ASSESSMENT OF ENVIRONMENTAL EFFECTS OF PEST ERADICATIONS IN THE PHOENIX ISLANDS

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SUMMARY

The Government of Kiribati with the support of Pacific Expeditions Ltd, NZ Department of Conservation ("NZDOC"), NZAID and Pacific Invasives Initiative (PII) is undertaking a pest eradication programme in the Phoenix Islands, Kiribati, in May-June 2008. The Phoenix Islands are outstanding seabird islands supporting millions of seabirds comprising 19 species. However, populations of most species are threatened by invasive alien species, including rabbits and rats. The target islands and species are as follows:

Target Islands	Rawaki, McKean and Birnie Islands, Phoenix Group
Approx Total Island Land Areas	Rawaki 58 ha, McKean 49 ha, Birnie 48 ha
Status of islands	Wildlife Refuges and part of the PIPA Marine Reserve owned by GOK. CEPF Polynesia/Micronesia Hotspot - KBA 133 Birdlife International – IBA
Target pests	European rabbits, Asian rats, Pacific rats
Operator	Pacific Expeditions Ltd
Sponsors	New Zealand Government's international aid and development agency (NZAID), through the Director-General of Conservation, Department of Conservation
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Proposal

The project targets the eradication of all three pests, European rabbits, Asian rats and Pacific rats. It is modelled on the successful eradication of rabbits and rats elsewhere in the Pacific and New Zealand and will significantly enhance the ecosystem and species values of these islands and provide a source of seabirds for larger islands in the Group that may be restored in the future.

The key components of the pest eradication programme are as follows:

- The programme is a one-off operation aimed at achieving eradication of all three species in 2008.
- Each island application involves the hand-laying/throwing of brodifacoum baits along grid-lines (2 applications on Birnie), plus bait stations for Asian rats on McKean.
- Supplementary techniques that may be required for Rawaki rabbits are shooting, gassing and dogging.
- Hand laying of bait will take approximately one day to complete for each island.

- Bait application is planned to take place over the months of May-June 2008. Because the operation is depending on good weather and landing conditions, the exact timing of bait application cannot be defined.
- The islands are uninhabited bird sanctuaries. Access will be via the RV Bounty Bay and its dinghies used for landing.
- Operational procedures will proceed in accordance with specified performance standards identified in the Operational Plan.
- Monitoring of target species will be undertaken in accordance with the specified monitoring standards in the Operational Plan.
- Monitoring of non-targets are identified in the Outcome monitoring plan.

Summary of actual or potential effects on the environment

In terms of actual or potential effects on the environment, the following assessment is made:

- Hand and aerial application of rodent baits containing brodifacoum has been used as an effective technique for a large number of island rodent eradication programmes both in New Zealand and overseas with minimal negative impacts to non-target species.
- Based on the findings of research on the effects of brodifacoum it is anticipated that the proposed activity will have no more than a minor adverse effect on the receiving environment.
- Direct discharge of baits to the intertidal, marine and hypersaline lagoons will be avoided because baits will be hand-spread.
- Land crabs (hermit crabs, ghost crabs, and potentially a few coconut crabs) may be on the islands and these may consume baits
- Some entry to the marine area may be gained via tissue and guts of hermit crabs which commute between land and sea.
- There will be no significant adverse effects on water quality as the bait breaks down readily in water but the toxin itself is insoluble. There is no freshwater available at the islands, and no freshwater is collected for consumption either by wildlife or humans
- Waders, particularly the bristle-thighed curlews, are potentially at risk via secondary poisoning. Curlews forage throughout the islands where they capture, anvil and consume hermit crabs. Some sub-adult curlews may be present on the islands, but all adult curlews will be on the breeding grounds in Alaska at the time of the operation.
- Other waders, e.g. wandering tattler and golden plover may be present in very low numbers because as for curlew above, adults will be back on the holarctic breeding grounds. They consume small crabs and other invertebrates (tattlers mainly along the shore and golden plover throughout the islands), so there is some risk of golden plover becoming secondarily poisoned.
- Frigatebirds forage mainly at sea – they parasitise other birds (force disgorging), but also taking their own prey and scavenged carrion. There is a slight risk that some individuals could take dead or dying rats, although most rats will die underground.
- Nesting seabirds could be placed at risk by the eradication via disturbance of colonies (if any are nesting), collapse of some burrows of shearwaters, standing on tern or noddy eggs or chicks. Because of the soft nature of the substrate, it is envisaged that shearwaters would reconstruct burrows relatively quickly and not suffer any loss of annual production. Also the extended breeding season in the tropics means that many failed breeders will relay. Impacts by the operators will be less than those of currently caused by rats and rabbits and of a very short-term nature.

- Because the islands are uninhabited and rarely visited, no risk to humans is envisaged. Operators including Kiribati staff will be briefed about risks of consuming crabs.
- The programme is expected to result in long-term benefits for indigenous flora and fauna.
- Appropriate performance standards and operating procedures will be implemented to ensure that any adverse effects associated with the storage, transport and use of hazardous substances (bait and other toxins) will be appropriately avoided, remedied or mitigated.
- The method of eradication may involve some physical modification to the islands, particularly Rawaki, where some burrows of seabirds (shearwaters) may be inadvertently damaged by being stood on. Other burrows (of rabbits and/or wedge-tailed shearwaters) may be destroyed if the rabbit dogs indicate the presence surviving of rabbits near the end of the project.
- There will be no impact on the heritage or cultural values of the islands. The coral walls of former dwellings and sheds will be left intact (mainly on McKean). There are very few surviving structures on Rawaki and these will be left intact.
- The proposal is one that seeks to enhance the natural environment, using proven methods to eradicate pests that are having an adverse effect on a range of native flora and fauna.

It is concluded in this AEE that the adverse effects on the environment will be minor and temporary in nature and the ensuing long-term benefits resulting from the removal of pests outweighs any risks posed by the activity. The proposed activity will be restricted to the islands and will have no significant negative impact on populations of indigenous animals, but many positive effects on these populations in the future.

Consultation

The project is a collaborative initiative between the Government of Kiribati, NZ Department of Conservation and Pacific Expeditions Ltd. Consultation has occurred widely with stakeholders including CI, New England Aquarium, SPREP and the Operational Plan has been peer reviewed by the Island Eradication Advisory Group. Permits are currently being obtained – refer Appendix 2. Feedback received to date is entirely favourable. Consultation with stakeholders will be ongoing leading up to and following the completion of this project.

Statutory framework

The following permits and authorisations are being provided by the Government of Kiribati:

- Agriculture permit for importing poison baits - c. 8 tonnes of PestOff 20 R rodent baits with brodifacoum at 20 ppm (or 0.02 g/kg or 0.0002%); less than 3 kg of magnesium phosphide (magtoxin). Note that the pesticides will be applied by or under the supervision of suitably qualified people following NZ DOC safety procedures
- Agriculture permit for importing two trained-rabbit dogs in transit and quarantine at Samoa
- Police permit for two small calibre rifles, one higher calibre centre-fire rifle and two shotguns and up 10000 rounds of rifle ammunition and up to 500 shotgun cartridges. Shooters will have NZ firearms licences.
- Traps (leg-hold and cages) will be used to catch rabbits if required (not sure if permit needed).
- Landing permits for visiting and carrying out this work on the Phoenix Islands
- In addition a permit for handling and banding seabirds (Phoenix petrel and white-throated storm petrel) is able to be provided by Department of Conservation in NZ, but this would require a letter of support from the PIPA. I can draft a letter of support if you wish.
- A permit to collect feather samples of seabirds.

No resource consents are required, but this AEE is provided in line with NZ DOC operations to apply for DOC consent for this operation.

PART 1 - BACKGROUND

1.1 The Phoenix Islands

The Phoenix Islands are a group of eight atolls, plus two submerged coral reefs in the central Pacific Ocean, 1100km North of Samoa, east of the Gilbert Islands and west of the Line Islands. Part of Kiribati, the largest atolls are Kanton (or Abariringa) and Enderbury Island. The other islands include Rawaki (formerly Phoenix), Manra (formerly Sydney), Birnie, McKean, Nikumaroro (formerly Gardner), and Orona (formerly Hull). During the late 1930s they were the site of the last attempted colonial expansion of the British Empire (the Phoenix Islands Settlement Scheme).

The islands and surrounding areas are home to some 120 species of coral and more than 500 species of fish. Kiribati has recently established a huge marine park in the area – the Phoenix Islands Protected Area (PIPA). Kiribati announced the establishment of PIPA at the 8th COP for the Convention on Biological Diversity in 2006. The NZ Minister of Conservation has offered technical support and assistance from New Zealand for the development of PIPA.

At various times, the islands have been considered part of the Gilbert group, but the name "Phoenix" for this group of islands seems to been settled on in the 1840s, after the island of that name within the group. Phoenix Island was probably named after one of the several whale ships of that name, known to be in the area in the early nineteenth century. The islands were visited and/or settled by Melanesian and/or Polynesian peoples in the past, but were uninhabited during the period of earliest European visits in the early 19th century. Whalers and guano collectors visited in the early and mid 19th century respectively and the coral slab walls of guano collectors' buildings are still standing.

Up to 1000 people lived on each of Manra, Orona and Nikumaroro during the period from the late 1930s to the 1960s. Since the 1960s only Kanton has had permanent inhabitants (41 people according to the 2005 census), but Orona was settled by c.200 people in 2001-04, during which time sharks and other fish were harvested along with other fauna. Successive human visits over the centuries have resulted in the introduction of many invasive species including Pacific rats, rabbits, cats, pigs and dogs.

The Phoenix Islands are identified as a Key Biodiversity Area in Conservation International's Critical Ecosystem Partnership Fund (CEPF) and an Important Bird Area by BirdLife International. These and other designations reflect the very high marine and terrestrial values which are inextricably linked. The marine values of PIPA are well reflected in the suite of 19 seabird species that breed on the islands - this includes the endangered Phoenix petrel, the white-throated storm petrel (classified as Vulnerable) and other declining populations of petrel species, together with globally important populations of frigatebird species ,booby species and blue noddies.

The islands are small to medium sized atolls with the windward (eastern) sides being strewn with coral rubble boulders, but the interior and especially the lee sides often comprise large areas of coral sands. The large Enderbury Island has extensive areas of soft sand and luxuriant shrubland suitable for seabirds that burrow and/or seek vegetation for nesting cover.

Key physical features and vegetation of the islands

Island	Total area	Land area	Lagoon	Substrate	Vegetation
Manra		c.500	Closed	Not visited	Forest, scrub, coconut
Rawaki	73.24	58.14	Closed	Rubble, c.50% sand	Grass, scrub
Enderbury	596.6	500+	Closed	Rubble, extensive sand	Grass, scrub
Birnie	50.95	48.2	Closed	Rubble, limited sand	Grass, scrub
Kanton		c.900	Open	Varied, extensive sand	Forest, scrub, coconut
McKean	74.32	48.77	Closed	Rubble, < 30% sand	Grass, scrub
Orona		c.600	Open	Rubble, sand	Forest, scrub, coconut
Nikumaroro		c.400	Open	Rubble, sand	Forest, scrub, coconut

Note: Land areas are total atoll area minus lagoon area.

Four of the five atolls in the north and east of the Group have small land-locked hypersaline lagoons. Two of the southern atolls – Orona and Nikumaroro - have large lagoons that are connected to the sea, but tidal flushing is weak. Only the large Kanton Island in the north has high rates of tidal flushing.

Many of these values are under threat however and the Government of Kiribati is preparing an integrated management plan for the Group.

1.2 Strategic Framework of the Project

The purpose of this project is to restore seabird populations as an essential component of the internationally recognised Phoenix Islands protected Area (PIPA).

The Phoenix Islands are recognised as a globally significant protected area. In particular the Phoenix Islands Protected Area (PIPA) is:

- The world's largest marine protected area,
- a proposed UNESCO World Heritage Site,
- an important 'Hotspot' and 'Key Biodiversity Area' (Area (#133) identified in Conservation International's Polynesia-Micronesia Ecosystem Profile,
- an Important Bird Area (IBA) identified by BirdLife International Pacific,
- a high priority in Kiribati's National Biodiversity Strategy & Action Plan (NBSAP).

However, a recent conservation survey (Pierce et al 2006) revealed that mammalian pests (rats, rabbits and cats) have impacted heavily on ecosystems and particularly birds. There have been significant changes in the status of mammal and bird species in the Phoenix Islands since the previous comprehensive fauna surveys in the 1960s. The greatest change has been on McKean where the large

Asian rat (*Rattus tanezumi*) has arrived recently coinciding with a 40% decline in seabird diversity, including the total loss of blue noddies (*Procelsterna caerulea*) and most procellariiform species. Most of the seabird species that were still persisting on McKean in 2006 were present in greatly reduced numbers and were generally breeding unsuccessfully. Pacific rats are present on Birnie.

The island with the highest diversity (18 species) of seabirds in 2006 was Rawaki. This is the only island in the Group that still supports a breeding population of blue noddies and the Endangered Phoenix petrel (*Pterodroma alba*) and Vulnerable white-throated storm petrels (*Nesofregetta albogularis*), while many other species also breed here as was the case in the 1960s. These seabird populations on Rawaki are critically important. The presence of rabbits (*Oryctolagus cuniculus*) is impacting on many seabirds on Rawaki through competition for burrows and shaded shelters with associated trampling of eggs and nestlings. Rabbits are also impacting on the vegetation with the loss or decline of the more palatable species; this in turn reduces nest site availability and burrow stability for seabirds, and impacts on the ecosystem as a whole.

The most urgent management actions required for the islands are to remove rabbits and Asian rats from Rawaki and McKean respectively. The removal of rabbits will secure a nucleus of recovering populations of the key threatened seabird species on Rawaki from which dispersal and recolonisation will occur to neighbouring islands in the Group when they become pest-free. Removal of rats from McKean will enable the recovery of existing populations on the island and more particularly allow birds currently attempting to breed or recolonise (e.g. storm-petrels and 2-3 shearwater species) to survive and breed successfully.

A three-island package of eradications would be feasible during one winter expedition and this should comprise removing European rabbits from Rawaki, Asian rats from McKean and Pacific rats from Birnie. The Birnie rat operation could potentially be treated as a trial and precursor to eradicating rats from the much larger Enderbury Island. With support from the Government of Kiribati (GoK), a detailed proposal has recently been prepared (including operational plans) to eradicate these invasive species and to establish biosecurity measures to prevent further invasions. This proposal was accepted by NZAID as an Overseas Development Aid (ODA) bid from the New Zealand Department of Conservation.

Two larger islands are also recommended to be considered for restoration via pest eradication – the 600 ha Enderbury and 500 ha Orona, both of which provide extensive areas of semi-pristine habitat suitable for seabirds, lizards, invertebrates and plants. Indeed these islands are the ecological gems of the Phoenix Group and are a very high priority for restoration, but they will also need significantly improved biosecurity measures implemented to prevent unauthorized landings and other threats.

The benefits of this project will include developing capacity to effectively manage these islands, and others like them, in the future including securing their long term ecological and economic viability by establishing a biosecurity system which should prevent the recurrence of similar threats. In addition to biodiversity conservation objectives this project will act as a flagship and point of focus for developing local capacity, which will raise awareness and generate further support for invasive species management and biodiversity conservation generally.

It is important to emphasise the supportive wider context for this project in the form of the development of the PIPA (management planning, resource valuation, education and awareness, trust fund development, etc) which is being facilitated by Conservation International (CI) and the New England Aquarium (NEAq) under a signed MOU with the GoK. The GoK has established a multi government agency Steering Committee as the key decision making body for the PIPA. The PIPA Steering Committee has endorsed action on these invasive species eradications as urgently-needed

interim measures to be implemented as part of the management planning process, i.e. these measures cannot wait until the full PIPA Management Plan is completed, due to the serious threat that invasive species currently pose to the survival of key bird populations in the Phoenix Islands.

1.3 Physical landscape of the target islands

The target islands – Rawaki, McKean and Birnie - are the three smallest members of the Phoenix Islands group. Each comprises predominantly soft coral sand in the midddle and leeward sectors of the islands, including at least part of the western beach. Coral particles increase in size towards the eastern sector of the island, including the beaches, where there is extensive coral rubble and driftwood. Driftwood (including tree trunks, occurs around the perimeter of the islands and some stumps and branches have been thrown up onto the top of the island. The area of bare sand is greatest on Rawaki.

There is no freshwater lens on any of the target islands, but all three do have a single hypersaline lagoon roughly in the centre of the island. These lagoons are of varying size between islands, that on Birnie being the smallest (2.5 ha) and McKean the largest (c.25 ha) and that on Rawaki intermediate at 15 ha. These lagoons also appear to vary in extent and depth over time, with large areas sometimes being exposed as soft or encrusted mud during dry periods. This was particularly noticeable on Rawaki in April 2006 when there were large dry areas present in the "lagoon". The lagoons appear never to be directly connected to the sea (unlike the larger atolls of Kanton, Orona and Nikumaroro), but it is likely that surges enter the lagoons during storm events. Baits near the lagoons will not be laid in water, but in dried encrusted mud only.

The landscape on all three islands (especially Rawaki and McKean) has been modified by humans, possibly mainly during the guano collecting period of the 19th century. Some areas have been excavated, now appearing as very shallow depressions in the topography, e.g. the north end of McKean. A concentric bomb crater is present on Birnie.

1.4 Habitat, Flora and Fauna of Rawaki, McKean and Birnie

The habitats of the target islands are relatively simple, and are dominated by:

- intertidal beaches and rubble
- elevated coral rubble on the south, east and northern sides of the islands, depauperate in plants
- coral sand, often lacking in vegetation
- swards of Lepturus grass, especially on Rawaki
- extensive areas of Portulaca, Sesuvium and Boerhavia, each area typically monotypic
- Isolated trees, e.g. Cordia on all three islands and a stand of Pisonia on McKean.

Table: Plant lspecies present on the three islands in 2006.

Family	Kiribati name	Species name	Rawaki	Birnie	McKean
Graminae	Teutente ni mane	*Lepturus pilgerianus*	✓		
	Teutente ni mane	*Lepturus repens*			✓
Urticaceae		*Laportea ruderalis*	✓		
Nyctaginaceae		*Boerhavia albiflora*	✓	✓	✓
		Pisonia grandis			✓
Alzoaceae	Uteuten toari	*Sesuvium portulacustrum*	✓	✓	✓
Portulaceae		*Portulaca aff. Lutea*	✓	✓	✓
Zygophyllaceae		*Tribulus cistoides*			✓
Tiliaceae		*Triumfetta procumbens*	Now absent		
Malvaceae	Te koura	*Sida fallax*	✓(2)	✓ *	✓
Boraginaceae		*Cordia subcordata;* te kanawa	✓(1)	✓	✓(1)

The target islands have varying bird faunas (refer Table below). Rawaki has the most diverse avifauna, supporting 18 of the 19 species that breeding the Phoenix Islands – the 19th species is white-tailed triopicbird, recorded only at Nikumaroro in 2006.

The avifauna of Rawaki includes many important species:

- Phoenix petrels (EN) – the only island in the Phoenix group currently supporting them
- White-throated storm-petrels (VU) – now the only island in the Group with a viable population following the invasian of Asian rats on McKean

- Four other species of petrels – Bulwer's petrel, wedge-tailed shearwater, Audubon's shearwater and Christmas shearwater
- Blue noddies – now the only island in the Group with a viable population following the invasian of Asian rats on McKean
- Lesser frigate bird - colony numbering many thousands
- Boobies of three species
- Red-tailed tropicbird – healthy breeding population
- Terns and noddies – several species including the only viable colony of grey-backed terns in the Group.

In 2006 McKean and Birnie had lower diversity and numbers of species than present at Rawaki, although McKean did support higher numbers of boobies. The lower numbers and diversity of smaller birds on McKean and Birnie reflects the presence of rats.

In addition all islands support bristle-thighed curlews and other waders species in the austral summer.

Table – Bird species recorded on the three islands in 2006 along with their approximate numbers of pairs (or individuals, i), **threatened or near-threatened species in bold**.

Kiribati name	Species	English name	Rawaki	McKean	Birnie
Te ruru	***Pterodroma alba***	**Phoenix petrel**	**11+**		
Te bwebwe ni marawa	***Nesofregetta fuliginosa***	**White-throated storm-petrel**	**20+**	**10+**	
Te raurau	***Procelsterna cerulea***	**Blue-grey noddy**	**7000 i**	**1 i**	**2 i**
	Bulweria bulweri	Bulwer's petrel	1		
Te tangiuoua	*Puffinus pacificus*	Wedge-tailed shearwater	250+	2 i	
Te tinebu	*Puffinus nativitatis*	Christmas shearwater	500+		
Te nna	*Puffinus lherminieri*	Audubon's shearwater	800+	60	
Te taake	*Phaethon rubricauda*	Red-tailed tropicbird	70	34	4
Te mouakena	*Sula dactylatra*	Masked booby	700	400	109
Te kibwi	*Sula leucogaster*	Brown booby	24	75	9
Te koota	*Sula sula*	Red-footed booby	3	60	3
Te eitei are e bubura	*Fregata minor*	Great frigatebird	5	400	
Te eitei are e aki rangi ni bubura	*Fregata ariel*	Lesser frigatebird	4300	1500	20i
Te tarangongo	*Sterna lunata*	Grey-backed tern	1000+	800 i	300
Te keeu	*Sterna fuscata*	Sooty tern	10000	500 i	P
Te io	*Anous stolidus*	Brown noddy	4000	1630	2000
Te mangikiri	*Anous minutus*	Black noddy	<10	6	1 i
Te matawa	*Gygis alba*	White tern	20+	100	27 i
Te kun	*Pluvialis fulva*	Pacific golden plover	P	P	P
Te kirikiri	*Heteroscelus incanus*	Wandering tattler	P	P	P
Te kewe	*Numenius tahitiensis*	Bristle-thighed curlew	P	P	P
Te kitibwa	*Arenaria interpres*	Ruddy turnstone	P	P	P

1.5. Historic and Cultural Heritage

There have been no artifacts or other evidence of past habitation on Birnie, but the presence of Pacific rats suggests that they may have been visited by former seafarers. Similarly there is little evidence of pre-European habitation on the other islands, except for the former presence of Pacific rats and

McKean and some possible pits and pre-European walls on both, although the latter are debated (draft PIPA management plan).

Rawaki and particularly Birnie support remains of coral walls and dwellings apparently constructed during the guano-collecting era, 1850s-1880s. The coral walls on McKean are particularly intact, with some up to 3 m in height.

1.6 Use and Access

Access to and use of these target islands is very limited due the followiung factors:

- The islands are very isolated, being one day's sailing or more from Kanton the nearest human habitation
- They are away from a regular shipping route
- The islands are bird sanctuaries and landing is not permitted without a permit from the PIPA steering committee
- Landing is difficult on all three due to their small size and difficult ocean currents.

In 2006 there was no evidence of recent human presence on these three islands, unlike for Orona and Nikumaroro, which can be landed on relatively easily. However, the MV Chance had been wrecked on McKean in about 2001-02

PART 2 - THE PEST ERADICATION PROPOSAL

2.1 General

The objectives are primarily to establish pest-free status for three islands, to allow for the recovery of terrestrial ecosystems and threatened species .This work is urgent because of the perilous state of the Phoenix petrel and some other seabird populations.

Brodifacoum is the best option for this work, because it provides the best chance of eradication. Eradication (not control) is the only option here, hence the use of brodifacoum.

The overall objectives are :

1. Eradication of rabbits from Rawaki (Phoenix)
2. Eradication of Pacific rats from Birnie Island
3. Eradication of Asian rats from McKean Island
4. Improving and sustaining biosecurity in the Phoenix Islands Protected Area via increased local capacity - training, awareness and partnerships

The specific objectives and expected outcomes are:

<u>1. Rawaki – eradicate rabbits</u>

- Recovery of the sensitive Rawaki ecosystem (the only rat free Phoenix Island).
- Phoenix petrel secured and then recovers and re-colonises the other islands i.e. Birnie and McKean, once they are pest-free.
- White-throated storm petrel secured then recovers and colonises Birnie, McKean etc.
- Blue noddy secured, then recovers and colonises Birnie etc.
- Recovery of many of the other 15 seabird species present, e.g. the currently declining Christmas shearwater, Audubon's shearwater, all other terns, noddies, tropicbirds and frigatebirds.

<u>2. McKean – eradicate Asian rats</u>

- Recovery of McKean ecosystem and ecological processes.
- Recover populations of white-throated storm petrel, Audubon's shearwater, Christmas shearwater, wedge-tailed shearwater, Bulwer's petrel, blue noddy, grey-backed tern and other tern and noddy species and frigatebirds.
- Future re-colonisation of island by Phoenix petrel.

<u>3. Birnie –eradicate Pacific rats</u>

- Recovery of the Birnie ecosystem (the least modified of the Phoenix Islands).
- Re-colonisation island for many seabirds including Phoenix petrels, white-throated storm petrel, Audubon's shearwater, Christmas shearwater, wedge-tailed shearwater, Bulwer's petrel, blue noddy, grey-backed tern, other terns, noddies and frigatebirds.

<u>4. Biosecurity measures implemented</u>

- Biosecurity regimes are being effectively and consistently applied by relevant Kiribati agencies and supported by stakeholders and visitors to ensure pest-free status is maintained and therefore flourishing seabird populations and ecosystems.

5. To improve Kiribati and Pacific capacity to eradicate invasive species from islands and to maintain effective biosecurity programmes

- Kiribati conservation managers develop the skills, knowledge & procedures to undertake further eradications, to monitor biodiversity and to maintain biosecurity regimes. These skills will be transportable to future projects.
- Conservation practitioners from other Pacific countries have new skills, knowledge & insights which they may apply in their own countries. This concept has already been working successfully in demonstration projects supported by the Pacific Invasives Initiative coordinated by the Invasive Species Specialist Group of IUCN and the Pacific Island Learning Network programme based in the Secretariat for the Pacific Regional Environment Programme.

6. New approaches developed

- Evaluating success of this approach against measured densities of bait-consuming hermit crabs for later wider application in the Phoenix Group and elsewhere in the Pacific.

7. Lessons shared

- Reports on the eradication operations – including activities, results and lessons learned circulated through various networks.

8. To raise awareness of invasive species issues and generate support for their management

- Local community awareness and support for conservation and biosecurity enhanced.
- Enhanced support in Kiribati for maintaining biosecurity regimes and initiating further island restoration projects.
- Further support from international conservation & funding agencies for invasive species management – in Kiribati, and elsewhere.

2.2 Eradication methodology (from operational plan version 6 March 2008 and changes identified verbally with Mike Thorsen 8 April 2008)

2.21 Timing

The expedition is scheduled to depart Apia on 21 May 2008, arrive in the Phoenix group in late May, and be completed by late June 2008. A schedule of tasks is provided in Section 1.5 and as Appendix 1.

2.22 Bait Packaging, Storage, and Transport

NEW ZEALAND

Pest-Off 20R bait will be packaged in 10 kg bags and loaded into 72 x 200 litre barrels with clay desiccant added and transported to Samoa via Rarotonga.

TRANSPORT TO, AND STORAGE AT, APIA, SAMOA

For transport from NZ to Apia, Samoa the barrels will be loaded into a shipping container in the hold of a transport vessel. Once at Apia the container will be held in a well-ventillated warehouse previously ant-proofed (see later). The target date for arrival of the container in Samoa is 3 weeks before departure of RV Bounty Bay to the Phoenix Islands. A customs broker (Ray Betham) will be contracted to coordinate activities that will maximise bait protection from sweating, ants, etc.

TRANSPORT TO PHOENIX ISLANDS

Prior to departure for the Phoenix Islands the container will undergo biosecurity procedures (see Section 1.3.9 of Op Plan). The majority of the bait will be loaded into watertight plastic barrels and stored on the deck of the Bounty Bay under tarpaulin covers. The remainder of the bait will be stored in the forward hull sections of the Bounty Bay in dry bags. During transit to the Phoenix Islands air flow will be promoted to bait storage areas when weather permits.

LANDING AND STORAGE OF BAIT ON PHOENIX ISLANDS

The ideal landing conditions will be days with little westerly swell. During these conditions bait will be landed by loading the 10 kg bags into the plastic barrels or heavy duty dry bags and ferrying these ashore in an inflatable boat. The plastic barrels or heavy duty dry bags will be manhandled to the storage site near the landing site and stored under a waterproof tarpaulin shade canopy. The tarpaulin canopy must extend beyond the bait, allow some airflow around bait, and be sufficiently secure to remain intact for 1 month. If weather conditions do not permit the landing of the inflatable the bait may be floated and hand-lined ashore from the inflatables, or direct from the Bounty Bay, onto the beach in either the sealed plastic barrels or in heavy duty dry bags and then transported as above. The decision on which method to use will be made by the Bounty Bay Captain in consultation with the Eradication Leader.

TRANSPORT ON THE ISLANDS

On the day of bait use the 10 kg bags will be transported around the island in backpacks by a small team of 2 people creating temporary bait dumps in the plastic barrels along the periphery of the lagoon. The temporary bait dumps will be on dry ground and marked with flagged poles. If the bait is not used that day the lids will be secured on the barrels overnight. These barrels will be covered by tarpaulins if the heat of the sun was considered to be a problem. As bait is used from each barrel during bait deployment it will be topped up as necessary from the main storage area at the landing site.

2.23 Eradication Methods

This operation will involve hand-spread cereal pellet baits containing Brodifacoum (Pest-Off 20R), in bait stations, fumigation, hunting and trapping. Rawaki island, with the highest diversity of bird species, will be the highest priority island for eradication effort, followed by McKean and then Birnie Islands. The operation on Birnie is also to test whether a bait application density of 2 x 12 kg ha^{-1} (=24 kg ha^{-1} total) (similar to used on other successful eradication programmes in the tropics) will be successful on islands with expected high non-target (crab) bait consumption. Further descriptions of how these methods will be applied are given in the technical specifications for each of the major task areas (Sections 2.2, 2.3, 2.4).

RAWAKI ISLAND (EUROPEAN RABBITS, C. 58 HA)

Stage one (initial knock-down of numbers):

Two hand spreads of Pest-Off 20R bait are planned. The first on Operation Day 2 at 50 kg ha^{-1} over the 36 ha leeward side and 25 kg ha^{-1} over the 24 ha windward side. A second application at Operation Day 5 at 20 kg ha^{-1} over the leeward side and 12 kg ha^{-1} over the windward side will occur three days following the first application. This second application has the dual purpose of compensating for potential bait loss due to consumption by crabs and to maximise the chances of rabbits discovering bait as a food source.

Note: a higher application rate of bait will be used on Rawaki because of the larger body size of rabbits relative to rodents means each animal needs to eat about 3-4 x 4g baits for an LD50 c.f. an estimated 1-2 baits for pacific rat and about 2-3 baits for black (ship) rats (D. Brown pers. comm.).

A total of 3408 kg of bait will be required for this.

Stage two (removal of remaining rabbits):

Following the initial knock-down in rabbit numbers a number of techniques will be employed from Operation Day 14 (9 days after second bait application) to remove the remaining rabbits. These techniques will be applied in the order from least disruptive to rabbit behaviour to most disruptive. These techniques are:

- Gassing of rabbit burrows using Magtoxin (back-up only as there is some doubt about its efficacy in this environment). Magtoxin is a granulated powder which releases the gaseous toxin magnesium phosphide.
- Shooting using suppressed .22 calibre rifles both during the day and at night while using spotlights
- Trapping (both leg-hold and live) at burrow entrances
- Excavation of burrows occupied by rabbits (as indicated by trained dog)
- Flushing of rabbits and shooting using 12 gauge shotguns
- Long-range shooting using centre-fire .22 calibre rifle from elevated shooting platform.

Stage three (provisional confirmation of success):

Monitoring for surviving rabbits will use a combination of dogging and sign searching. The rabbit team will remain on the island for the maximum possible duration (currently to Operation Day 26, a total of 12 days on the island) in order to detect any remaining rabbits.

A total of 2400 kg + 1008 kg = 3408 kg of Pest-Off 20R bait (1 x 50/25 kg ha^{-1} + 1 x 20/12 kg ha^{-1} = 70/37 kg ha^{-1} in total), c.10 kg of Magtoxin will be required for Rawaki.

MCKEAN (ASIAN SHIP RAT, C. 49 HA)

Stage 1 (initial knock-down of numbers)

Pest-Off 20R Rodent Bait, in a 2 gram (12 mm diameter) nominal size, will be hand spread at 20 kg ha^{-1} over the 30 ha leeward side and 12 kg ha^{-1} over the 20 ha windward side of the island on Operation Day 10.

On Operation Day 11 210 bait stations will be established over the whole island on a 50 m x 50 m grid and each of the stations will be stocked with 100 g of bait.

Stage 2 (removal of remaining rats)

Pest-Off 20R Rodent Bait, will be hand spread at 20 kg ha^{-1} over the 30 ha leeward side and 12 kg ha^{-1} over the 20 ha windward side of the island on Operation Day 18 (10 nights since first bait deployment).

The bait stations will be restocked to 100 g on Operation Day 18 and visited the next day to replenish (to 100 g) eaten bait.

Stage 3 (safeguard)

The bait stations will be rebaited with a fresh 200g of bait on Operation Day 24. These stations will be left in situ as a safeguard against any rats remaining.

A total of 2 x 840 kg = 1680 kg of bait will be required for hand spreads.

A total of 347 kg of bait will be allowed for bait station deployment.

A total of 2027 kg of bait (2 x 20/12 kg ha^{-1} = 40/24 kg ha^{-1} in total + bait in stations) will be required for McKean.

BIRNIE (PACIFIC RAT? C. 48 HA)

The identity of the rodent species present on Birnie is presumed to be Pacific rat. This will be confirmed on Operation Day 6.

Stage 1 (initial knock-down in numbers)

Pest-Off 20R Rodent Bait, in a 2 gram (12 mm diameter) nominal size will be hand spread on Operation Day 7 at 12 kg ha^{-1} over the entire island.

Stage 2 (removal of remaining rats)

Pest-Off 20R Rodent Bait will be hand spread on Operation Day 20 (14 nights following initial bait application) at 12 kg ha^{-1} over the entire island.

A total of 2 x 600 kg = 1200 kg of bait (2 x 12 kg ha^{-1} = 24 kg ha^{-1} total) will be required for Birnie.

CONTINGENCY BAIT QUANTITY

The area of each island has been rounded up when calculating bait quantities required (Rawaki from 58 ha to 60 ha, McKean from 49 ha to 50 ha, Birnie from 48 ha to 50 ha) to compensate for any discrepancies in calculations of island land area. A total of 7800 kg of Pest-Off 20R bait will be taken on the expedition which will allow for 1165 kg (15%) contingency on top of the total anticipated to be required. This will remain on board the Bounty Bay during the operation and deployed wherever necessary on the three islands. Examples of situations where the contingency bait may be required is due to loss or deterioration of bait in transit or a greater than calculated island area. Other contingency options are to not undertake the second bait application on Birnie (saving 600 kg of bait), not to undertake the operation on Birnie (saving 1200 kg of bait), or not to undertake the second bait deployment on McKean (least preferred option, saving .2400 kg)

POST-OPERATIONAL SURPLUS BAIT

Any surplus bait that has not been deployed on the island will be returned to Apia and then shipped to Christmas Island for use in island biosecurity programmes. Any baits that have been deployed on the islands will be left. It is expected that these will be consumed by crabs within days but if not, will weather to undetectable quantities over a 2-3 month period.

2.24 Monitoring

Monitoring design and methods are provided in detail in the monitoring technical specifications, below is an outline of what is proposed.

PRE-OPERATION MONITORING

Pre-operational monitoring will be concurrent with the beginning of the eradication.

Target pest species

Numbers of target pests on each of the islands will be determined using nocturnal transects as used in 2006 (Pierce et al. 2006). Breeding and body condition will be determined by autopsy of a sample of animals. The target species on Birnie (assumed to be Pacific rat) will be confirmed by examining caught individuals immediately following arrival on that island.

Non-target crab species

The density of hermit crabs will be determined by counting the number in measured transects on each island following Pierce et al. (2006).

Native species

The distribution and density of key threatened and sensitive native bird species on each island will be determined by the biota team on arrival on each island. Nesting sites and or concentrations of

threatened or of concern species will be marked and these positions made known to the eradication team. Bristle-thighed curlews and other waders that may be threatened by the poison operation will mostly have departed for Arctic breeding grounds during the operation; those individuals present will be monitored to determine whether any mortality occurs (refer AEE and Biota Monitoring Plan).

OPERATIONAL MONITORING

Bait deployment and bait longevity

The initial bait density immediately following hand spreading will be determined by counting the number of baits in randomly-sited 50 x 50 cm quadrats. If initial bait density is below target density (12 kg/ha = 0.15 pellets per quadrat, 20 kg/ha = 0.25 pellets/quadrat, 50 kg/ha = 0.63 pellets/quadrat on average) this will be immediately communicated to the eradication team and bait application rate will be adjusted accordingly. The quantity of bait used during deployment will also be monitored by counting the number of 10 kg bags used at regular periods throughout deployment and comparing this with the area treated. The quantity of bait remaining following deployment over the days the team remains at each island will be determined by counting the number of baits in randomly sited 50 x 50 cm quadrats.

Target pests

The density of target pests during the eradication will be monitored using nocturnal transects over the nights when the team returns to each island and, during the mop up stage of the rabbit eradication, by catch per unit effort. Target pest reaction to baits and bait stations will be done by observation of individuals.

Native species

The reaction of native species, particularly those at risk from the eradication, will be monitored by biota team throughout the eradication in order to provide knowledge useful for larger operations. In particular, numbers of bristle-thighed curlews and other waders and two species of frigatebirds (potential scavengers) may be present. Numbers of all at risk species will be determined before, during and after the operation on each island. Any concerns about the welfare of individuals/species will be communicated to the eradication team immediately. Any individuals found dead where mortality is thought to be due to toxins will have tissue preserved and analysed for toxin residues on return to NZ, subject to freezer space availability.

Post-operation monitoring

There will be no specific post-operation monitoring of target pests during this trip. Confirmation of eradication of rabbits will come in the follow-up trip in 2009. Initial confirmation of probable eradication of rodents will come in a follow-up trip in 2009 and final confirmation of eradication will not be done until a follow-up trip in 2010, or later. There may be opportunities to use NEAq and Pacific Expeditions to gain access to the islands for follow-up monitoring later in 2008 and/or in 2009 and beyond.

PART 3 - ACTUAL AND POTENTIAL EFFECTS ON THE ENVIRONMENT

3.1 POTENTIAL BENEFITS

Seabirds

Seabird diversity in the PIPA has declined since the 1960s particularly on McKean where small seabirds have all but disappeared following the arrival of Asian rats (Pierce et al 2006). This McKean catastrophe has seen blue noddies plummet from c.15,000 birds to one individual (whereas the population on Rawaki has been retained; c.10,000 in 1960s, c.7000 in 2006) and most procellariiforms have also been eliminated and red-tailed tropicbirds have declined.

The relative impacts of rats and rabbits on seabird species are summarised in the Table below.

Table – Likely severity of impacts of different pest species on seabirds in the Phoenix Islands

Severity of impact	Rabbit	Pacific rat	*Rattus tanezumi*	Cat (later target species)
Low-moderate	Most species	Pelecaniformes – all 6 local species	Pelecaniformes, except red-tailed tropicbird (serious)	Possibly tree nesters, i.e. red-footed booby, black noddy, white tern
Serious	Procellariiforms, blue noddy, perhaps red-tailed tropicbird	Procellariiforms (except perhaps wedge-tailed shearwater), terns	Tropicbirds, all terns, brown and black noddies (or higher impact)	All other seabird species are at this level of impact or higher
Catastro-phic		Storm-petrel, blue noddy	Blue noddy, all procellariiforms, possibly all 6 spp. of terns and noddies	Procellariiforms, ground-nesting pelecaniforms, blue noddy, most terns/brown noddy

Rabbits appear to be having a disproportionately high impact on seabirds that nest in large burrows (wedge-tailed shearwater) or beneath dense vegetation (Phoenix petrel), because many are occupied or visited by rabbits. It would be impossible for these seabirds to avoid significant proportions of eggs and chicks being trampled and killed by rabbits. Even surface-nesters, such as red-tailed tropicbirds and blue noddies are in competition with rabbits because they favour well-shaded nest sites or nest in vegetated areas and eggs of both these seabird species were observed to be rolled by rabbits. Furthermore, the loss of vegetated habitat on Rawaki due to combinations of drought and rabbit browse is resulting in large areas of open sandy habitat, which is not favoured by petrels, shearwaters, storm-petrels or blue noddies. The incidence of all these species breeding in open areas was much lower than in vegetated areas, presumably because of burrow instability (petrel/shearwater) and less cover being available for nests (storm-petrel/blue noddy).

Seabirds will recover quickly on these islands because:

a) Roosting and nesting attempts still occur by many species on all islands.

b) Local productivity and recruitment will increase dramatically following the removal of rat predation and rabbit disturbance.

c) Some inter-island movement by Phoenix petrels is already occurring (Pierce et al 2006).

d) Nesting habitat will improve, particularly on Rawaki.

e) The increase in numbers of small seabirds will allow frigatebirds to increase through increased food source (birds and their prey).

Reptiles

About 7 lizard species occur in the Phoenix Islands, but none have been recorded from Rawaki. Once the pests are removed and ecosystems recover, lizards will increase in abundance as has occurred in New Zealand islands (Towns 1991, Parrish and Pierce 1993) and there will be opportunities for (re-)introducing local species.

Invertebrates

The abundance and activity of ground-dwelling invertebrates such as beetles and large spiders, currently in low numbers, is likely to increase significantly as documented following other eradications (Empsom and Miskelly 1997).

Benefits to Ecosystems

Rabbits are well-known in their impacts of ecosystems. The simple plant community of Rawaki and the small size of the island increases the vulnerability of the plant community as a whole. Rabbit removal will result in immediate recovery of *Boerhavia* and *Portulaca* which are currently heavily browsed. Many other plant species are likely to recolonise and flourish in a pest-free environment. This in turn will lead to the following benefits:

- Increased stability of the coral sand flats.
- An increase in invertebrate diversity and abundance.
- Flow on benefits to lizards and birds (waders) due to more plants (and flowering and fruiting), and more invertebrates.

Past experiences in New Zealand

Beginning in the 1960s introduced rodents have now been removed from more than 90 islands in the New Zealand region (Towns and Broome 2003). In all cases these eradications have led to the long-term recovery of native species and ecosystems.

3.2 POTENTIAL ADVERSE EFFECTS AND PROPOSED MITIGATION

3.21 FAUNA, FLORA AND ECOSYSTEM

Overview

This operation is unlikely to result in any direct mortality of non-target native species, but there could be some secondary kills and other impacts such as nest losses. However, this mortality should be considered in the perspective of the long term benefits to the island ecosystems, including the diversity and abundance of seabird populations. The positive responses expected to occur from Phoenix petrels, storm petrels, shearwaters and terns and flow-on ecosystem benefits to others, e.g. Frigatebirds and shorebirds, far outweighs any minor impact that might occur to more common species during the operation. Recent operations such as the eradication of rats from Motuopao, Red Mercury and other New Zealand islands have resulted in spectacular responses in seabird populations (Towns et al 2006)

Bird deaths from poisoning

Potential risks

No seabirds or waders (shorebirds) present on Rawaki, McKean and Birnie are considered to be at risk directly from the poisoning because they are not known to consume brodifacoum baits. However there are some poisoning risks as follows:

- Bristle-thighed curlews from eating hermit crabs that have consumed bait.
- Pacific pacific golden plovers and turnstones from eating invertebrates that have consumed bait or dead rats or rabbits.
- Frigatebirds that might possibly scavenge on dead or dying rats or rabbits.

A few bristle-thighed curlews (*Numenius tahitiensis*) will be present on the islands. In April 2006 c.50 birds were present on Rawaki on 19-21 April, 2 on Birnie on 25 April and 6 on McKean on 28 April-1 May. This pattern suggests that the main exodus northwards was in late April and this is consistent with findings of curlew researchers (L Tibbits, USGS, Hawaii, pers comm.). Bristle-thighed curlews and the related Asiatic whimbrel (*N. phaeopus*) have been killed during poison operations at Palmyra and on islands in the Indian Ocean respectively. The mechanism is believed to not be direct poisoning, but secondary poisoning via hermit crabs the latter of which consume baits although the poison does not affect the crabs themselves. Hermit crabs appear to be the staple prey of curlews on some islands including in the PIPA. No fatalities of golden plover and turnstones have been recorded during brodifacoum operations, but individuals of a related species (New Zealand dotterel) have been killed. (Dowding et al 2006).

Mitigation

This operation has been timed to occur after the breeding populations of curlews ands other waders have returned to the breeding grounds in Alaska, this exodus occurring in late April-early May (see above), and birds returning in mid August onwards. The toxin will have broken down by the return dates in August. Thus, the only curlews that will be at risk will be sub-adults that remain on the tropical Pacific islands until they mature.

Options for dealing with the few curlew present include scaring them off the islands (but the close proximity of two of the poison islands, Rawaki and Birnie, makes this difficult to achieve), administering antidote Vitamin K1 (unlikely to be feasible) or monitoring survival of birds. It is considered that the latter option is the best approach for curlews, i.e. closely monitor birds to determine if any mortality actually occurs.

Because the eradications will occur during a sedentary phase of the curlew year, observations will be made to compare the number of curlew present at the beginning of the project with the number present at the end. Because curlews can easily be scared away, fewer birds present at the end will not necessarily indicate mortality, therefore searches will be undertaken for carcasses (the open terrain and clustering of hermit crabs on carcasses will assist this search). The livers of any dead birds will be collected and stored for toxin tests. This monitoring approach will help identify the level of risk to curlews, which will help in risk assessments for rat eradications on larger islands in the PIPA, e.g. Enderbury, and elsewhere in the tropical Pacific.

The same monitoring approach is preferred for golden plover, turnstones and frigatebirds, given that significant numbers of deaths are considered unlikely. Note that any sick birds observed will not necessarily be sick from poisoning, as one golden plover was seen suffering from apparent heat stress (flightless, listless) on Rawaki in April 2006. If maggots are evident on rabbit carcasses and if many golden plover are present, carcasses will be buried.

Damage to bird nests and breeding productivity

Potential risks

Seabirds of 19 species breed on and feed around the islands of PIPA where they are also joined by migrant seabirds of other species. Many breeding species are colonial with nests being located conspicuously on the ground, but others are solitary nesters, including surface and burrow-nesters. In 2006 McKean and Birnie had relatively low numbers of nesting birds and no large colonies, and this is likely to be the case again in May-June 2008. Rawaki on the other hand has the highest diversity and numbers of birds of the three target islands probably due to the absence of rodents. . The greatest risks associated with the operations is disturbing or impacting on nests on Rawaki. Key risks are:

- People and dogs standing on isolated nests of Phoenix petrel - this species nests in small numbers beneath *Lepturus, Portulaca, Boerhavia* and other vegetation and in shallow burrows.
- Falling through burrows of Audubons and Christmas shearwaters - these birds nest mainly in one colony along the western margin of the island, and some also nest in the Lepturus, with scattered pairs elsewhere. Their burrows are smaller and shallower and less often occupied or taken over by rabbits, but this does sometimes happen.
- Destroying large burrows of wedge-tailed shearwaters – these birds nest in the central sandy part of the island where they have large burrows, some of which may need excavating to remove rabbits late in the operation (refer operational Plan above).
- Standing on isolated nests of storm-petrels, blue noddies and grey-backed tern – storm petrels and blue noddies nest as isolated pairs, usually under the shelter of a shady plant or piece of coral, some noddy nests are in the open. Grey-backed terns nest in loose colonies.
- Excessively disturbing lesser frigatebird colonies causing desertion – these birds may or may not be nesting – if they are they are likely to be in a dense colony virtually anywhere on the island. They are prone to disturbance. Excessive disturbance could lead to predation of eggs/chicks by other frigatebirds and/or desertion.
- Possible accidental shooting of birds in or behind or flying through firing zone of rabbit targets.

Mitigation

The following precautions to minimise impact will be undertaken

- Phoenix petrels – on arrival at Rawaki the biota team will search for Phoenix petrel nests and prospecting sites (war-whooping is an effective method in provoking a response, particularly at night). Each site will be marked with a colour flagging tape (that denotes “sensitive bird”)

placed 1 metre to the north side of the site. A map will be compiled with the locations clearly marked and provided to the eradication team, including dog-handler. The eradication team will take particular care around those sites. A duplicate map will be kept by the biota team for adding any newly found pairs. Individual petrels will be banded and twink applied to crown to minimise multiple captures.

- Audubons/Christmas colony – the biota team will determine a low impacting route through the colony between camp and beach and flag this route for all to follow. This colony will be mapped and added to the Phoenix petrel map above. The whole team will be briefed about safest footholds around shearwater burrows. Damaged burrows will be reconstructed using coral slabs where possible, particularly if they are active burrows.
- Wedge-tailed shearwater burrows – where possible, those burrows suspected to harbour rabbits as well as shearwaters will be assessed by the eradication team as to whether protection measures can be implemented, e.g. flushing rabits out using a dog or rebuilding may be possible with nearby coral slabs.
- Storm-petrels, noddies and grey-backed terns – these will be too numerous to map (noddies and terns) or difficult to find (storm-petrels). Members will be briefed about likely nest sites (beneath plants, beneath coral, where a tern flies up from, etc) and shown how to avoid standing on those potential nest sites.
- Frigatebirds – if any colonies of nesting lesser frigatebirds are present they will be mapped by the Biota team. The eradication team will keep out of these nesting colonies and poison baits will be thrown or catapulted into these sites from outside. The presence of rabbits in and around these colonies will be assessed by the eradication team to determine if closer approaches are needed.
- Dogs – train dogs in the presence of seabirds in New Zealand. When on Rawaki, operator to reaffirm need of dogs to ignore birds.
- Birds being shot - the expected effect will be minor and involve a few individuals only. Mitigation is to have experienced shooters only, obeying standard safety rules, awareness of possible non-target species and behaviour.

Deaths to reptiles

Potential risks

Mourning geckos (*Lepdodactylus lugubris*) and Polynesian geckos (*Gehyra oceanica*) are known to occur on McKean. No reptiles are known from Rawaki and Birnie although it is possible that relict populations of gecko species do exisit there. There are no published LD50 data on the acute toxicity of brodifacoum to reptiles (Eason and Wickstrum 2001). No negative effects on reptiles (geckos, skinks) have been reported as a result of rodent eradication operations on islands in New Zealand possibly because of the low level of activity over the winter period. In fact, all monitored reptile populations have thrived following removal of rodents (Towns 1991, Newman 1993, Towns and Stephens 1997, Parrish and Pierce 1993).

The only documented mortality of reptiles during an eradication operation using brodifacoum is from Round island in Mauritius where Telfair's skinks (*Leiolopisma telfairii*) were observed eating rain softened baits and some were later found dead and subsequently found to have brodifacoum residues (Merton 1994) However skink numbers increased markedly on Round island following the operation (North et al. 1994). There was a 15 % mortality of the Caribbean gecko species *Sphaerodactylus macrolepis* when exposed to Talon-G (cereal pellets containing 0.02 g/kg brodifacoum) during pen trials .

Mitigation

None proposed. The geckos present on these islands are widespread (and abundant where mammalian pests are absent) in the Pacific. Pest removal will enable their natural recovery and/or reintroduction, the latter including other species present in the PIPA islands (Pierce et al 2006).

Invertebrates

Potential risks and mitigation

Invertebrate species (crabs, spiders, insects, etc) are not considered at risk from brodifacoum poisoning as invertebrates have a different blood clotting system to vertebrates (Shirer 1992). A number of recent studies in New Zealand have confirmed this to be the case . However, crabs are heavy consumers of baits and are also likely to consume dead rabbits and rats. There is a risk of curlews being poisoned by consuming hermit crabs that have eaten bait (refer birds above). Coconut crabs are rare or absent on the islands – one recorded on Rawaki in 2006. Studies have shown residues from land crabs are undetectable beyond 1 month after dosing (Fisher and Fairweather 2006). It is not clear from literature whether brodifacoum is broken down during excretory process in invertebrates. Brodifcaoum could therefore be returned to soils by this method, but quantities of toxin (and therefore the risks) would dilute rapidly and dissipate completely over time

Potential effects on ecosystems and flora

Potential risks

Except for the potential introduction of invasive alien species, no adverse impacts on the ecosystem and plants are anticipated. When baits disintegrate, brodifacoum becomes bound to organic matter in the soil where it is degraded by soil micro-organisms.

Invasive alien species that could potentially invade as part of this project are primarily alien ants, e.g. yellow crazy ants present at Apia and elsewhere, other invertebrates and rodents. Weeds are unlikely to benefit given their absence on these islands in 2006, however, future parties should be on the look out for invasive plants.

Mitigation proposed

- Appropriate quarantine measures will be taken for the bait at Apia (area beneath and around container sprayed prior to container arrival), bait barrels and bags checked en route to the PIPA.
- Equipment and gear going ashore will be kept in previously sprayed with cypermethrin (Ripcord) drums and other sealable containers.
- Examine island-bound clothing and gear for weeds, especially seeds.
- The ecosystem and ecological processes will greatly benefit from the removal of the rat and rabbit pests.

3.22 EFEFCTS ON SOIL AND WATER QUALITY

Potential risks and mitigation

Brodifacoum baits are most unlikely to be found in water because these Phoenix operations are hand spreads. However some may enter the seawater via hermit crabs which are common on these islands and move to water in late afternoon and evening to briefly saturate the brachial appartus (Pierce et al 2006).

Several studiies in New Zealand indicate that brodifacoum is not mobile in soil and is extremely insoluble in water (<10 mg/l water at pH 7). When baits disintegrate, brodifacoum remains in the soil where it will be slowly degraded by soil micro-organisms. Leaching from soil into water is therefore unlikely to occur at the Phoenix Islands except via crabs. Evidence from Red Mercury and

Coppermine islands in New Zealand suggests this process is likely to take little more than a month following the breakdown of baits.

No residues of brodifacoum have been detected in water bodies following pest control operations in New Zealand. Brodifacoum could not be detected in water samples taken after aerial application of brodifacoum even directly downstream from baits lying in stream beds on Red Mercury, Lady Alice and Little Barrier islands . Similarly, samples tested from bore water on Little Barrier Island and at Tawharanui did not detect any brodifacoum (Craddock 2004).

Brodifacoum is strongly bound to soil particles, and radio-labelled brodifacoum was found to be effectively immobile (i.e. not leached) in four soil types . Craddock reported that where soil residues were found below disintegrating Pestoff® 20R pellets at Tawharanui Regional Park, Auckland, the residues remained below the method detection limit (<MDL) from 110 days after the pellets were placed on the ground.

ICI suggests the half-life in soil varies from 12-25 weeks depending on the soil type and temperature. Analysis of soil samples from Red Mercury and Coppermine islands following rat eradication using brodifacoum showed no brodifacoum in any samples, including samples taken only one month after the operation (Morgan 1993, Ogilvie et al 1997). However, microbial degradation is dependent on climatic factors such as temperature, and the presence of species which are able to degrade brodifacoum. It is unclear what this situation will be in the Phoenix Islands, e.g. faster in tropics, but low rainfall here may slow the process.

After 153 days the highest residue level measured from soil extracted from underneath Pestoff 20R baits used on Little Barrier Island in 2004 was 0.07 mg/kg (R. Griffiths pers. comm. Pestlink report 0405WAR03). In 2001 a truck crashed into the sea at Kaikoura spilling 18 tonne of Pestoff 20R (20 mg/kg brodifacoum) cereal pellets into the water. Only one of seven sediment samples taken at the immediate location of the spill the next day contained measurable concentrations of brodifacoum (0.060 mg/kg). Further samples taken for 9 days after the spill were below the level of detection (0.02 mg/kg) (Primus et al 2005).

In conclusion, the risk of soil and water contamination at the Phoenix Islands is considered negligible.

3.23 CULTURAL EFFECTS

The Government of Kiribati has been fully briefed on the eradications proposed. This included consulation with the PIPA steering committee during 2007 and applications for permits in 2008. It fully supports the operations and staff will be particpating in the eradications (Pierce 2007).

3.24 LANDFORMS AND HERITAGE

Potential risks

The islands, particularly McKean, contain a number of derelict dwellings from the guano collecting era and other sites.

Proposed mitigation

There will be no modification of the physical landform of the islands as a result of the proposal

Although the building sites will be visited, they will not be modified in any way. They may be used for temporary shelter and shade for bait and expedition members. However, expedition members will be reminded of the need to respect exisiting structures.

It is therefore concluded that there are no potential adverse effects on heritage and cultural values associated with the islands.

3.25 OPERATOR HEALTH

Potential risks

Rodent bait containing brodifacoum (and additional toxins as contingencies) will be used to carry out the proposed eradication activities. These are identified as hazardous substances.

There is no clearly defined LD50 dose of brodifacoum for humans. As little as 1 to 2 mg of brodifacoum can produce clinical coagulopathy in adult humans, and Crop Care Australasia reports that the fatal dose of brodifacoum for a man is approximately 15 mg. However, there is a wide variation in susceptibility to brodifacoum among individuals. People suffering from anaemia or liver disease, or who are taking prescription anticoagulants are more susceptible to brodifacoum poisoning and should be protected from exposure).

The information on bait consumption required for poisoning adults (the only people that will be exposed to brodifacoum in this operation) is presented in the table below (based on Table 16 sourced from Fisher and Fairweather 2006). The calculations use the lowest reported oral LD50 in eutherian mammals of 0.25 mg/kg.

TABLE: AMOUNT OF BRODIFACOUM BAIT NEEDED TO BE INGESTED BY A HUMAN TO RESULT IN DEATH BASED ON THE LD_{50}.

	LD_{50} (mg/kg)	AVERAGE WEIGHT (kg)	AMOUNT (grams) OF 0.02 g/kg BRODIFACOUM BAIT FOR LD_{50}	Number of 0.02g/kg pellets
Small adult	0.25	60	750	375
Large adult	0.25	90	1125	563
These figures represent the amount of bait that would have to be consumed in one sitting for a 50% chance of death. This is a straightforward acute toxicity calculation without any 'safety factors' that are used to extrapolate the results of animal studies to humans.				

Despite extensive use of brodifacoum over the last four decades within New Zealand for rodent control and eradication, there have been no incidents of accidental poisoning recorded.

Possibly the greatest risk in the PIPA operation is if expedition members consumed crabs that had eaten the bait. The crabs that occur on these islands are mainly hermit crabs (*Coenobita* spp), but one coconut crab (*Birgus latra*) was found on Rawaki in 2006 (Pierce te al 2006).

Proposed mitigation

Bait will be in a container and transported by truck by the manufacturer to Auckland where it will be freighted to Apia, Samoa. There it will be met by a designated Customs broker and transported to a shaded storehouse. From there the bait will be loaded into barrels and dry bags and transported how???? to the RV Bounty Bay.

All handling and storage of hazardous substances will be undertaken in accordance with DOC Standard Operating Procedures (Refer Operational Plan).

Appropriate protective gear will be worn by personnel. All necessary measures will be implemented to ensure the safety of personnel and property.

Any excess bait will be used on the target islands, particularly the rat islands.

Overall, the proposal is not anticipated to result in any adverse effects from the use and storage of hazardous goods.

Erect signage at the islands in the unlikely event of any parties arriving soon after the operation.

Ensure operators are fully briefed on hazards and are adequately dressed and protected from toxin contamination following SOPs.

Before and during these operations, brief operators of the hazards of consuming crabs on the target islands.

3.26 PUBLIC ACCESS

Public access is by permit only so landings are unlikely to occur. Signage will be placed at the landing sites of each island as a precaution. The PIPA office is being kept fully informed and will pass the information on to any permit holders.

3.27 MONITORING OF EFEFCTS

It is proposed to implement a monitoring programme in order to avoid, remedy or mitigate adverse effects on the environment. These monitoring programmes particularly address the potential impacts and mitigation proposed for sensitive bird species (refer Appendix for details being developed).

3.28 ENVIRONMENTAL EFFECTS CONCLUSION

Adopting operational best practice will reduce the potential risk for those non-target species considered susceptible, i.e. curlews and some seabird species. Techniques developed in recent years are important components of this operation. For instance dull green dyed bait (to be used in this operation) has been shown to be the least attractive to birds. Timing the operation to coincide with the austral winter will also serve to minimise the risks to curlews and other waders. The type of bait proposed is one which is insoluble nature, meaning that the proposal will also avoid effect on marine life and flora.

The proposal will have significant positive conservation effects on the environment and these will clearly outweigh any adverse effects addressed above. As identified above, the mitigation proposed indicates that non-target species will be affected to a minimal degree, but that the long-term benefit to the habitat for these species will be improved by the programme and therefore enhance the island ecosystems and seabird populations. These in turn will provide stepping stones back to the larger islands that will subsequently be restored. Accordingly, it is considered that the proposal will have no more than a minor adverse effect on the environment.

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PIPA BIOTA MONITORING WORKBOOK FOR GOK STAFF

Contents

1. MEASURING VEGETATION OF RAWAKI, MCKEAN AND BIRNIE

Background

Mammalian pests (rabbits and rats) can have huge impacts on the composition of island vegetation over time through directly consuming palatable plants or their seeds and seedlings. For example some plants that are common on nearby Enderbury (e.g. *Tribulus*) are absent or scarce on Rawaki and co. Following the removal of rabbits and cats, it is expected that many of these palatable plant species will recover or recolonise these islands.

Objectives

- To measure plant species currently present as a baseline for any changes that may occur in the future (over many years)
- To determine current distribution and abundance of main plants as a baseline for measuring any changes in the future.

Methods

Photopoints – You will need digital camera, GPS and notebook in order to take pics from set photo-points on each island.

- Select 3 sites on each island that can easily be relocated in future (monument, mounds, old dwellings etc) and GPS the sites

- These 3 sites should allow view of representative of habitats (i.e. incorporate wide views of each island in plant-friendly habitat, i.e. not coral rubble)
- Take four digital photos from each photo-point (to the N, E, S, W) taken in that order. Set camera for standard lens (50 mm), i.e. not wide-angle or telephoto.
- Limit sky to 10% of picture frame.
- Download and label pictures, save and make backup copies to memory sticks/CD/.
- In future years, compare new photos with originals from 2008 to examine any changes relative density of plants.

Maps – if mapping you will need island map (Appendix), pencil and GPS to map the approximate distribution of any dominant plants on each island and GPS the ends and key sites, e.g. Where three different dominant plant types converge. Dominant plants are likely to be some of the following:

- Teutente ni mane (*Lepturus* spp.)
- *Boerhavia* sp.
- *Pisonia grandis*
- Uteuten toari (*Sesuvium*)
- *Portulaca*
- *Tribulus*
- *Sida* (Te koura)
- *Cordia*

Plant lists – you will need notebook and reference plant list (Appendix) to compile a plant species checklist for each island in 2008. Species recorded in 2006 are listed below.

Family	Kiribati name	Species name	Rawaki	Birnie	McKean
Graminae	Teutente ni mane	*Lepturus pilgerianus*	✓		
	Teutente ni mane	*Lepturus repens*			✓
Urticaceae		*Laportea ruderalis*	✓		
Nyctaginaceae		*Boerhavia albiflora*	✓	✓	✓
		Pisonia grandis			✓
Alzoaceae	Uteuten toari	*Sesuvium portulacustrum*	✓	✓	✓
Portulaceae		*Portulaca aff. Lutea*	✓	✓	✓
Zygophyllaceae		*Tribulus cistoides*			✓
Tiliaceae		*Triumfetta procumbens*	Now absent		
Malvaceae	Te koura	*Sida fallax*	✓(2)	✓ *	✓
Boraginaceae		*Cordia subcordata;* te kanawa	✓(1)	✓	✓(1)

2. COUNTING CRABS

Background

Crabs, especially hermit crabs, can consume large amounts of bait, and we know little about what bait loadings are needed to overcome specific crab densities. Therefore we need to record crab densities for all bait operations.

Objectives

Measure crab densities in representative habitat on Rawaki, Birnie and mcKean.

Equipment and Methods

- Set up transects on each island – c.20-40 per island
- Transects follow the bait lines on each island and are 2 m x 25 m
- Follow a stratified pattern (map it first)
- GPS the start (SW end) of each transect or use line/station markers, e.g. A1-A2.
- Mark each 25 m line during day with additional night-visible flagging tape.
- Also during day record substrate and plant species cover as a % to nearest 10% (or indicate 1 % if less than 5%)
- Survey after dark till c. 9 pm
- Use a 2 m long pole (aluminium or branch) with rope dangling from ends - may help to have flurotape at tip of string to improve visibility)
- Count all hermit crabs over c.1 cm diameter along the transect (few hermit crabs are less than 2 cm diameter)
- Identify and count any other crabs.
- Record wind and humidity on 0-4 scale
- If time permits repeat many of the transects on different nights in order to measure inter-night variability.
- Data sheet below.

Island:

Date	Time	Obs	Trans No.	M from Start	Gnd Moist	Cloud	Wind	%sand	%Port	%Boerh	%Sesu	%lept	%other	Hermit Crabs	Others CC	Others Ghost C	Waypoint E	N
25/05/08	1912	R Pierce	N1	50	0	0	1	60	20	10	10	1		51	1			
25/05/08	1945	R Pierce	N3	25	0	0	1	20	20	1	1	60	1 Sida	26				
Sum														77	1			
Average																		
SE																		

3. ANT SURVEILLANCE

Background

Invasive ants can impact on other insects, birds a, plants etc. We need to determine whether any invasive species of ant are present at PIPA/CXI. If none are present, then ensure they don't arrive (biosecurity) and keep ongoing surveillance. If present, then can they be eradicated and what further biosecurity is needed to ensure containment.

Objectives

Determine what ant species are present at CXI/PIPA.

Equipment and Methods

- Focus on landing sites, camps, storage areas, etc, GPS the site
- Set up 5 paired ant bait stations (small jars) on the ground at each site
- Each pair has a protein lure (one jar) and a sugar lure (other jar)
- Protein is peanut butter and soya bean oil
- Sugar is plug of cotton wool soaked in 20% sugar solution
- Operate for a few hours, preferably in shade, possibly as little as half an hour if hot or crabs attack
- If any obvious ant colonies, collect ants from these too
- Preserve in ethanol/alcohol – put all the sugar samples in one container and all the peanut butter samples in a separate container; no live ants transported
- Label with location, date, GPS coordinates and your name and address as below
- Have them analysed by Agriculture (e.g. Aata Binoka) or NZ specialists.
- Respond accordingly, e.g. eradication, tighter biosecurity if a departure point.

Example of datasheet for recording ant data in field			
Location: Rawaki landing site	GPS cords: E S	Date:	Observers:
Habitat: e.g. sparse Boerhavia on coral sand, some wood debris			
Stations: 5 pairs comprising: A: protein lure – peanut butter and soya oil B: sugar solution – 20% sugar and water on cotton wool			
Samples sent to:			
Results received: details, e.g. see next table			
Action required, e.g. containment, eradication, and by whom			

ANT SURVEILLANCE RESULTS OF PIPA CONSERVATION EXPEDITION 2006

The table below provides details of ant species found on seven islands in May-June 2006 (Darren Ward, pers. comm).

Species	Rawaki	Birnie	Enderbury	Kanton	McKean	Orona	Nikumaroro
Carnud	**P**						**P**
Mondes	**P**		**P**	**P**	**P**		**P**
Monflo			**P**		**P**		**P**
Parlon			**P**		**P**	**P**	**P**
Parvag						**P**	**P**
Phemeg						**P**	**P**
Tapmel			**P**				
Tetsim		**P**			**P**		

Species key: Carnud = Cardiocondyla nuda, Mondes = Monomorium destructor, Monflo = Monomorium floricole, Parlon = Paratrechina longicornis; Parvag = Paratrechina vaga; Phemeg = Pheidole megacephala, Tapmel = Tapinoma melanocephalum; Tetsim = Tetramorium simillimum

4. COUNTING BIRDS

Background

Mammalian pests have caused the decline of seabirds on all three of these target islands, particularly McKean and Birnie where rats have eliminated the smaller, more sensitive species – blue noddies, storm petrel, petrels and most shearwaters. With the removal of rats and rabbits, these sensitive species are expected to recover or recolonise the newly pest-free islands. Measuring these responses requires a combination of techniques, including approximate counts from boats, if future landings on the islands cannot be made.

Objectives

- Determine nesting locations of Phoenix petrels in order to minimise our impacts during pest eradications

- Determine locations of concentrations of any other sensitive species that may be nesting (particularly colonies of shearwaters and frigatebirds)
- Determine numbers and status of all bird species currently present on each island as a baseline, with particular emphasis on the sensitive species.

Methods

4.1. General precautions:

- Watch where you are putting your feet!
- Nests are often beneath plants like Portulaca, Lepturus and Boerhavia
- Walk round concentrations of **nesting** seabirds especially frigatebirds
- Where there are burrows, place foot at base of burrow, not on hummocks which could have burrow beneath

4.2. Precautions for Phoenix petrels on Rawaki:

- Work as one team with a supervisor. You will need headlamp, notebook, pencil, binoculars, flagging tape and marking pen, and the team will need map, GPS and banding gear.
- Determine Te Ruru locations from day 1 by observing where birds land during late afternoon and evening, and supplement this with night work (nest is usually beneath overhanging vegetation, shallow burrow, coral ledge etc)
- War-whoop to elicit responses – a sharp kek-kek-kek-kek-kek – from resident birds
- Capture and band birds with size E metal band, mark crown of each bird with twink (to avoid need for recapture)
- Mark each nest site with colour flagging tape on peg that indicates "important seabird", GPS and number site, mark site on map of island
- Provide completed map to eradication team.

4.3. Precautions for shearwater and storm-petrel areas - mainly Rawaki:

- You will need same material as for Te ruru above.
- Observe where shearwater colonies (burrows) are located
- Determine a safe route through the shearwater colony between landing and camp at Rawaki and put out flagging tape (same colour as for Te Ruru) across this route
- Find and map colony locations of all shearwater colonies and provide to eradication team
- During night-work, note any concentrations of storm-petrels and flag and map these sites and band storm-petrels
- Demonstrate to eradication team ways of minimising impact to burrows.

4.4. Precautions for Frigatebirds – any island

- You will need notebook, pencil and map
- Observe where frigatebird concentrations during first day on island
- Determine nesting stage if nesting at all – eggs, chicks (estimate % with each)

- Map colony and provide map to eradication team – sites to avoid if they can.

4.5. Precautions for other species – te raurau (BLNO), tarangongo (GBTE)

- You will need notebook, pencil and map
- Assess situation on Rawaki where both of these species should be nesting
- Blue noddies will be scattered solitary nesters, grey-backs clustered
- Introduce team to nest sites and precautions, e.g. avoiding site where bird has flown up from..

4.6. Estimating bird numbers for long-term monitoring

- Baseline species list – work as team to keep checklist of all species observed on the island – midday meeting to collate notes from previous 24 hours
- Species recorded in 2006 along with their approximate numbers.

4.7. Island Fly-ons for long-term monitoring

- You will need binoculars and notebook and pencil
- View from the boat (RV Bounty Bay) anchored opposite landing site on lee of island
- Two observers on BB upper deck, first observer looking out one side and second covering other side, both out to c.150 m from boat (i.e. max distance of safe species ID)
- Count during the last 90 minutes of light 1630-1800 h?
- Count the threatened and sensitive birds only (**bold in table below**) flying on to the islands in late afternoon
- Subtract those individuals returning to sea – in the note book, mark each sighting as e.g. 1, 5, 1, -1 etc, and add total at end (see below).
- Record all other species coming in, but no need to count them.
- Transfer totals and other count details to data sheet that evening.
- Aim for at least four evenings per for Rawaki and McKean and at least two nights of data at Birnie in May-June 2008.

Example of Fly-on page from notebook			
Site: Rawaki SE side	Observer	Date/time: 29-5-08; 1900-2100 h	
Kiribati name	Species	Running score	Total
Te ruru	**PhPe**	**1 1 1 -1 2**	**4**
Bulwer's petrel	**BuPe**		**0**
Te tangiuoua	**WTSW**	**5 4 1 5 3**	**18**
Te tinebu	**CXSW**	**1 3 3**	**7**
Te nna	**AUSW**	**3 4 5 1 1 1**	**15**
Te bwebwe ni marawa	**WTSP**	**1 1 1**	**3**
Te raurau	**BLNO**	**1 1 1 1 1 3 4 5 2**	**19**
Te taake	RTTB		P
Te mouakena	MABO		P
Te kibwi	BNBO		P
Te koota	RFBO		0
Te eitei are e bubura	GRFR		0
Te eitei are e aki rangi ni bubura	LEFR		P
Te tarangongo	GBTE		P
Te keeu	SOTE		P
Te io	BNNO		P
Te mangikiri	BKNO		0
Te matawa	WHTE		P
Notes: Light SE wind, clear.			

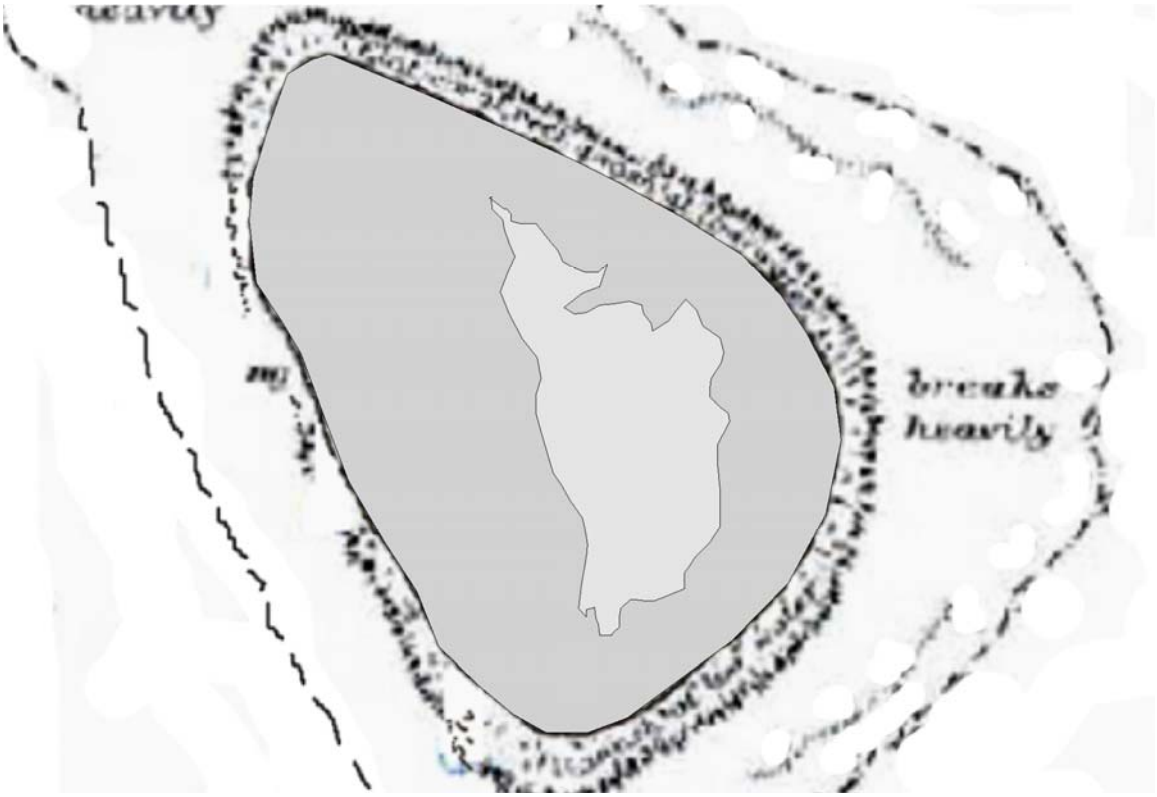
4.8. Te Raurau long-term monitoring

- You will need headlamp, notebook and pencil
- Carry out density estimates by distance sampling random transects at night on Rawaki, McKean and Birnie, by:
- Spotlight(headlamp) out to 10 m either side of approximate straight line route
- Count numbers per 100 m = 0.2 ha, replicated c.20 times, check variability
- Count more if needed (may be nil returns on McKean, Birnie).

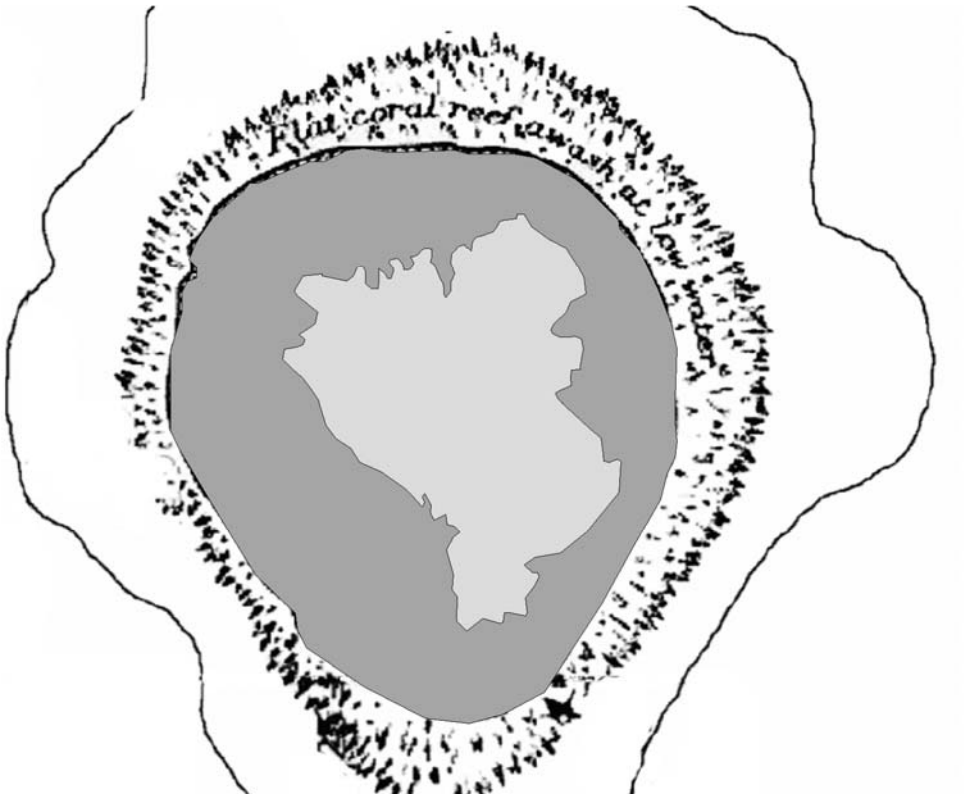
Note other fauna, e.g. lizard species, and numbers of individuals seen per day.

5. PIPA ISLAND MAPS

Rawaki



McKean



Birnie

APPENDIX 2 – PERMITS – dog permit to come.

GOVERNMENT OF KIRIBATI
Ministry of Environment, Lands and Agriculture Development
Plant Protection & Quarantine Section
Division of Agriculture
P.O. Box 267, Bikenibeu, Tarawa
Republic of Kiribati
Phone: (686) 28108/28096
Fax No: 28121
E-mail: agriculture@tskl.net.ki

Agr: 10/8a

Date: 1st April, 2008

TO WHOM IT MAY CONCERN

Re: Bait for Pest Eradication in the Phoenix Islands

This letter serves to inform you that the baiting team and the baits will be transported from Apia to the Phoenix Islands by RV Bounty Bay to carry out the pest eradication in May – June this year as part of the Pacific Island Protected Areas (PIPA) Project worked for the Government of Kiribati. The bait is c. 8 tonnes of pest-off 20R cereal pellets containing the anticoagulant brodifacoum which is the standard poison bait for rodent's eradication in the Pacific and New Zealand. It is manufactured by Animal Control Products at Wanganui, NZ. It will be used for the eradication of rats and rabbits from three small islands in the Phoenix group- Rawaki, Birnie and McKean.

Your assistance and support is highly appreciated.

Yours sincerely,

Binoka

.....

Ata Binoka
(For Director of Agriculture)

KIRIBATI POLICE

Telephone: Office (686) 26187
Facsimile: (686) 26370
Email: compol@tskl.net.ki

Police Headquarters
P.O. Box 497
Betio, Tarawa
Republic of Kiribati

"To serve & protect while working with the community to create safer Kiribati"

8th April 2008

TO WHOM IT MAY CONCERN

This is to request those whom it may concern to allow the bearer to possess/carry the following firearms;

- Two X small callibre rifles (.22 size)
- One high power centrefire rifle
- Two shot guns
- 10000 rounds of .22
- 500 shotgun cartridges

The firearms are to be use by the Phoenix Islands Protected Area Restoration Project Team for the pest eradication on three islands of the Phoenix group- Rawaki, Birnie and Mckean. The team will be travelling from New Zealand to the Phoenix group via Apia, Samoa in May-June 2008. Your assistance is highly appreciated

KIRIBATI POLICE FORCE

Iotita Kuarawete (ACPA)
Ag. Commissioner of Police

Research Permit

Permit No: ..01/08....

Issued to:

Chief Scientist: ..Dr...Ron...Pierce.....

Nationality: ...New...Zealand.....

The holder of this permit is authorized to conduct research work as per Permit Application No.

This permit is valid for the duration of : ...May - October, 2008

Other conditions governing this permit are on the attachment:

AUTHORISED ISSUING OFFICER .....

OFFICIAL STAMP

DATE....1st April 2008

ISSUED BY PIPA OFFICE

MINISTRY OF ENVIRONMENT LANDS AND AGRICULTURAL DEVELOPMENT

GOVERNMENT OF KIRIBATI