

BIOSECURITY PLAN FOR TETIAROA ATOLL, SOCIETY ISLANDS, FRENCH POLYNESIA



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June 2020

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Version History:

VERSION	DATE	AUTHOR	REASON FOR CHANGE
V1.0	June 2020	Souad Boudjelas	

Citation:

This document should be cited as:

Boudjelas, S. (2020). Biosecurity Plan for Tetiaroa Atoll, Society Islands, French Polynesia.
Unpublished document.

CONTENTS

1	INTRODUCTION	5
2	THE SITE	5
3	CURRENT BIOSECURITY activities.....	7
4	RISK SPECIES.....	9
5	RISK PATHWAYS	11
6	INTRODUCTION TO RISK REDUCTION	15
7	PRE-BORDER RISK REDUCTION	15
7.1	General measures.....	15
7.2	Management of risk goods.....	16
7.2.1	General goods	16
7.2.2	Nursery stock	16
7.2.3	Building material	17
7.3	Aircrafts	19
7.4	Sea vessels.....	20
7.5	Beachcomber loading/wharf area.....	20
7.6	Shipping containers	21
8	BORDER RISK REDUCTION.....	21
8.1	General measures.....	22
8.2	Containers	22
8.3	Goods	22
9	POST-BORDER RISK REDUCTION	22
9.1	Surveillance	23
9.1.1	Passive surveillance.....	23
9.1.2	Targeted surveillance.....	23
9.2	Incursion response	24
9.2.1	Rats	24
9.2.2	Invasive ants.....	25
10	MANAGING STAFF AND CONTRACTORS.....	25
11	MANAGING VISITORS	26
11.1	The Brando's guests	26
11.2	Visitors to Eco-station	28
11.3	Charter boats and the public.....	28
12	BIOSECURITY ACROSS THE ATOLL.....	29
13	TETIAROA BIOSECURITY MANAGEMENT TASKFORCE.....	29
14	EQUIPEMENT	30
	ACKNOWLEDGEMENTS.....	31
	REFERENCES.....	31
	APPENDIX 1: IMPACT SEVERITY DEFINITION.....	33
	APPENDIX 2: LIST OF STAKEHOLDERS	34

APPENDIX 3: TRAP MONITORING DATASHEET	35
APPENDIX 4: BAIT STATION MONITORING DATASHEET	37
APPENDIX 5: RODENT IDENTIFICATION GUIDE.....	38
APPENDIX 6: ANT SURVEILLANCE METHODS.....	40

1 INTRODUCTION

The purpose of this Biosecurity Plan is to provide Tetiaroa stakeholders with guidance to effectively reduce the risk of unwanted introduced species establishing and spreading. Maintaining effective biosecurity is essential for the sustainability of an island ecosystem. The Biosecurity Plan contributes to the protection and restoration of the atoll and to the implementation of the Tetiaroa Conservation and Sustainable Plan (CASUP): www.tetiaroasociety.org/tetiaroa-casup).

The Biosecurity Plan is based on the following principles:

1. Preventing the arrival and introduction of species on Tetiaroa that may become invasive is the best and most cost-effective management strategy (compared to eradication or long-term control): the focus is on reducing the risk at points of departure, during transport and at points of arrival.
2. The expectation that a prevention strategy could result in “zero risk” is not realistic. It is well established that even with the best prevention systems in the world, invasive species may still slip through the prevention net. Hence, there is a need for putting in place surveillance to enable the early detection of any risk organisms that have succeeded in evading the prevention net and taking rapid action to remove any such invading organisms.
3. Managing risk pathways is more efficient than managing individual risk species/organisms. Such an approach reduces the risk from a wide range of organisms rather than focussing on a small number of specific risk organisms.
4. Participation by all Tetiaroa’s stakeholders in biosecurity is essential. Biosecurity is about getting everyone involved to adopt the right behaviour and “do the right thing”.
5. Tetiaroa’s owners, SA Frangipani and Pacific Beachcomber, are responsible for the effective implementation of this biosecurity plan.

2 THE SITE

Tetiaroa Atoll is a priority conservation site in French Polynesia and an Important Bird Area for seabirds. It is also an important nesting site for sea turtles.

Historically, Tetiaroa was a favoured retreat for Tahitian royalties making it a site of high cultural value for Polynesians.

Tetiaroa lies 50 km north of Tahiti in the Society Islands, French Polynesia (Figure 1). The atoll consists of 12 vegetated motu of varying sizes, circling a large closed lagoon (Figure 2). Onetahi is the only motu which is inhabited. This motu hosts The Brando, a luxury eco-resort; a research eco-station; a staff village (250 residents); and a vegetable garden (or fa’apu).

The total land area is 510 ha.

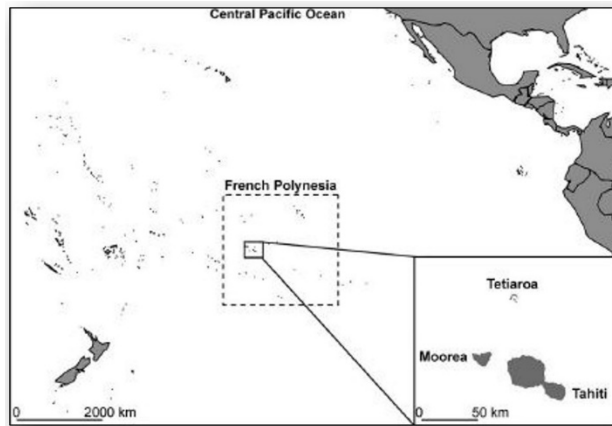


Figure 1. Tetiaroa location map (from Russell et al. 2011)

The motu of Tetiaroa are owned by SA Frangipani, which is majority owned by the Brando Estate. The lagoon remains the property of the French Polynesia government. Onetahi and Hounea have been leased to Pacific Beachcomber for commercial development. The remaining motu have been set aside for nature conservation.

Tetiaroa is accessible by air and sea. A reef dock was built to enable the transfer of goods and supplies from the ocean side of the reef to the lagoon side where they are landed on the motu dock on Onetahi.

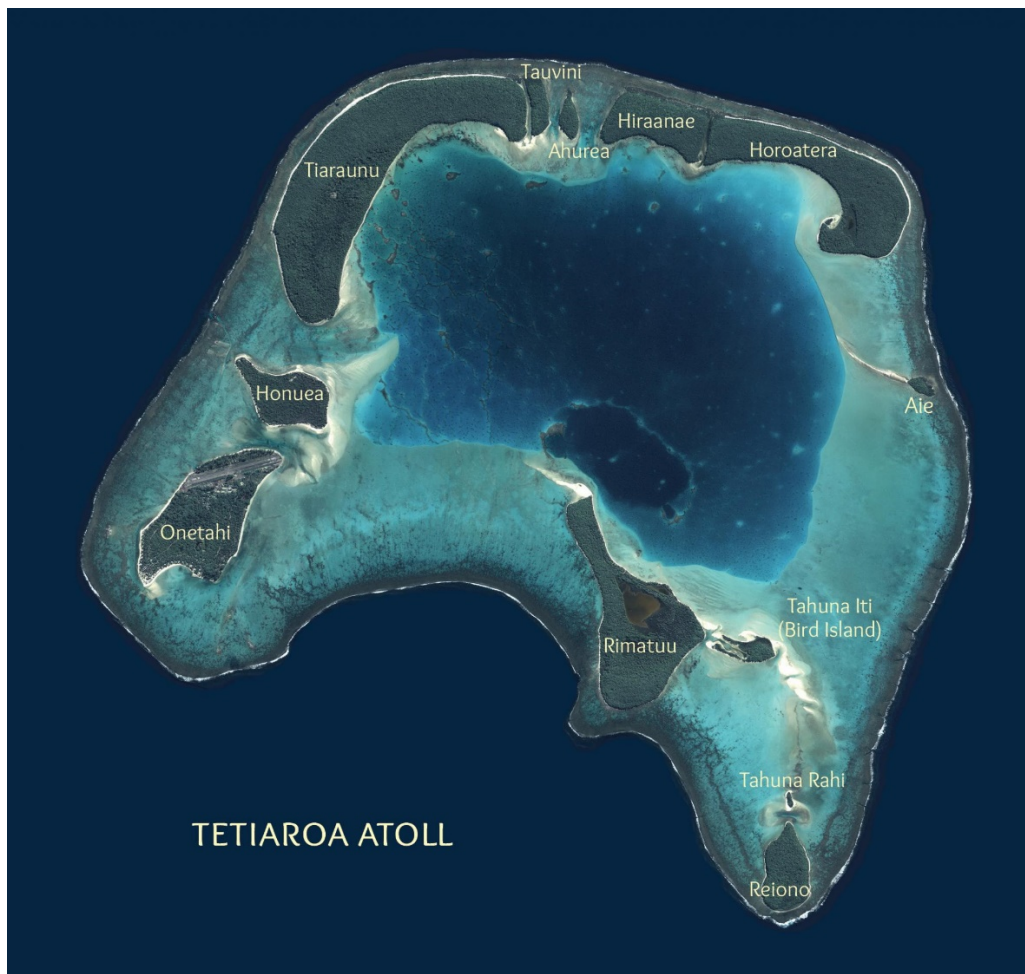


Figure 2. Map of Tetiaroa Atoll.

3 CURRENT BIOSECURITY ACTIVITIES

The author had to cancel a planned consultation visit with key stakeholders and facilities in mid-March because of COVID 19. This was replaced by remote discussions with stakeholder representatives via Skype and WhatsApp (see Appendix 2).

There was general consensus on the importance of biosecurity for Tetiaroa across all stakeholders. There was also agreement on the need for a dedicated person to manage the effective implementation of biosecurity measures across all entities on the island as well supporting the implementation of offshore measures. And, that this person is given the authority to fulfil this role.

Following are the main findings from these discussions regarding current biosecurity activities:

- Phytosanitary measures were appropriately applied during the construction phase but following completion, less precautions are being taken.
- For construction projects:
 - Development Tetiaroa (DT) includes biosecurity in discussions/negotiations of contracts with companies.
 - companies are required to sign the charter for the protection of the environment on Tetiaroa which includes a general requirement for phytosanitary control for goods to be shipped to the island including building material, equipment, machinery and foodstuffs.
 - companies need also to sign an agreement for site maintenance which requires phytosanitary control for: 1) the movement of goods, vehicles, equipment and machinery; and 2) the movement of local fruits and vegetables.
 - companies are required to have staff at the wharf to carry out pre-departure inspections.
 - non-compliance can result in a penalty of up to XFP 100,000. If remedial action is possible to be carried out at the wharf, it is at the expense of the company otherwise the goods are refused transport.
 - aggregates do not undergo any phytosanitary control prior to shipment to the island.
 - DT pays for rat control on the Taporo prior to transporting construction goods to the island.
- In 2018, Air Tetiaroa introduced a new directive for baggage handlers focussing on the transport of cut flowers which specifies that only flower consignments sourced from approved suppliers (such Tahiti Fleurs) or accompanied by a phytosanitary certificate are allowed for transported. Other airfreight is not subject to any biosecurity control.
- Tetiaroa Maritime Transport (TMT), carries out rat and insect control on their vessels, every six months.
- At the wharf in Papeete, pre-departure, the purchasing team for The Brando, open all packages and carry out visual inspection of all the goods for which they responsible (perishable and non-perishable foodstuffs, consumables and small equipment for the hotel) prior to these being loaded into containers for transport to the island.
- All new staff of The Brando are required to sign the charter for the protection of the environment on Tetiaroa. They receive training when they arrive on the island which includes a Green Tour. The tour covers sustainable development measures taken by The Brando, as well as, biosecurity issues such as food and plants they are not allowed to bring to the island, an introduction to the mosquito control project and how they can contribute to it, and what actions they need to take to help limit the proliferation of flies. In addition, these issues are often discussed with staff by the environment coordinator and the staff village manager. Despite this, staff have been known to bring fruit and vegetable, house plants and other plant material for planting. Such violations are not subject to any consequences.

- Most, if not all, gardening products are purchased from approved suppliers such as AgriTech, Heiata's Garden, Mr Bricolage, etc.

4 RISK SPECIES

Table 1 describes priority invasive alien species identified in CASUP and by some stakeholders as posing a high risk to biodiversity and socio-economic values of Tetiaroa. However, species listed in Table 1 are only a subset from a wide range of risk organisms that can cause harm on Tetiaroa, many of which may not yet be identified.

It is well established that risk organisms can move between locations by various routes or pathways; as hitchhikers on plants or animals, or on non-living objects such as heavy machinery (see Table 2 for risk pathways to Tetiaroa). A suite of risk organisms can be associated with a single pathway. For example, potted plants can carry ants, snails, nematodes, worms, fungi, weed seeds, etc. For this reason, a pathway approach to prevention is recommended as it addresses a wider range of risk organisms associated with a given pathway rather than focussing on a small number of specific invasive alien species.

Invasive species	Potential impact description	Potential impact severity ³ (Critical/High/Medium/Low)
Rodents: Pacific rat (<i>Rattus exulans</i>), Ship rat (<i>R. rattus</i>) Brown rat (<i>R. norvegicus</i>) House mouse (<i>Mus musculus</i>)	Rodents prey on adult birds, chicks and eggs, reptiles, crabs and invertebrates. They also consume native plant fruits and seedlings. They can spread leptospirosis, contaminate water and foods, damage fruits and vegetables, damage buildings and other household goods. Rodents can also be a nuisance to humans.	Critical
Mosquitoes including <i>Aedes vexans</i> and The bromeliad mosquito (<i>Wyeomyia mitchellii</i>)	Mosquitoes can vector diseases to humans such as dengue and Zika. They can also be a significant nuisance to humans through their biting.	High
Invasive ant species: little fire ant (<i>Wasmannia auropunctata</i>)	Invasive ants can have severe impacts on species and ecosystems, people's health and wellbeing and food security. The little fire ant, present on Tahiti, forms massive three-dimensional supercolonies which blanket the ground layer and the forest canopy. They sting people, cause blindness in domestic and wild animals and impede agricultural activity.	Critical
Invasive birds: Common Myna (<i>Acridotheres tristis</i>) Red-vented Bulbul (<i>Picnonotus cafer</i>)	All three bird species are present on Tahiti. Invasive birds can prey on endemic birds' eggs, chicks and adults. They can also compete with endemic birds for food and nesting sites, and spread invasive plants. They can also vector diseases to humans (e.g. salmonella), be a nuisance around habitations (because of noise and droppings) and cause damage to crops.	High

³ See Appendix 1 for an example severity definition.

Swamp harrier (<i>Circus approximans</i>)		
Invasive plants	No specific plants are mentioned in the CASUP. However, preventing new introductions of alien plants is a priority action under the plan.	

5 RISK PATHWAYS

Managing pathways by which species are introduced and spread is considered the most effective approach to preventing species' invasions. Such an approach reduces the risk from a wide range of organisms rather than focussing on a small number of specific risk organisms. Table 1 shows the main terrestrial risk pathways for Tetiaroa. Note that the risk of marine invasions to the lagoon is considered to be small because the atoll being closed to the ocean (i.e. does not have navigable passes that transfer water back and forth between the lagoon and the ocean), prevents any navigation into the interior of the lagoon but for small shallow boats (Cecile Gaspard and frank Murphy, pers. Comm.).

Tetiaroa receives significant quantities of freight on a regular basis including foodstuffs (perishables and non-perishables), nursery and landscaping material, equipment, building material, etc. The majority of this freight is transported on a barge from Papeete to Tetiaroa's reef dock. When the barge is not in operation or to respond to an urgent order from The Brando, small quantities of goods (including fresh produce) are transported on the shuttle in cool boxes and cardboard boxes.

A wide variety of goods (including fresh produce) are transported to Tetiaroa by air. This occurs on an occasional basis (or as back up when maritime logistics are not possible) and in much smaller quantities than those transported on the barge.

Several charter companies organise sailing cruises from Papeete to Tetiaroa (for a day or longer) which can include tours to motu Rimatuu and Tahuna Iti. In high season up to 40 people land daily on motu Rimatuu.

The atoll is also occasionally visited by local commercial and sports fishing boats from Tahiti. There are reports of fishermen camping on some motu.

Table 1. Main biosecurity risk pathways for Tetiaroa.

MODE OF TRANSPORT	CARRIER	POINT OF ORIGIN	DESCRIPTION	FREQUENCY PER ANNUM	VOLUMES/ NUMBERS	BIOSECURITY RISK PATHWAYS/CONTAMINANTS
HUMAN-ASSISTED PATHWAYS						
By sea						
Barge Size : 19 m x 6m Hold : 10 m ³	TMT Operated by a 3-person crew a (captain,	Papeete Transport line dedicated	Cargo - containerised in 8- and 10-foot containers	An average of 2 to 3 rotations per week.	A maximum of 20 tons. Can accommodate 12 passengers (if	Vessel itself Stowaways: rodents, flying and crawling insects, lizards, birds, seeds. Hull fouling: barnacles, algae, tunicates. General cargo containers

Freight is mostly transported on the deck.	mechanic and sailor).	solely to Tetiaroa.	- Bulk cargo of varying size transported on pallets.		no fuel is being transported inside the hull).	Interior: live/dead animals (flying/crawling insects, rodents, cats, skinks/geckos), soil/dirt, seeds, etc. Exterior: invertebrates, egg masses, soil/mud, seeds or grains, spider webs, nests, etc.
						Refrigerated containers Interior: cold tolerant pests and pathogens of fruits and vegetables. Exterior: invertebrates, egg masses, soil/mud, seeds or grains, spider webs, nests, etc.
						Frozen containers Exterior: invertebrates, egg masses, soil/mud, seeds or grains, spider webs, nests, etc.
						Non-containerised goods - rodents, invertebrates, seeds and other plant material, soil.
						Wood packaging: wood-boring insects, spiders, egg masses, soil/mud, etc.
						Wooden pallets - Even treated pallets can arrive contaminated with spiders, wood-boring insects, egg masses, soil/mud, etc.
Staff shuttles Size: 14.5 m x 5 m 2 hulls.	TMT Operated by a 3-person crew a (captain, mechanic and sailor)	Papeete Transport line dedicated solely to Tetiaroa.	- Passengers and baggage - Maximum of 48 passengers (all sitting seats). - Small quantities of freight incl. fresh produce.	3 rotations per week. TS charts the ferries for school visits.	2 holds of about 10 m ³ .	Vessel itself Stowaways: rodents, flying and crawling insects, lizards, birds, seeds.
						Non-containerised goods - rodents, invertebrates, seeds and other plant material, soil.
						Passengers and baggage intentional transport of plants and plant material (including fruits and vegetables). Unintentional transport of plant and plant material attached to items of clothing and footwear (e.g. shoes contaminated with soil containing seeds or pathogens), invertebrates, soil.
		Papeete		Occasional		Vessel itself:

Taporo VIII (700 tons /2000 m3)	SA Compagnie Française Maritime de Tahiti (CFMT)		Cargo (containerised and non-containerised) – Building material			Stowaways: rodents, flying and crawling insects, lizards, birds, seeds.
						General cargo containers: Interior: live/dead animals (flying/crawling insects, rodents, cats, skinks/geckos), soil/dirt, seeds, etc. Exterior: invertebrates, egg masses, soil/mud, seeds or grains, spider webs, nests, etc.
						Non-containerised goods: rodents, invertebrates, seeds and other plant material, soil.
Charter catamarans	Various charter companies	Papeete	Crew and passengers	Frequent		Boat Stowaways: Rodents. Crew members and passengers intentional transport of plants and plant material (including local fruits). Unintentional transport of plant and plant material attached to items of clothing and footwear (e.g. shoes contaminated with soil containing seeds or pathogens), invertebrates, soil.
Fishing boats	The public	Tahiti	Passengers	Occasional		Boat Stowaways: Rodents. Passengers intentional transport of plants and plant material (including local fruits). Unintentional transport of plant and plant material attached to items of clothing and footwear (e.g. shoes contaminated with soil containing seeds or pathogens), invertebrates, soil.
By air						
Twin otter	Air Tetiaroa	Papeete	Passengers and personal luggage. Cargo: occasional or as a back-up when maritime logistics not possible. Wide variety, including food supply (fruit and vegetable), transported	An average of 2.5 return flights/day	Max 14 passengers + 2 pilots Cargo volume: up to 350/400 kg (if special configuration).	Airplane (interior: cabin and hold): flying and crawling insects. Baggage Passengers Cargo

			with no special requirements.			
Britten Norman aircraft x 2	Air Tetiaroa	Papeete	Passengers and baggage. Cargo: occasional or as a back-up when maritime logistics not possible. Wide variety, including food supply (fruits and vegetables), transported with no special require/belongingsements.		6 passengers (standard configuration) + 1 pilot Cargo volume: up to 150 kg, on average	Airplane (interior: cabin and hold): flying and crawling insects. Baggage Passengers Cargo
Helicopter	Tahiti Nui Helicopters (TNH)	Papeete	Passengers No cargo (or extremely rare).		1-5 passengers +1 pilot No cargo	Passengers

6 INTRODUCTION TO RISK REDUCTION

In an effective biosecurity system, risk is managed across a continuum from pre-border to border and post-border (Figure 3). The goal of such system-wide approach is to minimise the risk of a harmful species arriving, entering and establishing in a new environment. This is achieved by placing multiple lines of defence across the continuum with most of the effort being focussed on reducing biosecurity risks pre-border (i.e. preventing arrival) and at the border (i.e. preventing entry). However, expectation that prevention could result in “zero risk” is not realistic. It is well established that even with the best biosecurity systems in the world, there are still invasive species that can slip through the prevention net. Hence, the requirement for post-border measures that enable the early detection (through surveillance) of any invasive species that have succeeded in evading the prevention net and rapid action to remove these (i.e. incursion response) while, eradication is still feasible.

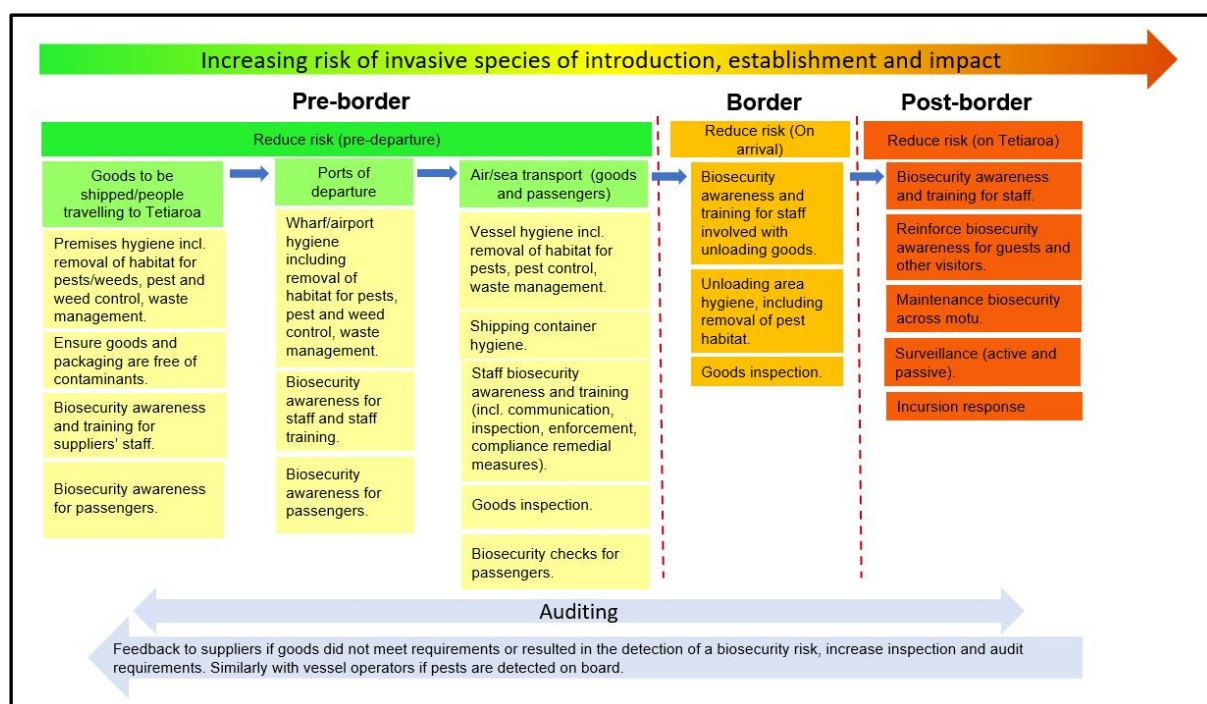


Figure 3. Biosecurity system-wide approach (adapted from Boudjelas and Froud, 2016).

7 PRE-BORDER RISK REDUCTION

7.1 General measures

- A person should be designated to oversee biosecurity activities at the airport and at the wharf in Papeete. This person should be trained in how to:
 - carry out goods and container inspections,
 - recognise different types of contamination and how to remove/treat these,
 - communicate with suppliers about any non-compliance issues and required remedial action(s),
 - record non-compliant goods/suppliers and remedial action(s). This would help identify repeated non-compliant good/suppliers. Equally, it will help identify responsible suppliers.
 - use pesticides safely and appropriately.

7.2 Management of risk goods

Tetiaroa receives, on a regular basis a significant quantity of sea cargo (goods include perishable and non-perishable foodstuffs, nursery stock, landscaping and building materials, equipment, and machinery. The majority of the sea cargo is transported on the barge with very small quantities (incl. fresh produce packed in chilly bins or cardboard boxes) transported on the ferries. The Taporo, a cargo vessel, is usually chartered to transport building materials for large development project. Some of these materials are sourced from overseas and transit through Papeete.

The island also receives smaller quantities of air cargo including fruits and vegetables.

Suppliers should be clearly informed about the importance of maintaining biosecurity for Tetiaroa, the importance of their participation in this effort and what is required of them. They should also be informed that their goods will be inspected for biosecurity compliance prior to being loaded in containers or on the barge and that any non-compliant goods will be refused transport until they have been remedied by the supplier.

7.2.1 General goods

The following requirements are for suppliers of general goods such as foodstuffs, furniture, equipment and machinery:

- All goods destined to Tetiaroa must be free of any infestation/contamination including rodents, invertebrates, seeds or soil. They must be checked prior to packaging/delivery for transport to the island.
- To pack goods, use a warehouse/room/area with a hard surface and which is free of rodents, invertebrates, seeds or soil.
- Keep packing and storage areas clean (no rubbish, food scraps, or soil) and maintain rodent and invertebrate control.
- If cardboard boxes are to be used for packing goods, they should be new, if possible, or in a good condition and all open edges and openings thoroughly sealed with packing tape. Cartons must be free of any contamination.
- If cushioning material is needed, do not use straw or any other plant material. Acceptable alternatives include shredded paper and bubble wrap.
- Check individual boxes just prior to delivery to ensure that they remain sealed and there are no signs of rodent damage, infestation by invertebrates, reptiles or any other type of contamination. If any boxes have holes or show signs of rodent damage, they should be opened, and inspected then, closed and resealed.
- If boxes are bulk packed on wooden pallets and shrink-wrapped, ensure pallets are compliant with the International Standards for Phytosanitary Measures No. 15 (ISPM 15) and are free from any external contamination and wood borer insects.
- Any used equipment or machinery must be thoroughly cleaned and any contamination removed (including soil, plant material, material of animal origin, and pests) before delivery to the wharf at Papeete.
- Minimise the time between packing and delivering goods for shipment.

7.2.2 Nursery stock

A suite of highly invasive species present on Tahiti can be transferred to Tetiaroa through the nursery pathway, including the little fire ant, the rosy wolf snail (*Euglandina rosea*) and several invasive plants.

Nursery stock should be sourced only from suppliers approved by the French Polynesia Biosecurity Agency or from suppliers that strictly adhere to the biosecurity requirements outlined below. These suppliers could become preferred suppliers. The list of approved suppliers can be found at: <https://www.service-public.pf/biosecurite/transport-interinsulaire-2/entreprises-agrees/>

There should be a dedicated quarantine area on the island where new plants can be inspected on arrival and subsequently observed before they are planted to confirm freedom from disease, pests and weeds. Similarly, for the compost before it is used.

Requirements for nursery stock suppliers

- Keep propagation areas clean, free of diseased or infested plant material.
- Implement nursery-wide pest and weed control to reduce the risk of transporting plant pests (e.g. ants, snails, mealy bugs, aphids, nematodes) and weed seeds on plants or in potted plant soil for plant species that cannot be transported bare root (i.e. free of soil).
- Pesticides including fungicides and insecticides must be used in accordance with the product label or good practice according to the manufacturer's instructions and statutory requirements.
- Horticultural oils may be used to control mites and other insect pests.
- Treat plants with systemic insecticides at least 14 days prior to transfer to the island. With repeated treatments used in accordance with the product label recommendations.
- Spray plants with a systemic fungicide up to 6 weeks prior to transfer. As fungicides do not kill fungi completely, seedlings should be left without fungi treatment for 6 weeks prior to transfer to enable disease to develop and diseased plants to be removed.
- Inspect plants just before transfer to the island to ensure that they are free of live insects and disease symptoms. Plants must be in good health on transport from the nursery. Remove unhealthy or suspect plants. Bagged plants should be free of weeds.

7.2.3 Building material

Raw and treated wood

In French Polynesia, raw timber imports are subject to an import permit which must be obtained prior to shipment to French Polynesia.

An import permit is not required for treated timber but must be accompanied by a phytosanitary certificate.

Contact the French Polynesia Biosecurity Agency for the permit and biosecurity conditions (including pre-shipment treatments, storage and transport) required for importing timber:

(<https://www.service-public.pf/biosecurite/import/importation-de-produits-autres-que-des-vegetaux/>)

Aggregates

Movement of aggregates can facilitate the introduction and spread of unwanted organisms. Contamination with soil/dirt can harbour nematodes, fungi and weed seeds and the spaces/voids between aggregate particles can harbour unwanted invertebrates such as insect and spiders.

Basalt aggregate quarried on Tahiti are imported to Tetiaroa for construction projects. These are shipped in 1 m³ bulk bags which are individually transported on the barge to the island. Currently, aggregates do not undergo any phytosanitary measures.

The following biosecurity requirements for aggregate imports to Tetiaroa should be included in the terms and conditions of contracts with building companies. Request that the aggregate is sourced

from an approved/certified supplier, if possible. Note that the French Polynesia Directorate for the Environment has issued certification guidelines for companies to help reduce the spread of invasive species in French Polynesia to protect biodiversity (<https://www.service-public.pf/diren/wp-content/uploads/sites/17/2019/06/Guide-de-Certification-entreprise-prot%C3%A9geant-la-biodiversit%C3%A9.pdf>).

Requirements

- Aggregate should be clean and free of any contaminants including soil/dirt, living insects, seeds and other plant material (e.g. leaves).
- If possible, aggregate should be sourced from an approved/certified supplier.
- Aggregate should be treated prior to shipment to the island. Ensure that the treatment method can fully penetrate to the centre of the bagged aggregate and is capable of killing microorganisms, invertebrates, hitchhiking vertebrates and weed seeds. Seek advice from the French Polynesia Biosecurity Agency on locally available, effective treatment methods and their safe application. Treatment must be carried out by an authorised person.
- It is important to note that fumigation by methyl bromide does not kill all weed seeds (Monaco et al. 2002; Bullians et al. 2009). This means that measures to minimise contamination should be considered along a continuum starting, from when the aggregate is being quarried to it arriving on the island and on the island itself, when awaiting to be used (post-border monitoring).
- Aggregate should be shipped within 1-2 days following treatment to minimise the risk of recontamination by weed seeds or invasive animals (ants, spiders, lizards, rodents, etc.).
- If storage is required pre-treatment, aggregate or other materials should be kept in an enclosed area or covered by tarpaulins to avoid seed contamination. Also cover with tarpaulins during transport.
- If storage is required post-treatment, keep aggregate or other materials in an enclosed area (e.g. sealed containers) to avoid recontamination.
- If transport is required post-treatment, cover consignments with tarpaulins to avoid seed recontamination during travel.
- Transport vehicles used to transport the aggregate should be clean and free of any contaminants especially, following treatment.
- Used bags should be in a good condition, clean and free on any contaminants prior to the bagging of aggregate.

Actions	Lead	When
Include aggregate biosecurity requirements in building terms and conditions of contracts with construction companies.	DT/Biosecurity Lead	During contract process.
Inspect the consignment including the outside surface of bags to ensure that they are free of contaminants. If not, refuse transport until remedial action has been taken.	TBSA/ delegated person at the wharf in Papeete.	Prior to loading on the barge.
Ensure consignment are accompanied by a valid phytosanitary certificate before loading on the barge. If not, refuse transport until remedial action has been taken.	TBSA/ delegated person at the wharf in Papeete.	Prior to loading on the barge.

7.3 Management of intentional introductions of new plants

No intentional introductions of new plant species should be allowed into Tetiaroa, unless it has been approved by Tetiaroa Biosecurity Taskforce. The approval process will require a risk assessment to be carried out for all proposed new introductions.

Actions	Lead	When
Develop a list of approved plant species for Tetiaroa.	Tetiaroa Biosecurity Management Taskforce	Following approval of the plan
Identify an invasive plant expert to assist with risk assessments.	Tetiaroa Biosecurity Management Taskforce	Following approval of the plan
Apply approval process to proposed new introductions.	Tetiaroa Biosecurity Management Taskforce	As required

7.4 Aircrafts

Animals such as rats, invertebrates, and reptiles have been reported to stowaway on aircrafts. The following requirements are applicable to both Air Tetiaroa and Tahiti Nui Helicopters.

Requirements

- Maintain a high level of hygiene on board aircrafts. Check for the presence of pests (i.e. actual pests seen or signs of their presence) as part of routine cleaning schedules. In the event of suspected or detected pests (e.g. rats, flying insects), the aircraft must not travel to the island until confirmation that the risk has been cleared. And the aircraft must be thoroughly searched to confirm pest-free status before resuming flights to the island.
- Use a long-lasting insecticide (e.g. Ripcord or long-lasting permethrin) inside the flight deck, cabin, and baggage holds to reduce the risk of transporting high-risk insect species.
- Thoroughly inspect aircrafts (including holds) prior to departure from Papeete.
- When aircrafts are not in use or unattended, keep doors closed at all times.
- Maintain rodent and invertebrate control programmes in the hangar and any other facilities located at the airport for which they are responsible.
- Encourage the airport authority to implement airport-wide rodent and invertebrate control programmes.
- Place a clearly labelled biosecurity amnesty bin in the check-in area.
- Encourage relevant staff to query/request inspection of risk items.

Actions	Lead	When
Operationalise the biosecurity requirement above.	AT/Biosecurity Lead	Following approval of this plan
Enhance biosecurity awareness amongst staff.	AT/Biosecurity Lead	Following approval of this plan
Train relevant staff to effectively deliver biosecurity requirements in their area of work.	AT/Biosecurity Lead	Following approval of this plan
Include biosecurity awareness information on the Air Tetiaroa/Tahiti Nui Helicopters websites to enhance voluntary compliance.	AT/Biosecurity Lead	Following approval of this plan

7.5 Sea vessels

The following requirements apply to both the barge and staff shuttles.

Requirements

- Maintain a high level of hygiene on board the barge and ferries: keep them clean and tidy to minimise shelter and food sources for invasive species such as rats and ants. Keep food in sealed containers. Keep waste in sealed bins with tight fitting lids. Remove all waste from vessels when moored at the wharf in Papeete.
- Maintain continuous rodent and invertebrate control programmes. Place sticky traps/glue boards (e.g. <https://www.epestsupplies.com.au/p/trapper-tunnel-cardboard-glue-board-cover/591>) on board the barge in the internal spaces off the loading deck and the wheel house. On the staff shuttles they should be placed away from passengers. The sticky traps and glue boards must be baited with a small piece of coconut or peanut butter and checked prior to each sailing. Keep record in the ships log of all sticky traps/glue boards servicing, as well as any biosecurity incidents that occur. A biosecurity incident is any incursion of a pest on to the vessel.
- If rodent or ant sign is detected, the vessel's departure must be delayed until the vessel is confirmed to be clear.
- Raise the gangway/loading ramp from dusk to morning and place rat guards on mooring lines. Rats are most active at night.
- If possible, avoid departing ports at dusk or dark to avoid any hitchhiking birds such as myna and/or night active insects that may be attracted to the vessel's lights.
- Vessels should not be allowed to call at Tetiaroa during the hours of darkness.
- Passengers travelling to Tetiaroa via the shuttles must be asked if they have checked their personal luggage/belongings for rodents, invertebrates, plants and plant material, soil prior to boarding. If the answer is no, request to inspect their personal luggage/belongings.
- Encourage relevant staff to query/request inspection of risk items.
- Place a high visibility biosecurity signage at the wharf.

Actions	Lead	When
Operationalise the biosecurity requirement above.	TMT/Biosecurity Lead	Following approval of this plan
Enhance biosecurity awareness amongst staff.	TMT/Biosecurity Lead	Following approval of this plan
Train relevant staff to effectively deliver biosecurity activities in their area of work.	TMT/Biosecurity Lead	Following approval of this plan

7.6 Beachcomber loading/wharf area

The following requirements must be implemented around the loading/wharf area:

- Maintain effective rodent and invertebrate control programmes. Bait stations for both ants and rats must be established and maintained throughout the area. Stations must be checked monthly by commercial operators, old baits replaced and bait take recorded.
- Remove overhanging vegetation within the area. Weeds and other vegetation provide food sources and habitats for pests and should be managed within and immediately adjacent to loading/wharf area.
- Provide waste bins with tight-fitting lids for all waste items (particularly food wrappers and drink containers) and empty regularly. Loose waste material such as food and wrappers and soft-drink cans provide an excellent food source for rodents, invertebrates (especially ants), reptiles and birds.

- Place all items to be shipped to Tetiaroa on clean hard surfaces (i.e. concrete, tar seal or compacted gravel) >15m away from any vegetation or soil. To ensure a low risk of weed seeds or risk organisms contaminating the goods while awaiting to be loaded.

7.7 Shipping containers

Shipping containers are a well-known biosecurity risk pathway. A large portion of the cargo destined to Tetiaroa is containerised. General cargo containers are used for non-perishable foodstuffs and other types of goods. Refrigerated and freezer containers are used for fresh produce and frozen foodstuffs, respectively.

Requirements

- Use containers which are in a good condition. Ensure door seals don't have any splits or holes.
- Prior to loading, containers' surfaces should be cleaned to ensure that they are free of any contamination. Sweep the floor with a broom, use a brush to remove any contamination on the floor, ceiling or side walls, etc. If possible, wash the exterior (including lugholes and locks) with a high-pressure water hose. Otherwise, brush/wash off any contamination (including soil/dirt, dead or live insects, snails, ants, seeds and other plant material, spider webs, insect egg masses, etc.). Also, inspect refrigeration systems at the back of refrigerated and frozen containers and remove any contamination. Use a powerful flashlight/torch for inspections inside the container and for inspecting lugholes and locks. Ensure the biosecurity inspection/cleaning kit is available for this operation.
- Spray containers' air vents with a long-lasting insecticide (e.g. Ripcord or long-lasting permethrin) to help keep out insects. Repeat treatment in accordance with the product label recommendations.
- Container doors should only be open during loading and unloading, doors should not be left open when unattended.
- Place a rodent bait station inside general cargo containers not containing foodstuffs.
- If possible, keep foodstuffs and other cargo in separate containers to allow fumigation of containerised non-foodstuff cargo prior to locking the containers. Use a pyrethrum-based insecticide to fumigate the containers.
- Once containers are locked, place a seal to show that the containers have not been opened after being locked and prior to reaching their destination.
- The origin of all goods should be recorded and kept on file to enable rapid identification of a risk pathway if contamination is detected on arrival.

Actions	Lead	When
Operationalise the above biosecurity requirements.	?	Following approval of this plan
Enhance biosecurity awareness amongst staff.	?	Following approval of this plan
Train relevant staff to effectively deliver the above biosecurity requirements.	?	Following approval of this plan

8 BORDER RISK REDUCTION

Measures are required at the border to confirm that pre-border prevention is working and to intercept any biosecurity risks that slip through the prevention net.

The biosecurity coordinator must oversee all biosecurity activities on the island including during the unloading of containers and non-containerised goods from the barge onto the reef dock, at the

motu dock, devanning (unloading) the containers and moving goods from the wharf to other locations.

8.1 General measures

- Maintain high level of hygiene at the reef and motu docks.
- High risk consignments such as building material and used machinery should be quarantined for 48 hrs on the reef dock.
- Any prohibited items (such as local fruits) should be confiscated and contained in strong bin bag and sent back to Papeete for appropriate disposal. Similarly, items displaying gross contamination (such a piece of machinery encrusted with a thick layer of mud) should be refused entry and reshipped back to Papeete at the expense of the sender.
- Establish a dedicated area (this could be the motu dock), away from vegetation (up to 15m, to remove habitat for any incoming pests) for inspecting containers, palletised goods and machinery. Preferably, the ground is concrete, tar-seal or compacted gravel to enable detection of any hitchhiker risk organisms. Always, ensure the biosecurity inspection/cleaning kit is available.
- Establish a clean, enclosed and well-lit area (this could be the freight depot) for inspection of goods to enable containment and removal of any risk organisms.
- Any risk material that cannot be adequately treated/disposed of on the atoll should be bagged and reshipped to Papeete for safe disposal.

8.2 Containers

- All containers should be devanned in the motu dock.
- Before opening containers:
 - Check the seal is not broken
 - Inspect all four sides of the container and remove (through sweeping, spraying, or catching and killing) any biosecurity risks such spider webs, snails, soil, etc. and place removed risk material in the biosecurity bin.
- As you open the containers' doors, keep a look out for any animals trying to escape.
- Stay vigilant as you complete the devanning of each container. Once completed, check for any signs of contamination on the floor, walls and ceiling of the container. Remove and dispose of any contaminants in the biosecurity bin. Then lock the containers.

8.3 Goods

- Visually inspect all goods in the freight depot prior to being moved to other locations on the island.
- Visually inspect consignments of fresh produce at the kitchen when it is unpacked to confirm absence of contamination/infestation.
- If a biosecurity risk is detected on inspection then treatment should be applied where possible, otherwise risk item(s) should be bagged and reshipped to the suppliers at their own expense.

9 POST-BORDER RISK REDUCTION

As mentioned earlier, it is unrealistic to expect that pre-border and at the border biosecurity risk reduction measures will be 100% effective. For this reason, biosecurity risk reduction measures must be extended post-border to address those risk organisms that manage to slip through the various prevention barriers or may already be present at low populations.

Post-border risk reduction has two components:

- Surveillance
- Incursion response i.e. eradication

9.1 Surveillance

Surveillance is essential to ensure that any invasive species that may have evaded the prevention barriers are detected as early as possible, while the opportunity to eradicate is still available and the cost to eradicate is comparatively low. There are two types of surveillance: passive and targeted (or active).

9.1.1 Passive surveillance

Resident staff, if they know what they are looking, are well placed to notice the arrival of new species on Tetiaroa. Raising awareness amongst staff of high-risk species and enabling them to detect their presence on the island is a cost-effective way to augment targeted surveillance for these species. This could be achieved through practical training on how to recognize target species or signs of their presence. Staff should be encouraged to remain vigilant and on the lookout for target species (or species they haven't seen before on the atoll) while doing their everyday jobs.

9.1.2 Targeted surveillance

Targeted surveillance involves actively looking for the target high-risk species on a regular basis. This type of surveillance requires on-going commitment in terms of effort and cost.

This surveillance should occur on motu of high risk of arrival of new species i.e. Onetahi and Rimatuu.

On Onetahi surveillance should be focused around this motu's northern part, and more specifically, the garden, airport and dock.

On Rimatuu: surveillance around landing area plus track.

9.1.2.1 Rats

Following rat eradication, it is recommended that targeted surveillance is to be carried out for rats on Onetahi and Rimatuu. In addition, surveillance for mice should be carried out on these motu.

- Place trail cameras the following high-risk locations:

Locations	No. of cameras
Garden	
Waste disposal area Focus the camera on half a coconut placed on the ground, close to the bins.	
At the motu dock	
At the airport where goods are unloaded	
?	
?	

- At all locations, run the cameras monthly, for 5 to 10 consecutive nights. Number each camera trap and note its location.
- Place sticky traps/glue boards right up against the inner side walls of building, bait with small pieces coconut and check weekly:
 - The Brando and staff kitchens
 - Food storage rooms
 - Freight depot
- Carry out monthly checks for signs of rat presence such droppings, hairs or urine smell.

Staff responsible for surveillance should be familiar with the surveillance protocol and capable of carrying out the work effectively. Ideally, two staff should be trained to avoid single dependency and allow for staff rotations.

9.1.2.2 Invasive ants

Target surveillance should also be carried out for little fire ants on Onetahi and Rimatu'u and yellow crazy ants on motu where it is not currently present, especially on Tahuna iti (Gruber et al. 2016). In addition, Gruber et al. (2016) recommended that the current yellow crazy ant infestations on Onetahi and Oroatera to be monitored, and the infestation on Aie managed.

- Surveys to determine presence/absence of invasive ants should be undertaken every 6 months within a 150 m radius from the following high-risk sites: where imported compost is kept, where imported potted plants are kept (while awaiting to be planted), staff kitchen and the wharf. In addition, carry out visual searches for invasive ants inside warehouses and green houses.
- Details of the ant surveillance protocol can be found in Appendix 6.

9.2 Incursion response

If an incursion occurs or is suspected, appropriate action must be taken immediately.

9.2.1 Rats

If surveillance results suggest that either rats or mice may have got to Tetiaroa, the following actions should be taken:

- Deploy Kamate rat traps in a 50 m x 50 m grid, centred on the suspected detection point and extending to at least 100 m either side of this point. This requires a total of 25 traps.
- Elevate the traps 1 m above the ground by nailing them to a tree. Nails should be left a bit loose so that they can easily be pulled out without damaging the trap. Elevating the traps will reduce crab interference. For each trap, record its GPS coordinates and mark its location with flagging tape. Number the traps sequentially, so they can be easily found during monitoring.
- Bait the traps with a small piece of coconut each evening. Check all traps daily, in the morning (as early as possible to avoid predation of any capture). For each trap, record if the trap is set or sprung and the presence/absence of bait. Use the Trapping Monitoring Datasheet to record the status of each trap (Appendix 4). Check for hairs and blood on sprung traps that may indicate rodent activity.
- If a rodent is caught, use the Rodent Identification Guide (Appendix 5) to determine which rodent species you are dealing with.
- Run the trapping for 1 week.

If at the end of the week there are still signs of rodent presence then, switch to baiting by replacing traps with bait stations.

- Use the same grid as above to deploy bait stations. This requires a total of 25 bait stations. Reuse the Protecta bait stations that have been purchased for the rat eradication.
- Elevate the bait stations 1 m above ground by fixing them to an inclined tree trunk or branch. Ensure that they are positioned such that they are easy to service.
- Secure a single PestOff (or similar i.e. Talon) rodent block with the metal wire stake bait inside each station. Check all stations daily. Replace bait blocks in stations where they have been completely removed or less than a quarter remains. For each station record the amount of bait missing and information that may indicate rodent presence (i.e. droppings) and any bait consumption by non-target species i.e. crabs (damage to the station) and ants. Use Bait Station Monitoring Datasheet in Appendix 4 to record this information.
- Maintain the bait stations continuously for at least two weeks after the last sign of rats has been detected and longer, if possible.
- It would be useful to supplement some traps/bait stations with the available trail cameras. Focus the cameras on traps/bait stations.
- Notify the eradication project partners of the suspected incursion immediately, outlining suspected incursion site, how big the infestation is i.e. one individual or several, how the incursion may have occurred, action taken so far and any assistance you may require.
- If an incursion occurs review the pre-border and border biosecurity measures to see if any changes are required to stop further incursions. If yes, revise the Biosecurity Plan.

9.2.2 Invasive ants

- If an invasive ant infestation is confirmed, the first steps are to identify which species and determine the extent of the invasion i.e. carry out delimiting surveys (PII 2013, Gruber et al. 2016). The French Polynesia Biosecurity Agency or the Directorate of Agriculture: diagnostic@rural.gov.pf may be able to assist with ant species identification.
- Seek advice from invasive ant experts to help prepare an adequate eradication response. Provide as much detail as possible to inform the advice they will give – the more they know, the better the advice is likely to be. Information should include the species name if known, or samples or images if not, infestation size, type of vegetation where the infestation has been found, land use, climatic seasonality, resources available, etc. Include photos of the area and other features.

10 MANAGING STAFF AND CONTRACTORS

All staff and contractors must be alerted to the biosecurity risks and advised what checks of personal gear and supplies must be undertaken prior to departure for Tetiaroa. They must also be made aware that their personal luggage/belongings will be checked prior to boarding the shuttle at Papeete.

Requirements

- All personal luggage/belongings need to be free of any animals, sealed in rodent proof packaging and checked for stowaways at the point of departure from Tahiti. Rodent proof packaging includes sealable day packs and overnight bags, solid boxes that have no holes and are taped closed, sealable plastic bins and barrels and PVC dry bags. Open bags and unsealed cardboard boxes are not suitable. A good rule of thumb is that if you can push the tip of a finger through a hole in your box or bag then it is not rodent proof.
- Cardboard boxes or insecurely packed items will not be allowed on the shuttle or the barge.
- Equipment should be checked as close to the time of departure as possible to reduce the risk of a risk species stowing away after you have packed. If unsure unpack, re-inspect and repack.
- All footwear needs to be free of contaminants such as mud as the latter may harbour weed seeds.

- While unpacking on the island, you will need to check again for signs of rodents, insects, other animals and plants. If possible, catch/kill any animal you may find and report to the biosecurity coordinator. If the animal escapes, urgently report what happened to the coordinator for appropriate action.

Actions	Who is responsible	When
<u>During recruitment process/pre-travel</u> Create a brochure or flier for new staff (like airplane safety card / graphic / cartoon story board) ➤ Strong visible message – along the lines of “Don’t let pests hitch a ride with you” ➤ use images more than text but include a brief introductory statement about the risk of invasives and an illustrated list of things to do to keep the island invasive-free.	Biosecurity Coordinator with assistance from Biosecurity Leads.	Following approval of this plan and prior to recruiting any new staff and contractors
Hand out a copy of the biosecurity information pack to new staff and contractors.	Biosecurity Coordinator with assistance from Biosecurity Leads.	During recruitment process
Inspect personal luggage/belongings and encourage staff and contractors to remain vigilant when they arrive on the atoll and when unpacking.	TMT/Designated person at wharf/shuttle	Before boarding the shuttle
Include biosecurity training for new staff induction.	Biosecurity Coordinator with assistance from Biosecurity Leads.	When new staff start work
Undertake refresher training for staff.	Biosecurity Coordinator with assistance from Biosecurity Leads.	Initially every 6 months, then annually when a high level of biosecurity understanding has been reached amongst staff
Create a mural in staff communal area Create and “In room” – Biosecurity brochure and ‘what to do if you see xxx or yyy on the island’	Biosecurity Coordinator with assistance from Biosecurity Leads.	As soon as possible
Provide staff that do not have adequate bags with biosecure containers (plastic totes) for transporting their personal gear and supplies	The Brando/Biosecurity Lead	As required.

11 MANAGING VISITORS

11.1 The Brando’s guests

The Brando will be responsible for enhancing biosecurity awareness amongst its guests. The booking process should clearly communicate what is required of guests in terms of biosecurity, they will be asked about biosecurity compliance during check-in and be given the opportunity and assistance (if required) to remedy any non-compliance issues.

Actions	Lead	When
In the booking process include biosecurity requirements for guests.	The Brando/Biosecurity Lead*	

<p><u>Pre-travel</u> All passengers travelling to Tetiaroa including guests must be asked to undertake checks of personal luggage for rodents and invertebrates prior to arriving at the airport</p> <p>Create a brochure on biosecurity / keeping the island free of invasive species. Strong visible message - along the lines of “just bring yourself [yourselves]” High quality photographic images Brief introduction to the island’s natural values followed by key message on what to do to keep the island free of invasive species. Consider producing versions in different languages to reflect the range of guests’ nationalities.</p> <p>This brochure is to be sent out to guests and published on The Brando’s website.</p>	The Brando/Biosecurity Lead*	
<p><u>Pre-departure</u> Confirm with passengers that they have checked their personal luggage for rodents and invertebrates prior to arriving at the airport.</p> <p>Invite them to stay vigilant when unpacking on the island and to report any findings to The Brando.</p>	Air Tetiaroa/staff at the check-in desk	At check-in time.
<p><u>On the island</u></p> <ul style="list-style-type: none"> ➤ A display in communal zone explaining on the island’s natural values and the restoration project (different media could be used). ➤ Informative talks / guided experiences could be offered to guests with a focus on the island’s natural values and benefits of island restoration/ biosecurity. 	The Brando/The Biosecurity Lead*	

* The Biosecurity Lead ensures that actions are completed. He/she may complete the actions himself/herself or delegate to the relevant person. He/she can seek assistance from other biosecurity leads as required. The development of some of resources may be outsourced to outside service providers.

11.2 Visitors to Eco-station

Visitors to the eco-station include scientists, members of community organisations and school children.

The requirements for staff and contractors apply to these stakeholder groups.

Actions	Who	When
Ensure that biosecurity requirements are communicated to TS visitors well ahead of their travel to Tetiaroa.	TS Biosecurity Coordinator	As required
Develop biosecurity awareness material and activities for school kids.	TS Biosecurity Coordinator	Following approval of the plan.
Enhance biosecurity awareness amongst community groups and scientists.	TS Biosecurity Coordinator	As required

11.3 Charter boats and the public

Access to the lagoon is open to the public. A significant number of visitors to Tetiaroa arrive on Charter boats and private boats. In addition to mooring 1 or 2 nights outside the reef, they also visit Rimatuu. During the high season, up to 40 people visit this motu. They also visit Tahuna iti or bird island.

Small fishing boats operate in the lagoon and fishermen are known to land and sometimes even stay on some motu.

Biosecurity risk reduction through these pathways will rely mostly on enhancing biosecurity awareness amongst these stakeholder groups. This should be augmented with patrols to confirm that awareness is working and resulting in voluntary compliance.

Requirements

- Maintain a high level of hygiene on board the catamarans. Keep food in sealed containers. Keep waste in sealed bins with tight fitting lids. Remove all waste from vessels when moored at the wharf in Papeete.
- Maintain continuous rodent and invertebrate control programmes. Place sticky traps/glue boards (e.g. <https://www.epestsupplies.com.au/p/trapper-tunnel-cardboard-glue-board-cover/591>) on board the catamarans where food is stored/prepared, in the wheel house and any cavities where rats can hide. The sticky traps and glue boards must be baited with a small piece of coconut or peanut butter and checked prior to each sailing.
- If rodent, ant or other animal signs are detected, the vessel's departure must be delayed until the vessel is deemed clear.
- Alert clients to the biosecurity risks and advise them to check their personal gear for rodents prior to travelling to Tetiaroa. All personal luggage/belongings need to be free of any animals, sealed in rodent proof packaging and checked for stowaways at the point of departure in Papeete.
- Crew and passenger mustn't leave any waste on Rimatuu.
- Encourage Marina managers/owners to maintain rodent and insect control.

Actions	who	When
Establish strong relationships with the charter companies. Raise their awareness about the importance	TS Exec Director?	Following approval of the plan

of biosecurity and what is required of them.		
Consider establishing a biosecurity label “Biosecure sailing” to be offered to companies actively contributing to biosecurity for Tetiaroa	TS Exec Director/TS Board?	
Undertake patrols to check if biosecurity awareness has resulted in enhanced compliance.	TS Biosecurity coordinator	As required

12 BIOSECURITY ACROSS THE ATOLL

TS biosecurity coordinator must oversee all movement across the atoll and ensure the following measures are effectively carried out:

- All vessels and equipment must be inspected and cleaned prior to returning to Onetahi or Honuea. Likewise, when travelling from Onetahi to other motu.
- If rodent or ant signs are detected, the departure must be delayed until the vessel or gear is confirmed to be clear
- Scientists and TS staff travelling across the atoll must undertake checks for rodents before returning to Onetahi.

13 TETIAROA BIOSECURITY MANAGEMENT TASKFORCE

An effective biosecurity system for Tetiaroa will require enhanced coordination across the various stakeholders. The Tetiaroa Biosecurity Management Taskforce (TBMT) (Figure 4) will be established to oversee the implementation of this plan. The Taskforce will be made up of biosecurity leads from the five TBSA entities (The Brando, AT, TMT, EDT, and DT), and a biosecurity coordinator from TS. TBSA will designate a biosecurity coordinator to lead this taskforce. The two coordinator will work closely together.

Considering that staff on Tetiaroa work 4 weeks on the island followed by 1 week leave off island, biosecurity leads will identify and train a member of staff within their respective entities to build capacity to cover them when they are on leave. When on leave, the biosecurity coordinator will delegate on a rotating basis to one of the biosecurity leads. The order of the rotation will need to be agreed amongst the members of TBMT. Staff work plans need to take this into account when being prepared.

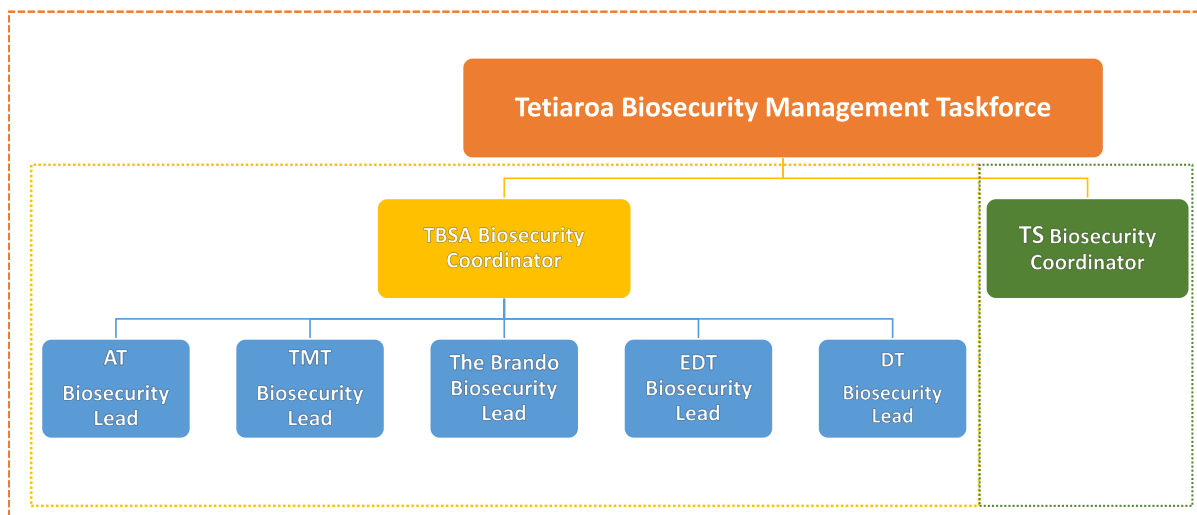


Figure 4. Tetiaroa Biosecurity Management Taskforce

Responsibilities of TBSA biosecurity coordinator:

- Leads the taskforce
- Coordinates activities across the different entities (including TS) on Onetahi and Papetee
- Provides support to biosecurity leads
- Facilitates/leads awareness raising activities and training for staff
- Represents the taskforce to TBSA management
- Carry out audits across the entire biosecurity management system
- Reports to TBSA management on progress

Responsibilities of TS biosecurity coordinator

- Oversees biosecurity between Onetahi and the other motu and across the motu.
- Provides support to TBSA coordinator
- Facilitates/leads awareness raising activities for charter boats, the public, school kids and community organisations

Responsibilities of biosecurity leads:

- Delivery of the biosecurity activities in their area
- Escalation of issues to taskforce and to their management
- Represent their entity at the taskforce

It is anticipated that actual biosecurity activities are embedded in day to day routine activities in all entities and hence, staff beyond the taskforce will contribute to these activities.

14 EQUIPEMENT

The following list is the equipment required for implementing different parts of the biosecurity Plan. This list is to be added to as required.

Equipment should be properly cleaned before storage and checked before use.
Follow manufactures' labels and guidance for handling and storage of chemical products.

Table 2 Equipment list

ITEM	NUMBER/AMOUNT
Awareness/information/training/data collection resources	
Biosecurity awareness leaflets targeting different stakeholders	
Biosecurity presentation for staff induction	
A copy of the Biosecurity Plan	
Species identification aides (laminated, if possible)	
Island map	
How to guides (e.g. deploying and maintain traps and bait stations, recognizing rat signs and where to look, how to record information, etc.)	
Copies of data collection sheets	
Notebooks, pencils, pens, markers	
Biosecurity inspection/cleaning kit	2
Wheelie bin	2
Strong waste disposal bags	2x100
Broom, brush and pan	2 of each
A torch and batteries	include spare batteries
A knockdown insecticide spray containing	A year supply
Rodent control/surveillance/incursion response	
Trail cameras	5
Kamate traps	25
Protecta bait stations	25
Sticky traps	Yearly supply
Pestoff rodent bait blocks	
Flagging tape (different colours)	A few rolls
GPS	2
100 m tape measure	1
70% Ethanol for storing rat samples (for post-eradication monitoring)	
Surgical plastic gloves for handling the rats	
Invasive ant surveillance	
Pottles	Buy bulk
Lures (sugar and protein based (details in Appendix 3))	
Flagging tape	A few rolls
70% Ethanol for storing ant samples for identification	1 litre
Ant collection gear – hand lens, vials, waterproof labels, tweezers, thin paint brush, ziplock bags	1

ACKNOWLEDGEMENTS

Many to all stakeholder representatives for their valuable insights into the context and current biosecurity practices. My thanks to Frank Murphy, Stan Rowland, James Russell, and Richard Griffiths for their feedback on the draft of the plan and to Graham Allen for proofreading it.

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APPENDIX 1: IMPACT SEVERITY DEFINITION

Impact category	Explanation of severity of impact		
	Biodiversity	Economic	Cultural
Critical	Loss of a threatened species from the island	Inability to re-grow crops, no income from tourism, and/ or high costs in management.	Extinction or permanent destruction of cultural value.
High	Loss of at least one native species from island.	Loss of major crops, income from tourists, or high control costs.	Major degradation of cultural significance.
Medium	Decline in populations of many native species.	Decrease in food and income from crops, and/ or tourism.	Degradation in an area or decline in species of significance.
Low	Decline in population of at least one non-endemic species	Small decrease in crop yields	Small changes in abundance of culturally significant native species or quality of an area on the island.

APPENDIX 2: LIST OF STAKEHOLDERS

Name	Company/organisation	Role	Link of company/organisation with Tetiaroa
Frank Murphy	Tetiaroa Society (TS)	Executive Director	Conservation, education and research
Bruno Chevallereau	Tetiaroa Marine Transport (TMT) TBSA (Tetiaroa Construction) EDT	Directeur général de TMT and EDT (Energy de Tetiaroa)	Marine transport Gestion / tri des déchets (EDT)
Nicolas Leclerc	Tetiaroa Marine Transport (TMT) TBSA (Tetiaroa Construction)	On site supervisor	Marine transport
Cécile Gaspar	PBSC	Directrice du développement durable de PBSC (maison mère de TBSA)	Sustainability
Pascal Lombard	TBSA	Directeur de projets TBSA	Construction
Guillaume Bosio	TBSA	Responsable des achats The Brando	Purchasing Departement
Boris Kopec	The Brando	Coordinateur, developpement durable	Sustainable development
Silvio Beon	The Brando	Directeur General	Management of The Brando
Loïc Hurtrel	The Brando	Directeur Général Adjoint	Management of The Brando
Isabelle Honorez	PBSC	Secrétaire Générale PBSC	
Laurent Darcy	Air Tetiaroa	Directeur général d’Air Tetiaroa	Air transport
Baudouin de Monstiers	Island Conservation	Eradication Operational Manager	Motu restoration
David Ringler	University of Auckland	Researcher	Research
Araceli Samaniego-Herrera		Researcher/eradication expert	Research/motu restoration
Richard Griffiths	Island Conservation	Eradication expert	Motu restoration
Hervé Bossin	ILM	Researcher/Entomologist	Mosquito and fly control

APPENDIX 3: TRAP MONITORING DATASHEET

Start date: _____ End date: _____
 Name of observer: _____

[illegible]

For each day and each trap record the trap status using the following codes:

- BP/NS = Bait Present/Not Sprung (trap is as it was originally set)
- BP/S = Bait Present/Sprung (caught nothing)
- BG/NS = Bait Gone/Not Sprung (bait taken but trap not triggered)
- BG/S = Bait Gone/Sprung (Trap triggered but caught nothing)
- Rat (or other animal species). This should record any animal caught (e.g. rat, mouse, crab, bird, etc.). Use the Rodent Identification Guide (Appendix 4) to determine which rodent species you have caught.

APPENDIX 4: BAIT STATION MONITORING DATASHEET

Start date:	End date:
Name of observer:	

[illegible]

Note: text in italics are examples. Delete before use.

APPENDIX 5: RODENT IDENTIFICATION GUIDE

Extracted from Pacific Invasives Initiative 2011. Guideline on rodent identification. Resource Kit for Rodent and Cat Eradication. www.pacificinvasivesinitiative.org/rk/index.html.

Species characteristics for the house mouse, Pacific rat, ship rat and Norway rat:

CHARACTERISTICS	HOUSE MOUSE <i>Mus musculus</i>	PACIFIC RAT <i>Rattus exulans</i>	SHIP RAT <i>Rattus rattus</i>	NORWAY RAT <i>Rattus norvegicus</i>
Normal adult weight	Smallest of all species. Up to 25 g but can grow larger when rat competition removed	Up to 130 g (see note 3)	Up to 225 g	Up to 450 g
Max. head-body length (HBL)	115 mm	180 mm	225 mm	275 mm
Tail length	Slightly shorter or longer than HBL. Uniformly grey brown	Slightly shorter or longer than HBL. Thin and uniformly dark	Much longer than HBL. Uniformly coloured	Clearly shorter than HBL. Thick with pale underside
Ears	12.0-15.0 mm	15.5-20.5 mm. Cover eyes when pulled forward. Fine hairs do not extend beyond edge of ear	19.0-26.0 mm. Cover eyes when pulled forward. Fine hairs do not extend beyond edge of ear	14.0-22.0 mm. Do not cover eyes when pulled forward. Obvious hairs extend beyond edge of ear
Adult hind foot	15.0-21.0 mm, small and thin	24.5-31.0 mm	28.0-38.0 mm	30.0-41.5 mm
Colour of upper side of hind foot	Uniformly grey	Outer edge dark near ankle, rest of foot and toes pale.	Uniform colouring over whole foot, usually dark	Always completely pale
Fur on back	Dull grey-brown	Brown	Brown or black (see note 4)	Brown
Fur on belly	Uniformly grey	White-tipped grey giving irregular colour	Uniform monotone of grey, white or creamy-white (see note 4)	Similar to Pacific rat
Length of droppings	3.9-7.6 mm	6.4-9.0 mm	6.8-13.8 mm	13.4-19.1 mm
Number of nipples	10-12	8	10-12, usually 10	12
Habits	Mainly ground-dwelling though	Agile climber; not known to burrow	Very agile and frequent climber;	Burrows extensively; climbs much less

	capable climber; nests in small holes.	but digs small holes; nests mainly on ground; feeds on ground and in trees; infrequent swimmer.	rarely burrows; nests mainly in trees and shrubs; infrequent swimmer	frequently than other rats; strong swimmer; nests underground; very wary
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(From: D.M. Cunningham and P.J. Moors, GUIDE TO THE IDENTIFICATION AND COLLECTION OF NEW ZEALAND RODENTS, 2nd Edition, 1993. New Zealand Department of Conservation.)

Additional identification notes

1. If identification is in doubt, always keep and preserve at least the head for later detailed examination. Preserving the whole specimen can also be useful.
2. Juvenile rats are sometimes difficult to identify and distinguish from mice, but the species can usually be separated on the basis of tail length, fur colour, and hind foot and ear characteristics. If in doubt, keep the whole specimen either frozen or in 75% ethanol with the gut cavity opened.
3. The normal maximum weight and head-body length are given for each species. However, larger Pacific rats may occasionally be encountered; maximum values are about 190 g and 170 mm.
4. There are three colour forms or morphs (not subspecies) of *Rattus rattus*:
 - (a) "*Rattus*" uniformly black back (sometimes has a bluish look); uniformly grey belly,
 - (b) "*Alexandrinus*" brown back with long black guard hairs; uniformly grey belly
 - (c) "*Frugivorous*" brown back with long black guard hairs; uniformly white or creamy-white belly.

APPENDIX 6: ANT SURVEILLANCE METHODS

Extracted from PII. 2013. Delimiting Surveys for Invasive Ants. Pacific Invasives Initiative, Auckland, New Zealand.

Prepared for the PII Island Biosecurity Training Course by: Disna Gunawardana, Plant Health and Environment Laboratory, Ministry of Agriculture and Forestry, Auckland, New Zealand.

Ant surveillance needs to be conducted both visually and using attractant baits.

1. **Visual Surveillance:** Visual Surveillance is conducted over the entire surveillance area, regardless of presence of ant habitat, by walking systematically over the area looking for ants. Where debris is present and easily moved, the item/s should be shifted to facilitate the inspection. Any suspect ants found should be collected and identified. Always label the ant sample as a visual sample, and the location need to be marked on the ground and recorded on a map or survey form that indicates the area where they were found so that the site could be re-visited for further investigation.
2. **Attractant Bait Surveillance:** Attractant Bait Surveillance need occur only in favoured ant habitats (see below for list). Both protein-based baits and sugar baits should be used. Baits can be prepared and laid in small plastic pots (jars). When the baits are collected the lid is replaced and any ants recruiting to the bait are trapped inside. Density of bait placement is based on a minimum of two baits per equivalent of a 15 m × 15 m grid (225 m²). Separate protein and sugar-based baits must be composed and laid as follows:
 - a) *Protein-based bait composition.* Prepare protein bait by smearing a line of blended peanut butter and soybean oil (the size of half a pea), and a line of raw, fatty sausage meat to the inner side of each bait container, maintaining a 1 cm gap between the two smears. (If predicted temperatures are greater than 25°C, ensure a larger quantity of sausage meat is applied to prevent bait drying out).

OR

Canned tuna could be used if the above ingredients are not available. (Simple method)

- b) *Sugar-based bait composition.* Prepare a sugar-based bait pot by placing a small plug of cotton wool (approx. one third of cotton ball) soaked in 30% sugar solution inside of each container

OR

Smear light coloured jam inside the pot.

- c) Only fresh baits are to be used to ensure consistent attractiveness to foraging ants.

Bait pot placement is to be implemented as follows:

- Bait pots need only be laid in areas of favoured ant habitat. Where there is no favourable ant habitat in a 15 m × 15 m grid, no baits need be placed;
- Where favourable ant habitat is found, at least one protein-based and one sugar-based bait pot must be placed in the 15 m x 15 m grid;

- The bait pots are to be placed 10 m apart where possible. A minimum of 1m between bait pots must be met at all times. Spacing between protein and sugar bait pots should be at least 1m apart.
- All bait pots laid must be able to be traced back to place of location, in case of an exotic ant detection where the area needs to be investigated.

Environmental conditions

- Both visual and attractant bait surveillance can only be conducted when the air temperature is consistently at mid 20°C and below 36°C (measured in a sheltered and shady position) with little or no wind.
- Bait pots shall be placed in the shade where practicable. Surveillance should not occur during or after rain while the sealed surface is still wet. Also, no rain should occur between placement of bait traps and their retrieval.
- Bait pots must be collected at or close to 1/2 hour following placement to prevent baits drying out. However, if large numbers are recruiting to baits, reduce the time the bait is exposed to the ants to 20min, 15min or 10min., or alternatively consider doubling quantity of bait in each pot.

Label Format for collected ant specimens

- Site name, where collected, collector: initials and surname
- Date collected: month spelt out and year in full

Solomon Islands Henderson, Honiara Mango tree trunk M.A. Thomas 30 August 2011
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Favoured ant habitats

The list of favoured habitats is long and should serve as a check list to reinforce habitat preference principles.

1.	Tree trunks (visual inspection and bait at base if appropriate).
2.	Flowers.
3.	Shrubs and poles.
4.	Building edges and foundations.
5.	Hard seal (concrete/asphalt) slab edges.
6.	Cracked concrete/asphalt and junctions between pavers
7.	Disturbed sites.
8.	Drains and culverts.
9.	Electrical generators and fittings.
10.	Exposed rocks.
11.	Fence palings.
12.	Grass areas.
13.	Verges.
14.	Hot water pipes and heaters.

15.	Isolated weeds.
16.	Logs.
17.	Loose gravel.
18.	Low vegetation (including grass).
19.	Plant pot bases.
20.	Road margins.
21.	Rubbish piles.
22.	Shiny/corrugated surfaces.
23.	Soil.
24.	Tree crotches and hollows.
25.	Vertical surfaces.
25.	Weed and plant re-growth.
27.	Wooden structures.
28.	Underneath stones, concrete rubble, timber and debris