

Outline for the Proposed Eradication of Feral Cats from Malden Island

in the Line Islands, Republic of Kiribati.

Final, Dec 2015

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Frontispiece – a known daytime cat shelter on Malden Island, in front of the prime nesting area for terns and frigatebirds (and the most utilised cat habitat), with part of the internal lagoon in the background.

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1. Introduction

This plan covers the proposed operations to eradicate feral cats (*Felis catus*) from Malden Island, an uninhabited Wildlife Sanctuary within the southern Line Island group, part of the Republic of Kiribati.

The removal of cats from this island should allow significant recovery of populations of many seabird species present on Malden including various noddy and tern species, whilst also potentially allowing the successful recolonisation and/or reintroduction of cat-sensitive seabirds such as the IUCN 'Endangered' Phoenix petrel *Pterodroma alba* and the white-throated (Polynesian) storm petrel *Nesofregatta albigularis*, and various shearwaters and petrels. This work is urgent because of the perilous state of the Phoenix petrel and some other seabird populations.

Eradication of cats will be achieved by a sequenced combination of suitable techniques, including trapping, shooting and possibly use of toxins and trained dogs. This will need to be followed up by sustained monitoring efforts to target any remaining feral cats.

Although the island is large, the feral cat population is small and the island is very favourable for their eradication in terms of sparse vegetation and flat terrain, which increases the prospects for efficient and successful eradication of cats. A significant factor in the project will be the logistics required to access and operate on this remote and difficult to reach island.

A visit was made to Malden in September 2015, and a report including a pest animal eradication feasibility assessment was completed (Pierce et al 2015), which recommended eradication of cats at the earliest opportunity. This plan outlines the proposed operational details.

2. Project Goal, Objectives and Outcome

2.1 Goal

- The recovery and restoration of important seabird and other fauna communities on Malden Island.

2.2 Objectives and Outcomes

The specific objective for this plan is:

- Eradication of feral cats from Malden Island.

Anticipated Outcomes:

The removal of cats will see recovery of both ground-nesting and tree-nesting seabirds and lizards and reduced predation of migratory shorebirds and other fauna.

At a population level the following locally breeding birds are certain to benefit from cat eradication – Red-tailed Tropicbird, Brown Booby, Red-footed Booby, Sooty Tern, Grey-backed Tern, Brown Noddy, Black Noddy and Blue-grey Noddy. Based on population responses elsewhere (e.g. Kiritimati, Jarvis, Howland, Baker) the following additional species are likely to recolonize after cat removal without further intervention – Phoenix Petrel, Wedge-tailed Shearwater, Tropical Shearwater, and probably Christmas Shearwater, White-throated Storm-petrel and White Tern.

Fauna to benefit from reduced predation levels would be Bristle-thighed Curlew (VU = IUCN Vulnerable), skinks, geckos and probably mice and green turtles (VU). Malden is a key island for Bristle-thighed curlews which would likely benefit from both a reduction in predation rates from cats, and perhaps also from potential increases in mice, given that small rodents are common prey of the curlews on Pacific islands (L Tibbitts, USGS, pers. comm.). Cats are also a known predator of turtle eggs and hatchlings (Seabrook 1989), including green turtles (Hilmer et al 2010). During our visit cat tracks were common on the sandy beaches where the turtle nests were located and their removal may enhance turtle productivity at Malden to some degree.

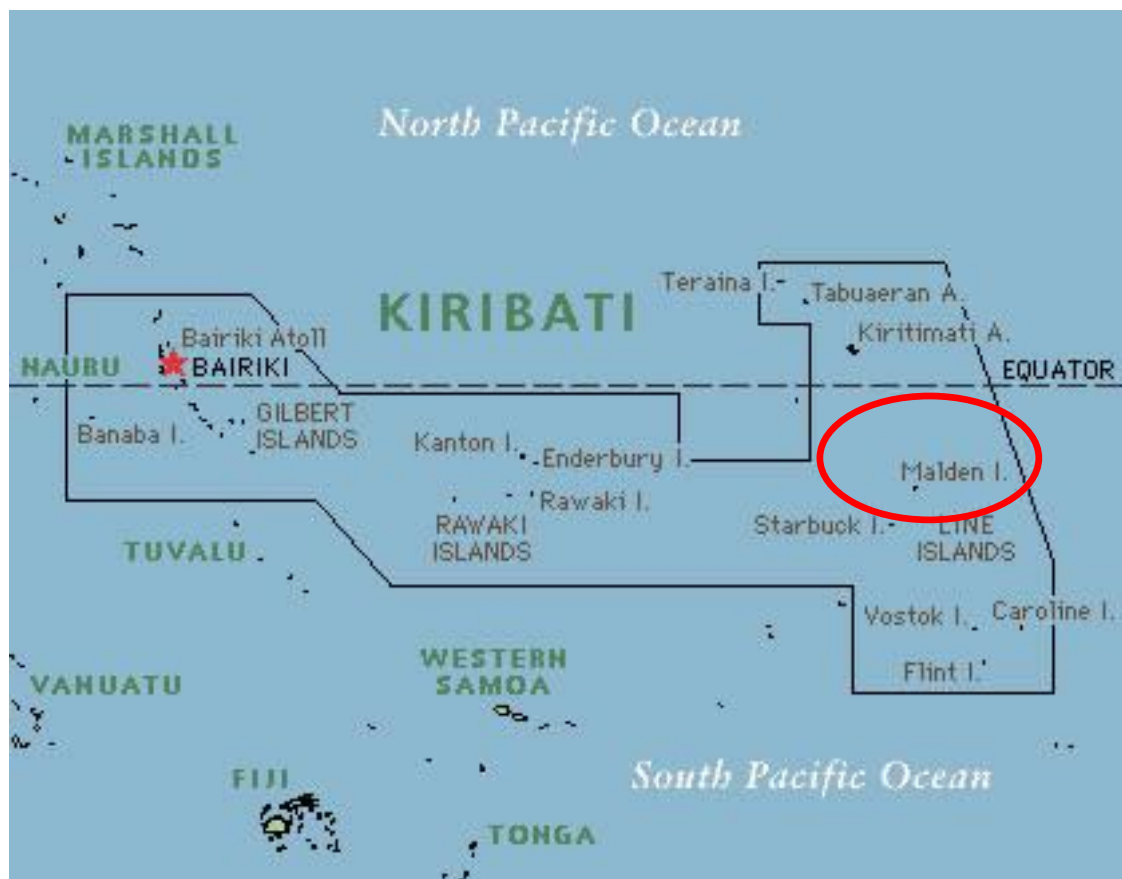
Strategically, cat removal at Malden would provide significant gains in the Line Islands by providing a large secure island for endangered seabirds, notably Phoenix Petrel and White-throated Storm-petrel (both EN), and other sensitive species including shearwater species and blue-grey noddies. This would reinstate a geographic link with the large populations of most of the seabird species on Kiritimati to the north and the island groups to the south including the northern Cook Islands and Tuamotu. The importance of this gain is highlighted by the increased pressure on Kiritimati populations stemming from increased development and the recent arrival there of *Rattus rattus* adding to the existing pressure from feral cats, *Rattus exulans*, mice and human predation (Pierce et al 2012).

3. Background Information

3.1. Site Description

Malden Island (3850 ha) is a remote, uninhabited atoll located at 4°S latitude and c.700 km SSE of Kiritimati (Christmas Island) in the Line Islands of Kiribati. It is seldom visited by humans today, but has experienced a long history of Polynesian and British occupation, with long periods of settlement during guano extraction in c.1870-1930, and military occupation during nuclear testing of 1957-62. These later periods of occupation saw significant habitat destruction through guano excavation and associated infrastructure works, along with the introduction of feral pigs, goats, feral house cats and house mice, which led to decimation of the flora and fauna of Malden over the one hundred year period. Although only cats and mice persist today, the previous legacy has resulted in tree-land and shrub-land now being severely depleted.

No reliable topographical maps are available for Malden but Google imagery is good.



Map 1. Location of Malden Island. The nearest port, international airfield and inhabited island is Kiritimati (Christmas Island) 700km to the NNW.

Malden Island is in the trade wind belt with SE to NE winds predominating 91 % of the time throughout the year. Weather details were recorded during the early British occupation of 1890-1919 and no more recent information is available.

Weather records at Malden during 1890-1919 showed highly variable annual rainfall between 100-2375 mm (mean 727 mm). Rainfall is typically highest in January to May, and the mean annual temperature was 29.3 Celsius (range of 23.9-37.2). This general pattern is likely to be similar pattern today but may vary between El Nino Southern Oscillations (ENSO) events.

To the north of Malden, and north of the equator, Kiriritimati is experiencing increasingly wet and warm years particularly during El Nino years, and this may also be expected on Malden.

During the 2015 visit the daytime temperatures were moderately high with temperatures (°C) estimated to be reaching the low 30s, but cooler in the evening and at night. Direct sunlight and the almost complete lack of available natural shade made for uncomfortably hot work in the period 1000-1630 h, except on cloudy days during which working conditions were relatively pleasant. Refracted sunlight and latent heat of the coral rubble in sparsely- or non-vegetated areas exacerbate the effects of sun and temperature and working conditions could become almost intolerably hot, especially if the usual trade breezes were absent.

Malden Island is a large, pentagonal-shaped closed atoll with a shallow hypersaline lagoon at its centre. This large internal lagoon is estimated to range between 1122 and 1637 ha (29-42% of the total land area of Malden) depending on rainfall and associated water levels. Therefore, approximately 515 ha is either sparsely- or non-vegetated mudflat or ephemeral shallow water bodies.

Habitat Type	Area (Ha)
Vegetated areas – low herbs, grasses, shrubs	1900
Trees	<1
Lagoon	1122-1637
Ephemeral water/bare mudflats	0-515
Bare coral rubble/sand	313
TOTAL:	3850

The entire outer perimeter of the island is composed of an elevated rim (up to c.10 m asl.) of coral debris with the fringing beach also comprised predominantly of coral debris. These non-vegetated coral rubble areas total c.313 ha, and are a hostile environment little used by wildlife or cats. The total vegetated area of Malden is about 1900 ha.

Malden is depauperate in trees and shrubs, vegetation being dominated by grasses and low scrub. It has only a handful of Te Puka (*Pisonia grandis*) and Te Ren (*Heliotropum foertherianum*) around the coastal fringe, in small groups or as scattered individual trees.

There are four main vegetation zones present, dominated area-wise by *Sesuvium portulacastrum* on the low-lying seasonally flooded flats surrounding the lagoon. There are many scattered areas of the

low-growing shrubs Te Boi (*Portulaca*), Te Koura (*Sida fallax*) and grasses on elevated ridges extending through the *Sesuvium* zone. A variable-width band of grasses and *Tribulus*-dominant vegetation forms a band around the perimeter of the island vegetated zones, while small localized stands of trees mainly along NW Bay which are dominated by Te Ren and a few Te Puka.

The prevailing ocean current and wind direction is from the easterly quarter. The only sandy beach is a 2 km long beach on the lee (NW) side of the island. The principal landing site for the island is on this NW beach and even this is a “wet landing” and can be hazardous with a relatively steep beach profile and ‘dumping’ waves. Landing is possible in calmer conditions elsewhere on the island but cannot be relied upon.

Inland from this perimeter rim, the topography slopes gently downward and flattens out to a broad plain which gives way to the large central lagoon. Scattered throughout are many (mainly artificially excavated) pools of brackish water.



Map 2. Aerial Image of Malden Island.

Malden Island is designated as a Wildlife Sanctuary and is identified as an Important Bird Area (IBA) (Birdlife International 2010).

A total of 19 species of birds were recorded in September 2015. These included 11 species of breeding seabirds, three visiting seabirds, further seabird species offshore, and four migratory waders. Key components of the avifauna include globally and nationally important populations of Lesser Frigatebird (*Fregata ariel*), Grey-backed Tern (*Sterna lunata*) and Sooty Tern (*Onychoprion fuscata*), Masked Booby (*Sula dactylatra*) and the Brown Booby (*Sula leucogaster*).

Also present in good numbers were Red-footed Booby (*Sula sula*) and Great Frigatebird (*Fregata minor*), while there are small or remnant populations of Red-tailed Tropicbird (*Phaethon rubricauda*), Blue-grey Noddy (*Procelsterna cerulea*), Brown Noddy (*Anous stolidus*), and Black Noddy (*A. minutus*). Single individuals seen of Wedge-tailed Shearwater (*Puffinus pacificus*) and Phoenix Petrel (*Pterodroma alba*) suggest the possibility of a rapid return of these species to breeding on Malden if cats are removed. The island is important to several migratory waders, including the Bristle-thighed Curlew (*Numenius tahitiensis*) Pacific Golden Plover (*Pluvialis fulva*), Ruddy Turnstone (*Arenaria interpres*) and the Wandering Tattler (*Heteroscelus incanus*).

Species likely to have been once present include the Tropical Shearwater (*P. l'herminieri*), White-throated (Polynesian) Storm Petrel (*Nesofregetta fuliginosa*), Christmas Island Shearwater (*P. nativitatis*), Bulwer's Petrel (*Bulweria bulwerii*), and the White Tern (*Gygis alba*).

The island is also important as a breeding ground for some marine species such as the 'Endangered' green turtle (*Chelonia mydas*).

3.2 The Feral Cat on Malden

The target pest species is the feral cat *Felis catus*. Cats appear to be in low densities on Malden, probably sustained by the large sooty and grey-backed tern colonies for much of the year. The estimated population is less than 20 individuals.

House cats were introduced (presumably for rodent control) in the 1860's or earlier, and by 1866 had "run wild and increased with extraordinary rapidity" and had reportedly caused a substantial (c.80%) reduction in tern numbers at one colony within two years (Dixon 1877).

In September 2015, cats were "uncommon" (Pierce et al 2015) during a four-day visit, with only nine sightings, five during the day (in most cases considered likely to have been disturbed from daytime retreats rather than being out actively hunting during the day) and four at night. These sightings were confined to about one third of the island's area from the Te Ren grove at NW point, extending south-west to the frigatebird colony near the linear mounds of earth (see Map 2). Cat sign was present but notably rare elsewhere on the island, possibly reflecting the more hostile habitats on the windward shores of the island and the relative lack of colonial seabird prey (especially tern species) in such areas at the time of our visit. A cat skull and carcass remains were found in an old shipping container on the northern coast, and occasional footprints were seen in softer substrates on beaches and lagoon edges, but it was apparent that cat densities were heavily concentrated in the fairly small area described above.

Terns typically breed in two extended pulses per year in the tropics and so at Malden they represent readily available prey for most months of the year. During the non-breeding periods of terns their nocturnal roosting flocks would still provide some night-hunting opportunities for cats, so it is likely that cats will for most of the year aggregate around the tern colonies.

Malden appears to be a relatively hostile environment for cats with very little shade and few protected den sites, possible periodic scarcity of seabird prey and perhaps occasional periods with very limited fresh water. This is likely to be accentuated during El Nino periods when oceanic warming and food scarcity may cause several bird species (including the terns) to abandon nesting. Consequently at times the cats could go through population bottlenecks, but at other times the food resources (especially nesting terns) would appear almost unlimited.

In addition to the observed impact, cats are clearly preventing other bird species from recolonizing Malden. Before cat introduction, Dixon (1877) noted at least three procellariid species to be present (probably wedge-tailed shearwater, Phoenix petrel and one or two others). These have not been recorded breeding on Malden since then, and any prospecting individuals of these species would be very susceptible to cat predation.

Similarly, Dixon reported presence of white terns during his stay on the island, but this species is notably absent now, and this can reasonably be attributed to cat predation.

From these observations and the known impacts of cats elsewhere in the Line and Phoenix Islands (Rauzon 2011, Pierce et al 2012), a general assessment of cat impacts can be inferred at Malden (Table 1).

Table 1. Species of Note on Malden Island, and the Probable Effect of Cats.

Species	IUCN Status	2015 population	Effect of Cats
Phoenix petrel	Endangered	1 seen 2015	High. Recovery or recolonisation severely impaired due to cat predation
Wedge-tailed shearwater	Not threatened – Least Concern	1 seen 2015	
Masked booby		10,000 pair	Probable low impact of cats,
Red-footed booby		1,000 pair	Moderate impact of cats
Brown booby		200+ pair	Probable moderate to severe impact of cats,
Great frigatebird		3,000 pair	Low impact
Lesser frigatebird		15000+ pair	
Red-tailed tropicbird		<50 pair	Probable high impact of cats on this species
Brown noddy		few	High impact. Population is low due to cat predation, but persists on tiny predator-free lagoon islets.
Black noddy		<500 pair	Populations severely repressed by cat predation
Blue-grey noddy		>20 pair	
Grey-backed tern		7,000+	High impact. Populations probably declining due to cat predation, and productivity little above zero.
Sooty tern		250,000 pair	High predation but possibly little impact on overall population due to sheer numbers.
Great crested tern <i>Sterna bergii</i>			1 bird
Bristle-thighed curlew	Vulnerable	300+ birds	Not breeding on the island – external factors affect status. Predation may have moderate impact on population levels on island and this could be significant for Bristle-thighed Curlew species population.
Pacific golden plover	Not threatened – Least Concern	200+ birds	
Ruddy turnstone		50 birds	
Wandering tattler		200+ birds	
Reptiles	Not threatened – Least Concern	Mourning gecko, snake-eyed skink.	Moderate impact of cats. Probably stable but lizard populations significantly suppressed by cat predation
Green turtle	Endangered	nesting in low numbers	Moderate. Turtle nests / hatchlings may be affected by cat predation to some extent.
Invertebrates, plants	No endemic or threatened species known		May be positive by keeping mouse populations low.

Note: green highlight = important regional populations.

4. Operational Details

4.1. General Overview

To undertake feral cat eradication, a small team will be placed on Malden for 5-6 weeks, the precise duration and time dependent on suitable schedules of the likely charter ship the SV Kwai. If the work is not completed before the scheduled pick-up, a second trip will be arranged as soon as practically possible – ideally before any surviving cats have a chance to mate and raise litters to independence (c. 3 months).

Team members should ideally all be experienced cat-trappers or hunters, but with expected practical limitations in the availability of such, each team should have at least one experienced person per any assistant, the latter needing to be capable, observant and reliable fieldworkers. They will be a mix of Kiribati (Wildlife Conservation Unit) and international eradication workers.

As they will be left on the island unsupported for some weeks, the team will need to be capable of working harmoniously and enduring long periods in isolated environments, and be entirely self-sufficient in their set-up. Equipment to support such a situation will include a satellite phone, emergency EPIRB, bulk fresh water stores and an emergency desalinator, generous food supplies, first aid, power supply, etc. They will base themselves in tents or within the deserted village.

One person will be appointed Team Leader (TL), and this person will be responsible for maintaining communication within the island team, and beyond the teams (i.e. to overall Project Manager and charter vessel skipper, etc.).

The primary focus of the team will obviously be to detect and target any cats, but depending on circumstances this may or may not take all of their allocated time. Spare time may be gainfully used in further monitoring of native biota, such as counts of turtle nests (start of the peak nesting period may coincide with the cat team's presence), and island-wide counts of nesting seabirds to add to monitoring databases. Both could readily be done in conjunction with searches for cat sign in those areas.

The charter vessel will be contracted to retrieve the field teams 5-6 weeks after their placement, but some flexibility may need to be built in to schedules, to be able to respond to circumstances as they arise. The team will board and depart the charter vessel at Kiritimati Island, with the possibility of one staff member aiding in loading boat supplies in Hawaii and even travelling on the boat with the supplies to Kiritimati if necessary. Timing of weekly international flights to Kiritimati and the arrival of the charter boat there will be coordinated as far as possible.

Should further work be required on the island after conclusion of the first trip (i.e. positive evidence or strong suspicion of cat presence still on the islands), then options can be examined close to that time. This may include a short extension in the boat charter period (if possible), or chartering an alternative vessel for pick-up, or planning for a return trip within several months. The latter is the worst case scenario and is the option planned for here.

4.2. The Project Team

The proposed operation will be undertaken under the auspices of Eco Oceania Pty Ltd with scientific and technical input from Ray Pierce and selected subcontractors.

Local (Kiribati) staff from the Wildlife Conservation Unit (WCU) on Kiritimati will be involved in the project for trap operation and general monitoring for cats and wildlife, and will have some skills in cat detection and trapping from their feral cat control work on Kiritimati but they are unlikely to have skills in shooting (or use of dogs), therefore at least two international staff with such skills will be required.

Table 2. Staff Positions

Position	Key Roles	Person Assigned
Project Manager (PM)	<ul style="list-style-type: none"> Overall project responsibility Staff selection Scientific monitoring May be part of field team or more likely off-island main contact 	Ray Pierce
Cat Team Leader	<ul style="list-style-type: none"> Leading field team Shooting, trapping skills 	TBC
GoK representatives	<ul style="list-style-type: none"> Trapping and monitoring for cats Wildlife monitoring assistants Logistics on Kiritimati 	TBC
Dog handler/Cat hunter	<ul style="list-style-type: none"> Cat hunting , trapping and shooting skills 	TBC
Hawaii logistics contractor	<ul style="list-style-type: none"> To aid Kwai or project staff with sourcing and delivering key equipment and supplies possibly including firearms, dogs, toxins 	TBC
Charter Vessel & Crew	<ul style="list-style-type: none"> Delivery of team to and from Malden from CXI and/or Hawaii Possible sourcing/loading of project supplies and equipment, Hawaii. 2+ crew and outboard inflatable to assist with off-loading personnel and supplies on Malden Provision of food, accommodation for the project team aboard ship. 	Kwai's Master and crew

Ideally, every essential aspect of the operation will be able to be carried out by at least two people, to cover for sickness, injury or sudden/unexpected departure from the project. A team of four is

more than sufficient to cover the island thoroughly so long as there is a spread of skills over the team.

4.3. Outline of Eradication Techniques

The best detection/control method would be at least two fully trained cat-detecting dogs, and if possible, cat-*hunting* dogs. These may, with sufficient advanced warning be able to be trained and/or obtained from NZ, Hawaii or other sources where such dogs have been extensively used (e.g. Mexico). The very flat terrain on Malden and the lack any of dense vegetation means that dogs would be highly effective against cats, and search coverage of all areas could be 100%. However, getting the dog teams to the islands could be tricky, with international borders to cross, and logistical difficulties associated with such a remote location. A similar situation was faced in getting a rabbit-indicating dog to Rawaki (in the Phoenix Islands) for the rabbit eradication there in 2008 which would provide valuable lessons here (see Pierce et al 2008). The highly trained and valuable dogs may also have to undergo significant periods of quarantine, and their owners/handlers may not wish to have their dogs out of action for so many months. Their use although highly desirable would depend largely on availability, and as this cannot currently be guaranteed, planning needs to occur on this basis.

If dogs are available, the dog(s) and handlers would repeatedly cover as much of the island as possible during the field trip, and search paths tracked using GPS. Cats located could either be run down by the dogs, shot by hunters, or failing immediate success, traps set in the vicinity. The heat of the island would mean dogs could only work a portion of each day, and then would need to be rested. Dogs from tropical locations (e.g. Hawaii or Mexico) may be more suited to work on Malden than dogs from New Zealand or other temperate climates. Dogs would provide a highly effective method, but regardless, all other options as outlined below would occur concurrently with dog use to maximise speedy capture or killing of all cats on the island.

If dogs are not available, the work will be undertaken by a four-person cat hunting and trapping teams placed on islands. They would have a range of equipment, including rifles and spotlighting gear, traps of at least three different types with selection of covers and ramps, some long-life baiting options (e.g. freeze-dried, pelleted or tinned baits, or scent-based lures), and means to catch fresh bait (fishing lines, spears or nets).

It is assumed that toxins suited for feral cats (e.g. PAPP, 1080) will be too difficult to import across international borders. PAPP is now being trialled (with considerable success) in Australia as 'Curiosity' cat bait and in New Zealand as 'Predastop', while 1080 is used in fish-meal polymer baits for cat control in NZ. However, it requires a certified licence holder to use these toxins, and as they are not licenced in other (transit) countries such as Kiribati, Fiji and the USA the import of such substances across international borders could be too problematic. This option will however be investigated should funding for a cat eradication be obtained.

Once the team is established on the island, they will firstly determine the stage of nesting of terns and other seabirds, and search for cat predation amongst the seabird colonies, as a focal point for hunting and trapping. All cats seen will be recorded (location, colour and patterning etc.) so later kills can be matched as well as possible against the known individuals.

At all times from Day One, the presence of cats will be actively searched for over the entirety of the island. The setting and checking of traps or night-time hunting will not require all of the field team, so on a daily basis some staff will always be dedicated to wide-ranging and prolonged surveillance. Overnight camps using shades or existing stone building remains or shipping containers may be desirable to ensure all areas of the island are thoroughly searched.

Detection will rely heavily on searching for sign:

- sightings of cats
- freshly predated bird carcasses
- foot prints on sand on beaches or mud on lagoon margins.
- motion-detecting cameras in key locations, possibly used with lures or baits
- eye-shine in spotlights

Scats (droppings) provide useful field sign elsewhere but this is unlikely to be the case here – they are unlikely to last long because of scavenging crabs. No scats were seen on the 2015 visit.

On this relatively open and flat island this searching should be highly effective and should be an effective method of determining presence/absence over time.

For the first week or so, non-intrusive ‘knock-down’ techniques will be used. Trapping (or use of toxins if these are brought) will occur, but active hunting or any actions that may cause cats to become increasingly wary of humans will be avoided. This ‘traps-only’ start will aid in keeping cats naïve of humans so they do not become educated too quickly to hunters and so not learn to avoid them. The length of the initial ‘traps only’ period will depend on field results – if highly successful it may be extended, but if captures are poor then active hunting will be initiated sooner.

The focus will be on relatively few, but well-placed and maintained, chimney traps as these appear most suitable with low risk to non-target birds, reduced interference from hermit crabs and offer what may appear to be attractive shade and shelter to cats. Other trap options should also be tried, including Timms traps, cage traps (shaded with cut vegetation), Conibears, and different types of sets for Victors. Placement of traps or baits will need to be at the discretion of the trappers, based on information gained on site. There will be no set spacing between traps. The cats are presumed to have relatively large home ranges, and quality of trap sets rather than quantity should be the goal.

The team will need to be skilled in cat trapping and able to understand the situation and quickly adapt to what methods are working, or any trapping variations that need to be trialled.

The use and sequence of techniques will be determined by discussion and consensus among the island’s cat team, the Team Leader and the Project Manager. Methods will generally attempt to follow established ‘best practice’ (e.g. as per PII’s Rodent and Cat Eradication resource kit Guideline

for Cat Eradication), but variations due to local circumstances may need to be incorporated in field actions and the sequence of methods.

Methods for use in 'knockdown' will include:

- Victor 1 ½ leg-hold traps (in a variety of possible set-types, including hazed and baited sets, unbaited walk-through sets, in chimney tunnels, etc.)
- Other trap options in smaller quantities, including SA Conibear kill traps on wooden ramps, cage traps, and Timms traps.
- A variety of long-lasting baits and lures will be brought with the team to the island. These could include Connovation 'solid state' lures that absorb and hold attractive scents, freeze-dried rabbit meat (e.g. Erayz), catnip oil or other scent-based attractants such as 'Cat-astrophic' from Australia, sound lures (Felid Attracting Phonic computer chips emitting kitten meows or other potentially attractive noises), tinned or dry commercial catfood, and glycerine (a.k.a glycerin, glycerol) to mix with urine or faeces of cats shot/trapped as a proven scent lure (commonly known as 'Pongo').
- Use of baits and lures such as fresh fish and fresh water and if possible urine or scats from other previously killed cats (especially females). Freeze-dried and/or tinned bait will also be taken to use where required.
- Possible use of toxic baits (PAPP or 1080), if permitted

These methods may be used throughout the project, to supplement the follow-up measures. Decisions will be made by consensus if possible or by the Team Leader. Once either the bulk of the cats are caught or it becomes apparent the traps are not working, or after at least ten days of trapping effort, hunting will begin.

The follow-up methods will potentially involve:

- Mobile searching during the day (focussing on possible daytime retreats). Possible use of a shotgun with larger-sized pellets for close range shooting where possible
- Mobile spotlighting at night (targeting seabird colony areas but travelling as widely as possible) using rifles (.22 or similar) with scope-mounted spotlights, and possibly a shotgun for shorter distances.
- Static observation points (OP's) where observers can sit ideally in an elevated position under shade with binoculars or telescope looking for cat activity in early morning or late evening, or similarly at night with a long-range spotlight.
- Use of hunting or indicating dogs, if available

Great care will be required to shoot only when very confident of hitting the animal. Given the short time frames of the field trip a human- or spotlight-shy cat could be a significant problem. Rifle bipods or similar shooting supports would help ensure accuracy of shots. Team members will be drilled as to not taking 'risky' shots with preference to defer such attempts in order to target the individual cat another day.

As many different techniques as practically possible should be taken to the island and employed to avoid an over-reliance on any one technique, regardless of how effective it may seem. Some cat-trapping techniques and crab-excluding devices have been briefly trialled during survey work on

Orona in 2009 (Pierce et al 2010), but further planning and development work is desirable, and a small range of construction materials (e.g. timber planks, large-diameter PVC pipe) should be taken to improvise trap design if needed because of unforeseen issues encountered on the island. The Team Leader or Project Manager will endeavour to obtain the most up-to-date information on cat trapping or hunting methods immediately prior to organising such supplies for the field trip to ensure the widest possible range of options are taken to the island. Lures that are specifically attractive to cats and not to crabs or ants, and/or lures that are long-lasting in hot climates would be especially useful. Some such as 'Pongo' lure, audio lures (FAP) and 'Cat-astrophic' lure have been used successfully in previous cat control or eradications (e.g. Johnston et al 2010, Hanson et al 2010).

Because of the high risk to seabirds, traps should generally be covered or alternatively sited well away from seabird concentrations. Wood 'chimney' trap covers have been used in New Zealand with success. The covers prevent access by most seabirds but provide a positive attraction to cats. Under the covers are Victor leg-hold traps (or Conibear kill traps) and a bait or lure.

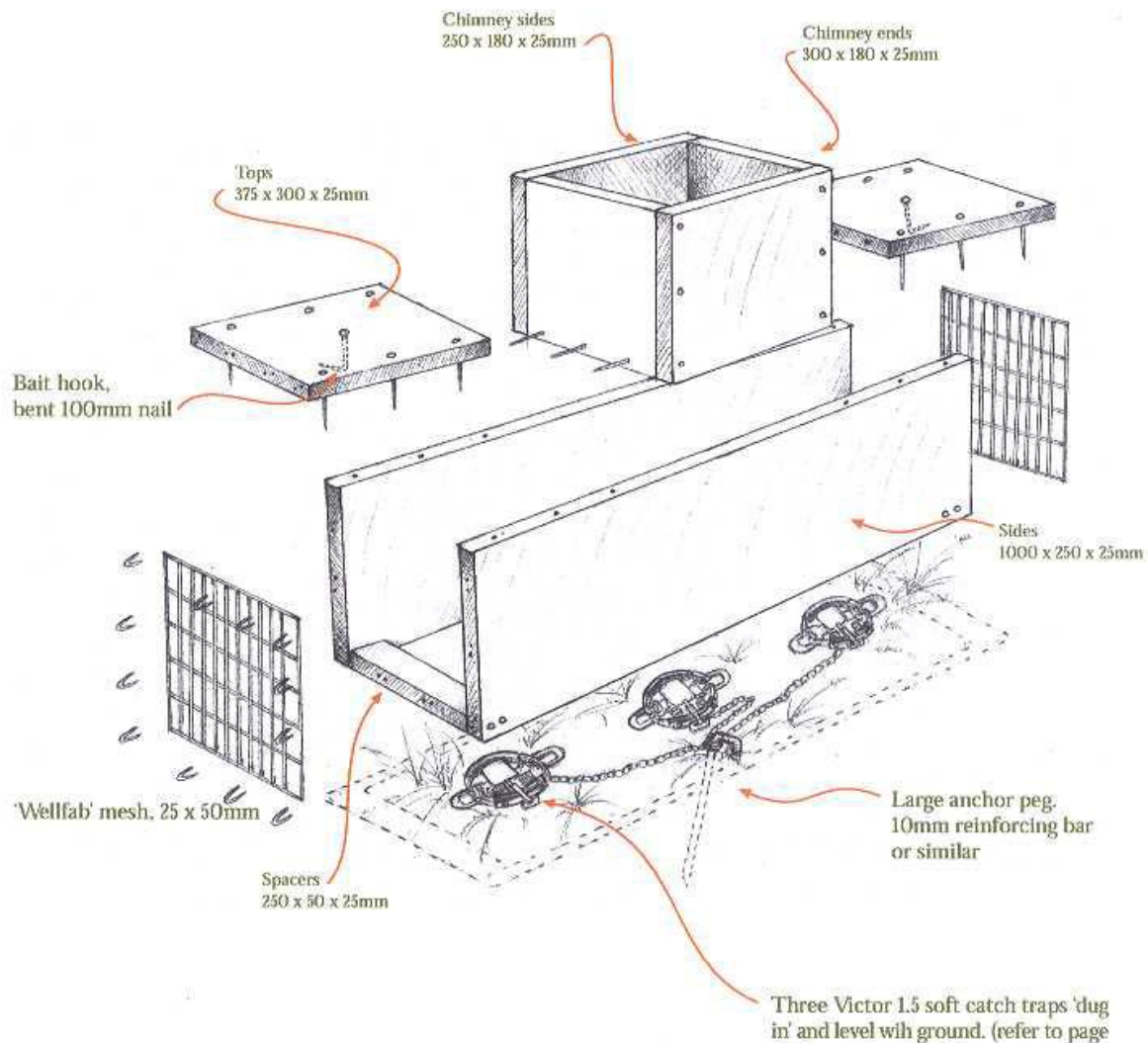


Figure 1. A 'chimney-type' wooden trap cover for cat traps. A cat enters through the top 'chimney' while the bait and traps cannot easily be accessed by crabs, birds or other non-target species.

Although cats do not need to drink fresh water (they can get sufficient moisture from prey) they do drink it where it is available. Fresh water may at times be in shortage on Malden and therefore be attractive for cats. In very dry conditions, bowls placed in a strategic location (e.g. under shady trees or near possible daytime retreats) could encourage cats to make regular use of the resource, and hunters could establish an ambush site or a site for camouflaged traps.

Shade during the heat of the day is also important to cats in such an environment, and areas known to be frequented by cats for shade should be searched, all such likely areas recorded and GPSed for regular repeat checking, and potentially similarly targeted for stake-out or strategically placed traps.

Daily or regular walks would be conducted around all sandy or muddy portions of coast and lagoon margins to look for prints made overnight. The 2015 survey showed cats made regular use of the sandy NW beach area. All old sign should be recorded and where possible wiped over, to avoid confusion with any new sign. However, it would not be practically possible to clear all the sandy beaches of prints, but a 1-2 m line perpendicular to the beach could be brushed with a wide broom or rake or custom-made sweep in several places. This would remove any existing cat tracks and this 'clean' strip of sand would be enough to detect if a cat passed over that portion of the beach between checks.

The small areas of trees on the island also seem attractive to cats, either as shade or for hunting the red-footed boobies that nest and roost in them. 'Cubby' sets of Victor traps are a possibility in such locations, though hermit crabs would be a potential disruptive factor. Baits and even traps set a foot or more off the ground in the trees (as done on Christmas Island) could eliminate crab disturbance. Stalking such areas with a shotgun (or dogs) may also target any cats sheltering in the shade of the trees.

Fresh fish should be caught whenever possible in the late evening (this was easily achieved in the 2015 trip), and used immediately to bait traps. This should be regularly possible off the sandy beach at the landing. It is possible some fresh fish bait could be held in a portable 12V cooler to keep fresh for a day or two. However, the attraction of fresh baits will be fleeting, and the expectation is that there will be heavy reliance on longer-lasting options such as scent lures to draw cats towards any traps.

Spotlighting at night will be very effective to detect cats in the open, wide and flat areas found on the island. It is highly probable that the field team will reliably be able to detect any surviving cats by this method. Key areas to target may be identified by prior sightings and of other field sign such as freshly predated carcasses and fresh footprints.

Infra-red motion-detecting cameras can also be used very effectively, especially in conjunction with attractive bait to establish cat activity in certain areas. Similarly, night vision systems could be very effective, but are a very costly option.

4.4. Timing

Timing will be dictated largely by the availability of the SV Kwai and the scheduling of its Cook Island run. This is the only charter vessel known to pass by Malden on a reasonably predictable schedule. It is likely that using any other charter vessel option would add prohibitively large amounts to a budget. Nevertheless, the Project Manager should not totally discount possibilities of alternative options, such as yachts departing from Hawaii, Christmas Island or other locations.

There is little known seasonality on Malden, and the cat team will have to accept whatever weather and seabird breeding situation is present when they arrive, and it may have some minor bearing on their activities, but eradication should be feasible whatever the weather conditions, or whether or not the terns are breeding, or whether wading birds are present. Most waders are absent in the period May-August, but there are likely to be significant numbers of non-breeding bristle-thighed curlews present, and the timing of tern nesting is difficult to predict.

4.5. Operational Biosecurity

To ensure that the operation proceeds with little or no threat of its own actions to the biosecurity of Malden, the transportation of all personnel, equipment and supplies will follow an approved biosecurity/quarantine process.

A designated biosecurity officer will be appointed for this project. He/she will have overall responsibility for ensuring compliance with all agreed biosecurity measures. They will implement and/or oversee all biosecurity measures for all stages of the project voyage. The Project Manager (Ray Pierce) will work alongside this person to provide advice and support.

Details will include the briefing of all team members, food and equipment destined for the island to be physically checked for sign of alien species and stored in rodent proof containers, rodent bait stations are to be placed aboard the ships used, pyrethrum spray applied and visual inspections of holds and storage areas to be made before and during the voyage, etc.

Particular care will be taken with inspection and preventative treatment of goods stored at, or vessels departing from, ports where infestations of invasive species (e.g. yellow crazy ants) are known or suspected.

All ship holds should be thoroughly checked and sprayed prior to use – this could include the full spraying with a broad-spectrum, long-lasting insecticide spray (e.g. ‘Ripcord’) prior to stacking the equipment.

The risk of importation of pest plants/animals (particularly yellow crazy ant, present at CXI, but currently being targeted in control operations) will be managed by adopting the following quarantine protocols.

The ship should ideally carry rodent bait stations and commercial ant toxin stations and/or insect glue boards for at least one month prior to departure, revitalized at Kiritimati.

All previously used camping equipment is to be visually checked and sprayed with Ripcord® insecticide (active ingredient cypermethrin) or similar residual-action insecticide, prior to the voyage from Kiritimati, and will be double-checked en route.

All expedition gear (excluding bait) going ashore will be sprayed with Permethrin-based (as these have a residual effect) household fly spray, preferably when in barrels/bins/dry-bags well in advance of the landing.

All personnel are to visually check and clean personal equipment (e.g. packs and daybags, rainwear and other outer wear, socks) for seeds or other contamination (soil, insects, etc.).

5. Logistics

5.1. Transport to and from Malden Island

The preferred option is to use the SV Kwai to deliver the team to Malden, from Christmas Island. For considerable economic savings, this would preferably be when the Kwai is on its approximately twice-yearly voyage to the Cook Islands. It could alternatively be a standalone charter for the Kwai but this would add a moderate additional cost.

An emergency alternative only is to charter an alternative vessel, from Kiritimati if one is available but most probably from Hawaii, with a pick-up of staff at Kiritimati. This would most likely have significant extra costs.

It takes c. 3 days for the Kwai (at likely travel speeds of c.5 knots) to travel to Malden from Kiritimati, and 12 days total from Hawaii. Travel times are of course dependent on wind strength and direction, and sea conditions.

The non-Kiritimati based members of the operational team will travel by commercial airlines to Kiritimati/Christmas Island (CXI) on the weekly flights via either Nadi or Honolulu arriving at least two days before the scheduled departure date of the charter ship from CXI to Malden. Very rarely the plane may not land due to weather or other issues but this would have to be an acknowledged operational risk and options to hold the charter vessel until project staff can arrive would be investigated.

While Kiritimati offers some retail outlets for food and other supplies, it is unlikely all equipment and supplies could be obtained there, so many supplies, particularly bulk and specialist supplies) may need to be sourced and placed on the Kwai whilst in Hawaii prior to departure for Kiritimati. Certain project staff or contractors may need to spend several days in Hawaii to co-ordinate and organise equipment and supplies to be loaded onto the Kwai, though it may be feasible to do this 'remotely' by subcontracting the Kwai staff or a Hawaiian contact (e.g. Eric VanderWerf of Pacific Rim Conservation or staff of Island Conservation), or through liaising directly with commercial suppliers. If there are Hawaii-based people selected for the project then part of their contract could be to assist in such tasks. If dog teams are obtained for the project, it is probable that the easiest way to get them to Malden is for the dogs to be loaded in Hawaii.

Pick-up from Malden will depend on Kwai schedules, but the team will liaise with the skipper of the Kwai as to expected dates. The operational team will return to NZ, Kiribati and other origins from CXI as soon as possible after the completion of the operation.

5.2. Camping on the Island

Malden Island can be a harsh environment for field staff, especially as they could be 'on their own' for several weeks with no creature comforts apart from what they bring and provide themselves.

Shade and water will be paramount. Good food and a means of keeping fresh food and some water cool may be very important for morale.

A shaded but ventilated communal area will need to be established with comfortable chairs and cooking facilities. A large tarpaulin spread over the stone wall remains of the old guano-collectors building, and held in place with the aid of guy ropes or stone weights would suffice, but large commercially available gazebo-type sun shelters are also suitable. Smaller shades will also be required for overnight or daytime rest camps or static observation points elsewhere on the island.

Fresh water will be in limited supply – a minimum of 1,000 litres (at least 6 litres per person per day) will have to be ferried ashore in 20-litre containers and stored safely in a shaded area. Larger containers (e.g. plastic drums) can be used ashore as bulk storage, but all water would need to be hand-moved in and out of the landing boat, so weights of water containers going in and out of the landing boat need to be manageable. Although it is likely that some rain will fall during the trip, there can be no assurance of this. Whatever water collects off tarpaulins should be collected if possible to add to supplies, even if suitable only for washing or emergency supply. Salt water can be used for rinsing cookware and for bathing, and diluted down with fresh water for some cooking. The team will need to keep track of fresh water use and take action where needed. A hand-operated or 12V desalination unit, a means of distillation from seawater, or water purification tablets for rainwater or water from the brackish pools in some parts of the island are alternative emergency options.

A power system will be needed to recharge the batteries for spotlights, GPS's, trail cameras, etc. This would involve some small (possibly foldable or flexible) solar panels, a large 12V deep-cycle battery or two, and a small inverter. The size of the battery and inverter need to be calculated to exceed the expected demands once these are accurately determined. The power system would also ideally run a small 12V freezer or cooler to keep some fresh foods, bait and water cold. Various 12V or gas-operated portable (Coleman-type) coolers/freezers are commercially available.

A limited number of back-up alkaline batteries for key equipment may need to be taken as substitutes if the recharging facilities fail.

Apart from a small species of ant, the mice and the hermit crabs (which are 'nuisance species' only) there are no biting or dangerous insects such as mosquitos, scorpions, wasps or midges.

5.3. Communications

During the voyage the team will rely on the ship's communication systems.

During the landing and while the ship is stationed offshore, ship-to-shore communications will be via VHF radios.

While the field team is left on the island, communications with the ship and other external agencies will be by a satellite phone. At least two people will be familiar with its use, and will have emergency contact numbers.

For communication between team members on the island, two or more handheld VHF radios are to be used.

Post-operation, a debriefing will occur with relevant GoK personnel on Kiritimati.

5.4. Government of Kiribati Consents and import /export permits

The Government of Kiribati would need to give permits for the field team to enter the Malden Wildlife Sanctuary.

Permits will be required to import firearms to Kiribati, as apart from one WCU shotgun potentially available, there are no suitable firearms currently on Kiritimati. The international team members may wish to bring their own firearms but this may present issues depending on where they are coming from. The simplest option could be to purchase firearms specifically for the project in Hawaii, to be loaded directly onto the Kwai before its departure for Kiritimati. This may require the presence of a team member in Hawaii to facilitate this, and/or assistance of a US resident in Hawaii (e.g. Pacific Rim Conservation, Island Conservation, or US Fish and wildlife staff).

Alternatively, team members with personal firearms (or the Project Manager or Team Leader on their behalf) will need to apply for export/import permits to get their firearms to Kiritimati via Fiji or Hawaii, in plenty of time to ensure they arrive safely. The WCU shotgun from Kiritimati will also be taken if in good operational order, and this may need authorisation from the Police for project staff to use it and to take it to Malden.

A similar situation may apply if dogs are to be used on the project – an import permit is required to bring the dog into Kiribati and an export permit from country of origin, and vice versa to return the dog to its home at the end of the project. This was successfully done for a dog taken to Rawaki for the rabbit eradication in 2008, but it was not without issues (Pierce et al 2008).

6. Environmental and Non-target Species Issues

There is potential for non-target species to be affected by methods employed by cat hunters or trappers.

Any dogs used will need to be aversion-trained and/or under reliable control of their handlers to avoid chasing or harassing of non-target species, especially ground-nesting seabirds.

Cat trappers will of necessity set out leg-hold or other traps that may have an incidental by-catch of other species. However, by careful setting using covers, visual screens, ramps, and choice of trap site the risk to birds (which typically use more open areas except for curlews which can also use rubble areas searching for crabs, etc.) will be reduced to negligible levels. Baits (especially fresh fish) visible from the air may be targeted by frigatebirds, though they will generally try to take them whilst in flight and not land to be caught in the traps.

It is highly probable that baits used to attract cats to traps (e.g. fresh fish) will also attract crabs, and if so, some individuals will no doubt be caught and injured or killed in such traps. However, the nuisance value of crabs interfering with traps is well known, so every endeavour will be taken to establish traps at sites and using such techniques as to minimise the attraction to crabs and the likelihood of them either stealing bait or getting caught in traps. Hermit crabs are moderately widespread over the island but are not particularly common, except around the stone house remains.

Ants or other invertebrates such as cockroaches may be attracted to and consume bait, but this will be a nuisance value only. 'Fresh' baits will need to be replaced regularly due to spoiling from heat. Wherever possible such bait will be hung from wire hooks rather than placed on the ground to minimise easy access to bait by invertebrates.

Spotlighting at night may create some disturbance to nesting birds but the effect will be minor and temporary. Intensive spotlighting on Rawaki in 2008 did not have any detectable significant effect on nesting seabirds.

The extensive walking likely to be involved in this project will cause temporary disturbance to seabird colonies but will not have any lasting effect. Experience has shown the birds will quickly accustom to non-threatening human presence.

While all care will be taken with operation of firearms, there is a remote chance individual birds may be hit (e.g. due to flying across firing zone or from ricochets). However, virtually all shooting is likely to occur at night in conjunction with spotlighting, when most birds are not flying. The extremely small number of shots likely to be taken means the risk is negligible.

7. Monitoring

7.1. Pre-operation Monitoring

In general, sufficient pre-operational monitoring (Pierce *et al* 2015) has occurred to provide an approximate baseline for determining response of indigenous bird species to removal of cats. No further pre-operational monitoring is deemed essential in this regard, but all available opportunities will be taken to add to existing data, including during the operation itself, especially if this occurs in a different season to that of the September 2015 survey.

7.2. Operational Monitoring

Bird species will be monitored during the cat eradication fieldwork as a check against the 2015 data.

Species of birds predated by cats and the approximate number of predated carcasses will be recorded.

Measurements and colour, broad age assessment, breeding condition of females and DNA samples will be obtained from any cats caught or shot, and retained for later analysis as required.

Any non-target species deaths or captures will be recorded.

7.3. Post-operation monitoring

Any suitable time (ideally 1-2 years) after the eradication, a small field team should spend time on the island searching for any sign of cats (including live individuals, predated or scavenged eggs, seabird carcasses, footprints, and droppings), and monitoring response of native fauna, to confirm the success of the operation. The effect of cat removal on the mouse populations will be evaluated. This team should comprise at least 3-4 people: at least one acknowledged expert in detecting cat sign, and at least one bird monitoring expert (preferably someone associated with pre-operational monitoring, for consistency), and at least one GoK representative.

Cat sign would be focused on any evidence of predation at tern colonies, and prints on sand.

These results should be incorporated into an official post-operational report.

Response of some species, e.g. the petrels and shearwaters may take many years to become obvious, particularly with regard to number of breeding pairs. However, the highly rodent-sensitive blue-grey noddies and grey-backed terns will provide the best short-term indicators in the form of breeding success (i.e. proportion of chicks successfully fledged per egg laid) along with any predation sign on abandoned eggs.

Response should be more obvious for the various tern and noddy species, where predation of eggs by cats is quickly discernible. Successful breeding of species such as the blue-grey noddy will be a clear indication of the success of the operation.

Longer-term monitoring is outside the scope of this operational plan but is recommended to be conducted at opportunistic intervals thereafter as part of the island's general management and compared with baseline data as per Pierce et al (2015).

8. Health & Safety

A separate Health and Safety Plan will be produced to cover health and safety risks to personnel. All field staff will be required to read this before departure. They will be fully briefed again of risks and methods to minimise these once on the island.

Full medical insurance including medi-vac should be obtained for project staff. A comprehensive first aid kit will be taken to the island.

The Project Manager should know what medical conditions any team members have prior to departure, and ensure they take sufficient supplies of their regular medications for treatment or prevention of the condition during the trip.

With experienced staff, the inherent risks of cat eradication are not high. However, the remote location and lack of immediate off-island support means any safety issue could be compounded by such factors.

Sunburn, heat exhaustion and dehydration will be constant risks, while large amounts of walking especially over coral debris or other hard substrates could result in abrasions, blisters and minor strains. Minor health issues for humans can be addressed through adequate precautions, adherence to field rules, and the team's First Aid kit. Such issues are not anticipated to occur at any significant level, and should not threaten the successful accomplishment of the operation.

There is always some risk associated with use of traps, toxins and firearms, but the team will be selected on the basis of experience and prior safety record. Care will be taken to ensure all the project staff are aware on a daily basis where firearms, toxins and any camouflaged traps will be in use. It is highly unlikely that serious effects would occur on human health, given adequate safety procedures and adherence to these.

Medical emergencies may require calling up the charter vessel or other ships in the locality (e.g. currently tuna-fishing vessels often fish in the general area) to transport the person to the nearest appropriate medical facility (e.g. Kiritimati, Honolulu) with commercial transport to take them further afield if necessary.

All hazards associated with the operation and how they will be managed will be identified in the Operational Health & Safety Plan. All staff will be fully briefed on these operational hazards prior to participation and will adhere to all management actions as identified in the plan. Regular discussions with all members of the team and include health and safety concerns in these discussions. Training of less experienced staff will occur before the operation and refreshed on the island before undertaking each task.

The cat eradication team left on Malden will be very isolated, and immediate rescue may not be possible given the situation. They will have a wide range of emergency medical equipment available, along with at least two means of communications, and the importance of safety will be reinforced regularly. Regular communications and contingency options will be pre-arranged.

9. Task List

PLANNING & PRECURSOR WORK

TIME	TASK	RESPONSIBILITY	DONE?
Sep 2015	Cat eradication feasibility study and pre-operational monitoring of wildlife,	Pierce et al 2015	✓
Dec 2015	Development of 1 st draft, operational plan with preliminary budget	Contractor (D. Brown)	✓
Dec 2015 /Jan 2016	Dissemination of 1 st draft Ops Plan, seek review and collate feedback from key stakeholders and advisory groups.	R. Pierce, D. Brown	
February 2016	Obtain GoK support of project and identify key contact staff, responsibilities for initiating funding responses, permitting, etc as below	Ray Pierce	
	Initiate funding processes and secure funding for operation. Agree on fund administration role	Ray Pierce	
Asap after funding confirmed	Appoint Project Manager (if not RP)	Funding Agency	
	Seek and appoint Cat Team Leader (TL) and any technical advisors	PM	
Year prior to Operation	Establish contract for ship, schedule dates	PM	
Asap after funding confirmed and TL appointed	Seek and select dog teams and/or international cat trapper/hunter	PM	
	Revision of 1 st Draft Operational Plan	PM/TL	
	Dissemination and peer review of 2 nd draft Operational Plan	PM	
	Finalise Operational Plan	PM/TL	
>3 months prior to Kwai charter	Confirm source, type, and details of firearms, any toxins, any dogs, specialised lures, etc. and organise purchase/contracts, import/export permits and delivery.	PM/TL	
	Obtain all permits required for all staff, firearms and any dogs to enter Kiribati and Malden	PM/TL	
	Cat team Leader to liaise with PM and review list of resources required for cat team	PM/TL	

>3 months prior to Kwai charter	MOU developed with Kiribati Government regarding operational activities, permits and clearances, staff, etc.	PM/GOK	
>2 months prior to Kwai charter	Confirm GoK representatives	PM/WCU	
	Confirm all staff and personal contracts, and finalise contracts	PM	
	Passport details obtained for all project team	PM	
	Book all necessary international return flights and accommodation for project staff	PM	
	Finalise cat team and arrange schedules/ book flights and accommodation as required	PM	
>1 month prior to Kwai charter	Personal equipment list/background info prepared and circulated to all staff	PM	
	Health & Safety plan developed and circulated	PM/TL	
	2 x field staff to undertake outdoor First Aid training (if necessary)	Designated team members	
	Medical Insurance arranged for all team members	PM	
	All field equipment (Sat Phone, radios, dry-bags, GPS's, camping equipment etc.) identified/purchased	PM/TL	
	All Safety Gear purchased	PM/TL	
	Operational Readiness Check		

OPERATIONAL

TIME	TASK	RESPONSIBILITY	DONE?
Day before loading	Audit of ship biosecurity measures	PM/Biosecurity officer	
Day(s) before Kwai departure from Hawaii	Ship loading in Hawaii – provisions	Ship's crew or Hawaiian contractor.	

Prior to ship departure	Confirmation that all supplies and equipment has been received and loaded.	PM (general supplies) Team Leader (bait and technical)	
As per charter	Ship departure from Hawaii	SV Kwai	
	Ship arrival in Kiritimati	SV Kwai	
As per charter	Pick up project personnel and Kiribati-sourced supplies and eqmt	SV Kwai	
Prior to departure from CXI	Brief operational field team. Specific tasks allocated to individuals and lines of communication confirmed	PM/TL/WCU	
As per charter	Travel from Kiritimati to Malden, field team dropped off.	SV Kwai	
On arrival at Malden	Get all supplies safely ashore. Establish camp.	Project Team assisted by Kwai crew	
	Cat eradication – initial monitoring, knockdown using traps (and toxins?), followed by spotlighting.	Project Team	
Latter stages of field trip	Intensive monitoring to detect any remaining cats – decide if second hunting trip required	Project Team	
Kwai arrival back at Malden	Pick-up of team, return to Kiritimati via the SV Kwai, unload gear and personnel at Kiritimati	Project Team	
	International staff return to home locations		

POST-OPERATIONAL

TIME	TASK	RESPONSIBILITY	DONE?
a.s.a.p. after return	Preliminary debrief at Kiritimati. Formal operational debrief	TL, WCU staff	
a.s.a.p. after return	Written report to GOK/funding agencies on field operations	PM with TL	
a.s.a.p. after return	Prepare for second trip if required – repeat ‘Pre-operational’ tasks as above, as necessary	PM and TL	

1-6 months after first trip	Second trip - next Kwai trip past Malden or special charter. Tasks as per 'Operational' section above.	Project Team	
1 year+ after 1 st trip or in lieu of 2 nd trip	Conduct cat detection monitoring	PM or contract expert, and/or supported by local staff	
1 year+	Declare success or failure of project	PM	
1 year+	Publish post-operational report	PM, TL, WCU	
	On-going monitoring of wildlife response, etc.	WCU, supported by Eco-Oceania?	

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APPENDIX 1

Preliminary Budget

ITEM	DETAILS	COST Aus\$
Project Manager and/or Team Leader	Planning and pre-operational tasks. Staff selection, logistics, permits, etc. 25 days @ \$400	10,000
Cat trappers /hunters	Team leader and 1 other, @\$350/day for 200 person/days	70,000
Kiribati staff	2 x WCU/Ag Dept staff – salaries covered	0
Hawaii logistics person	Aiding in purchasing/delivering eqmt and bulk food, and specialist items (firearms, traps, etc.) or logistics relating to dogs and/or project personnel in Hawaii. 10 days @ \$400	4,000
Food	400 person-days @ \$12/day	5,000
Camp and Field equipment	Firearms and ammunition; spotlights and LED torches; generator and fuel and/or a solar system to recharge batteries and a small freezer/cooler; water containers and emergency desalination; shade devices; traps, covers and non-target excluders; baits and lures; motion-detecting cameras; GPS units; field equipment and supplies; cooking equipment.	18,000
Ship charter	Up to 4 trips of 3 days @\$3,500/day, plus possible extra Hawaii costs (loading/transporting project gear from Hawaii).	50,000
Flights, accommodation non-Kiribati staff	Up to 4 return international trips with transit accommodation and meals in Fiji and Kiritimati @ \$2500 ea. plus any import costs for dogs, firearms or toxins.	15,000
Post-operational reporting	8 days @\$350/day	3,000
	Subtotal	175,000
	Contingency 10%	17,000
	TOTAL	192,000

The length of the second trip (and therefore associated staff costs) could also be reduced dependent on results of the initial trip.

It is possible that not all funds are required in a single financial year – the costs of running a second trip (e.g. half the food costs, half the ship charter and half the international staff wages and travel costs) may be required only if a second trip is deemed necessary, and some months after the funding for the first trip is required.

APPENDIX 2. Suggested Field Equipment for Cat Team

Camp:		
Tents for 4 people	4 x fold-out camping chairs, 1 table	Tarpaulins x 2, ropes and conduit pipe or large commercial sun-shade for shade cover.
Sleeping mats x 4	Sealable (crab- and ant-proof) buckets/bins – enough for all food and sensitive eqmt.	Hand cleanser (alcohol based)
Clothesline and pegs	Wash basins x 2 (one personal, one for dishes)	Spade, toilet paper.
Dish brush, dish cloth, pot scourers, tea towels, detergent	Tool kit – hammer, saw, file, pliers, adjustable wrench, multi-bit screwdriver, tie-wire, assorted nails, staples.	Generator with petrol container and basic maintenance kit (plug spanner, spare spark plug, oil) OR solar panels with regulator and deep cycle battery and small inverter).
Dry bags x 4	12V portable cooler bin/small freezer	Voltmeter + spare battery
First Aid kit (comprehensive)	Sunscreen (bulk)	Insect sprays
Satellite phone and charging device	EPIRB	Power multi-board.
LED lantern with 12V charger	Rechargeable batteries (AA, AAA) and recharger	Island 'diary' for daily observations
Food/Eating:		
Water containers – 20l containers and/or 100-200l drums to be pre-filled and/or from ship supply) 1,000 litres+	Emergency desalinator	Water filter/treatment for rainwater.
Gas cooker and 2-3 x 9kg gas bottles, plus small spare cooker and fuel.	Matches and gas lighters	Cooking utensils – sharp knives, tin opener, fish slice, wooden spoon, cutting boards x 2, sealed plastic bowls/containers.
Spare set plates, cups, eating utensils.	Cooking pots, frypan.	Food (for 200+ person-days, long-lasting and/or non-perishable).
Field Equipment:		

22 rifles x 2, each with silencer, cleaning kit, 100 rounds ammunition, spare magazine, spotlight mount, bipod or similar gun rest.	Victor 1 ½ padded traps x 20	Alternate traps - Timms trap x 1-2, cage traps x 2, SA Conibear x 2 with setting tool, etc.
6 x wood chimney traps (kitsetted, with mesh ends, nails, staples).	Motion detector cameras.	Resealable plastic bags, various sizes
Spare trap boards, restraining cord or wire, wire for making bait hooks.	Spotlights x 2-3, plus 200+lumen LED torches x 2-3	Batteries for spotlights/torches (rechargeable, and alkaline alternatives)
Netting, sections of PVC pipe, wood planks etc. for trap surrounds /platforms	GPS x 3-4	Notebooks and pencils x 5
Fishing lines, hooks, etc. or net	Copy of Op Plan, cat eradication Best Practice document, & reference material specific to island.	Track tape – 2 rolls of different colours
Dissection kit and disposable latex gloves, a few vials, 500ml ethanol	Copies of island map and/or satellite image (some laminated for field)	Spare binoculars or telescope and tripod
Screw-lid specimen and/or bait jars	Zip-lock bags (assorted sizes)	WCU shotgun and 20 rounds ammo (size 3 pellets)
Portable 'beach shades' for field shelter x 2	500g glycerine (for making scent lures)	Felid Attracting Phonic (FAP) – cat sound lures
Lens cleaner fluid and wipes for scopes, binoculars, etc.	VHF radios or walkie-talkies x 2-3	
Broom or rake for sweeping beach cat-tracking strips	Cat lures (long-lasting) – fish-based pellets, Erayz freeze-dried bait, catnip oil, commercial dry or tinned cat-food, 'Cat-astrophic', etc.	
Personal Equipment:		
Spare personal torch	Sleeping bag, pillow	Day bags
Binoculars	Laptop computer?	Personal medication and toiletries
Sunglasses and sun-hat (incl. spares).	digital camera	Basic personal first aid kit for field use
Personal cups, plates, eating utensils	personal clothing incl. wet weather gear	drink bottles
Recreational equipment (books, cards, games, music player etc.) for downtimes.		