear and outside clothing

Box 1 Control of Insect Pests

Insect pests can be controlled by the careful and appropriate use of insecticides. Whilst fumigating cargo in sealed unit is the best single prevention measure, to prevent a range of pests, this is not proposed unless there is s specific issue to be addressed.

1) Surface spraying around stores and compounds. Safe long acting pyrethroid-based Deltametherin and Lambda-cyhalothrin (Icon) are recommended – both are available in the Seychelles and are safe to use. Lower wall, skirting boards, dry floor areas, stacked cargo etc can be sprayed. Crawling insects contacting the surface will be killed for several weeks after application.
2) Ant bait stations can be used a back up. There are several types of bait available the commercial bait “Amdro” (Hydramethylon impregnated corn bait) has been used effectively to reduce big headed ant on Aride. An alternative is Borax (used as a bleach and food preservative) mixed with sugar and water. Baits require ants that share food in the colony to kill the queens – it doesn’t not work on white footed ant (which don’t share food).

Bait stations may be very useful in controlling ant in areas not sprayed (kitchens and offices)

Prevention on Boats and Planes

- All boats should have at least four rodent bait stations on the boat, it where rodents are likely to occur, in the hold, cabins and sheltered part of deck
- The holds of boats should be sprayed with long-lasting insecticide every two months or prior to a visit to the outer islands for charter boats
- Staff should be trained in pest management, and report sightings of insects, reptiles and birds. Such pests should be destroyed
- An agreement needs to be put in place with a non IDC boats (charters, visiting vessels) to minimize pest risks

Prevention on Arrival on the Outer Islands

With most cargo being landed on the beach or some through tender, there are no easy containment measures. Optimal measures would be to have a secure landing sight and secure pest proof store for unpacking. This is not viable and the following is recommended:

- Increase vigilance and monitoring of arriving pests. All staff should be trained in the risks from imported pests and management to prevent invasive pests. Any arriving pests should be identified (to group of pest if not to species)
- ICS conservation officers should provide additional technical support helping monitor arriving pests, by assisting with identification etc, but should not be responsible for pest abatement or destruction
- Arriving pests should not be transferred further around the island but should be contained by spraying or bait stations. Contingency supplies will need to be kept on the island
- Options for secure stores or unpacking rooms should be investigated.

Monitoring and Response

Monitoring of pests in and around cargo departure sites will be helpful:

- All staff should be familiar with pests and the need to prevent spread
- The presence of pests in and around departure sites should be reported to the Pest Control Officer and appropriate control measures implemented
- Monitoring of pests arriving on the islands should also be reported to the Pest Control Officer and mitigation measures implemented (this will depend on type of pest)
- A regular programme of spraying and recharging bait stations should be implemented (this can be contracted out or be done in house, but it must be done regularly and documented)
- Unusual or unknown animals or plants should be where possible be collected and submitted to the pest control manager (local experts, conservation officers etc are available to assist with identification)

Box 2 Rodent Prevention

The best way to control rodent pests is by placing good quality bait in to a network of bait stations. Whist most of the outer islands already have rats, it is a good precaution to prevent second species from arriving as well as reducing damage and soiling of produce in storage.

Rodent bait is normally made from Second Generation Anti Coagulants (SGAR), which are relatively safe to handle but are toxic (human poisoning is very rare). However correct handling and management is important.

A bait station such as the "Pestoff departure lounge Pest off departure lounge " made in New Zealand is ideal the station locks to prevent removal of bait and keeps it dry increasing palatability.

Bait should be changed regularly. After being placed, inspected and recharge every few days and then 2 weekly or monthly after that. Old bait should be removed and destroyed.

Mitigating Other Pathways

Ship wrecks, natural dispersion and unauthorized landings. The risk from these events is small because they are infrequent. The most effective mitigation will be:

- Monitoring and vigilance to observe and report high risk activities. This could include a monitoring programme after a boat is grounded or awareness to spot that new birds are spreading to an island
- Launch contingency plans in response to an incursion high risk event: 1) investigation phase, 2) operational phase and 3) stand down and review. (See Government of Seychelles/UNDP/GEF, 2014, General Emergency Response Plan for Pests, Diseases and Alien Invasive Species)

Regulation and policy restrictions

In addition to physical barriers regulation by IDC has been and will continue to be important in preventing pests, measures that should be continued are:

- Inspection of personal baggage and confiscation of unsafe items (e.g. infected plant materials)
- Inspection of baggage includes foot wear and clothing items that may contain weed seeds
- Prohibition of soil imports
- Phyto-sanitary certification of all manures and composts and similar materials issued by SAA
- Restrictions / discouragement of live plant imports.
- Phyto-sanitary inspection of plant materials for pests by SAA.
- The progressive introduction of hygiene standards (bait stations and hold insecticide spraying is mandatory) for private charter vessels (starting with voluntary principle) and them moving to contractual arrangement
- Progressive introduction of hygiene standards for third parties using IDC transport or private transport to the OI (military supplies, hotels and development companies). Agreement through MOU.
- Hotels operating on the outer islands use only native plants or “safe white listed” naturalized plants for hotel gardens and landscaping.
- Prohibit untreated timber, bark wood chips etc
- An information leaflet issued for all visitors to the outer islands (see annex)
- Signage advising basic pest abatement measures at departure and arrival sights
- A training programme implemented for IDC staff on pest identification and management
- Measures should be incorporated in to the revision of the National Invasive Alien Species Strategy, and links created with the new Biosecurity Agency

Management and Staffing of Pest Prevention Measures

Extensive pest prevention measures are already undertaken by IDC, coordinated by the Environmental Health Manager. Its recommended that the Environmental Health Manager has overall responsibility for the Pest Prevention Protocols, maintaining oversight of pest prevention measures.

The skills and training to implement control measures include:

- Ability to identify invasive species with a basic understanding of biology, life cycles etc
- Ability to use pesticides including a basic knowledge of products, application and legal requirements
- Knowledge of prevention measures
- Ability to implement and / or inspect measures such as bait stations
- Ability to visit islands and liaise /provide advice remotely

The Focal persons on the island would need to have skills in identifying pests (roughly), the ability to launch containment and contingency responses (hold pesticide license).

One need highlighted was awareness of new threats – i.e. poorly known invasive species. It would be helpful to have the Pest Abatement Officer to be linked to the new Biosecurity Agency, which has the mandate to record and monitor new pest invasions, to receive notifications and alerts.

Recommended Training Requirements

The training of staff will be important for the prevention of pests. The following training is recommended for staff nominated for pest control on islands, staff responsible for screening baggage and passengers, staff responsible for logistics and store mangers:

Practical Pest Prevention course: a bespoke course of about 2 days which covers

- Understanding the impact of pests to businesses, health and the environment
- Basic identification of pests – it would not be reasonable to expect staff to be able to identify to species level – but can gain an understanding of the main pest groups and key threats
- Agricultural pests (SAA)
- Pathway ways and risk assessment (understanding how various pests may be transported)
- Practical pest control – deploying bait stations, safe and effective use of insecticides, monitoring and reporting
- Checking and inspection
- Interception and monitoring in arrival
- Launching a contingency response
- Documenting and reporting pests

Annex 1: Implementation Plan

IDC requested an implementation plan out lining key activities. These are based on

1. Short term actions that can be implemented quickly and efficiently and will contribute to the overall ability to reduce pest risks
2. Medium term actions that will help reduce risks but would require more resources and will not be implemented quickly
3. Long term actions – high end measures including planning and upgrading infrastructure

Short term Actions

- Implement training course in pest prevention focusing on giving a basic knowledge of pests types, pathways and prevention methods, the training over 1-2 days targets, line mangers and front line staff (assistance from OIP).
- Produce high quality leaflet and poster advising on prevention of pests

Medium Term Action

- Strengthen hygiene around loading sites by placing bait stations and insecticide treatments, especially area 21 including removal of waste materials
- Strengthen hygiene measures on boats including maintaining active bait stations and routine hold spraying - devise code of practice for charter vessel
- Agree restrictions on personal items to be taken to the islands – document in "staff handbook"
- Have one trained focal point on each island monitoring cargo arrivals
- Agree pest management protocols with other businesses operation on OI (especially permitted plant list)

Long-term

- Identify infrastructural requirements for containment and treatment of cargo in new infrastructure including optimal measures of cargo fumigation

Annex 2 Contingency Packs

Contingency Packs (Each Island)

1. 2 x 10 liter sprayer
2. Insecticide (Icon x2 packs)
3. Ant bait station x10
4. Rodent bait: 1 bucket and 10 rodent bait station
5. Rubber boots x2pr
6. Disposable protective suit
7. Mask and x2 changes of cartridges
8. Pill boxes/insect boxes (for collection of specimens)