

# Ua Pou Islets Pacific Rat Eradication, Monitoring and Biosecurity, Marquesas Islands French Polynesia.



## PROTEGE Final Report September 2024

## Summary

The Ua Pou islets Pacific rat eradication operation was undertaken in August-September 2023. It attempted a global first of aurally broadcasting rodent bait by drone from a small ship in open sea across the islets of Motu Tākaè, Motu Oa, and Motu Mokohe, at Ua Pou in the Marquesas Islands. The aerial bait application resulted in only two of the three islands having bait successfully applied across their entirety, nonetheless, monitoring 12 months later has confirmed Motu Oa and Motu Tākaè are rat free as is the partially isolated section of Motu Mokohe that was also baited.

The eradication success is supported by the establishment of biosecurity knowledge and practices throughout the Ua Pou communities. The results of the seabird and other environmental monitoring will help sustain a commitment over time, as well as benefiting the wider conservation community.

The operation demonstrated that drones could be operated off a boat for rodent eradication purposes but was constrained by the consistently strong winds and swell conditions. A larger vessel with a deeper draught is recommended for similar operations in the future and would likely increase the number of flyable days and improve the ease with which take-offs and landings are undertaken by the drone pilots.

## Acknowledgements

The effort to eradicate rats from the Ua Pou islets has only been possible due to the committed and considerable contributions of many. Among these are SOP Manu the BirdLife Partner in French Polynesia whose relationship with the communities, and leaders and their conservation technical and logistical capabilities was critical to the project's success. Similarly, the Ua Pou Mayor Joseph Kaiha, the Hiva Oa Mayor and the CODIM without whom the project would have had no boat to operate from but also through the assistance provided in many other ways. The people of Ua Pou in taking up the challenge for restoring and protecting these islets, participating in numerous consultations and trainings and in getting the field teams safely to and from the islets.

Grant Harper of Biodiversity Restoration Specialists and Envico Technologies for all the technical expertise and support and DIREN, SPREP and SPC through the PROTEGE Steering Committee for never giving up despite what at times appeared like mission impossible.

The action has been funded by the 11th European Development Fund (FED) of the European Union.



A Tiki given to SOP Manu (Tehani Withers centre, and Roberto Luta left) from Joseph Kaiha, the Mayor of Ua Pou (right)

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## 1. Introduction

The Protégé project aims to promote sustainable and resilient economic development in the face of climate change in the French Overseas Territories and Pitcairn (OCT). Funded by the European Union's 11<sup>th</sup> Development Fund the project is applying an integrated approach to sustainable renewable resource management and enhancement.

One of the project components is invasive species management coordinated by SPREP in Apia Samoa, in partnership with SPC in Noumea New Caledonia.

The two main components of the invasive species outcome are:

- Implementation of invasive species eradication and management on priority sites in the OCTs
- Implementation of monitoring and management of invasive species in terrestrial ecosystems.

As part of the invasive species component three islets of Ua Pou Island in the Marquesas archipelago were identified as priorities for Pacific rat (*'Iore*) eradication and biosecurity protection.

A prior assessment identified the uninhabited islets of Motu Oa, Motu Tākaè and Motu Mokohe as important sites for seabirds notably Sooty Terns with the largest colony in French Polynesia but also other nesting seabirds including shearwaters, petrels, boobies, and frigatebirds, historically globally threatened Phoenix Petrel, and Polynesian Storm Petrel were also present. The feasibility study identified a rodenticide would need to be applied aerially to ensure complete bait coverage of each islet and expose every rat. The selected method to apply the bait was with Unmanned Aerial Vehicles (UAV or drone) acknowledging the limitations and operational risks associated with this emerging technology.

The project sought to eradicate Pacific rats from the three islets, inform potential rodenticide (brodifacoum) risks in the marine environment, establish a seabird baseline (to inform a response to the successful eradication of rats), establish biosecurity to prevent the reintroduction of rats or other IAS and build local capacity for the biosecurity, invasive species management and seabird conservation. With the support of DIREN, SPREP, and SPC the project was locally led by the Société d'Ornithologie de Polynésie (SOP Manu) and managed by BirdLife International (Pacific) implemented from October 2021 to September 2024.

The report summarises the Pacific rat eradication operation and results, as well as the seabird monitoring. The toxicology monitoring, biosecurity and capacity developed are reported in the annexes.

## 2. The Site

Motu Mokohe, Motu Tākaè, & Motu Oa, are three islets close to the southern coast of Ua Pou Island in the Marquesas archipelago of French Polynesia. Ua Pou (9°24'S, 140°04' W), some 1500km NE of Tahiti, is the third largest of the Marquesas Islands. The three motu are the largest of the Ua Pou islets and lie off the east coast (Motu Mokohe) and southern extremity of the island (Motu Tākaè, & Motu Oa). All are steep, with cliffs of varying extent, and maximum altitudes ranging from 100-229m (Figs. 1 – 3).



Ua Pou has about 2000 inhabitants, mainly living in the principal township of Hakahau on the northeast side of the island, and Hakata’o on the southwest coast, linked by a gravel road. There is a regular air link to Tahiti and a mixed sea freight/cruise ship service provided by the *Aranui 5*, stopping at Hakahau. The local economy is based on fishing, copra, tourism and crafts.



Figure 1. Motu Mokohe



Figure 2. Motu Tākaè



Figure 3. Motu Oa

The three islets are owned by the Government of French Polynesia and locally ‘managed’ by authorities on Ua Pou. The Direction de l’Environnement (DIREN) and the Tavana Hau (Polynesia government delegate) have authority on the islands, but the SDR (Service du Development Durable) and mayor can also grant access to the islets. The islets are uninhabited, but Tākaè and Oa have been visited for harvesting of Sooty Tern eggs, which still occurs principally on Oa and by the inhabitants of Hakata’o. Landing on the islands can only be done on calm days but access is limited particularly on Tākaè, due to the encircling cliffs, steep, and unstable terrain.

Ua Pou lies within the trade winds and receives winds year-round, almost always from the east-north-east. The climate is dry with rainfall averaging 685mm on the coast but is likely much less for the islets receiving little to no rainfall between August and February.

All the islands have Pacific rats present (Table 1), which threaten the seabird populations.

Table 1. Ua Pou and the target islands; their order of priority (1-3), their distance offshore, size, and Pacific rat/ship rat/cat/goat presence.

Island	Distance offshore (m)	Area (ha) [planar]	Pacific rats present (2021)	Ship rats present	Goats present (2019)	Cats present
Ua Pou	-	10,560	✓	✓	✓	✓
<b>Motu Oa<sup>1</sup></b>	<b>1,060</b>	<b>38.2</b>	✓			
<b>Motu Mokohe<sup>2</sup></b>	<b>60</b>	<b>21.0</b>	✓			
<b>Motu Tākaè<sup>3</sup></b>	<b>30</b>	<b>7.9</b>	✓			

The islets have no permanent landbirds and the avifauna is represented by seabirds (Table 2), of which the endangered Polynesian storm petrel (*Nesofregetta fuliginosa*) and Phoenix petrel (*Pterodroma alba*) have bred on Motu Mokohe and Motu Oa, although there are no recent records. Phoenix petrel was last reported for Motu Mokohe in 1990 (Seitre & Seitre). Five seabird species have been recorded on Motu Tākaè, 12 on Motu Mokohe, and 14 on Motu Oa.

Lizards are present with a small numbers of gecko and skink species being recorded during the few site visits.

Land crabs are present, but nocturnal surveys revealed very low numbers and no hermit crabs or coconut crabs.

All the islands are mainly covered in low herbs or grasses, although some remnant *Pisonia* and Miro *Thespesia populnea* trees are found on Motu Mokohe. On Motu Oa some noni trees *Morinda citrifolia* are present and fruiting during at least one field visit.

Table 2. Seabirds recently recorded on each islet.

Common name	Species	IUCN red list status	Mokohe	Tākaè	Oa
Blue noddy	<i>Anous cerulea</i>	Least concern (LC)	✓	✓	✓
Brown noddy	<i>A. stolidus</i>	LC	✓	✓	✓
Sooty tern	<i>Onychoprion fuscatus</i>	LC	✓	✓	✓
Spectacled tern	<i>O. lunatas</i>	LC			✓
Masked booby	<i>Sula dactylatra</i>	LC	✓		✓
Brown booby	<i>S. leucogaster</i>	LC	✓	✓	✓
Red-footed booby	<i>S. sula</i>	LC			✓
Greater frigatebird	<i>Fregata minor</i>	LC	✓		✓
Lesser frigatebird	<i>F. ariel</i>	LC			✓
Wandering sandpiper	<i>Tringa incana</i>	LC	✓		
Pacific golden plover	<i>Pluvialis fulva</i>	LC	✓		
Bulwer's petrel	<i>Bulweria bulwerii</i>	LC	✓		✓
Polynesian storm petrel	<i>Nesofregetta fuliginosa</i>	Endangered (EN)	Pre-1995		Pre-1995
Pacific shearwater	<i>Puffinus bailloni</i>	LC	✓	✓	✓
Phoenix Petrel	<i>Pterodroma alba</i>	Endangered (EN)	Pre-1995		Pre-1995
Red-tailed tropicbird	<i>Phaeton rubricauda</i>	LC			✓

### 3. Project Goal

The principal goal of the project is to allow natural restoration of endemic and native fauna and flora on the islets of Motu Mokohe, Motu Tākaè and Motu Oa (at Ua Pou), through the eradication of Pacific rats. The project also sought to establish biosecurity for the islets building local capacity to prevent the reintroduction of rats and share knowledge in assessing the recovery and condition of seabird populations.

In helping strengthen local/national support for the use of rodenticides as an eradication tool, the project also assessed the presence and persistence of brodifacoum in the coastal marine environment (following an aerial baiting operation).

As the first operation (globally) to attempt a drone delivered rodent baiting operation from a ship in open seas, the project also assessed the method as a proof of concept for small, isolated islands.

Several objectives and outcomes were identified for the operation and are detailed in the Motu Mokohe, Tākaè, and Oa Feasibility report (Harper G, 2021).

## 4. Rat Eradication Operation

The eradication of rats from the three Ua Pou islets Motu Oa, Motu Mokohe and Motu Tākaè was conducted through a series of technical studies informing the operation requirements; logistics (vessels, bait spreading equipment, authorisations, personnel etc.); implementation of the baiting operation; and Island leader and community consultations throughout. The technical studies included an initial eradication feasibility assessment prior to the Protégé project, and under the Protégé project a technical feasibility study (Harper G, 2021), an assessment of drone baiting capability (Envico 2022) and an operational plan (Harper G, 2022) all contributing to inform the design, preparation, stakeholder support and the baiting operation implementation.

Despite the small size of the islets, their isolation and steep terrain were key components in what was a complex operation, amplified by the Covid19 pandemic. The extensive cliffs and inaccessible terrain of all islets required that the bait be applied aerially for complete coverage of each islet. A helicopter with a bait spreading bucket and practices developed for successful rodent eradications is the recognised method for these conditions, but with the nearest potential helicopter services 1500kms away in Tahiti, alongside the specialist piloting expertise needed costs were extremely high for three small islets. Drones indicated a potential alternative albeit the technology for applying rodenticides was in early development, the first trial globally having been conducted in 2019 by a New Zealand based company Envico Technologies. Discussions with Envico about the sites, operation requirements and drone capabilities indicated baiting could be successfully delivered potentially using a network of repeaters enabling the drone operations and flights to be separated by distances greater than a kilometre and unimpeded by steep terrain. Envico, was the only company globally with the capability needed, and consultations indicated an operation would be viable for the Islets, with the baiting developed in support of a drone operation (feasibility assessment and subsequent operational plan). As preparations progressed uncertainty with the drone operating beyond line of sight/through a network of radio repeaters identified the need for a site visit. In 2022 Envico drone pilots and engineers visited the islets to confirm if a communications network providing 100% coverage for all three islets could be established. Ultimately, this confirmed a remotely controlled drone operation would not be possible for any of the three islets (Envico 2022). The assessment identified the drone could achieve 100% bait coverage (for all islets) by maintaining line of sight operations (between the drone and operator) but it would need to do so from a boat in open sea conditions. The stability requirements for the drone to launch and land were such that this was considered marginally possible at best due to the sea conditions and the availability of vessels large enough to counter Ua Pou swells.

Helicopter options were reinvestigated including the locally operated Tahiti Nui Helicopters and Air Champagne a France based company. Offshore helicopter services were difficult to procure in part due to a pilot needing aerial baiting expertise and European licensing but also delivery and relocation costs. While there was some possibility with both options initially ultimately availability and other operational constraints meant neither could provide the services needed.

A ship-based drone operation remained the only possibility and following an extensive search among commercial and private operators for a vessel capable of maintaining a stable platform in sea conditions up to one metre the Ua Pou Mayor (Joseph Kaiha) made the island ferry (Kaoha Tini) available. At just under 30m in length, over 20 tonne and a beam of more than 10m it was by far the best and indeed only option. The offer of the Kaoha Tini was hugely significant not only as the



difference in the operation being able to proceed, but as a gesture of tremendous goodwill by the Mayor and Ua Pou community. The Kaoha Tini provides daily services for the community between Ua Pou and Nuku Hiva and would cease for the three weeks of the operation. To assist over this period the project arranged with local boat operators to maintain some service.

In parallel with the technical preparations the project maintained regular contact with the Ua Pou Mayor, Council, and the island communities particularly Hakahau and Hakata'o. These consultations sought feedback into the proposed eradication, identification of issues and concerns and ensured everyone was aware of the risks and mitigations required. SOP Manu led these consultations and in building on an established relationship SOP Manu (and the Project) received universal support for the islet's restoration including for the six-month no harvest period of fish and crabs following application of the bait.

A readiness check for the operation was undertaken by the operation team (SOP Manu, Biodiversity Restoration Specialists NZ, Envico, BirdLife) in July 2023. A review of the technical preparations (operational plan), logistics, community engagement and support confirmed substantive requirements were in place. The remaining requirement was the installation of the drone landing platform on the Kaoha Tini, scheduled to occur immediately prior to the operation, once the Ferry was available. The operation was confirmed ready to take place from mid-August 2023 (Harper G 2023).

The operation team comprised three Envico personnel from New Zealand, the Biodiversity Restoration Specialists Technical Advisor to the operation also, from New Zealand, the BirdLife International Protégé Project Manager from Fiji, the Ua Pou Islets eradication Project Manager from SOP Manu and the Ferry captain and vessel personnel. The team were scheduled to arrive on Ua Pou by the 21<sup>st</sup> of August and the baiting to commence on the 23<sup>rd</sup>. On the 19<sup>th</sup> of August SOP Manu were advised the Kaoha Tini was no longer available having suffered a catastrophic mechanical failure (broken camshaft). Conversations between SOP Manu, the Ua Pou Mayor and Mayors of the other Marquesas Islands *Communauté de Communes des îles Marquises* (CODIM) resulted in the Ferry from the Island of Hiva Oa (*Te Ata o Hiva*) being made available with the captain and 5 crew. A remarkable gesture and demonstration of the support for SOP Manu and its work in the Marquesas without this intervention it is unlikely an operation could have been conducted in 2023. The Te Ata O Hiva arrived at Nuku Hiva in the morning of the 23<sup>rd</sup> and the drone loading platform was fitted to the stern deck due to differences in measurements between the two vessels this took longer to complete, and it was late afternoon before the Ferry got to Ua Pou.

The baiting operation occurred from the following day (Aug 24<sup>th</sup>) ending on the 2<sup>nd</sup> of September with the operation team departing the Marquesas on the 3<sup>rd</sup>. The operation is described in detail in the *Ua Pou Islets Rat Eradication Report* (Harper G, 2023).

The main results are one islet (Motu Tākaè) received two complete bait applications, one islet (Motu Oa) received one full application and two-thirds of the second, and Motu Mokohe received a single application to the western portion of its two interconnected islets but no final swath to half the coastline. Of the 15 days planned for the operation baiting was only possible for two full days and partially on three others the majority of which was from the 30<sup>th</sup> of August to the 1<sup>st</sup> of September. The drone required a stable launch and landing platform on the Ferry and a wind speed of less than 20km per hour for complete and even bait distribution, for all or part of 13 days the wind exceeded

20km hour and a sea swell of half a metre or greater. The small and consecutive number of days with suitable conditions also meant the two bait applications for each islet had to run concurrently and not with the seven-day interval between each application, as planned.

The incomplete bait coverage for two islets and the truncated bait application period for all islets meant the likelihood of every rat on each islet being exposed to bait was less and a higher risk of the eradication failing on one or more islets. The extremely dry conditions for several weeks prior to the bait application and over the period of the operation and possibly for several days if not weeks after the baiting had occurred meant there may have been little alternative food for rats at least on Motu Tākaè and Motu Mokohe. On Motu Oa tens of thousands of Sooty Terns were present and while their nesting stage was unknown the number of terns is suggestive of the presence of eggs and or chicks, a food resource for rats. The dry conditions and absence of land crabs or other substantive bait competitors to rats would also allow the bait to remain available over an extended period increasing the potential for lethal exposure by the rat population.

Several lessons were learnt from the operation primarily that a drone rodenticide baiting operation from a ship in open sea is possible, but it is highly dependent on favourable wind and sea conditions or being able to mitigate those that occur. Sea swells of between half and one metre were expected for the area and for most of the operation this is what occurred, to compensate a vessel of sufficient length, beam and draft was sought to provide a stable drone platform. Despite being the only available options, the Ferry's were considered likely to be suitable but only found to be stable in swells of less than half a metre. The Te Ata O Hiva (the Ferry used) was 8metres shorter than Kaoha Tini but it's unlikely this would have substantially improved the stability and ability to operate the drone.

Other lessons associated with the drone, pilot capacity, and weather forecasting are described in the Ua Pou Islets Eradication report.

Operations in similar conditions would require a larger ship and deeper draught to reduce the vessel movement. A longer duration for the operation may also increase the likelihood of favourable conditions however either option would increase the operational costs, potentially significantly.

## **5. Monitoring**

### **5.1 Rat Eradication**

One year after the baiting operation surveys were conducted to detect if rats were present on each islet. Confirmation of eradication success is typically two years after rat baiting, but as rats breed year-round in the tropics a recovering survivor population is detectable after 12 months. From the 29<sup>th</sup> of August to the 7<sup>th</sup> of September SOP Manu with the assistance of the local communities surveyed each islet and found no direct or indirect presence of rats on Motu Oa, Motu Tākaè, and for the western islet of the interconnected Motu Mokohe islets.

Multiple detection devices were deployed on each islet including rat traps, rat chew cards, motion cameras and for Motu Oa and Motu Mokohe night and daytime searches were conducted by the monitoring team. Islet size and access limitations resulted in differences between the number of detection methods and sampling size for each islet but with more than one method used and a

sampling rate sufficient to detect rats had any survived the results confirm Motu Oa and Motu Tākaè are rat free.

Table 3. Rat detection methods and monitoring effort.

Detection methods	Motu Oa	Motu Tākaè	Motu Mokohe <sup>1</sup>
Rat traps	261 trap nights (87 traps over 3 nights)	33 trap nights (11 traps over 3 nights)	180 trap nights (60 traps over 3 nights)
Motion cameras	192 hours (2 cameras 8 nights)	108 hours (1 camera 9 nights)	
Chew cards	135 chew card nights (45 cards over 3 nights)	15 chew card nights (5 cards over 3 nights)	
Ground searches	yes	no	yes

<sup>1</sup>Western motu of the two interconnected islets

The western islet of the two interconnected Motu Mokohe islets is also rat free however the eastern islet was not baited (in the 2023 operation) due to unfavourable conditions. The rat status for the eastern islet is unknown as it is inaccessible and has never been surveyed nonetheless it is likely that Pacific rats are present and the probability of them reinvading the western islet remains. Albeit made more difficult as a land bridge only occurs at very low tides and in calm conditions given the exposed coastline the frequency of both conditions occurring together is possibly low. The monitoring indicates Pacific rats have not reinvaded from the eastern motu (if present).

Fig 4. Motu Mokohe the rat free eastern islet and rat monitoring points



## 5.2 Brodifacoum residue monitoring

Potential non-target species pathways from rodenticide use in rat eradication operations are an important part of the risk assessment and mitigation planning. For this operation exposure was identified for inter-tidal crabs and coastal fish, crabs are not affected by the toxin (brodifacoum) and use of a directional spreader bucket and precise flight lines for the bait application meant minimal bait would fall in the sea. To prevent any secondary transfer of the rodenticide to people a 6-month non-

harvest period of crabs and fish from each islet and the surrounding coastal waters was agreed to by the Ua Pou communities and applied.

Toxicology studies to date have shown no to low levels of rodenticide presence in fish following baiting operations on islands in open seas but it is typically present in crabs and particularly land crabs. Research demonstrates rodenticide is normally no longer present in any of these animals 3 to 4 months after exposure and certainly within 6 months. To help add to this body of information the project collected fish and crabs from each islet to determine if any species had brodifacoum present in their flesh or organs. The sampling targeted collection of 5 benthic and 5 pelagic fish and 5 terrestrial and 5 inter-tidal crabs at 10 days, 3 months, and 6 months after bait application any terrestrial fauna found dead/dying were also included for analysis (Harper G 2023).

A total of 45 fish and 35 crab samples were collected from the islets (BirdLife 2024) with the toxicology analysis to be conducted by the University of French Polynesia. Ultimately, this proved not possible and following a lengthy engagement process with laboratories in New Zealand and Australia, Manaaki Whenua – Landcare Research New Zealand were contracted. The export/import authorisations and frozen transportation to NZ took some time to complete but the samples have been received and are undergoing analysis by Manaaki Whenua. The detailed toxicology report is included as an annex to this report (Annex 1).

### 5.3 Marine Birds

The three islets are seabird islets and notably Motu Oa with over 100,000 Sooty terns, and 12 known species (Table 2) there are no permanent land birds. The monitoring sought to establish a baseline against which changes could be assessed following the eradication of rats. Surveys were primarily confined to Motu Oa and Motu Mokohe, due to the difficult and dangerous access only acoustic recorders were deployed on Motu Tākaè.

Transects and quadrats were used for all resident species with evidence of breeding as the primary population measure/indices. Four surveys were conducted between October 2021, and September 2024 (Withers T 2021, 2022, 2023, 2024). The seabird monitoring data is summarised in tables 4 and 5

Table 4. Motu Oa seabird transect counts October 2021 to September 2024

	Oct. 2021		Feb. 2022		Jun. 2023		Sep. 2024	
	Nests	Adults	Nests	Adults	Nests	Adults	Nests	Adults
Brown Booby	58		Yes		92	>30	2	2
Red-footed Booby	20				7	20		
Masked Booby	64		Yes		50	13	3	33
Frigatebird Spp	46		Yes					
Greater Frigatebird					54	>15	47	>50
Lesser Frigatebird					3	2		
Red-tailed Tropicbird	1						1	1
Sooty Tern	155		Yes			>250	153	>10,000
Tropical Shearwater		12						

Table 5. Motu Mokohe seabird transect counts October 2021 to September 2024

	Oct. 2021		Feb. 2022		Jun. 2023		Sep. 2024	
	Nests	Adults	Nests	Adults	Nests	Adults	Nests	Adults
Brown Booby	26		Yes		24		1	>10
Red-footed Booby								
Masked Booby	45	5	Yes		27		32	>80
Frigatebird Spp	2	100	Yes	50				
Greater Frigatebird								
Lesser Frigatebird								
Red-tailed Tropicbird	1				4		0	5
Sooty Tern	79		Yes	<100				
Tropical Shearwater	1	30						

The transects comprise a circuit traversing the coastal margin of each island which for Motu Oa encircles the plateau and Motu Mokohe similarly the outer crest overlooking the coastal cliffs. Counts do not represent the total population for each species and timing of breeding alongside time constraints and competing priorities has meant variability across surveys for each species. For most species breeding has occurred in each of the 4 months surveyed with greatest numbers in October and June. Except for Sooty Terns and possibly Tropical Shearwater the removal of Pacific rats is unlikely to have a substantial effect on these species and populations. To increase consistency between years it is recommended monitoring be conducted in either October or June.

Six acoustic recorders were deployed on the three islets (3 on Motu Oa, 2 on Motu Mokohe and 1 on Motu Tākaè) from February 2022 to September 2024 (Withers T 2022, 2024). Running every night for 2 hours from dusk and for two hours prior to dawn and recording for 5 minutes in every 15 the recorders were targeting petrels and shearwaters. This two-year record provides a strong record for any procellariiformes and notably threatened species (Phoenix Petrel and Polynesian Storm Petrel) but also cryptic species (i.e. Bulwers Petrel) present prior to the eradication of rats. These ground nesting species are expected to benefit from the removal of rats which repeat monitoring will assess in 3-5 years' time. The baseline data will be assessed by Conservation Metrics in 2024.

While Sooty Terns are the most numerous seabird for all three islets Pacific rats are known to prey on the terns eggs and chicks. Additionally, the eggs are harvested by the local community mostly from Motu Oa also the largest colony with more than 100,000 birds. To calculate the colony density/size and assess reproductive success transects and quadrats were trialled on Motu Oa. The irregular breeding of Sooty Terns combined with the isolated location made it difficult to know when most of the Terns were on eggs. None of the four surveys coincided with this and counting nests in a pre-egg laying or chick phase wasn't possible as the birds would disperse. Aerial photography of the colony was attempted using a drone however, the operator was unable to get low enough (because of bird strike concerns) to enable individual nests to be identified. The drone (a commercially available DJI Mavic) was attacked by terns at heights greater than 100m damaging the drone.

Burrow occupancy has been assessed for Tropical Shearwater on Motu Mokohe. Fifteen marked quadrats with 80 burrows were surveyed in Feb 2022 and June 2023 and had zero and three burrows respectively occupied with a Tropical Shearwater adult (Withers T 2022, 2023).



For each survey dawn and or dusk observations over a one-hour period were made from vantage points to observe seabirds coming into Motu Oa and Motu Mokohe. These surveys mainly sought to identify shearwaters and petrels and particularly species that may be present but difficult to detect such as Phoenix Petrel, Polynesian Storm Petrel, Bulwers Petrel and potentially others. No confirmed sightings were made but the June 2023 survey noted a petrel off the coast of Motu Oa with plumage typical of Phoenix Petrel or possibly Tahiti Petrel (Withers T 2023)

#### 5.4 Other Taxa

An invertebrate baseline was established for Motu Oa, and Tākaè. The surveys indicated a low species diversity largely attributable to the limited vegetation and dry environment. Arthropods and other invertebrate groups were identified as indicators for the eradication of rats and a monitoring protocol was developed for the islets (Ramage T 2022) and a species identification guide (Ramage T 2022).

Native, non-native and invasive plants were surveyed on Motu Oa and Mokohe and 5 vegetation monitoring plots established on Motu Oa and 3 on Mokohe each covering a 100m<sup>2</sup> area. Permanent photopoints were established for each plot. Species abundance and height/size classifications were noted for each species (Withers T 2023).

### 6. Biosecurity

Over the project period SOP Manu has met with all Ua Pou communities that do or may access the islets, to discuss the project and the importance of biosecurity. Specific training in biosecurity practices has been conducted with the fishing association, schools and other stakeholder groups and individuals. Initially these consultations addressed the effects of rats (and other invasive species) for the islets' native fauna and flora and that taking action to prevent their reintroduction (or the introduction of other threats) is critical to the ecological restoration and ongoing protection. Developing awareness of the biosecurity practices and the obligations for everyone visiting the islets was an integral part of the project development these consultations informing the likelihood of the measures being supported. Subsequent consultations addressed the practical actions (summarised in Table6.) including demonstrations and training of stakeholders. Training was delivered to children at the local schools (20-50pupils depending on the school), the fishing association (cooperative Avaika) 10 board members, and to the village guides supporting each of the field expeditions approximately 25 in total (4-5 trained each time). The need for biosecurity and discussion of the implementation measures was supported through community meetings attended by 50-60 people and held at least twice in Hakata'o and Hakahau, door to door visits were also made in both communities and others. The Cooperative Avaika committed to ensuring all members would be made aware of the biosecurity requirements and support for compliance.

Table 6. Biosecurity Checklist<sup>2</sup>

**THE PROTECTION OF ISLANDS IS EVERYONE'S BUSINESS**

<b>Materials transported</b>	<b>Action</b>	<b>Check</b>
Hiking or other bags	Shake your bag and check the inside, including the pockets. Make sure there are no holes. Make sure bags are tightly wrapped/closed (no broken zips etc.)	
Shoes	Clean your shoes/boots, remove all traces of soil and seeds. Check the soles and laces for seeds. Rub shoes with soapy water if they have been worn in the bush before.	
Clothing	Check your socks, clothing and Velcro fasteners for seeds. Manually remove all seeds. Clean in the washing machine if necessary, supplementing with manual removal.	
Equipment and clothing	Once you've inspected and cleaned your gear, put it in a bag/bag with a zip or a good closure.	
Food	Pack all food in sealed containers after inspecting it (confirming an absence of rodents, ants, cockroaches, lizards and all other animal and plant life). Rigid plastic containers with a strong closure are recommended avoid cardboard boxes which often host insects/eggs.	
Sleeping equipment	Check sheets, cushions, floor mats etc., including shaking your sleeping bag and packing it inside a waterproof closed bag.	
Tents and camping equipment	Shake and check camping equipment. Pack in bags with zips. Crockery, kitchen equipment, etc. must be clean before being packaged.	
Boat/Canoe	Check your boat/canoe for rats and mice, ants and other insects, seeds or any other animals and plants before leaving the dock or beach. For larger vessels (i.e. with a cabin or closed spaces) rat baits should be stationed permanently inside the vessel (and replaced every 2-3 months or as required). If a rat is found alive on the boat, do not land on the motu, do not throw it into the sea (rats can swim).	
Fishing equipment	Clean your fishing nets and rods. Clean the hooks well, to prevent the smell from attracting ants, rats, etc.	
Clearing equipment	Clean cutters and other land clearing equipment (mowers, shovels, rakes, etc.). Do not bring bags of copra that are not new. Remove all traces of soil.	

<sup>2</sup>The checklist is a translation of the French version

Awareness materials highlight the importance of biosecurity including through several communications in local and national media. Awareness materials include the Biosecurity Checklist (Table 6) made available to the Avaika Cooperative, the Ua Pou Council, and local Mayors, and copies of the presentations given at biosecurity meetings/consultations. A temporary biosecurity (and eradication operation warning) sign was installed on each of the islets and at the boat access ramps in Hakata'o and Hakahau (Figure 5).

Figure 5. Temporary biosecurity (rat eradication warning) signs displayed on each of the three islets (left) and boat landing areas in Hakata'o (right) and Hakahau



With confirmation the islets are rat free permanent signboards have been designed to replace the temporary signs reminding people of the biosecurity obligations the status of the islets (Figure 6). The signs will be in the same location as the temporary signs

Figure 6. Permanent biosecurity sign information<sup>3</sup>

Rats and other pests are the biggest threats to the biodiversity of our islands. Rats are no longer present on the motu of Ua Pou, thanks to a successful rat eradication operation in September 2023.

This action is part of the PROTEGE project, implemented by SPC and SPREP and funded by the European Union, in collaboration with the French Polynesia Government, CODIM and the municipality of Ua Pou.

These islands are home to many native plants and birds in the Marquesas: everything must be done to ensure that rats, ants and invasive plants never arrive on these islands!

In addition to being part of Polynesian heritage, the birds protected in this way are useful to fishermen to locate schools of fish! Seabird colonies are also known to increase marine resources around motu thanks to their guano.

If you are going to these islands, INSPECT your belongings and your boat or canoe for rats, ants or plant seeds by following the biosecurity protocol below. Please contact the town hall in case of doubt on 40 91 51 05.

The Town Hall of Ua Pou 40 91 51 05

The DAG de Ua For 40 925 418

The Department of the Environment 40 47 66 66

The SOP Manu 40 52 11 00

Taraka egg collection

The practice of collecting Taraka (Sooty Tern) eggs has existed for a long time in the Marquesas, and even today, this practice is done from time to time, during the fruiting of the Uru (Breadfruit). If you are an egg collector – for future generations, and the protection of the motu of Ua Pou, you must manage the resource. Respect the premises, do not leave waste and only take the eggs you need for family consumption (sale is prohibited). Indeed, overconsumption of eggs can lead to the disappearance of Taraka colonies. And of course, follow the biosecurity measures!

<sup>3</sup>A translation of the French version.

## 7. Project outcomes

All three islets had bait applied, and although only one (Tākaè) received two full applications and none with the planned seven-day interval between applications, rats have been successfully eradicated from Motu Oa, Tākaè and the western islet of Motu Mokohe, conditions prevented bait application to the interconnected eastern islet nevertheless one year later the western islet remains rat free.

A seabird monitoring baseline has been established for the three islets and for Motu Oa this also includes vegetation and invertebrate baselines. Future monitoring will enable comparative change and the ability to evidence the benefits of rat eradication. Data collected on brodifacoum presence in marine life will also provide valuable information for future rat eradication operations in French Polynesia (and elsewhere).

Biosecurity has been established for the three islets with the Ua Pou communities and the island's leaders. While the training and information provided in support of the biosecurity practices are an essential component it is these local relationships, networks and support for protecting the islets that SOP Manu has developed that provides the basis for effective biosecurity. Signage and awareness information will help reinforce the action needed as will continuing to maintain the relationship and interest.

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