



# Secretary Island Operational Plan

## Part A - Stoat Eradication

SOUTHLAND CONSERVANCY – 2005



Department of Conservation  
*Te Papa Atawhai*

# Secretary Island Operational Plan

## Part A - Stoat Eradication

Chris Golding, Pete McMurtrie, Kerri-Anne Edge, Murray Willans

2005

Produced by  
Department of Conservation  
PO Box 743  
Invercargill, New Zealand  
June 2007  
978-0-478-14228-0 (hardcopy)  
978-0-478-14229-7 (web PDF)

Publ.info.

© Copyright June 2007, New Zealand Department of Conservation

DISCLAIMER AND RESTRICTION OF USE: THIS IS A DRAFT REPORT. It has not been reviewed or approved for publication. The Department of Conservation takes no responsibility for the accuracy of the report and the findings and opinions expressed therein. While it remains a draft, this report is restricted for internal use within the Department of Conservation. It must not be sent or copied in whole or part to any external agency, cited in any publication, or quoted publicly without prior written consent from the Chief Scientist (Research, Development & Improvement Division), Department of Conservation.

## CONTENTS

1.	Introduction	5
1.1	Conservation Objectives	7
1.2	Operational Objective	7
2.	Infrastructure	8
2.1	Traplines	8
2.2	Huts and Bivvies	10
2.3	Communications	10
2.4	Transportation	10
2.5	Quarantine	10
3.	Stoat control	12
3.1	Initial Control	12
3.1.1	Traps	12
3.1.2	Tunnels	13
3.1.3	Tunnel Placement	14
3.1.4	Pre-baiting	14
3.1.5	Trapping	15
3.1.6	Data Collection	15
3.2	Re-invasion	16
3.3	Trapping Maintenance Programme	18
3.3.1	Secretary Island	18
3.3.2	Re-invasion control traps (Mainland and Stepping Stone Islands)	
3.4	Monitoring and Programme Evaluation	18
3.4.1	Result Monitoring	18
3.4.2	Outcome monitoring	19
4.	Staffing	20
5.	Milestones	21
6.	References	22
	Relevant DOC DME numbers:	23
	Appendix 1	24
	Appendix 2	25
	Appendix 3	26
	Appendix 4	27

Appendix 5	28
Appendix 6a	29
Appendix 6b	30
Appendix 6c.	31

# 1. Introduction

Secretary Island is the second largest (8140ha) and highest island on the Fiordland coast, rising to an elevation of 1196m above sea level. The island supports a diverse range of plant communities and habitats, ranging from lowland beech-podocarp forest through to sub-alpine scrub, tussock tops and herb fields. For a more detailed summary of the vegetation of Secretary Island refer to McNutt (2003) and Monks et al. (2005).

Secretary Island is relatively isolated which has restricted the number of mammalian pest species that have invaded its shores. Only capable swimmers such as stoats (*Mustela erminea*) and red deer (*Cervus elaphus scoticus*) have managed to reach the island. Other notable pest species such as rodents (*Rattus* sp and *Mus musculus*) and possums (*Trichosurus vulpecula*), which are common throughout many areas of New Zealand, are absent from Secretary Island. Due to the absence of rodents an abundant and diverse range of invertebrates exist on Secretary Island including significant populations of knobbled weevil (*Hadreamphus stilbocarpae*), cave weta (*Raphidophoridae* sp.), and tunnel-web spiders (*Hexathele/Porathele* sp.). The vegetation on Secretary Island has remained unaffected by the damaging affects of possums, with populations of possum palatable species still remaining (mistletoe sp., and mountain lancewood *Pseudopanax linearis*). Prior to 1962 the scientific value of Secretary Island's unmodified flora was identified and the island was declared a 'Special Area' of Fiordland. This 'special area' status was uplifted in the early 1980's in accordance to the National Parks Act 1980 (refer to Fiordland National Park Management Plan (1991). However, under the New Fiordland National Park Draft Management Plan (2002) the island status is classified as a 'Restoration' island (see Appendix 1).

Deer are thought to have arrived on Secretary Island in the early 1960's, and by 1970 a permanent population had established (Sansom and Von Tunzelman, 1985). Permanent vegetation plots and transects were first established in 1975 in order to measure deer impacts (Bathgate, 1977). An attempt at eradicating deer from Secretary Island was also undertaken by the New Zealand Forest Service. This eradication programme was reviewed in 1982 and was deemed to be an unrealistic goal at the time (Cuddihy, 1982). The programme finally ceased in 1986. Since then commercial deer recovery and recreational hunting has continued on the Island.

There are no accurate records for when stoats arrived on Secretary Island. Stoats were first recorded on Resolution Island (35km south of Secretary Island) in 1900 (Hill & Hill, 1987) and it is likely that stoats also arrived on Secretary Island about this time. The impact of stoats on native wildlife has been well documented throughout New Zealand (see King, 2005). For an island such as Secretary, which has no rodents, the effects stoats have on wildlife are thought to be much greater than in areas with both stoats and rodents. The removal of stoats from Secretary Island will give protection to many species on the island that are vulnerable to predation such as Fiordland crested penguin (*Eudyptes pachyrhynchus*), titi (*Puffinus griseus*), Northern Tokoeka (*Apteryx australis*), weka (*Gallirallus australis*), karearea (*Falcon novaeseelandiae*), kakariki (*Cyanoramphus auriceps*) and Fiordland skinks (*Oligosomo acrinasum*). Fiordland skinks have been located in very low numbers on the North west coast at Rocky Point (Goodman and Lettink, 2005).

The absence of rodents and possums, combined with a diverse range of habitats and a large area, provides Secretary Island considerable potential for restoration. The removal of stoats and deer will protect existing flora and fauna values on the island as well as increasing the potential for introducing a wide range of species which are threatened in other areas of New Zealand. These introductions could include such species as saddleback/tieke (*Philesturnus carunculatus*), South Island robin/toutouwai (*Petroica australis*), yellowhead/mohua (*Moboua ochrocephala*), rock wren/Hurupounamu (*Xenicus gilviventris*), and North Island kokako (*Callaeas cinerea willsoni*). An island ecosystem such as Secretary Island offers the best chance for achieving the goal of a pest-free sanctuary. The water surrounding the island provides natural and defensible boundaries which can be protected at a significantly lower cost when compared to similar areas on the mainland.

Considerable progress has been made in the area of control and eradication of stoats over the last five years. The eradication of stoats from Te Kakahu (Chalky Island) in 1999 (514ha) and Anchor Island in 2001 (1130ha) (see Willans, 2000 and 2001) have been planned and implemented in such a way that the methods used on these islands can be transferred to much larger islands such as Secretary Island.

Because of the proximity of Secretary Island to the mainland, some level of stoat re-invasion is likely. A study was initiated in 2000 to attempt to better understand stoat immigration rates to islands of varying distances from the mainland (Department of Conservation, Investigation Number 3406, Elliott et. al. un pub.). Stoats were trapped over four years on 20 Fiordland islands ranging in size from 2 to 200ha and within varying distances from the mainland, in order to produce a predictive model of stoat re-invasion. Information from this study will provide a useful tool for the long term management of Secretary Island and other in-shore islands where stoat control is planned. The model predicts that islands beyond 500m from a source population in Fiordland conditions receive very little stoat re-invasion. Therefore, permanent trapping networks on islands such as Secretary, Coal, and Resolution Islands, all candidates for stoat eradication programmes, are likely to keep stoats at such low levels that they will only have a very small impact on endangered wildlife there.

Current scientific opinion supports the view that large populations of any species are likely to be more genetically robust than smaller populations (Armstrong and McLean, 1995). If the removal of stoats is successful then Secretary Island will become the largest predator-free island in coastal New Zealand and has the potential to support viable populations of threatened and endangered species in the long term.

The proposal to make Secretary Island stoat free was first put forward in 2001 (Munn, 2001). Since 2001 there have been several expeditions to the island to assess the potential for stoat eradication. This assessment has included invertebrate observations, bird counts, observations of freshwater fish communities, and monitoring for the presence of rodents and possums (see Munn, 2001). Re-measurement of the New Zealand Forest Service permanent vegetation plots and vegetation plots established by Professor Alan Mark (University of Otago) were also completed in 2004 (Monks et al., 2005). In November 2003 a joint proposal for pest eradication from Auckland, Secretary and Resolution Islands was put forward to the government. In May 2004 funding was approved to undertake restoration of both Secretary and Resolution Islands over the next ten years.

The objective of this document is to outline an operational plan for the removal of stoats from Secretary Island and its continued maintenance in a stoat-free state. Planning is also underway to remove and/or control to zero population density red deer. This work is due to commence in 2006 and is dealt with in a separate discussion document (Brown, 2005) and operational plan (Crouchley and Brown, in prep.).

## 1.1 CONSERVATION OBJECTIVES

To enhance the existing ecological values of Secretary Island by eradicating stoats and to minimise the risk of reinvasion by reducing stoat density on the adjacent mainland and stepping stone islands. To reintroduce threatened species (e.g. mohua, tieke - saddleback, South Is. robin) to Secretary Island once it is stoat-free.

## 1.2 OPERATIONAL OBJECTIVE

To establish a network of marked trap lines, flyable bivvies, and VHF communications over Secretary Island for the purpose of removing all stoats from the island.



## 2. Infrastructure

### 2.1 TRAPLINES

A number of the old New Zealand Forest Service routes (early 1970's) are still present; however these only cover a small percentage of the island. To remove stoats a widespread network of trap lines will be required (see Figure 1). Trap lines will be marked routes across the island. Routes will be cut, cleared and marked following similar guidelines to the Standards New Zealand Handbook: Tracks and Outdoor Structures (SNZ HB 8360, DME WGNRO-20578). Secretary Island is very steep and in some places tracks will require fixed ropes where unassisted climbing is difficult or dangerous. Fixed ropes will be established following the same standards used on other Fiordland islands (refer TEAAO-17001, Fiordland Islands Fixed Rope Inventory). As stoat trapping is planned to take place in winter, when the days are short, markers along the trap lines will have a small piece of reflector tape, especially at the end of each line and on lines leading to huts/bivvies. Reflective tape will improve safety on the island by assisting potential late returns.

Figure 1 shows the proposed network of trap lines. Due to the nature of the terrain on Secretary Island the final placement of these trap lines is expected to vary (see Appendix 2 for actual trap lines). Proposed trap lines follow main ridge lines and spurs, habitat boundaries, waterways and easily traversable terrain. The trap line network has been designed so that no area on the island is greater than 700m from a trap. Home range estimates for stoats vary according to gender, season, and food availability (Erlinge, 1977; Murphy and Dowding, 1995; Alterio, 1998). Murphy and Dowding (1994) reported an average home range for four male stoats of 206 (SE = 73) ha and 124 (SE = 21) ha for 5 female stoats in a Fiordland *Notbofagus* forest when rodent numbers were low. The trap line network proposed for Secretary Island, therefore, should ensure that every stoat is likely encounter a trap tunnel (Appendix 3). Based on a two-dimensional map of the island, the proposed trap network equates to approximately 100km of trap line. To obtain a required average trap density of 1 trap set per 9ha (see Stoat Control), approximately 135km of trap lines will be required. Given the steepness of the terrain on Secretary Island 100km is likely to be an underestimate. Taking into account the extra distance for altitude, and also placement of traps along the coast (approximately 16km), the required 135km of trap line should be achievable. A further 5.5 km of trap line will be cut along the adjacent mainland from Open Cove to Deas Cove and additional traps will be accessed by boat along Thompson Sound and from Espinosa Point to Pack Point in Doubtful Sound. Twenty-eight kilometres of the Secretary Island trap network already exist as part of the old NZFS track network, however, these existing tracks will require considerable re-cutting and marking before trap lines are established.

The success of the stoat trapping will rely on a network of trap lines that are well maintained and cover the whole island. It is crucial that the establishment of the trap network is finished before trapping begins so that stoats become familiar with using the lines. Furthermore, a well established trap network will allow for quick and efficient trap checking.

From October 2004, eight contract staff will be employed to establish the network of trap lines on Secretary Island and on the adjacent mainland. Cutting of trap lines is planned to commence in November 2004 and is expected to be completed before April 2005. The progress and standard of the trap line network will be monitored during this period by the Project Manager (Kerri-Anne Edge), the Assistant Project Manager (Pete McMurtrie) and Ian Thorne (Visitor Assets - Tracks). The progress checks will provide an early indication of whether the number of traps/tunnels estimated for the project is adequate and will also allow more time to purchase extra equipment or include more trap lines if necessary.



Figure 1: Location of old NZFS tracks (red) and proposed new network of trap lines (blue) on Secretary Island and the adjacent mainland. Dotted lines indicate traps that will be accessed via boat. Black lines on Bauza designate an existing trap network. Locations of the existing three huts are also shown.

## 2.2 HUTS AND BIVVIES

The locations of the existing huts, Rocky Point, Stantley Burn, and The Gut, are shown in Figure 1. These three huts will be upgraded to accommodate staff during the project (see TEAAO-17751 Business Case: Secretary Hut Upgrade). In addition, up to six flyable bivvies, that can be periodically moved, will be placed on the island (see TEAAO-19201 Secretary Island Construction Works Tender Document; TEAAO-18623 Business Case: Secretary Island Flyable Bivvies).

## 2.3 COMMUNICATIONS

Communication to Te Anau from Secretary Island will be provided by single sideband (SSB) radios at the huts and bivvies and by handheld VHF radios while in the field. A portable mini-repeater is to be erected on All Round Peak to provide local VHF coverage around the island and an emergency link to Te Anau Base via the Mt Irene Marine Repeater on VHF Channel 66 (see TEAAO-18043 Business Case: Secretary Island Communication).

## 2.4 TRANSPORTATION

The department's boat, '*MV Southern Winds*', is based in Doubtful Sound and will provide both transport and accommodation in and around Secretary Island during the project. *MV Southern Winds* also has two small tenders which can be used to transport staff to shore.

Helicopters will be used to position teams and stores on the island as well as translocating bivvies, traps and tunnels, etc.

## 2.5 QUARANTINE

Island quarantine for this programme will be undertaken in accordance with the Island Biosecurity Plan: Southland Conservancy (Agnew & Roberts, 2004). All food items including fatty or waxy items (soap, candles etc.) will be packed into plastic fish bins with lids that can be tightly sealed with a cable tie, or 20 L buckets with sealable lids. Food will be packed directly in fish bins from the supermarket, butcher and green grocer. This food will then be re-packed and stored at the Te Anau Quarantine Store before being transported to the island. Particular care will be taken to ensure that all foods products are clean and well packaged, especially with vegetables i.e. potatoes must be pre-washed, lettuce must not have dirt on the root system. All personal gear (staff and volunteers) will be packed using the self quarantine check list (Fiordland Island Quarantine Procedures TEAAO-14955) and then inspected by DOC staff prior to each trip.

All the wooden trap tunnels were constructed in winter 2004 and stored at the Te Anau AO workshop. Prior to transportation to Deep Cove, Doubtful Sound, each tunnel will be swept out to remove seeds, spiders, nesting material etc. and have the traps placed inside. Tunnels will then be stacked onto pellets and completely

wrapped in shrink wrap. Immediately prior to being flown to the island from Deep Cove these pellets will be broken down into smaller loads, visually inspected, and cleaned if necessary.

After their construction the six bivvies to be used on Secretary Island will be stored in the court yard at the back of the Te Anau AO Workshop. Bivvies will be placed on clean boards/bearers to ensure they are not in direct contact with the ground. They will also be made as rodent proof as possible; all possible entry points will be blocked with the appropriate measures and rodent bait stations placed inside. An inspection of these entry points and the bait station is to be conducted at Deep Cove immediately prior to flying them to the island.

Each Bivvy will be thoroughly cleaned on the inside; floors must be vacuumed and the wall, bench and floor spaces washed down with Vercon™ (an anti-viral/bacterial agent). The person cleaning the bivvy must wear clean foot-wear, preferably rubber gumboots treated with Vercon™ while cleaning. A fumigation bomb will be released inside the bivvy to kill any unwanted invertebrates prior to flying it to the island.

## 3. Stoat control

### 3.1 INITIAL CONTROL

The successful removal of stoats from three islands on the Fiordland coast, Te Kakahu (Chalky), Anchor, and Bauza Island, has provided valuable information about removing stoats from inshore islands. A combination of methods developed during these island eradications will be used to remove stoats from Secretary Island during the 2005 winter (see Appendix 4 for a summary of methods used on these smaller islands).

The response of stoat numbers to a beech masting event will not be as dramatic on Secretary Island (compared to the mainland) due to the absence of rodents. However, some bird and invertebrate species are known to increase in abundance following beech masts which could influence stoat numbers. The absence of a beech mast event on the Fiordland coast in autumn 2004 means that there will not be a stoat plague during the 2004/05 summer. Therefore, stoat numbers are expected to be at their lowest during winter 2005. Winter is also the preferred time to trap stoats on Secretary Island due to a low level of suitable prey (see Appendix 5). Note this absence of prey also includes invertebrates, which have been shown to be a significant part of a stoats diet (Smith, 2002).

#### 3.1.1 Traps

Mark IV Fenn™ traps will be used in all tunnels during the initial knockdown of stoats on Secretary Island. Each trap will be waxed to minimise corrosion. Traps will be used as double sets (i.e. two traps per tunnel). This method has been highly successful with earlier stoat eradication operations in Fiordland.

There is a possibility that Fenn™ traps could be phased out in the future (due to animal welfare legislation) in favour of an alternative trap (e.g. DOC 150™). The wooden tunnels on Secretary Island have been designed to fit both Mark IV Fenn™ traps and DOC 150™ traps. Double Fenn™ traps may be changed to single set DOC 150™ traps on Secretary Island after the knockdown period (see section 3.3).

Double set DOC 150™ traps will be trialled in the mainland trapping part of the Secretary Island programme. This trial will use the first production run of DOC 150™ traps and be the first coastal field trial so it will be important to monitor trap performance and durability before phasing out the Mark IV Fenn™ trap. Plans are also underway to trial DOC 150™ in a single set to eradicate stoats from a smaller island (Coal Island, 1163 ha) at the same time as the operation on Secretary Island (Murray Willans, pers. comm.). If this trial proves successful DOC 150™'s could then be used as an eradication tool on larger islands such as Resolution.

A further advantage of using the DOC 150™ trap is that it can be more trap selective (see Re-invasion 3.2).

### 3.1.2 Tunnels

A combination of tunnel types (wooden, aluminium, and wire mesh) were used on Te Kakadu and Anchor Island (Table 1). Wire mesh and wooden tunnels were used for the Bauza Island eradication. Stoats were provided with a variety of tunnels because, although extensive research has been undertaken to determine the tunnel type most stoats prefer (Burns, 1993, Butler, 2003), it is possible that a few individual stoats will prefer to enter something different to the majority. This is an important consideration when aiming for eradication.

TABLE 1: PERCENTAGE OF STOATS CAUGHT FROM EACH TUNNEL TYPE ON TE KAKAHU AND ANCHOR ISLAND.

TUNNEL TYPES	TE KAKAHU (514 HA)		ANCHOR ISLAND (1130 HA)	
	% OF TUNNELS	% TOTAL STOATS CAUGHT (N.)	% OF TUNNELS	%TOTAL STOATS CAUGHT (N.)
Wooden	60	20 (3)	59	62 (10)
Aluminium	27	33 (5)	24	22 (4)
Wire mesh	13	47 (7)	17	22 (4)

A combination of wooden (c.65% = 600 tunnels) and wire mesh tunnels with coreflute lid (c.35% = 300 tunnels) will be used on Secretary Island (see Appendix 4a, b, c for proposed tunnel designs). Aluminium tunnels will not be used. The main difference between wooden tunnels and aluminium and wire mesh tunnels is the fact that the wooden tunnels have wooden floors while the aluminium and mesh tunnels have natural dirt floors. The wire tunnels will have a thin wooden base to keep the wire in shape but this will be covered in a 1cm layer of dirt. Because the mesh tunnels are easier to make weka proof than the aluminium tunnels and also they provide the greatest point of difference from wooden tunnels it was decided that aluminium tunnels could be dispensed with. This combination has also been used successfully on Bauza Island. A higher proportion of wooden-to-wire mesh tunnels will be used on Secretary Island. Wooden tunnels offer greater long term protection from exposure to salt air as well as increased reliability, with less chance of dirt, twigs etc. fowling the trigger mechanism.

Due to weka, kea, kiwi and kaka being present on Secretary Island, the tunnels will be of sturdy construction to avoid being damaged, and to also minimise any risk of injury to the birds. Wire mesh tunnels will be pegged to the ground.

Current standard best practice for tunnel design includes internal wire mesh baffles between the tunnel entrance and the trap. These baffles serve two purposes - 1. To direct the target animal entering the tunnel directly over the trigger plate and 2. Further reduce the chance of by-catch by making it impossible for a bird to spring the trap with its beak. In the initial stages of trapping on Secretary Island internal baffles will not be used in the tunnels. We felt that the addition of baffles would be a significant departure from the tunnel design previously used in island stoat eradication operations. After consultation with Daren Peters it was felt that the use of a baffle to direct a stoat onto the trigger plate is less of a concern for the smaller Mark IV Fenn™ and DOC 150™ traps than for Mark VI and DOC 200's which are more widely used due to the space next to trigger plate being quite small. For the purpose of preventing by-catch two alternative methods to baffles will be used.

In Fenn tunnels wire staples will be placed on the entrance-side of each Fenn trap to further prevent the trap being pulled/sprung by non-target species. DOC 150's will be screwed into the box.

Wooden tunnels will only be used in the mainland trapping part of the Secretary Island eradication. Nails will be used to narrow the entrance to prevent weka by-catch.

### **3.1.3 Tunnel Placement**

Approximately 900 tunnels will be required to yield an average density of one double-trap set per 9 hectares. Tunnels will be spaced at approximately 150m intervals (measured on the ground using a hip-chain line) along all trap lines during April and May 2005. Additional traps will be placed along the north-east coast of Secretary Island adjacent to Thompson Sound. These coastal traps will be serviced by boat and spaced at 150m intervals, although this distance will largely be determined by the terrain and safe landing sites. All tunnels along the coast will be wooden to provide better protection to traps from the salt air. Tunnels will be placed on level ground alongside trap lines or in a position where an operator can easily service them. Each trap site will be marked in both directions with a pink triangle, individually numbered, and a GPS location recorded. In tussock areas tunnel sites will be marked with a coloured (tangerine) fibre glass pole and a pink triangle.

### **3.1.4 Pre-baiting**

In previous stoat eradication operations in Fiordland, tunnels were pre-baited prior to trapping. It is difficult to know how significant pre-baiting was in terms of the success of these eradications. Pre-baiting is relatively low cost and the amount of bait take during pre-baiting for the previous operations suggests that the initial knock-down period may be reduced by this practise. Pre-baiting may also attract stoats that are reluctant to enter a tunnel because they can detect that other stoats have previously entered them.

Pre-baiting will be undertaken on Secretary Island two times between June and mid July 2005 (see section 5. Milestones). Traps will be placed in approximately half of all tunnels and will be set and sprung with the safety catch on during the pre-baiting period. Tunnels will be baited with one fresh hen's egg and a piece of meat (c.3cm cube) on the bait block between traps. Three meat types will be used- beef, rabbit and venison. This will cater for individual stoat preference. An additional hen's egg will also be placed outside the trap tunnel on the ground and another raised above weka-height balanced on nails on a tree (approx. one metre up). This regime should ensure that stoats become familiar with the traps and tunnels and that they associate the tunnels with food. After the first pre-bait round, tunnels will be left undisturbed for a period of one week after which time the level of bait take will be recorded and all tunnels will be re-baited. The second pre-baiting will be left for one week before the trapping begins. The level of bait take will be recorded after both pre-bait periods.

### 3.1.5 Trapping

All traps will be set on Secretary Island over a period of 3-4 days during July 2005. Each tunnel will be baited with a hen's egg and a piece of meat (beef, rabbit or venison) between the traps. The pre-baiting period will provide a clear indication of the time required to service traps on the island. The final trapping schedule will be confirmed after the first pre-baiting. It is envisaged that a team of 12 staff (combination of DOC and contractors) will undertake the trapping on the island. Each person will be allocated a block and will service approximately 20-30 traps per day during the initial 2 week knockdown period (Table 2). A team of four will service traps along the coast and will be based on the MV Southern Winds. This team will consist of one skipper, a dinghy driver, and two trappers. A period of fine settled weather will make the coastal work safer and easier. Trapping will be completed no later than 31st July due to natural food supplies becoming available (See Appendix 5).

The quality of the trapping effort during the initial knock-down will have a large influence on the success of the eradication operation. It is crucial that all staff responsible for trap setting are experienced stoat trappers to ensure traps are set properly and that problems are identified and rectified immediately. A day before the trapping is to be undertaken all trappers will be briefed and demonstrated the standard of trapping required. Any problems throughout the stoat trapping period will be discussed during nightly scheduled calls. The project manager will make a decision how these problems will be resolved.

TABLE 2: PROPOSED DAILY SCHEDULE FOR EACH PERSON DURING THE FIRST STAGE OF THE KNOCKDOWN BASED ON CHECKING/SETTING 20-30 SETS PER DAY PER PERSON.

---

Day 1	Transport to Secretary Island
Day 2	Set 1/3 of allocated traps (approx 20-30 traps)
Day 3	Set 1/3 of traps (approx 20-30 traps)
Day 4	Set last 1/3 of traps (approx 20-30 traps)
Day 5	Check traps from day 1
Day 6	Check traps from day 2
Day 7	Check traps from day 3
Day 8	Rest day
Day 9	Replace meat and check traps from day 1
Day 10	Replace meat and check traps from day 2
Day 11	Replace meat and check traps from day 3
Day 12	Transport off the island

---

### 3.1.6 Data Collection

The amount of bait taken from the two pre-baiting periods prior to trapping will be recorded. Detailed daily trap records will be recorded by each person during the knockdown period including the following:

- Date
- Name of trapper
- trap location
- trap type



- animals caught target or non-target
- sprung traps
- bait taken and bait type used
- stoat body weight and sex
- stoat sex

The whole stoat carcass will be frozen as soon as possible and kept for analysis. Each stoat will be aged from the teeth and baculum bones, have its body length measured, a tissue sample taken for DNA analysis and its stomach removed for diet analysis.

### 3.2 RE-INVASION

Secretary Island is exposed to the mainland on three sides, the southern, eastern and north-east coasts (Figure 1). Stoats are known to swim, with the maximum accepted stoat swimming range approximately 1200m, although they have been recorded on islands beyond this distance from the mainland in the past (e.g. Pigeon Island, Lake Wakatipu) (Loh, 1993). The majority of Secretary Island is beyond 1200m in a direct line from the mainland; however there are stepping stone islands in between. Given this proximity to a source population of stoats, and the results from the Stoat Immigration Study (Department of Conservation, Investigation Number 3406, Elliott et. al., un pub.), ongoing but low and manageable re-invasion to Secretary Island is likely. Trap lines will be established at set off points on the mainland and on stepping stone islands to minimise this risk.

Results from the Stoat Immigration Study also demonstrated that stoat immigration from the mainland to coastal islands in Fiordland was no higher in beech or rimu masting years than non-masting years (Elliott et. al., un pub.) and that trap lines still maintain high (66-90%) vacancy rates even during beech masting events. The trapping programme on Secretary Island will provide a more rigorous test of the model presented by Elliott et. al. (un.pub.).

DOC 150™ traps will be used on the mainland adjacent to Secretary Island. These traps will be adjusted to be set off at 240 gm thus able to catch a female stoat but lessen the by-catch of rats. This adjustment may increase the trap vacancy for stoats. These traps will be field tested on the mainland adjacent to Thompson Sound before the trapping begins.

Three key areas where stoats are likely to re-invade from have been identified (Figure 1):

- 1) North east coast across Thompson Sound;
- 2) Across Patea Passage to Bauza Island and then onto Secretary Island;
- 3) Across Pendulo Reach to Seymour Island and then onto Secretary Island.

1. Thompson Sound separates Secretary Island from the mainland on the north-eastern side. It is accepted that stoats can swim 1200m, making much of the north-east coast within swimming distance. Initial results from the 'Stoat Immigration Study on Fiordland Islands' have shown that the risk of re-invasion is significantly reduced for islands greater than 500m from a source population

(Elliott et. al., un pub.). The narrowest distance from Secretary Island to the mainland across Thompson Sound is approximately 950m. A trap line is to be established at this narrow point from Open Cove to Deas Cove, a distance of 5.5 km and trap tunnels will be spaced at a density of 100m intervals.

The rest of the adjacent mainland coast along Thompson Sound (15km) will also be trapped, and will be serviced by boat. As with the north-east coast on Secretary Island the placement of these traps will largely be determined by terrain and safe landing sites. The distance between traps will be 100m where possible. Approximately 150 double sets (using DOC 150™) will be required for this section.

2. Bauza Island lies between the south-west coast of Secretary Island and the mainland. Te Awaatu Channel (also known as the Gut) separates Bauza Island from Secretary Island, with the closest point between the two islands being 200m. Patea Channel separates Bauza Island from the mainland with the closest distance being 600m. The closest distance directly from the mainland to Secretary Island is 2km, which is considered beyond stoat swimming range. Stoat trapping of Bauza Island and surrounding islands (Table 3) is already underway. Stoats were removed between winter 2002 and winter 2003; no stoats have been caught on Bauza Island since June 2003. These islands will continue to be trapped as part of the Secretary Island Restoration Programme.
3. The distance from Common Head on Secretary Island to the mainland (1250m) is near the limit of a stoat swimming distance. Seymour Island is in the middle of Pendulo Reach and is considered to be a stepping stone island which could assist stoats to reach Secretary Island. The distance from the mainland to Seymour Island is 600m and from Seymour Island to Secretary Island is 950m. No stoats have been caught on Seymour Island since trapping began in August 2000. Trapping on Seymour Island will also continue as part of the Secretary Island restoration programme. A short trapline of approximately 15 tunnels spaced at 100m will be established on the mainland around Pack Point to manage re-invasion. These traps will be serviced from a dinghy.

This part of the trap network will require 180 wooden tunnels with double DOC 150™ sets (Total 360 traps).

All tunnels will be baited with a fresh hen's egg and a cube of meat (beef, rabbit or venison)

TABLE 3: TRAPS CURRENTLY ON ISLANDS SURROUNDING SECRETARY ISLAND.

Bauza Island	40 double MkIV sets	480ha	600m from the mainland	Stoats removed 2003 No stoats caught since June 2003
Utah Island	4 single MkIV sets	c.15ha	750m from the mainland	No stoats caught
Seymour Island	2 double MkIV sets	10ha	600m from the mainland	No stoats caught
Shelter Islands	2 double MkIV sets	19ha	450m from Bauza	Stoat caught May 2002

### 3.3 TRAPPING MAINTENANCE PROGRAMME

#### 3.3.1 Secretary Island

After the initial pulse of trapping (2 weeks in July 2005), all traps will be left set and re-baited with fresh hen's eggs and meat. These traps will be next serviced in the first year following the knockdown in November 2005, February 2006 (to detect dispersing juveniles), and July 2006. After this period they will be checked in November 2007, February 2007, and depending on the results from these checks, again in May 2007. Assuming the resident stoat population has at that stage been removed, the checks will drop down to two annual trips, in November and May. Note: the timing of this schedule of trap servicing may be altered slightly to align with the deer eradication plan for the island.

All mesh tunnels will be removed from Secretary Island after approximately 18 months (November 2006). Wooden tunnels will be left in place and are more durable, providing better protection for traps in the long-term. Wire tunnels pose a greater risk of material becoming caught in the trigger mechanism, especially with infrequent servicing. The majority of tunnels will be changed from double-sets to single-sets in November 2006 to allow for trap replacement (all Fenn™ traps in Fiordland are on an approximate 18 month replacement rotation where they are removed, sandblasted and waxed). The distance between tunnels will then be approximately 300m along all trap lines and 150m along the coastline leaving an average density of approximately 1 trap tunnel per 14ha on Secretary Island (cf. 11.3 for Te Kakahu and 14.2 for Anchor).

It is envisaged that Fenn™ traps will be phased out sometime in the future and they are likely to be replaced with DOC 150™ traps or something similar (refer section 3.1.1.).

#### 3.3.2 Re-invasion control traps (Mainland and Stepping Stone Islands)

After the initial knock down period, mainland and stepping-stone traps will be serviced twice annually in November and February. This timing of checks allows traps to be baited with fresh bait just prior to the juvenile dispersal period and then cleared after the majority of juveniles have dispersed. This programme has worked successfully on Great Island in Chalky Inlet (see TEAAO-7271)

### 3.4 MONITORING AND PROGRAMME EVALUATION

#### 3.4.1 Result Monitoring

A number of indices will be used to determine the success or otherwise of this programme. These include the number of adult and juvenile stoats trapped over time, the ratio of male to female stoats, and if necessary DNA from each individual stoat trapped.

Based on the Te Kakahu and Anchor Island stoat eradication programmes it is predicted that the majority of stoats will be killed in the first three nights of trapping, the balance being caught either over the remaining 10 days or in the period leading up to the November 2005 servicing trip. The eradication of stoats

from Secretary Island over a similar time frame to Te Kakahu and Anchor eradication programmes will be confirmed if no stoats are caught during the February and July 2006 servicing trips.

If low numbers of stoats (i.e. 30 in Feb 06 then less than 20 per check there after) are caught in subsequent servicing trips up to May 2007 (July, November 2006, February, May 2007) and the indication is that numbers have declined to zero, then it would be concluded that while the eradication of stoats over a larger area like Secretary Island takes longer, it is still possible. If by May 2007, stoats continue to be caught on Secretary Island and the numbers do not decrease then the trapping programme will be reviewed.

Due to the varying home ranges of male and female stoats the sex ratio of male to female captures should provide a good indication of whether or not the whole population on Secretary Island is vulnerable to the trapping programme (King, 1994). Ideally at least 50% of all adult captures should be female. If the converse is true and markedly more adult males are being caught than females then it is likely that some female home ranges do not overlap with trap lines. Two factors should then be examined: trap density and spacing.

Hair samples will be collected from each fresh capture and bone samples from stoats that have been dead for a longer period of time. A preliminary analysis will be undertaken of 10 stoats from Secretary Island and 10 from the adjacent mainland to determine whether there is sufficient genetic structuring to distinguish island from mainland stoats. If the capture rates do not decline to zero over the first two years of the programme then DNA analysis may enable us to determine whether new immigrants are being caught or whether we are still targeting the original resident population (Dianne Gleeson, pers. comm.).

At least one trained stoat dog will visit the island every six months as part of the twice yearly trap servicing programme. Searches will be conducted on and off the stoat track network. All sign or indication of stoat presence while using dogs will be recorded with a G.P.S. location and checked again on each trap check. During the November 2005 stoat check special attention will be paid with dog searches to areas that have the largest distance between trap lines i.e. area where it is possible that stoat may not have encountered a trap tunnel. On subsequent trap checks dog searches will be focused on sites where stoats were most recently caught.

### **3.4.2 Outcome monitoring**

A wealth of information is readily available on the negative impact stoats have on New Zealand's native wildlife (King, 2005). For that reason it is unnecessary to invest heavily in outcome monitoring for this programme. The terrain and scale of Secretary Island would require significant resources in order to undertake any sophisticated species monitoring.

Baseline information for key animal species, however, will be collected prior to the removal of stoats. This work includes skink and invertebrate monitoring, 5-minute bird call counts, kiwi call counts, and bat surveys. Five minute bird call counts will be conducted during each November trap check and kiwi call counts at 5-yearly intervals following two consecutive February counts. A plan will be developed for ongoing monitoring of other species, including future introductions, as required.

## 4. Staffing

Project Manager - Kerri-Anne Edge

Operational Support - Pete McMurtrie - fulltime contract for 14 months beginning September 2004

Eight track staff (up to 6 month contract beginning in October 2004 - successful applicants will need suitable experience using track clearing equipment and working in teams in isolated conditions).

During the pre-baiting staff and the first stage of knockdown a combination of permanent and contract staff will be used for the trapping. Staff will be required to be experienced at working in backcountry conditions and competent at setting Fenn traps.

Volunteer staff will be used to supplement the programme from March 2005 in the following areas:

- assisting with track clearing and marking
- marking out trap network
- laying out trap tunnels
- pre-baiting

The advocacy benefits of including volunteers in this programme cannot be underestimated. However it will be critical to ensure that the project team are working to a high standard before additional people are included.

## 5. Milestones

DATE	ACTIVITY	STATUS
September-October 04	Obtain CAPEX approval for hut upgrades. Completed	
	Upgrade Rocky Point, Stantley Burn and Gut Huts	Completed
September 04	Tender for construction of flyable bivvies and get final CAPEX approval	Completed
September/ October 04	Obtain HO approval for radio repeater including projections for coverage, AM sign-off for Resource Consent, and confirmation from Channel 66 User Group.	Completed
	Obtain CAPEX approval	Completed
October 04	Locate temporary bivvies	Completed
3 Dec 04	Ground-check placement of stoat traps on a variety of routes to check spacing and number of stoat traps required.	Completed
	Check suitable landing sites for coastal traps.	Completed
	Check track standards.	Completed
14 Dec 04	Confirm track cutting programme is on schedule. If not, make adjustments as necessary.	Completed – wet summer may impact on finish time
1 Feb 05	Confirm trap availability and that all trap tunnel construction complete	Completed
1 Feb 05	Confirm track cutting programme is on schedule. If not, make adjustments as necessary.	Completed
23 Feb 05	Comments received on stoat operational plan	Completed
28 Feb 05	Confirm stoat trapping team	Provisional – some adjustments subsequently made but included a good back-up list
1 May 05	Confirm trap tunnel placement programme is on track, if not make adjustments as necessary.	Completed tunnel laying by May 25th
20 May 05	Confirm stoat trapping team and bait availability	Completed
20 June 05	First pre-bait	Completed
27 June 05	Discuss 1st pre-baiting programme and make any adjustments as required	Completed
5 July 05	Second pre-bait	Completed
3 July 05	Confirm trapping programme is organised to proceed as planned and the team have a clear understanding of the agreed plan.	Completed
One day prior to commencement of trapping	Assemble trapping team in Te Anau and run a briefing to confirm the programme.	Completed

## 6. References

- Agnew, D.; Roberts, A. 2004. *Island Biosecurity Plan: Southland Conservancy*. Department of Conservation Unpublished Report, Southland Conservancy.
- Alterio, N. 1998. *Spring home range, spatial organisation and activity of stoats *Mustela erminea* in a South Island Beech Forest, New Zealand*. *Ecography* 21:18-24.
- Armstrong, D.P.; McLean I.G. 1995. *New Zealand translocations: theory and practice*. *Pacific Conservation Biology* 2:39-54.
- Bathgate, J.L. 1977. *Secretary Island: the state of its preservation from deer*. New Zealand Forest Service Unpublished Report.
- Burns, R. 1993. *Northern Te Urewera Ecosystem Restoration Project Annual Reference Report 2002/2003*.
- Butler, D. 2003. *Rotoiti Nature Recovery Project Triennial Report July 1998 - June 2001*. Department of Conservation Unpublished Report, Nelson/Marlborough Conservancy.
- Cuddihy, M.J. 1982. *Secretary Island Special Area - Discussion Paper*. New Zealand Forest Service Unpublished Report.
- Elliott, G.; Willans, M.; Edmonds, H.; Crouchley, D. Un pub. *Stoat Eradication from islands in Fiordland*.
- Erlinge, S. 1977. *Home range utilization and movements of the stoat, *Mustela erminea**. *Wildlife Biology and Ethology*, XIIIth Congress of Game Biology, pp. 31-42.
- Goodman, A.; Lettink, M. 2005. *Secretary Island Fiordland Skink Survey*. Department of Conservation Unpublished Report, Southland Conservancy (SOUCO-55590).
- Hill, S.; Hill, J. 1987. *Richard Henry of Resolution Island*. John McIndoe Ltd.
- King, C.M. (ed) 2005. *The Handbook of New Zealand Mammals, 2nd Edition*. Oxford University Press.
- Monks, A.; Lee, W., Burrows, L., McNutt, K., Edge, K-A. 2005. *Assessment of forest changes on Secretary island, Fiordland National Park, from 1975 to 2003, based on long-term plot measurements, in relation to the presence of red deer*. Landcare Research Contract Report LC0506/007.
- Murphy, E.C. and Dowding, J.E. 1994. *Range and diet of stoats (*Mustela erminea*) in a New Zealand beech forest*. *New Zealand Journal of Ecology* 18: 11-18.
- Murphy, E.C. and Dowding J.E. 1995. *Ecology of the stoat in *Nothofagus* forest: home range, habitat use and diet in different stages of a beech mast cycle*. *New Zealand Journal of Ecology* 19:97-109.
- Loh, G. 1993. *Proposal to release *Mobua* on Pigeon island in Lake Wakatipu*. Department of Conservation Unpublished Report, Otago Conservancy Office, File BIR 5/3.
- McNutt, K. 2003. *Secretary Island - Permanent plot Re-measurement*. Department of Conservation Unpublished Report, Southland Conservancy.
- Munn, A. 2001. *Secretary Island Report: A consideration of the ecological values of the island and the potential for restoration, 10-17 October 2001*. Department of Conservation Unpublished Report, Southland Conservancy.
- Sanson, L.V.; Von Tunzelman, J.R. 1985. *Wild Animal Control Plan for Secretary Island, Fiordland National Park*. New Zealand Forest Service Unpublished Report, Invercargill.
- Smith, D. H.V., 2002. *The Movement, diet and relative abundance of stoats *Mustela erminea* in the Murchison Mountains (Special Takabe Area), Fiordland*. Unpublished thesis accepted for degree of Master of Science, University of Otago, Dunedin.
- Smith, D.; Jamieson, I.G. 2003. *Movement, diet, and relative abundance of stoats in an alpine habitat*. Department of Conservation Internal Series 107.

- Willans, M. 2000. *Te Kakabu O Tamatea Stoat Eradication Project. Annual Review 1999/2000*. Department of Conservation Unpublished Report, Te Anau Area Office.
- Willans, M. 2001. *Anchor Island Stoat Research Project, Progress Report*. Department of Conservation. Unpublished Report, Te Anau Area Office.

#### RELEVANT DOC DME NUMBERS:

WGNRO-20578	Tracks and Outdoor Visitor Structures SNZHB 8630:2004
TEAAO-17001	Fiordland Islands Fixed Rope Inventory
TEAAO-17751	Business case Secretary Island hut upgrade
TEAAO-19201	Secretary Island Construction Works Tender Document
TEAAO-18623	Business case Secretary Island flyable bivvies
TEAAO-14955	Fiordland Island Quarantine Procedures
TEAAO-19363	Report on the re-measurement and establishment of grassland vegetation monitoring on Secretary Island Fiordland Natural Park, January 2005.
SOUCO-54011	Weed Management Kit Secretary Island
TEAAO-17449	Summary of results from Fiordland Stoat Immigration study



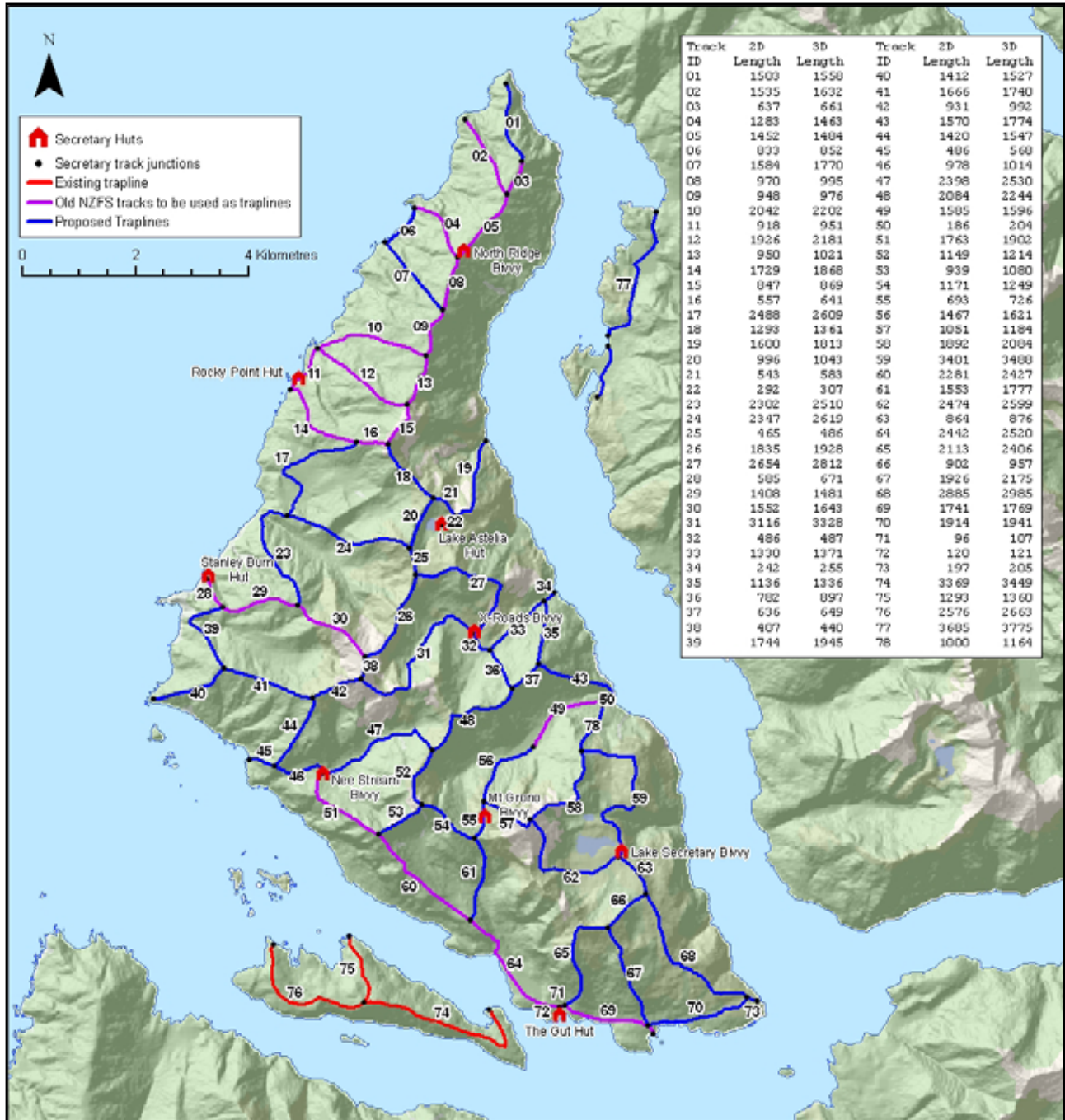
# Appendix 1

FIORDLAND NATIONAL PARK DRAFT MANAGEMENT PLAN (2002): ISLAND MANAGEMENT CATEGORY; RESTORATION

Primary Conservation Function	Recovery of viable populations of threatened species of particular communities.
Criteria for recognition	Opportunities for restoring habitats of threatened species and for restoring threatened communities, both those of islands and the mainland; modified and extremely modified islands of all sizes
Protective action for species and biotic communities	Consistent precautions against establishment of introduced plants and animals (with certain exceptions, see below) and against illegal visits and fires.
Protective and restorative action for archaeological sites	Sites of archaeological value protected with restoration of selected 5
Restorative action for biotic communities	Restoration of island Communities formerly present and extension of some still existing. Restoration of mainland communities where appropriate on islands free of limiting factors of the mainland.
Translocation of species not natural to the island	Island Communities: as for refuge islands excepting use of certain introduced plants as temporary cover. Mainland communities (on islands): permitted for appropriate mainland species and, in special cases, for animal taxa from the Pacific or Australia <sup>8</sup>
Habitat manipulation for particular species	Island Communities: choice of communities to be restored sometimes influenced by habitat requirements of threatened species. Mainland communities (on islands): major manipulation of habitats sometimes needed
Scientific activity	Experimentation using carefully monitored trials to measure progress of programme.
Visitors, education and interpretation	<ul style="list-style-type: none"> <li>i) low impact activities not possible in an open sanctuary;</li> <li>ii) permitted visitor to a few selected islands with interpretation/supervision:</li> <li>iii) volunteer help with restoration work on some islands. Refer 4.14</li> </ul>

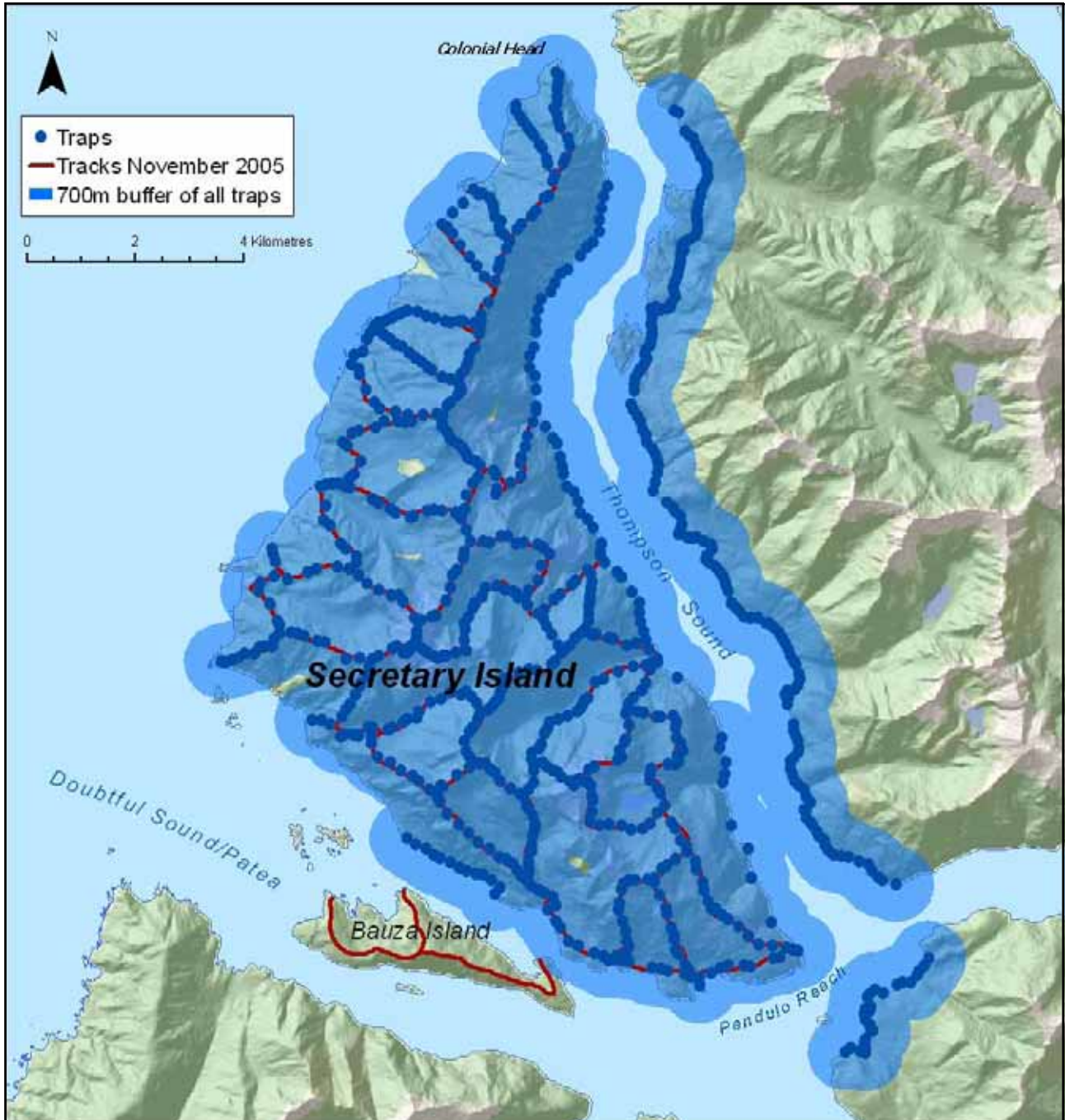
# Appendix 2

TRAP LINES ON SECRETARY ISLAND AS OF APRIL 2005 SHOWING 2-DIMNSIONAL AND 3-DIMENSIONAL DISTANCES FOR EACH LINE.



# Appendix 3

TRAP LINES ON SECRETARY ISLAND AS OF APRIL 2005 SHOWING A 700M BUFFER AROUND EACH AS AN INDICATION OF TRAP COVERAGE.



# Appendix 4

## SUMMARY OF STOAT ERADICATION METHODS USED ON THREE ISLANDS IN COASTAL FIORDLAND.

	TE KAKAHU			ANCHOR			BAUZA		
<b>Time</b>	1999			2001			2002		
<b>Area (ha)</b>	514			1130 (1100 excluding lake)			480		
<b>Traps used</b>	MkIV Fenns			MkIV Fenns			MkIV Fenns		
<b>Trap distance</b>	70-80m (some 50m)			150m			200m		
<b>No.traps</b>	140			161			41		
<b>Meters track/ha</b>	25			17.76 (18.1 excluding the lake)			15.6		
<b>Ha/ trap set</b>	3.4			6.8 (excluding the lake)			11		
<b>Tunnels used</b>	Tunnel types	% of tunnels	% total stoats caught	Tunnel types	% of tunnels	% total stoats caught	Tunnel types	% of tunnels	% total stoats caught
	Wooden (floors)	60	20	Wooden (floors)	59	62	Wooden (floors)	?	100
	Aluminium (no floors)	27	33	Aluminium (no floors)	24	22	Aluminium (floors)	0	
	Wire mesh (no floors)	13	47	Wire mesh (no floors)	17	22	Wire mesh (floors)	?	
<b>Pre-baiting</b>	13 <sup>th</sup> -16 <sup>th</sup> June			c.30 <sup>th</sup> June and 7 <sup>th</sup> July			25 <sup>th</sup> June and 15 <sup>th</sup> July		
	Half fish half eggs			1 <sup>st</sup> just eggs no tunnels 2 <sup>nd</sup> inside and out of tunnels alternately meat and eggs.			All pre-baiting was eggs and meat and eggs on nails c.1m above ground		
	Pre-baited for 2 weeks			1 <sup>st</sup> for 1 week 2 <sup>nd</sup> for 2 weeks			Both pre-baits were for 2 weeks		
	Almost all eggs gone, very little fish taken			1 <sup>st</sup> , 75% bait gone 2 <sup>nd</sup> almost all bait gone			Almost all baits taken by the re-bait on 15 <sup>th</sup> July		
<b>Trapping</b>	29 <sup>th</sup> June- initial checks every 2 <sup>nd</sup> day for 18 days			20 <sup>th</sup> July- initial checks every day for 8 days			5 <sup>th</sup> August- initial checks		
	Baited with 1 egg or 1 day old chick or fish			Baited alternatively with meat and eggs			Each tunnel baited with a hens egg and a piece of meat		
	1 <sup>st</sup> night c.80% of traps set, 2 <sup>nd</sup> night the rest set and other checked. For the next 12 days traps were checked, more tunnels were put in place in relation to sign. 14 days total.			1 <sup>st</sup> night half baited, 2 <sup>nd</sup> night other half baited, for the next 5 days all traps were checked. 7 days total			Report vague but traps set over 2 nights and checked for 2 days.		
<b>Catch data</b>	Initially 15 caught during winter 1999 1 caught October 1999			18 initially during winter 2001 1 caught November 2001			5 initially during winter 2002 4 caught November 2002 1 caught February 2003 1 caught April 2003		

# Appendix 5

FOOD AVAILABILITY FOR STOATS ON SECRETARY ISLAND. HIGH-LIGHTED AREAS (EXCLUDING INVERTEBRATES) ILLUSTRATE WHEN BIRDS BEGIN NESTING TO WHEN THE YOUNG HAVE FLEDGED.

	January	February	March	April	May	June	July	August	Sept	October	Nov	Dec
Grey Duck												
NZ Scaup												
Weka												
Kereru												
Kaka												
Parakeet												
Fiordland Crested Penguin												
Rifleman												
Brown Creeper												
Grey Warbler												
Fantail												
Bellbird												
Silver eye												
Blackbird												
Redpoll												
Tomtit												
Kiwi												
Titi*												
Invertebrates												

\* Very few birds, if any, nesting on the island.



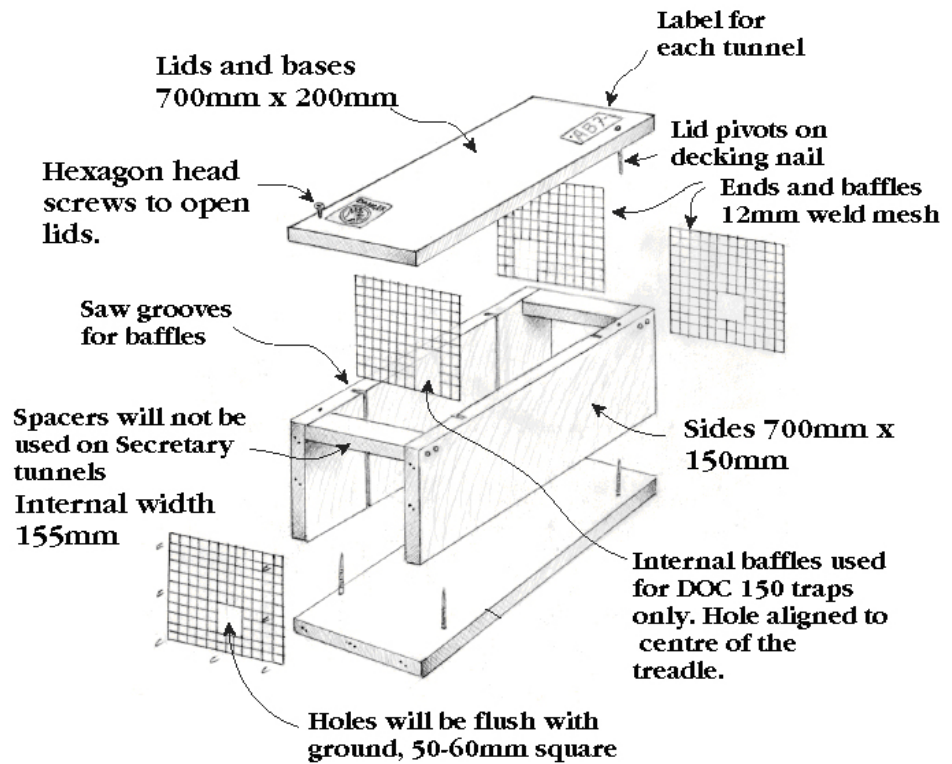
# Appendix 6a

Wire mesh tunnel with corflute lid to stop the traps being set off by heavy rain.



# Appendix 6b

Wooden tunnel design. Drawing - P.Waddington. Grooves for safety catches not shown, see Appendix 4c.



# Appendix 6c

Wooden trap tunnel with Mark IV Fenn™ traps.

