

The Feasibility of Eradicating Feral Cats and Brush-tailed Possums from Northeast Chatham Islands, New Zealand



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GA Harper

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Cover photo: Forest patch near Lake Kaingarahū , NE Chatham Island (G. Harper)

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EXECUTIVE SUMMARY

This feasibility study assesses whether feral cats and brush-tailed possums can be eradicated from northeast Chatham Island, New Zealand. The presence of feral cats and possums on Chatham Island precludes the increase, or re-establishment, of populations of larger endemic native birds from pest-free islands south of Chatham, and in the case of possums, the recovery of native vegetation.

NE Chatham Island encompasses some 7500ha and includes the Kaingaroa village and farmland as well as extensive areas of fernland, wetland, patches of forest and an exposed coastline.

Three options for dealing with the current impacts of feral cats and possums were considered; Do Nothing, Sustained Control, and Eradication. Both of the former were seen as sub-optimal, with little benefit for the local ecosystem from either option and in the case of Sustained Control there was a significant risk of funding, resources and effort being wasted if control ceased. Eradication was determined to be the only effective and enduring solution to the adverse effects of feral cats and possums at the site.

If successful, this operation would be the largest possum eradication worldwide, and the largest cat eradication undertaken in New Zealand and the first for both species on an inhabited island. A ground-based eradication operation is estimated to cost about NZ\$12 million, partially owing to the island's isolation and the distances that staff, equipment and supplies would need to be shipped, in addition to substantial staff costs. There is a possible significant saving if the 'knock-down' portion of the operation were to use aerially applied toxic bait, the benefit of which would have to be weighed up against likely resistance from at least portions of the local community. The likely risks associated with attempting an eradication at the site relate to obtaining the social license for the operation, permission to use the removal tools on private land, possible non-target interference, and some logistical challenges involved in carrying it out. The principal drawback of the proposed eradication as a stand-alone operation is the likely ongoing re-invasion by both species via the coast, even if a pest-proof fence was erected to deter them. This latter issue, when coupled with the limited biodiversity benefits likely to be secured, reduces the viability of the eradication as a stand-alone project as biosecurity would be required in perpetuity, with no guarantee of successfully excluding either feral cats or possums.

However, if the proposed operation acts as a trial site for a more comprehensive objective of feral cat and possum removal from all of Chatham Island, then the NE Chatham project would serve as an effective stage from which to advance that larger goal.

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1. INTRODUCTION

A proposal for an attempt to eradicate feral cats (*Felis catus*) and brush-tailed possums (*Trichosurus vulpecula*) from the northeast Chatham Islands, New Zealand, is being led by the Chatham Restoration Trust (CRT), with an initial feasibility study.

This feasibility study is the first step in the planning process for the proposed eradication. The CRT have commissioned and funded Biodiversity Restoration Specialists (New Zealand) to undertake the feasibility study.

This report documents the findings of the study to determine the feasibility of eradicating feral cats and brush-tailed possums from NE Chatham Island. It describes the goal, objectives and anticipated outcomes of the project; the importance of the site; the likely benefits and costs of removing feral cats and possums; the recommended eradication methodology; strategies to enhance the likelihood of success and sustain outcomes. The report also makes recommendations for the next steps in process for advancing the proposed eradication and preventing them from reinvading the site.

The feasibility study is based on information gathered from an initial consultation with the Chatham Island community, DOC and local practitioners along with a site visit to the island by the author in August 2022.

This report will assist the CRT, CIC, Chatham Island residents, Iwi/Imi, DOC, and other project partners with their decision-making regarding the proposed eradication. It will also assist with the preparation of funding proposals for a full eradication project.

2. GOAL, OBJECTIVES AND OUTCOMES

2.1 Goal

To undertake an eradication of feral cats and brush-tailed possums (hereafter referred to as 'possums') from Northeast Chatham Island to;

- A. allow natural restoration of endemic and native fauna;
- B. improve social and health outcomes for the local community;
- C. foster economic opportunities for the Chatham Island community;
- D. enrich the cultural and recreational experiences on the island; and,
- E. inform the feasibility of the possible eradication of feral cats and possums from Chatham Island in its entirety.

2.2 Objectives and Outcomes

The objectives that this action will achieve and the outcomes that can be expected as a result of achieving these objectives are:

Objectives	Outcomes
1. Engage with the community in the development and application of the proposed cat & possum removal operation.	1.1 The outcome(s) the community desires for the proposed operation is/are clear. 1.2 The community supports the operation that is implemented. 1.3 Chatham Islanders are employed and develop skills associated with the project.
2. The Chatham Island community supports the results of the project.	2.1 Water supplies, home gardens and agricultural activities cease to be degraded by possums. 2.2 The project's employment opportunities are taken up by locals. 2.3 Other Chatham Island communities request the expansion of the project for the whole island.

2. Eradicate feral cats and possums NE Chatham Island.	2.1 Cease cat and possum predation of native land bird, wader and seabird species and allow their populations to increase.
	2.2 Facilitation of the re-population of the site with native seabird, wader and land-bird species currently missing.
	2.3 Provide for the reintroduction of the endemic Chatham Island skink (<i>Oligosoma nigriplantare</i>).
	2.4 Allow the recovery of native plants and indigenous forest remnants.
	2.5 Facilitate the recovery of native ecosystem processes and interactions.
3. Fine-tune current techniques for the eradication of cats and possums from Chatham and other large inhabited islands.	3.1 Improved techniques for cat and/or possum eradication are deployed to increase their social acceptability and efficacy when conducted on private property and public land.
4. New cat and/or possum removal tools and techniques, and methods/techniques to circumvent re-invasion, are tested and improved.	4.1 New cat and possum eradication and biosecurity techniques are transferred to other proposed large-scale cat and/or possum eradications on Chatham and elsewhere.
5. Establish environmental monitoring indicators and demonstrate outcomes	5.1 Biodiversity indicators are in place before the operation and eventual outcomes communicated.
	5.2 Cat and/or possum monitoring best practice techniques and tools are improved to support future eradication operations and guidelines.

3. THE SITE

The Chatham Islands (Moriōri: *Rēkohu* / Māōri: *Wharekaōri*; 44° 00'S. 176° 30'W, Fig. 1) comprise an archipelago of two main islands and several smaller islands, some 800km east of the South Island. The main island, Chatham, is largely flat, with remnant volcanic peaks in the north and a gently dissected sloping plateau to the south, separated by the Te Whanga lagoon. Although Chatham Island covers some 90,000ha, this large lagoon of ~20,000ha means that only ~70,000ha is dry land. Chatham is inhabited, and along with the inhabitants on Pitt Island (6000ha) to the south, some 600 people make the islands their home (Martin Jenkins 2017). The principal industries are agriculture (pastoral farming & fishing) and increasingly, tourism. Both islands have large expanses of pasture but on Chatham in particular there are substantial areas of fernland, shrubland and remaining native forest in varying degrees of health, with the largest area of forest in the south of the island. The weather is notable for the strong, gusty, westerly quarter winds and some 200 days of generally light rain spread through the year, totalling some 850mm per annum (Pearce 2016).

There are several small settlements on Chatham, usually based about small ports, with Waitangi being the main township, all linked by gravel roads. Electricity is generated by diesel generators with many houses augmenting this with wind turbines or solar panels. Satellite TV and broadband internet is commonplace. There is a few shops, and supplies are brought in from New Zealand on a regular shipping service. There is a sealed airstrip for a regular passenger aircraft service in the north of the island. About 90% of the island is privately owned or in Moriōri or Māōri trust ownership, with <10% remaining land tenure being in Public Conservation Land.

Northeast Chatham Island (~7500ha) is about 10% of the terrestrial land mass of Chatham Island and has generally low to rolling terrain, with a mix of pasture, some small areas of native or pine forest and shrubland, and large areas of ferns and rushes grading into wetland along the lagoon and edges of several lakes. The coastline is rocky in the northeast, but has long surf beaches on the northern and eastern coasts with associated sand dunes and a channel draining the lagoon in the south (Fig. 2).

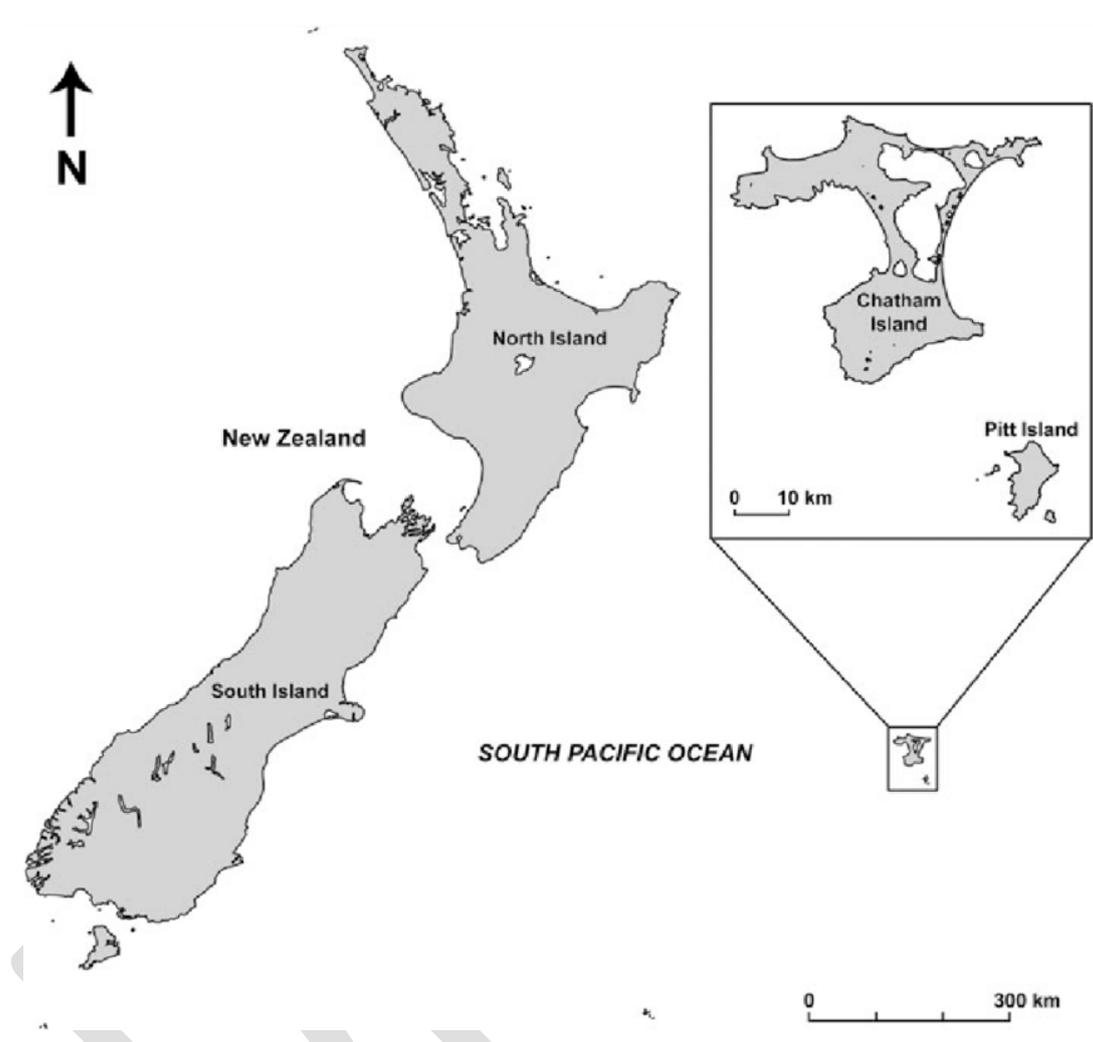


Figure 1. Location of the Chatham Islands, New Zealand.

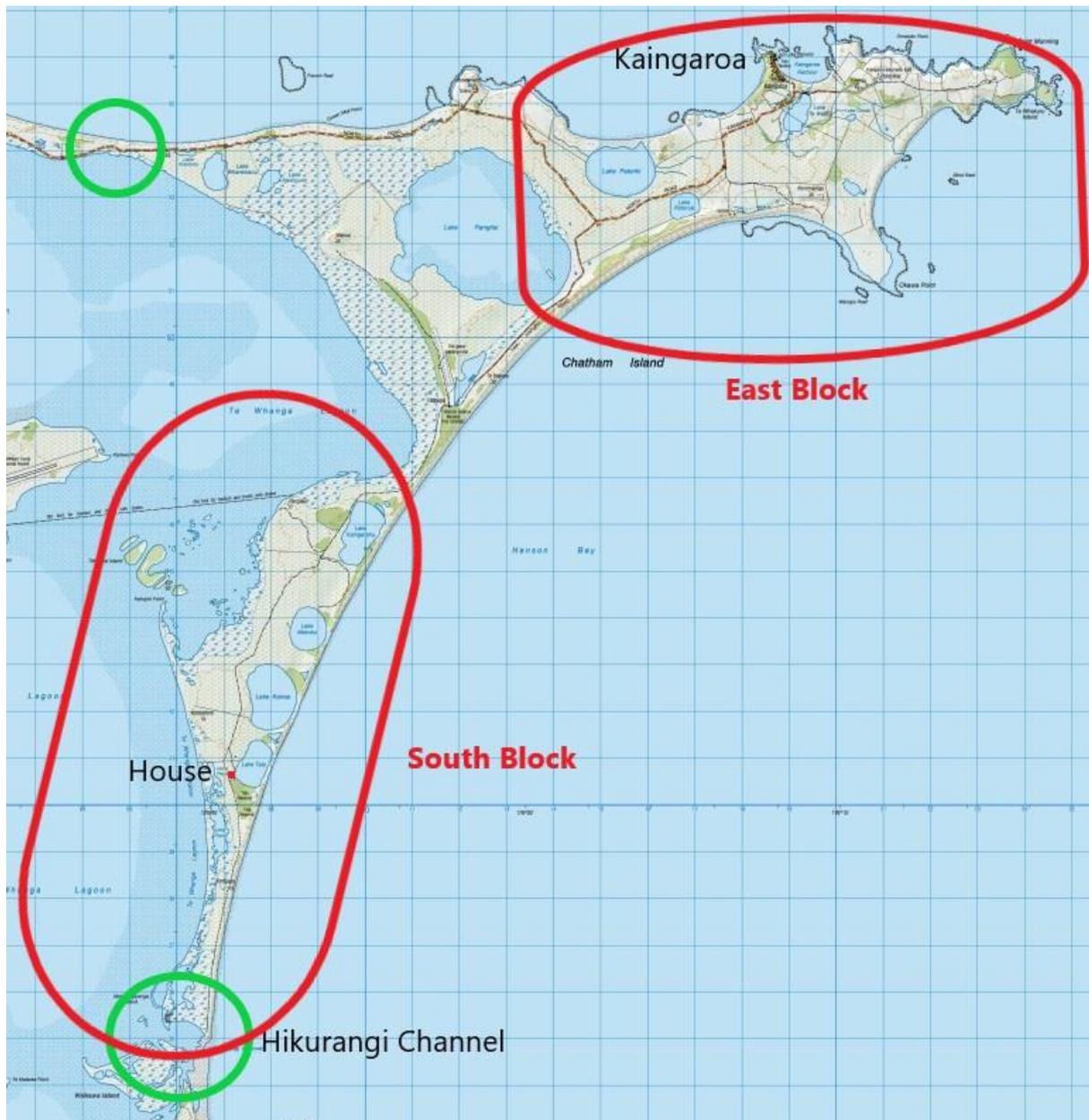


Figure 2. Northeast Chatham Island, showing the Hikurangi Channel and the narrow northern isthmus (Green). A suggested division of the site into operational blocks is presented (Red) and their boundaries are tied to 'pinch-points' in the geography. The remaining land would be the 'west' block.

The islands were initially settled by Moriori about 1500. European settlement began in 1843 (Hunt 1990) and native forest was progressively cleared around ports and further afield. Many of the endemic bird species once present on the island are now only found naturally on the southern islands of Mangere/Maung' Rē and Rangatira/Hokoreoreo/South East, which include the rare iconic black robin (*Petroica traversi*), Chatham Island snipe (*Coenocorypha pusilla*), Forbes parakeet (*Cyanorhamphus forbesi*), shore plover (*Thinornis novaeseelandiae*), the Chatham Island tomtit (*Petroica macrocephala chathamensis*) and tui (*Prosthemadera novaeseelandiae chathamensis*) (Aitkin & Miskelly 2004). Some seabirds

and waders are still resident, including small numbers of the Nationally Critical Chatham Island oystercatcher (*Haematopus chathamensis*, Fig. 3) which is vulnerable to cat predation. Increasingly, landowners have been involved with ecological restoration efforts on Chatham and Pitt Islands, mainly based around conservation covenants, re-planting and fencing off native forest (Aitkin & Miskelly 2004).

Current direct threats to the re-establishment of native birds on Chatham Island include introduced feral cats, possums, and rodents (three *Rattus* species, & *Mus musculus*) and to a lesser degree the introduced buff weka (*Gallirallus australis hectori*), and feral pigs (*Sus scrofa*). Sheep, farmed and wild cattle, and feral pigs can also degrade native forest where they have access, which reduces its utility for native birds. Recreational hunting of feral pigs appears to have little effect on controlling their population, but is strongly supported by a section of the community. Farmers are generally less enamoured with feral pigs as they damage pasture and kill lambs.



Figure 3. Chatham Island oystercatchers.

4. THE TARGET SPECIES:

4.1 FERAL CATS AND THEIR IMPACTS

Cats are a medium-sized wild terrestrial predator in New Zealand (♂: ~3.5kg, ♀: ~2.5kg) and were introduced by Europeans from the 1700s onwards. Globally, cats have contributed to at least 14% of modern bird, mammal and reptile extinctions so it is likely cats have had significant deleterious impacts on the native fauna on Pitt Island. The impacts of feral cats on vertebrates have been reported from at least 120 different islands on at least 175 vertebrates (25 reptiles, 123 birds, and 27 mammals) (Medina et al. 2011).

Cats are supremely adapted as a predator (Turner & Bateson 2000). They can forage diurnally and nocturnally using eyesight with enhanced low light vision and specialised to detect movement very well (Case 2003), which is complemented by sensitive hearing. In areas with little or no free-standing freshwater, but plentiful prey, cats can obtain all their water requirements from their prey (Prentiss et al. 1959). Their home ranges in rural areas can range from 50-400ha and their ranging behaviour and home range size will vary along with the abundance of the principal prey items (Harper 2007).

Introduced mammals are usually the most common prey item for cats, with rabbits being preferred, followed by rodents, so mice are likely to be a large component of their diet. Ground nesting birds, particularly seabirds, are also actively depredated (Bonnaud et al. 2011). Where prey composition is influenced by availability cats will readily prey-switch between prey items. In the case of Pitt Island it is highly likely that sheep or pig carcasses will be readily consumed and be a significant additional food source.

Cats have been eradicated from many islands worldwide, with the most common methods being trapping, shooting and poisoning (Campbell et al. 2011). Cats can persist at low population densities during eradication operations so sustained effort is required to achieve total removal. Trapping, particularly leg-hold trapping, is effective at significantly lowering cat numbers, although the humane, but usually less effective, kill traps available can be useful to target trap-shy animals. Cats are also vulnerable to poisoning using 1080-laced baits, and secondary poisoning through consumption of brodifacoum-poisoned rodents in particular, but less so through poisoned rabbits, where the viscera may not be consumed. The recent development of para-aminopropiophenone (PAPP) has provided an effective and humane cat poison. Detection by dogs and shooting are also effective removal techniques at low density. Cat removal success tends to be inversely related to prey density, so reduction in prey animal abundance will significantly improve cat eradication efforts.

On Chatham Island, cat habitat selection will likely be strongly mediated by a combination of the availability of prey and carrion, and shelter (Langham 1992, Harper 2007). The latter requirement will be especially important for female cats nursing young and they will require secure dry sites sheltered from poor weather. This would suggest that on Chatham Island

forest areas, and buildings such as barns, would be the prime denning sites for adult females in particular.

On islands, native or exotic mammals are usually the most common prey item for feral cats, followed by birds, particularly seabirds (Bonnaud et al. 2011). Prey composition is influenced by availability however, and on islands where prey diversity is often restricted other prey items can become important. For example, on sub-tropical Raoul Island rats were the predominant prey once both land bird and seabird numbers had been reduced (Fitzgerald et al. 1991). On tropical Jarvis and Howland islands feral cats ate mice, lizards and insects (Kirkpatrick & Rauzon 1986) in addition to seabirds, where 59% of feral cat stomachs examined from trapped or shot cats contained flesh and feathers of sooty tern adults and eggs (Rauzon et al. 2005). Feral cats extirpated terns, two noddy species, two shearwater species and storm petrels on these islands. In southern New Zealand islands, with a similar climate to the Chatham Islands such as Stewart Island/Rakiura, cats preferentially prey on rats, with small forest birds comprising most of the rest of the diet, but also including kereru (*Hemiphaga novaeseelandiae*) and red-crowned parakeets (Harper 2005). However, on the Auckland Islands, with mice and pigs present, there was an almost equal mix of mice and small ground-feeding passerines such as redpolls (*Carduelis flammea*) and dunnocks (*Prunella modularis*) as feral cat prey in both summer and winter (Taylor 1975, Harper 2010). Hence, the introduction of feral cats is likely to have been devastating to the suite of native birds on Chatham Island. The current depauperate state of Chatham Island's native fauna, compared with nearby pest-free Mangere and Rangitira Island islands (pers. obs.), indicates how the presence of invasive predatory mammals (cats, rodents & possums) can deplete an island's biodiversity.

4.2 POSSUMS AND THEIR IMPACTS

Adult possums are a similar size to cats (2.1kg – 4.7kg on Chatham Island) with little difference in weights between sexes (Cowan 2005). They were repeated introductions to New Zealand for the fur trade from 1858 onwards, with most introductions occurring around the beginning of the 20th Century.

Possums are arboreal marsupials, and are well adapted for climbing with five digits on hands and feet with strong claws, and a prehensile tail. They will move between adjacent trees at height or will also regularly travel across the ground to access isolated trees or shrubs. They are found in a variety of habitats as long as suitable food and cover is available. Possum population density can exceed 10 individuals/ha in favourable forest types, with forest/pasture margins recording 25/ha. Populations appear to be regulated by food supply and intra-specific interference at high population density. Home range size varies with males generally having larger areas than females (♂: 1.9ha, ♀: 1.3ha, with range lengths of about 250-300m), which may be longer if individuals are searching for favoured foods, such as pasture or fruit, or for a mate (Cowan 2005).

Possoms are primarily herbivorous, and are known to have serious effects on the health and productivity of native vegetation which can lead to tree mortality in favoured species through defoliation (Sweetapple et al. 2004). Many introduced plant species are also eaten and they are a pest in domestic and production orchards and gardens (Cowan 2005). Indeed their effects on native and introduced vegetation are often only revealed once possums have been controlled to low numbers or eradicated, with a corresponding response in vegetative growth and fruit production (Nugent et al. 2002, Sweetapple et al. 2016).

There is increasing evidence revealing their predatory behaviour, with particular adverse effects on native invertebrates and birds. Possums have been recorded eating eggs, chicks and adults of a variety of species, from small passerines like sparrows to larger species such as kereru (*Hemiphaga novaeseelandiae*, or 'parea' [*H. Chatamensis*] in the Chatham Islands), kokako (*Callaeas cinerea*) and kaka (*Nestor meridionalis*) (McLeod 2002, Moorhouse et al. 2003, Prendergast et al. 2006, Harper 2009, Byrom et al. 2016, Brown et al. 2015, O'Donnell et al. 2017). The incremental loss of Chatham Island tui and tomtit from Chatham Island as possums spread from their introduction site in NE Chatham in 1911 suggests they were a significant factor in the demise of these native birds there.

5. MANAGEMENT OPTIONS

5.1 Do Nothing

Maintaining the status quo on Northeast Chatham Island will not address the current substantial impact cats and possums have likely caused on the native vegetation, production pastureland, or endemic bird and lizard populations. Furthermore, if no action is taken to reduce the impacts of feral cats and possums on the island further damage to the island's ecosystem will occur over time, and preclude any re-introductions of native species from Rangitira or Mangere islands, or increases in populations of plant and animal species that are present, such as the oystercatcher.

Another sub-option is to delay control or eradication of feral cats and possums until other control tools are developed. Although there has been a substantial amount of research conducted on other more humane control tools than poison, few commercially viable tools have been forthcoming in recent times and appear unlikely to be available in future. Some specific control technologies are discussed below.

5.2 Biological control

Little effective advance on biological control of cats or possums has been achieved in recent time and no method for applying biological control of cats, possums or rodents on a landscape scale is presently available with little likelihood of one being commercially available in the foreseeable future (Campbell et al. 2011, Barnhill-Dilling et al. 2019). For

feral cats, a few diseases, particularly feline immuno- deficiency virus, can reduce populations but are not known to eradicate populations. Moreover, the presence of any population of domestic cats, even if de-sexed, would preclude the use of biological control, due to resistance from local inhabitants.

5.3 Species-specific poisons

In regard to feral cats, Para-aminopropiophenone (PAPP) has been developed, which is a more carnivore-specific toxin, with fewer non-target impacts than other poisons. It is also more humane, with cats becoming lethargic and sleepy within 35 minutes and dying within two hours (Eason et al. 2014, Johnston et al. 2020). This poison has been used for cat control in New Zealand (de Burgh et al. 2020) and for cat control and eradications on Australian islands (Johnston et al. 2011, Robinson et al. 2015) so could conceivably be used in this proposed eradication. However, PAPP would have to be carefully deployed to reduce non-target interference from species such as wild pigs and weka, which will reduce the efficacy of uptake by cats, meaning at least a few feral cats will remain after an initial attempt to knock-down the population.

Although there is currently research being undertaken on poisons that are more species specific for possums, only limited progress has been made. There is research being conducted using genetic techniques to find the 'Achilles heel' of possums in order to develop a specific toxin, but it is in its relatively early stages and no commercial available poison is likely in the foreseeable future (Warburton et al. 2021)

5.4 Vectored Immunocontraception or disease

Although contraception tools are available for cats, all require capture of the animals. Eradication of feral cats through Viral-vectored immunocontraception (VVIC) is theoretically likely to be successful (Courchamp & Cornell 2000) but no effective VVIC has been developed and any subsequent landscape scale delivery method is similarly lacking (Campbell et al. 2011). Thus for feral cats this method has little likelihood of being available in the foreseeable future.

Bait-delivered fertility control is being considered as the most likely method to reduce possum abundance, but is still in early stages of development (Ji 2009). It also has the issue of bait acceptance by possums, which affects uptake, so will only reduce possum numbers, not eradicate them.

5.5 Trap-neuter-release (TNR)

TNR was developed to reduce populations of feral cats and requires them to be live-trapped, operated on by a veterinarian to neuter/spay them, then released, with the ultimate goal being that a population goes extinct through eventual lack of reproductive success. In the case of the NE Chatham Island it would require virtually all of the cat population for the entire island to be trapped. This would require at least the same effort as

required for a landscape-scale control or eradication programme with the additional expense of needing several veterinarians on call on the island for an indeterminate period simply to carry out surgical procedures on the trapped cats. There is also the added probability that the attempt would likely fail as the one attempt at eradication of feral cats using TNR thus far was not successful (Campbell et al. 2011).

TNR has not been developed for possums.

5.6 Sustained control

Sustained control means maintaining feral cats and possums at low population levels in perpetuity, and a control programme has been carried out on portions of NE Chatham Island, mainly using cage traps. However, once any control is reduced or terminated the cat and possums populations will quickly return to pre-control levels, with no lasting social or biodiversity benefit despite any previously expended cost and effort. Thus a sustained level of control at the *required level of effectiveness* is essential, despite any possible future changes in funding, staffing, frequency of supply or oversight. Where sustained control has been conducted elsewhere, such as control of invasive mammals for the protection of seabird populations for example, it is regarded as substantially less cost-effective than eradication (Pascal et al. 2008).

On-going control of feral cats and possums across NE Chatham Island would include the need to cut and maintain tracks and set out traps, but also require continuation of the servicing of infrastructure. In the case of sustained control the resource demands would continue for ever and be subject to any future vagaries in cost and effort, and enthusiasm within the managing body.

A sub-option for sustained control is the construction of additional predator-proof fences around areas of forest and then control or removal of feral cats and possums within the fences. However this option will be problematic to implement for two reasons. Firstly, the fence will need to be high enough and designed to eliminate any possibility of cats and possums climbing/jumping over them. This will require a fence at least 1.8m high with an angled 'hood' to preclude them from climbing over the top. To gain the most benefit from a fenced site of high biodiversity value it would also need to preclude rodents. Moreover, to fully leverage the benefits of fenced sites they should be of a size that would hold self-supporting populations of the native species of concern. Pest proof fences are expensive to establish and need ongoing maintenance, and there do not appear to be any sites of a size needed to match the criteria mentioned above, with even the Hapupu Reserve (33ha), being only marginally large enough.

In summary, sustained control of feral cats and possums in the NE Chatham Island would be problematic to maintain. A similar programme in NW Chatham Island has had diminishing returns for the cat removal effort being applied. If at any stage, for whatever reason, feral

cat and/or possum control is suspended or ceases altogether, the resources and effort will have been expended for no enduring benefit.

5.7 Eradication

Eradication means the complete removal of the target species from the site of interest, usually an island (Cromarty et al. 2002). Eradication of cats has been successfully conducted at over 80 islands around the world, including at least 11 islands over 2000ha. In New Zealand a similar number of cat and possum eradications have been carried out, with 19 successful cat eradications and 17 successful possum eradication operations. (Clout and Russell 2006, <http://diise.islandconservation.org/>). The eradication of these invasive species is a proven and enduring method for protecting the biodiversity values of those islands (Howald et al. 2007, Campbell et al. 2011, Parkes et al, 2014). Although eradications can be expensive, they are conducted within a fixed period with a definite end point, after which little additional expense or effort is required, which is usually in the form of biosecurity measures to prevent reinvasion. The current feral cat and possum control at NE Chatham is reliant on continued funding in perpetuity and will not result in enduring biodiversity gains as feral cats and possums will always remain.

There are seven criteria that an eradication project must fulfil to increase the likelihood of lasting success (Bomford and Bailey 1995):

1. The rate of removal exceeds the rate of increase at all population densities.
2. Immigration is prevented
3. All reproductive animals must be at risk
4. Animals can be detected at low densities.
5. Discounted benefit cost analysis favours eradication over control.
6. Environmental impacts of the programme are acceptable.
7. Suitable socio-political environment

Other factors include;

8. Success is favoured by small spatial extent of the population.
9. Programme is effectively managed, and its status is reliably monitored and accurately recorded.

The rest of this document only considers the option of eradicating feral cats and possums from the NE Chatham Island as the other options have a variety of issues that preclude their implementation, namely a lack of enduring effectiveness for removing cats and possums and/or continuous financial outlay. If other options are selected despite these drawbacks, then the required techniques will need to be assessed. In the case of sustained control, the techniques required will be virtually identical to eradication techniques discussed below, but will be applied in perpetuity with a less intense level of application.

5.7.1 Previous cat eradications elsewhere

There have been at least 146 successful cat eradications conducted worldwide, with at least 19 unsuccessful attempts (Campbell et al. 2011, <http://diise.islandconservation.org/>).

Techniques using a combination of toxins and a variety of trapping and hunting techniques have a higher success rate. There have been several recent successful cat eradications carried out on much larger islands, and with similar or more challenging terrain as Chatham Island (Parkes et al. 2014, Table 1). Four cat eradications have been successful on islands much bigger than NE Chatham, with Marion (29,000ha) being the outlier. All successful cat eradications on islands >2500ha used toxins (Campbell et al. 2011).

Table 1: Successful cat eradication operations on large islands worldwide.

Island (Country)	Area (ha)	Terrain	Climate	Year completed	Techniques
Socorro	13,200	Steep,	Semi-arid tropical	2017	Trapping and shooting
Rangitoto/ Motutapu (NZ)	3,842	Hilly, some cliffs	Warm temperate	2009	Aerial poisoning for rats. Follow up with poisoning/trapping/dogs for cats
Raoul (NZ)	3,046	Steep & cliffs	Subtropical	2005	Aerial poisoning for rats. Follow up with poisoning/trapping/dogs for cats
Ascension (UK O.T.)	9,700	Hilly & cliffs	Arid tropical	2004	Poisoning/trapping
Macquarie (Aust.)	12,800	Plateau & cliffs	Sub-Antarctic	2000	Trapping/shooting/dogs and poisoning
Marion (South Africa)	29,000	Steep, cliffs	Sub-Antarctic	1991	Disease, trapping/shooting/dogs and poisoning
Little Barrier (NZ)	2817	Steep, deeply dissected	Warm temperate	1980	Disease, trapping/shooting/dogs and poisoning

5.7.2 Possum eradications in New Zealand

Of the 17 possum successful eradications completed, usually using a mix of toxins, trapping and shooting, with dogs used for detection on larger islands. The majority of operations have been on islands <200ha, with only four on islands over 1000ha. Note the mix of techniques for the largest islands, including the use of toxins. The largest was on Rangitoto (2321ha) which is about 1/3 of the proposed area for possum eradication in NE Chatham Island. At present four larger possum eradication projects are being attempted on mainland New Zealand, but none have been successfully completed as yet.

Table 2: Successful large possum eradication operations

Island	Area (ha)	Terrain	Year completed	Techniques
Kapiti	1965	Steep, cliffs	1986	Aerial poisons, trapping & dogs
Whenua Hou	1396	Hilly, cliffs	1987	Poisons, trapping & shooting
Motutapu	1510	Hilly, some cliffs	1994	Trapping, dogs, poison
Rangitoto	2321	Low volcanic hill	1994	Aerial poisons, trapping, dogs, shooting
Whanganui, Coromandel	283	Hilly	1995	Unknown
Pomona	262	Steep hill, cliffs	2008	Trapping

6. TECHNICAL APPROACH

6.1 Current cat and possum removal

6.1.1 Feral cats

Cage trapping for cats is being undertaken by the Hokotahi Moriori Trust on their farmland and covenanted public conservation land since 2021, employing a single ranger. On other land no control is undertaken. Reference to other cat operations suggests that the entire cat population on NE Chatham may be about 350 individuals (50-60/1000ha, Parkes et al. 2014), and only a portion of this population is subject to control.

6.1.2 Possums

Concurrently with the cat trapping, possums are also being cage-trapped by Hokotahi Moriori Trust on the land they are farming and on covenanted public conservation land. The population density of possums is likely to be high on forest-pasture boundaries,

medium in shrubland, and low in pasture, which suggests possum abundance will be very patchy through the NE Chatham site and will vary depending on prevailing environmental conditions (refer to Section 4.2). A wet winter for example, will likely cause a significant decline in overall numbers (Cowan 2005).

6.2 Proposed operational approach

6.2.1 Overview of options

There are two operational options for removing possums and feral cats;

1. Ground operation. All the proposed work, including the possible use of toxin, would be ground-based. This is highly likely to take longer and be more expensive than Option 2. However, with this option the risk of poisoning non-target animals is much reduced.
2. Mixed aerial and ground operation. This operation would commence with an aerial application of toxic bait for possums, probably only across the southern block (~1900ha) and possibly the western block (~2600ha), as there is no human habitation, a lot fewer stock and more shrubland and marshland on these blocks than on the eastern block (~3000ha). This operation would likely deliver a significant knock-down of possums (~80-90% of possums removed) and, to a lesser degree, cats, which would reduce the time and cost required to remove any remaining animals. However, an aerial operation would increase the likelihood of non-target poisoning of species such as some bird species, including weka and waterfowl, feral pigs, and rodents.

For the purposes of this feasibility study, this report will outline what is required for deliver Option 1. However, if it is deemed that Option 2 may be a realistic option then the outline and cost for its delivery will need to be re-visited.

6.2.2 Ground based Eradication Operation

A team of about 11-13 will be needed for the field operation, including a Field Manager. A larger team will be able to maintain pressure on the target populations and likely shorten its duration.

It is suggested that possums are targeted first, as they are likely to be in higher abundance than feral cats, and will interfere with traps set for cats. Moreover, cats will be the more difficult target animal to remove their removal should be conducted once possums have been removed. The continuous possum removal operation will also habituate feral cats to humans prior to the eventual switch to cats, which may increase the initial success of the cat removal phase.

The operation for both species should include a mix of trapping, shooting and dog detection, with toxins used for the initial knock-down. Initially the block could be divided into three (East, West and South, Fig. 22) and the entire team could be engaged in intensive trapping

and/or poisoning to knock down the population in each block, before switching to an extensive long-term removal phase across all three blocks simultaneously. There is the possibility of a once-off use of PAPP for initial knockdown of cats, but this will need careful implementation after consultation with locals.

A team of about 13, excluding the manager and possibly one-two persons on leave, would mean ten staff would be engaged full time to cover 7500ha, or about 750ha each. This number of staff is equivalent to the number engaged on Marion Island (29,000ha) and about double the staff numbers on Macquarie Island (12,800ha) (Parkes et al. 2014), so the hunting pressure on possums and cats on NE Chatham Island would be more intense than either of these operations, which *should* translate to a shorter duration, and lower cost than estimated, as Criteria 1 & 3 (Section 5.7) for effective eradication should be adhered to. Moreover, this conservative approach is likely to offset the pitfalls of some previous cat, and probably possum, eradications which had a longer than expected duration. (Campbell et al. 2011). Moreover, the lagoon margins will be difficult areas to service traps as they will be subject irregular inundation and drying cycles, which may extend the time required to remove the last target animals (Fig. 4)

Eradication field staff could work from a Hokotahi Moriori Trust house at Kaingaroa and a house at Lake Taia at the southern end of the site (Fig. 5).

Supplies will be constrained by shipping schedules, and likely to be affected by adverse weather, so effective and realistic pre-planning will be essential to ensure that shortages do not curb the establishment phase and start of any eradication programme.



Figure 4. Hikurangi Channel (lower left), showing the seaward sand dunes, and interior lagoon edges subject to irregular drying and inundation



Figure 5. Lake Taia house, which could be used to base a team for servicing the southern block.

6.2.2 Timing

A cat eradication operation should preferably begin in early winter, as rodent abundance is likely to be declining. Similarly, possum control should begin in winter when food supply is limited and the prevailing wet, cold conditions reduce survival. The current cage-trapping control programme could continue until the possum/feral cat eradication begins as it is reducing the overall possum/feral cat population, which will likely shorten the eradication operation.

6.2.3 Control tools

Having any possums/feral cats in the population that are familiar with the current control technique (cage trapping) will increase the resources and time required to remove them, so an eradication operation should immediately switch to removal techniques the remaining animals have not been exposed to.

Several control tools will need to be applied to remove both cats and possums. These tools should include; trapping (mainly leg-hold traps and several types of tree-mounted traps) as cage traps have a poor record for eradication operations (Campbell et al. 2011); possibly poisoning (away from houses), using ground application of PAPP for cats, and several toxin options for possums, if agreed by landowners and locals. Aerial application of toxin for possums should be considered, but may not be accepted by all land owners/leasees (See Section 7.1). Toxin used will be subject to availability and legal requirements for use.

In the latter stages of the operation techniques will like move to spotlighting or using rifles with night-vision scopes from roads and open ground (again, away from houses); using dogs for detection and hunting, and use trail cameras for detection and monitoring.

Almost all the successful cat eradications on large islands (Table 1) used toxins for the initial knockdown. Similarly all the successful possum removal campaigns on islands >1000 ha (n = 4) utilised poisoning of possums with toxic baits for an initial knockdown, with two using aerial bait application (Table 2). At this stage the use of toxins for an initial knockdown is still open for debate with the Chatham Island community, although the use of 1080 will be contentious (Section 7.1). As cats will still have their usual prey (e.g. rodents & small birds, carrion) present, they are unlikely to be under any undue food stress so it is expected that the complete removal of feral cats will take several years to complete, including a monitoring period. Similarly for possums, there will be food present year round, with the main stress on the population being through adverse climate.

For cats Victor 1 ½ soft jaws leg-hold traps are likely to be the most effective traps and have performed well in most cat eradications. Traps are likely to be effective along road edges, the edge of thicker forest and along beach edges. Cat trapping requires a high level of skill to ensure each trap has the maximum potential to catch a cat without creating a trap-shy cat and to set traps to reduce stress to cats and any non-target animals. Indicator dogs would be a useful control and surveillance tool and would be employed if available. Dogs can

indicate the presence of cats from scent and this would provide useful information to aid in planning and placement of resources during the latter part of the eradication.

Note that cat trapping will also trap weka, which appear to be in reasonable numbers on Chatham Island (pers. obs.). Weka are likely to interfere with the trapping effort and with an intense trapping and/or poisoning effort it will result in a decline in their numbers also. The use of soft-jaw leg-hold traps will reduce serious injuries to weka and any cat detection dogs can be trained to avoid weka, so these options are likely to reduce the likelihood of this outcome.

For possums, there are a variety of traps, including the Victor 1 ½ soft jaws leg-hold traps for ground sets, as well tree-mounted traps, of both manual and automatic re-setting versions. Some automatic re-setting traps are showing promise for assisting an operation of this nature, and may be particularly useful in maintaining pressure where intensive trapping has ceased in the early stages of the operation if the suggested block removal schedule is used (Section 6.2.1).

The trapping information, indicator dog tracks and spotlighting will need to be well recorded and have GPS data recorded for each technique used. From this, a picture of the control effort and effectiveness will become obvious and will reveal any possible gaps where additional effort is required.

Any shooting (using low calibre centre-fire rifles such as .223) and spotlighting would have to be carried out where no humans were present and would need to be well signalled so no public wander into the control area.

Any domestic cats will need to be neutered/spayed and all should be fitted with a collar with reflective tape, so that trappers or spotlighting staff can identify them immediately. A complimentary technique is to require pet cats to be kept inside at night during the operation to reduce their risk from control tools.

6.2.4 Planning

Planning for the allocation of time and subsequent budgeting for a cat and possum eradication operation is problematic as the time taken to eradicate any remaining animals can be very elastic, and often has an attenuated final stage while the few remaining individuals are removed (Cowan 1992). Planning will have to refer to recent cat and possum eradication operations on similar islands for an indication of the likely resources required for success and allocation of funds and effort accordingly. The advantage of NE Chatham is the suite of roads and tracks and the islands' relatively gentle terrain. Disadvantages will include the large areas of marshland, dense low shrub and fernland; the confounding presence of domestic cats, weka, pigs, dogs and stock interfering with traps; and the need for daily or twice-daily access to traps to check/set traps at dawn and/or dusk.

There are a variety of options for approaching the eradication operation, which could tie in with an associated cat eradication proposed for Pitt Island for example. If the possums are removed first from NE Chatham, then at least some staff from the Pitt Island cat operation could transfer to NE Chatham as the Pitt Island operation winds down in its closing stages. This would maintain continuity in skills and employment for the duration of both proposed operations.

7. SUSTAINABILITY

7.1 Re-invasion risk

The NE Chatham site will need to be isolated from the rest of Chatham Island if it is to remain free of cats and possums. There are likely to be occasional incursions of cats over the Hikurangi Channel, either by swimming or when it periodically closes, especially during dry periods. The other and more substantial risk site for reinvasion will be via the narrow isthmus on the north coast, which is 300m at its narrowest point.

Currently, the only enduring method for providing a hard boundary for pest mammal reinvasions will be a pest-proof fence. However, a fence will 'leak' around its edges as a fence will need to terminate in sand dunes on the north boundary at a surf beach, and within the Te Whanga Lagoon on the southern side. Cats in particular are likely to walk along the wrack line on the surf beach, when searching for marine detritus such as dead seabirds or fish, or when searching for mates, so this will be a significant pathway for re-invading animals. Moreover, during dry spells, and particularly with a strong north-northwest wind blowing, the lagoon bed can be exposed for up to two to three kilometres from the coast. A fence could also be damaged during a southeast or westerly wind, if lake weed piles up against the fence mesh. This problem can be alleviated by building lower fences either side of the fence to intercept weed before it reaches the pest-proof fence.

In any case, possums and cats will be able to walk around the edge of a fence. There are several ways of reducing the reinvasion around fence edges, which can be used in combination. These include;

- A. Intensive trapping for about a kilometre in front and behind the fence to reduce overall cat and possum abundance and remove dispersing animals.
- B. Adding fence 'wings' on the NE Chatham side and trapping intensively on this 'inside' of the fence.
- C. Adding 'trap holes' in the fence, with treadle-plate cage traps inserted, to encourage any animals inspecting the fence to enter through what appears to be a gap in the fence.

D. Adding fence wings on the 'outside' of the fence and include 'trap holes' in these fences (see 'C').

E. Other developing tools for deterring cats, which include ultrasonic speakers, triggered by IR cameras (H. Shah [Evorta™], pers. comm.) could also be considered.

All these options will need to be augmented with a robust detection and removal programme, at the very least on the 'inside' or eastern side of the fence. Similarly, at the Hikurangi Channel a similar detection/removal infrastructure and servicing regime will be required because cats in particular will be able to swim the channel occasionally, and both feral cats and possums are even more likely to cross the channel if it closes. This biosecurity work will require the permanent employment of 1-2 staff to service the detection and removal devices (trail cameras, traps, bait stations etc.) for the foreseeable future.

Domestic cats are likely to remain within NE Chatham at Kaingaroa and at farm houses. In order they do not re-establish a new population of feral cats the cooperation of the local island residents will need to agree to all remaining domestic cats being de-sexed. This could be supported by a local bylaw banning the import of all but de-sexed cats into the Chatham Islands, including Pitt Island.

Although cats are known to be ineffective in controlling rodent population cycles, worldwide there still exists a strong culture of using cats for rodent control and may provide an incentive for people to reintroduce cats into the area. If feral cat eradication is likely to proceed, there will need to be strong community support for their removal which should translate to resistance to unauthorised re-introductions.

Reinvasion of NE Chatham and the subsequent re-establishment of feral cats and possums will be a significant risk to the sustainability of the project. A enduring commitment to control reinvasion and respond to incursions will be required to maintain its cat- and possum-free status, at least until these pests are removed from the whole of Chatham Island.

8. SOCIALLY ACCEPTABLE

The social licence for a feral cat and possum eradication operation is one of the most critical aspects of the proposed operation. The locals will want to have the feral cats and possums removed from NE Chatham. The removal techniques will require acceptance by landowners and residents, as access to all land tenures will be essential to put all cats at risk of eradication tools deployed (refer to eradication criteria Section 5.7).

As a general observation the Chatham Island lifestyle and values encompass a strong streak of independence and self-reliance and community spirit, along with a degree of suspicion about government interference. The CIC and the Department of Conservation have most obvious local and national government presence on the island respectively, and DOC has a

role in land management on smattering of reserves on Chatham and Pitt Island, along with the southern islands.

7.1 Local support for the eradication

There appears to be strong local support for possum removal, both at NE Chatham and across the whole Chatham Island, whereas support for feral cat removal is a little more equivocal, but is mainly founded on the risk to domestic cats by the possible eradication techniques. Feral cat control is generally politically fraught in New Zealand with strong feelings both for and against their removal, and this is probably also reflected in the Chatham community.

The principal concern for locals was around toxin use, with several people voicing opposition to 1080 (sodium fluoroacetate) in particular, whereas some noted they would not support use of any toxins. Some of this concern was related to the risk of human consumption of feral pigs that may consume toxic bait, and while there was also unease or outright opposition to 1080, it did not appear to be derived from direct experience, as 1080 has not been used on the island for several decades.

7.2 Stakeholder support for the eradication

Land tenure in NE Chatham is relatively straightforward, with three principal and a few smaller landowners or leasees present. All we engaged with strongly support the proposed eradication operation as does the the local iwi/imi and the Department of Conservation. As the Chatham Island Council is funding this Feasibility Study it is assumed the local unitary authority also does. The author understands that both local iwi/imi also approves of the proposed eradication.

The Taia Block (southern block) is public conservation land currently in a covenant and farmed by the Hokotihu Mori Mori Trust. It is subject to a Waitangi Treaty Settlement process and is due to be transferred to local Mori Mori or Māori land trusts. The final decision rests with Minister of Conservation, but the process has been stalled for several years. This situation needs to be resolved, preferably before any eradication work begins, so the operation can proceed without the risk of being shut-down by a new landowner, although the both of the possible new landowners strongly support the proposed project.

There is obviously some need to build community support for the proposed eradication and this will require consistent communication and dialogue. A project coordinator has been employed and been engaging with landowners and community for past 18 months and has gained social license for the operation and the overarching vision of the Chathams Restoration Trust. This position will be essential in the lead up to, and during, any eradication operation. This person will be the main contact and representative for the operation and has extensive experience and history with the Chatham community and pest control or eradication operations elsewhere.

Employment of locals provides a degree of certainty for income, which improves the strength of the community. Where possible, locals should be employed where they have shown the expertise to carry out the work, or the desire to upskill and build local capacity. With regard to the proposed cat eradication operation itself, it requires a high degree of expertise, professionalism and determination to undertake cat *eradication* work in particular. There will be opportunities for motivated and proven local staff to be involved but the best people for the job should be employed, which will not necessarily be locals.

Table 2. Key Stakeholders

Key stakeholders identified so far:

Name	Organisation	Contact details	Notes/comments
NE Chatham landowners and leasees	Individuals	Chatham Island	Preliminary discussion with some locals about feral cat and possum removal has been conducted. More detailed proposals regarding removal techniques, land access, staffing, and plans after feral cats & possums are eradicated, will need to be discussed and agreed before proceeding with eradication planning.
Moriori Imi Settlement Trust (MIST)		Maui Solomon	A significant Chatham Island landowner and partner with DOC.
Hokotehi Moriori Trust		Tony Blackett	Treaty partner, and farming the Taia (southern) block
Ngāti Mutunga o Wharekauri Iwi Trust (NMOW)		Gail Amaru	Treaty partner
	Chatham Island Council		Requirements for bylaw on cat de-sexing for Chatham Island domestic cats.

	Conservation Board		
	NOTE – this is incomplete		

9. POLITICALLY AND LEGALLY ACCEPTABLE

This eradication operation would need to take place largely on private land owned by relatively few landowners, including Moriori land, and Public Conservation Land. Permission to access properties to apply toxins, service traps or hunt cats and possums on an almost daily basis will require on-going and long-term permissions from all the landowners. This will be a critical requirement for the operation to proceed as all cats/possums will need to be subject to the removal methods to ensure success (Section 5.7). At this stage there have been initial discussions about whether the cat and possum eradication would be supported by the community, but explicit discussions about land access have not been initiated. Obtaining access permission will likely involve extended and careful consultation with all landowners.

There will also need to be agreement from residents that any domestic cats within NE Chatham and any cats brought into the area in future would need to be de-sexed. DOC can assist with this action as they do on Pitt Island, but it should also be supported by a local council bylaw. A similar bylaw exists for cat owners on Stewart Island/Rakiura.

All the techniques described in Section 6 are legal for use in New Zealand and DOC has protocols that their operational staff to refer to that can be used. Any use of PAPP for cats, or other toxins for possums, would require the operational staff to have a Controlled Substance Licence and be an approved handler. The operational staff will need to follow the legal requirements in regard to humane control and dispatch of the animals.

10. ENVIRONMENTALLY ACCEPTABLE

Most of the environmental impacts from the cat and possum eradication would likely derive from the repeated use of existing 4WD roads and tracks, along with the establishment of some new tracks to improve access.

The impact of trapping, shooting and any possible poisoning of feral cats and possums should be limited almost entirely to these two pest animals, although possible non-target trapping of weka and some small birds could occur. The use of soft-jaw traps, lure masking,

and effective hazing will likely reduce the risk of capture and injury to non-target species at ground level.

Any possible use of PAPP would need careful deployment. Cats are highly susceptible to PAPP, much more than almost all other species and particularly non-carnivores, and extremely small amounts (80mg) are required in each cat bait to be effective. There are few non-target species on the island that would take the meat baits, and it can be presented to minimise off-target take by weka, gulls, rodents, feral pigs, etc. As the poison breaks down into its non-toxic constituents during its action within the animal no residual toxin is left in the ecosystem. Methylene blue is a readily available antidote (Eason et al. 2014). The principal concern for using PAPP would be for domestic cats and dogs, which could be managed simply by constraining them for each of the 1-3 nights the poison is presented within bait stations for a knock-down of cat numbers during the early part of the eradication.

The baits can be presented in bait stations, in very small amounts (0.04g) within a bait matrix (meat ball). When applied with non-toxic pre-feeding followed by 1-2 nights where toxic bait is available, it reduces to very small levels the amount and time it is accessible. It is soluble in water and is readily broken down by soil organisms. These attributes, along with its mode of action (breaks down as it poisons) means there is virtually no risk to non-target species such as sheep or pigs, or humans as a secondary consumer (Eason et al. 2014).

Similarly, for ground-based application of toxic baits for possums can be presented to reduce non-target consumption. There are a suite of toxic baits that can be used (Warburton et al. 2021), although only 1080 could be used for aerial application without a special dispensation. If this latter option is pursued, the southern portion of the NE Chatham site is the best location for this, as it has limited public access, and terrain that suits aerial techniques better than ground baiting (Section 6.2.1)

11. CAPACITY

A team of about 10-12 field staff would be needed to ensure consistent and intense pressure is applied to the feral cat and possum populations to ensure their rapid knock-down and removal (Section 6.2.1). There are staff involved in several cat control operations currently operating in New Zealand and Australia, and as well as numerous personnel from previous possum eradications and control operations, which suggests that sourcing experienced poisoning, trapping and hunting staff should not be especially difficult

Where local Chatham Islanders can show they have the required experience and motivation for the eradication operation they should be employed. This would build local capacity in eradication techniques which would be applicable further if the project expands to

encompass Chatham Island, and is also transferable elsewhere. Certainly in the establishment phase there is scope for employing locals to assist with the initial trap network set-up.

Accommodation is available at a house in Kaingaroa, and the Taia house in the southern block. There will likely need to be some modifications to the houses for increased number of staff, including additional beds, insulation, and improved power supply for example.

It is essential that an operation of this size and cost has effective and enduring institutional, financial, and planning support from the managing entity from the funding body through the Senior Manager/Director level down through the management levels. This is to both champion the project and secure funding for it for its entire duration, but also to support the local community, and assist the staff carrying out the eradication.

It is highly likely there is the capacity to engage in this project.

12. AFFORDABILITY

The estimated cost for the eradication is \$11.1 million and an approximate cost estimate is presented below (Table 3). There will be a requirement for improvements to housing (the Taia house and at Kaingaroa), 4WD vehicles (utes & Polaris all-terrain or similar), and foot-track/4WD road construction/improvement and cat-aversion fence establishment (~\$1.5 million). Some of the establishment phase operation should use locals and equipment and these options should be explored (see Section 11).

Note that the estimated cost in Table 3 assumes that the operation will be a ground operation and staged so it begins with possum removal followed by feral cat removal. If aerial baiting for possums (and possibly cats) is used in the southern, and possibly the western blocks (~60% of the site), the operation is highly likely to be shorter in duration and cheaper. It is estimated that an aerial operation could trim about two years off the duration of a ground-based operation with a possible saving of about \$1.5 million when the aerial operation costs are included, for a total cost of about \$9.6 million.

The principal cost for the eradication will be staff time. Once equipment like traps and bait stations are purchased, there is a low-level of expenditure for their replacement & maintenance. Unfortunately cat and possum eradications are notoriously difficult to plan the timing for, as a few individuals of both species that remain in the latter stages of the operation are generally the most difficult to remove, so a proportionally large amount of time can be spent on them (Cowan 2002). The eradication will be conducted by a team of trappers/hunters, supported by a small team of detection dogs and handlers. As the eradication proceeds and possums/cats become scarce, a larger team of detection dogs and handlers will be needed to direct the focus of the entire team on the remaining animals. Once it is assumed the last possum has been removed, the eradication will then transition

to the cat eradication stage, possibly using staff from the proposed Pitt Island cat eradication, with on-going monitoring for possums concurrently for the next 12 months. Once all feral cats appear to have been removed then the operation transitions to a monitoring stage, to ensure no feral cats remain, and possibly to the set-up stage for expansion of the operation to adjacent portions of Chatham Island.

It will be essential that experienced and motivated eradication field staff and dog teams are employed to expedite the operation and careful selection will be required to obtain the best operators available.

It is pertinent to note that if sustained control was to continue as an option of managing possums and feral cats then a portion of the estimated cost outlined above would need to be paid in every successive year of control, to maintain possums & feral cats at low levels at the site in perpetuity.

With the likely reinvasion across the northern isthmus and the Hikurangi Channel to the south, there will be a need to maintain detection and interception tools and incursion response capabilities. This will require permanent staff dedicated to the maintenance and monitoring of this biosecurity system. This has not been costed for this operation, but would likely be in the order of \$150,000-\$180,000 per annum.

However, if the project then expands from NE Chatham, then biosecurity for this area will be subsumed into an eradication operation for the entire island.

Table 2.

Indicative budget for the eradication of feral cats & possums by a ground-based operation on NE Chatham Island (NZ\$)

Note: that this estimate does not include cost for ongoing biosecurity/incursion response at each end of the site (fence and Hikurangi Channel). The fence cost is based on a 2022 quote. A more detailed budget estimate, and a re-assessment of the fence cost, will be required prior to approaching funding agencies.

NE Chatham Feral Cat & Possum Eradication Estimated Budget		
Planning stage:		
Community survey & community impact assessment.	Contractor	\$40,000
Project Plan	Contractor	\$20,000
Environmental Impact Assessment	Contractor	\$15,000
Operational Eradication Plan	Contractor	\$15,000
Project officer	Continuation of the current position Once funding is secured, allow for at least 3-4 years planning before implementation.	\$?
Communication officer	Part-time position (2 days/week) until 6 months from eradication start (3 years)	\$170,000
Planning stage sub-total		\$260,000
Establishment Stage:		
House improvements to for housing additional staff.	Improved insulation, additional beds, improved power and heating etc. Contracted builder and materials	200,000
Track establishment in the southern block	3 staff x 3 weeks + equipment (chainsaws/scrub-bars etc)	20,000
4WD track improvement	Digger hire + operator and roading material	80,000

2 x 4WD utes	2 x \$75,000 plus transport to Chathams	160,000
2 x Polaris 4WD & transport to Chatham	2 x \$50K	100,000
Aversion fence and trapping buffer	300m fence on dry land, + 2km fence in Te Whanga Lagoon, including lake weed fences, traps + staff + flights + accommodation + transport of materials to Chatham Island	1,500,000
Establishment stage sub-total		2,060,000
Operational stage		
Year 0. Set-up	Project Manager and Ops manager – planning, staff recruitment, logistics, procurement & road/track establishment	200,000
Year 1. Staffing (Possum knock-down)	1 Ops Manager, 8 trapping/hunting staff + 2 dog teams for 8 weeks (\$400/day each). [11 staff in total]	700,000
Year 2. Staffing (Continued reduction - possums)	1 Ops Manager, 8 trapping/hunting staff + 2 dog teams for 8 weeks (\$400/day each).	700,000
Year 3. Staffing (possum mop-up)	1 Ops Manager, 6 trapping/hunting staff + 4 dog teams for 16 weeks (\$400/day each).	720,000
Year 4. Staffing (feral cat knock-down)	1 Ops Manager, 8 trapping/hunting staff + 2 dog teams for 8 weeks (\$400/day each).	740,000
Year 5. Staffing (Continued reduction - possums)	1 Ops Manager, 8 trapping/hunting staff + 2 dog teams for 8 weeks (\$400/day each).	750,000
Year 6. Staffing (cat mop-up)	1 Ops Manager, 6 trapping/hunting staff + 4 dog teams for 16 weeks (\$400/day each).	760,000
Year 7. Staffing (cat / possum eradication success)	1 Ops Manager, 6 trapping/hunting staff + 4 dog teams for 16 weeks (\$400/day each).	770,000

monitoring)		
Project Manager	Planning, staff recruitment, logistics, procurement & reporting 7 years x \$80K/year	560,000
Community Officer	Full-time. Begins contract one year before eradication begins. Point of contact for community, property access, etc. 8 years x \$65K/year	520,000
GIS technician	Part-time for 7 years.	105,000
Administration	Part-time support for \$15000 x 7 years.	105,000
Shipping	To/from Chathams for equipment	120,000
Return flights for off-island staff (return to NZ once each year)	12 staff @ \$1500 each per year	66,000
Food @\$30/pp/per day for 7 years	7 years x ~\$100K each year	700,000
Additional Rental accommodation staff (dog teams etc)	\$350/week x 52 weeks x 7 years	127,400
Diesel, and gas bottles	50km/day x3 vehicles x 7 years + 4 gas bottle every 3 months.	61,500
Dog food	4 dogs @\$5/day x 7 years	15,000
Equipment costs	Traps, rifles, ammunition, trail cameras, field gear, GPS, lures, bait, office equipment, replacements, maintenance, etc.	180,000
Operational Stage sub-total		7,900,000

Combined Establishment and Operational stages	10,220,000
Contingency (20%) (Rounded)	2,045,000
Implementation Stage, Expected cost (rounded)	12,265,000

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13. CONCLUSION

The eradication itself is technically feasible with limited environmental impact, and there appears to be a strong overall desire within the Chatham Island community to remove possums and to a lesser degree, feral cats. The proposed NE Chatham possum and cat eradication would be the largest ever attempted for possums, and the largest for cats in New Zealand. It will also be the first attempted on an inhabited island in New Zealand, and one of very few on such a large island worldwide, so is not without significant challenges. At ~7500ha it is a large site, is a relatively isolated and has a long logistical chain. The site does have some advantages, as it has local support and geographically includes several pinch points to aid operation management. As invasive mammal eradications on settled islands are only being attempted relatively recently, it will serve as a model for similar eradications on the Chatham Islands, and elsewhere in New Zealand, such as Rakiura/Stewart Island and Aotea/Great Barrier Island, and worldwide.

The significant cost of the operation, at NZ\$12 million, could probably be reduced by implementing aerial baiting on at least portion(s) of the site, as this would likely shorten the operational duration. This option, rather than a ground operation, is more likely to be opposed by a section of the community as they are generally wary of poison use and in particular 1080, and certainly not least by the hunting fraternity, who value pig hunting and may be at risk from secondary poisoning. The cost of possibly alienating a portion of the community will have to be carefully weighed up against the likely required budget to achieve the project's success. There is certainly a need for continuing community engagement before the proposal starts in order to understand and respond to concerns that locals may have. It is likely there will be a degree of compromise required to make the project acceptable to the majority of Chatham Island residents.

The likely biodiversity benefits from eradicating possums and cats from the site are limited, as rodents and feral pigs will remain. The benefits will mainly accrue to a degree of improvement to forest diversity and structure in the stock-fenced reserves, and to a few bird species such as parea and tui, and some seabird and wader species like the endemic oystercatcher. There will almost certainly be social and economic benefits from the operation, with increased employment and skills uptake, and the cessation of possum damage to gardens and pasture, and fouling of water supplies. Less obvious outcomes, such as improved tourism numbers or increased local produce may also occur.

However, there will be an ever present risk of reinvasion by both cats and possums via the northern isthmus and southern channel, requiring constant vigilance and expense to ensure they do not re-establish. If these species cannot be effectively blocked from reinvading it means the project fails the second of the nine criteria for successful eradication, namely that immigration is prevented. However, if the NE Chatham project expands to all of

Chatham Island, then this issue is moot. If the project is a trial to learn how to remove cats and possums from the rest of Chatham Island, and showing the local community how it can be done, then this is the best site for the operation on the island.

As the aims of this proposed eradication operation are a mix of biodiversity improvement, social, cultural and economic goals, and the provision of a proving ground for eventual expansion, this proposed project will serve as an example of the multiple benefits that can flow from invasive species eradications on inhabited islands in New Zealand and further afield.

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14. RECOMMENDATIONS

The following recommendations are in loose chronological order, and will need to be part of the process to implement the NE Chatham project.

1. Give the NE Chatham project a name that has an acronym that is easy to relate to and use.. The *Predator Free Chathams Project* (FCP) is good as a moniker for the long-term project as a whole, but not user-friendly for day to day use and may not be readily recognised by locals. Try something with a vowel or two (e.g. Chatham Island Invasive Pest Eradication Project – CIPEP) that rolls off the tongue.
2. Continue engagement with landowners & leasees well before the operation planning begins to obtain agreement on techniques and tools for feral cat/possum eradication purposes, and on formal terms for any property access. Establish an effective database to begin the process of formally noting the meetings, land tenure, access, eradication tools allowed, and associated agreements.
3. Undertake a formal survey of the community support for the proposed eradication and any concerns. This document will need to be presented to funders to show you have a strong level of support for the project (~75-80%+), and also likely issues that need further work on. It is suggested this, and 4. below, are carried out by an independent contractor with experience in social surveys.
4. Undertake a survey for, and then draft, a formal community impacts assessment. This will be needed to take to funders to show CRT has taken the community concerns into consideration when planning the project. See 3., above.
5. Source funding source(s) for the operation, or operational phases.
6. Once funding is secured, ensure the integrity of the proposed project by undertaking a transparent tender process for suitably qualified eradication practitioners to provide planning, technical advice, documents and oversight.
8. The overall project governance should be provided by a Steering Group comprising members from CRT, CIC, DOC and community stakeholders.
9. Oversight of the technical portion of the eradication will require the formation of a Technical Advisory Group (TAG), comprised of persons with experience of eradications on inhabited islands, with some cat and possum eradication/and or research experience. 10. Draft a Project Plan for the operation. This document provides the overarching details of how the eradication will be run and managed and sets out the detailed stages leading to and including the operation. It will also set out how the NE Chathams operation sits within the wider Chatham Island goal, so it is suggested that this includes the general overview of the entire Chatham Island

eradication, but focusses on NE Chatham for now. It can be added to and amended for the entire island as lessons from the NE Chatham operation can be used to inform the approach for the rest of Chatham Island. For an operation of this size it would be advisable that an independent experienced eradication contractor drafts it.

11. Continue with regular updates for the community, which should increase in frequency as the operation start date approaches. This should use several channels to reach all community members. This will be essential to circumvent the inevitable rumours that will appear in an information vacuum. Refer to the CRT Communication Plan.

12. Draft an Environmental Impact Assessment. This is likely be a requirement of the local council or Regional Council, but in any case will be an essential document if the project is challenged, especially in court. An independent, experienced eradication contractor should be able to provide this service.

13. Draft an Operational Eradication Plan for feral cats and possums on NE Chatham. This document sets out the details of how the eradication(s) will work on the ground. Additional planning documents should include a Health & Safety Plan and Compliance Register. Again, in order to expedite the process and ensure a quality product, contracting an independent, experienced eradication contractor would be advisable.

14. Maintain a brief on the transfer of ownership of the Taia (southern) block of NE Chatham.

15. Contact Keith Broome (Island Eradication Advisory Group - DOC) to oversee independent review of all plans/assessments associated with the proposed eradication.

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Appendix 1. Site Visit

The author visited Chatham Island from 8-12 August and met with several landowners and leasees. He also had a meeting with the Mayor and ECAN representatives, mainly to discuss biosecurity. Much of the site was traversed on August 13th days to assess the site for cat and possum eradication.

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