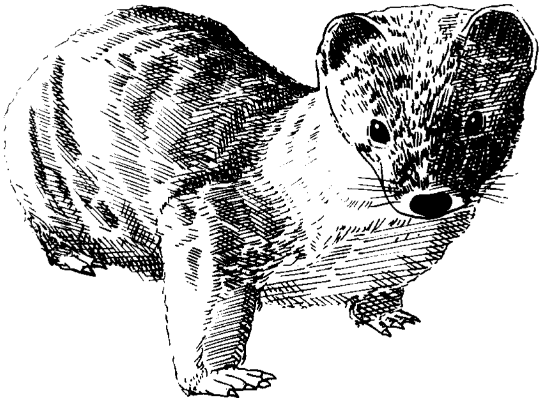
CONSERVATION
TE PAPA ATAWHAI

MUSTELIDS



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AN INTRODUCTION TO MUSTELIDS IN NEW ZEALAND

Elaine Murphy

In New Zealand we have three mustelid species, ferrets *(Mustela furo)*, stoats *(M. erminea)* and weasels *(M. nivalis)* which were introduced from England in the 1880s to try and control rabbits. They all display the typical long and thin mustelid body shape and females are about two thirds the size of males.

Ferrets are stockier and larger than either stoats or weasels and can vary in colour from white to brown to black. Their face is generally paler with a variable dark mask over the eyes. Both stoats and weasels are brown on top and white underneath. Stoats always have a black tip to the tail and are bigger than weasels. Weasels have a short brown tail and have a variable underside pattern. In very cold areas, stoats and weasels can turn white in winter.

Ferrets seem to prefer to live on or near open pasture or tussock, particularly in drier areas favoured by rabbits *(Oryctolagus cuniculus)*. They are rare in Northland, Taranaki and the east coast, and on the west coast of the South Island. Stoats are the most abundant of the three species, and are found everywhere, from sea-level to well above the treeline. In open country where there are ferrets and cats *(Felis catus)* (e.g. MacKenzie Basin) however, stoats are not so common. Weasels are widely but sparsely distributed and are the least common. They are found in grassland, scrub and forest.

Ferrets eat mainly small mammals such as rabbits and rats, but also feed on birds, lizards and frogs. They don't climb very well, so this restricts their diet to mostly ground-living animals. Stoats are opportunists and good climbers; they eat whatever is around, mostly birds, rats, mice *(Mus musculus)*, rabbits and invertebrates, especially weta. Weasels seem to eat mainly birds, mice and lizards (but we don't know a lot about them).

Ferrets, stoats and weasels all give birth around October. Young of the year from all 3 species become independent and are caught easily in December and January. Stoats, unlike ferrets and weasels, can only have one litter a year but in good years, can have eight or more young. Ferrets have four to eight young per litter aand weasels have about five young per litter (based on very little information).

The home range of ferrets varies in different habitats. At Pukepuke Lagoon, Moors & Lavers found female ferrets had an average home range of 12 ha and males 31 ha. On the Otago Peninsula, Dymond (1991) found the home range of a male ferret to be 107 ha. In the MacKenzie Basin, Pierce found female ferrets had an average home range of 111 ha and males 288 ha. The home range of stoats during a plague year in Fiordland beech forest was on average 69 ha for females and 75 ha for males. No one has looked at home range of weasels in New Zealand.

There has been very little research on the control or eradication of mustelids in New Zealand.

The effects of mustelids on native fauna may well have been under-estimated because few control operations have been undertaken or monitored. It is very important that the fundamental differences between sampling, control and eradication are clearly appreciated if a control operation is to be attempted.

SAMPLING:

- to see what predators are present
- monitor numbers
- diet analysis, age structure etc. i.e. finding out about the predator

CONTROL:

- don't *care* about the predator itself
- *only* measure of success is the enhanced survival or productivity of the species you are trying to protect
- you may need to kill 5 predators ... or 100,000

ERADICATION:

- get rid of every last one
- at this stage only possible on *small* islands e.g. Adele and Maud Islands but re-invasion is a problem

Before undertaking any CONTROL, you should know what species you are trying to protect and have one (or more) criteria for success. If it FAILS, this could be because the control was not effective, the predator was not responsible, or the situation is a lot more complex than you think!

The papers presented at the workshop summarise some of the latest research and management being undertaken on mustelids. O'Donnell described how trapping for stoats can dramatically enhance productivity and survival of the yellowhead, a threatened bird species. Crouchley reported on all the different methods used to try and catch stoats on Maud Island, high-lighting the drastic need for work on development of a bait and lure specifically for stoats. Murray reviewed successful management techniques to decrease the effects of predators on black stilts *(Himantopus novaezelandiae).* McKinlay told us of the co-operative effort between DOC, Otago University and private individuals, to study and try and minimize the effects of mustelids on yellow-eyed penguins *(Megadyptes antipodes).*

Trapping for mustelids in most cases has been shown to afford protection to threatened species, however it is very labour intensive and not very efficient. Mustelids are still having a detrimental effect on many of our threatened fauna and we need to develop methods for efficient control and eradication.

CURRENT MUSTELID RESEARCH

Ferrets

Population ecology - Central Otago & MacKenzie Basin. John Robertshaw et al. (Landcare Research, Alexandra)

Yellow-eyed penguin predators - Otago Peninsula. Henrik Moller et al. (Otago University)

Lure based on anal sac secretions. Kay Clapperton et al. (Private, Landcare Research)

Stoats

Development of new bait/lure. Eric Spurr et al. (Landcare Research)

Control methods for protection of yellowheads - Fiordland. Colin O'Donnell, Peter Dilks & Graeme Elliott (DOC)

Bait field trials - Arthurs Pass. Steve Phillipson (DOC)

Population ecology - Fiordland. Elaine Murphy & John Dowding (DOC)

Diet switch after 1080 poison drops - Mapara. Elaine Murphy & Phil Bradfield (DOC)

Ageing stoats - Fiordland & Mapara. Elaine Murphy & Malcolm Thomas (DOC/Landcare Research)

Bait trials - eggs/mice/cat food. Elaine Murphy, Carol Gardiner & Wayne Eggieton (DOC)

Predator aversion experiments with NZ robins. Richard Maloney (MSc, Canterbury)

General

Populations of mustelids in Pureora. Kim King (Private)

Bait field trials - Mapara. Ian Flux & Phil Bradfield (DOC)

Bait field trials - Kaharoa. Hazel Speed (DOC)

RESEARCH IN THE PIPELINE

Richard Maloney, Christine Reed & co-workers: impacts of habitat modification and rabbit poisoning on predators in the Tekapo area

Henrik Moller & students: predation of giant skinks by ferrets (& cats)

Christine Reed & Richard Maloney: teaching captive-raised black stilts about predators

Elaine Murphy & Ian McFadden: ecology of stoats & cats in the central North Island & their response to large-scale aerial poisoning operations

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Dilks, P., O'Donnell, C.O. & Elliott, G. 1992. Predator trapping in the Eglinton Valley, Fiordland, 1990-1991. Science & Research Internal Report No. 114, Department of Conservation, Wellington, New Zealand. 15pp.

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Murphy, E.C. & Dowding, J.E. 1991. Ecology and behaviour of stoats in a South Island beech forest. Unpublished report to Science & Research Division, Department of Conservation, Wellington, New Zealand. 14pp.

Murphy, E.C., Gardiner, C. & Eggleton, W. 1992. Preliminary bait trials with captive stoats. Science and Research Internal Report No. 128, Department of Conservation, Wellington. 6pp.

O'Donnell, C.O., Dilks, P. & Elliott, G. 1992. Control of a stoat population irruption in beech forest to enhance the breeding success of a threatened species, the yellowhead, in Fiordland, New Zealand. Science & Research Internal Report No. 124, Department of Conservation, Wellington, New Zealand. 16pp.

Taylor, R.H. & Tilley, JAV 1984. Stoats *(Mustela erminea)* on Adele and Fisherman islands, Abel Tasman National Park, and other offshore islands in New Zealand. *N.Z. Journal of Ecology* 7: 139-145.

STOAT CONTROL EXPERIMENTS IN THE EGLINTON & HAWDON VALLEYS

Colin O'Donnell

Despite the perceived threat of stoats *(Mustela erminea)* to some mainland bird populations, until recently there have been few data available to support these concerns. Research on the impacts of predators on hole-nesting forest birds has been undertaken in the South Island since 1983. The work has focused on mohua (yellowhead) (*Mohoua ochrocephala)* and kakarild (yellow-crowned parakeet) *(Cyanoramphus auriceps auriceps)*. The two major objectives were:

1. To determine the precise impacts of predators, particularly stoats, on populations of hole-nesting forest birds.
2. To refine techniques for the control of stoats using trapping.

Recent research has shown that mohua (a threatened, hole-nesting bird) suffer periodic population crashes in response to stoat irruptions that follow heavy beech seeding. A heavy seedfall in 1990 provided an opportunity to assess the impact of stoat predation on mohua by experimentally managing the predicted stoat plague. Mohua productivity was compared in two study areas, one trapped and one untrapped. There was a significant difference between the nesting success of mohua in the areas with 80% of the nests in the trapped area fledging young, compared m 36% in the untrapped area. Pairs produced nearly twice as many young in the trapped area from fewer nests and a higher proportion of adult females survived.

We continued our experiment during summer 1991-92 to determine if trapping would increase breeding success in a year when we predicted that stoat numbers would be low. Results confirmed that very few pairs remained in the untrapped area one year after the stoat plague, and that all the successful groups were still in the trapped area. Only 29 stoats were caught during the summer and no predation on mohua nests was recorded. There was no apparent difference between the nesting success of mohua in the two areas. However, overall breeding success was the highest ever recorded (from 5 seasons). Thus, stoat control during a non-plague year appeared to increase mohua nesting success markedly. Stoat control may not be always necessary in years when predator numbers are low but could be a valuable tool in assisting more rapid recovery in bird populations after population crashes.

The success of the stoat control experiment indicates that further development of stoat control techniques is warranted. Development should focus on both refining techniques for cost-effective trapping, and on searching for new techniques. Trapping could be developed by finding more effective lures, tunnel designs and trapping grid layout.

So far the effectiveness of different bait types, tunnel designs and trap positions in trapping stoats has been investigated in the Eglinton Valley, Fiordland and Hawdon Valley, Arthur's

Pass. Broken eggs were significantly more effective stoat baits than synthetic lures based on the anal sac secretions of mustelids and more effective than tinned cat food and possum carcase baits. Bait trials showed no significant difference between capture rates using broken eggs and dead mice (*Mus musculus*), but broken eggs were significantly more effective stoat lures than unbroken eggs, indicating that scent is probably an important cue to attracting stoats.

Tunnels with partially camouflaged traps were no more effective than those with wooden bases and visible traps, which are faster and easier to check in the field. More stoats were caught at the edges of our trapping grid.

Fenn trapping can be an effective localised predator control technique if optimum baits, tunnel designs and trap layouts are used. The trials significantly increased the breeding success of mohua within the trapped area. Of all the baits tested to date broken eggs and dead mice are the most attractive. Eggs are still recommended because they are relatively easy to obtain, store and handle in the field.

MAUD ISLAND STOAT CONTROL

Dave Crouchley

Maud Island (309ha) has high conservation value, largely because it is rodent free. At its closest point, Maud is 900m from the mainland and the maximum known swimming distance of stoats *(Mustela erminea)* is 1100m. It was not until May 1982 that the first stoat was sighted and trapping started immediately. Seven stoats, all less than one year old, were caught between December 1982 and August 1983, which indicated that the first animal seen had mothered a litter on the island. After the August 1983 capture, no further sign could be found - the original animal probably having died.

Stoats re-invaded the island seven years later. In December 1990 a stoat was caught and then in February 1991 a skull was found. When two further stoats, both of the same age class, were trapped in August and October 1991 it was suspected that another litter had been born. Two further stoats of the same age class were killed in December 1991 and January 1992, further supporting this theory. Sign would suggest at least one stoat is still present.

Mainly Fenn traps have been used in various types of tunnels and with a variety of baits and lures. Edgar traps were introduced in 1991.

Capture details:

Date	Age	Sex	Method	Bait/lure
Dec 82	<1 yr	♂	Fenn in a box	Fish
Dec 82	<1 yr	♂	Fenn in a box	Fish
Jul 83	<1 yr	♀	Fenn in a box	Unbaited at guinea pig (*Cavia porcellus*) cage.
Jul 83	<1 yr	♀	Fenn in a box	Unbaited trap in box in a gap in barrier across track.
Jul 83	<1 yr	♀	Fenn in a box	Scent gland of a stoat
Jul 83	<1 yr	♀	Fenn in a box	Unbaited trap in box in a gap in barrier across track.
Aug 83	<1 yr	♂	Fenn in a box	Unbaited trap in box in a gap in barrier across track.
Dec 90	Unk	Unk	Fenn in a box	Unbaited
Feb 91	>2 yr	♀	Found dead	
Aug 91	22mths	♂	Edgar trap	Whole egg
Oct 91	<2 yr	♀	Edgar trap	Whole egg
Dec 91	2 yr	♀	Fenn - no box	Unbaited, no fence, camouflaged
Jan 92	2 yr	♀	Shot	Called in with polystyrene squeaker
Jun 92	<1 yr	♀	Double ended treadle, unbaited, in sand pit	
Sep 92	Unk	♀	Edgar trap	Whole egg

Maud Island stoats have been extremely trap shy and have shown little interest in baits. They appear to have been feeding mostly on skinks, geckos and insects. Captures using baits were made during late winter/early spring and when the young would have just left the den.

Trapping was more successful when clean traps were set with gloves to reduce human scent. Beaches, sandpits and regular searching for droppings or kills have been used to detect the presence of stoats.

Trapping at possible launch sites on the mainland was established in November 1991. Stoats are being caught on two peninsulas 900 and 950m distant from Maud and this is seen as important in the long-term control of the stoat problem on the island.

MACKENZIE BASIN BLACK STILT AREA PREDATOR CONTROL

Dave Murray

Black stilts *(Himantopus novaezelandiae)* are an endangered species endemic to New Zealand. Since the 1960's breeding has been confined to the Mackenzie Basin. The current (1992) wild population is 72 which includes six productive breeding pairs and five non-breeding pairs.

Predation by introduced mammals (cats *(Felis catus),* ferrets *(Mustela furo),* stoats *(Mustela erminea)* and rats) has been the main cause of decline. The native harrier hawk *(Circus approximans)* and black-backed gull *(Larus dominicanus dominicanus)* are natural predators. A clutch of 4 eggs is laid in nests close to water on open shingle beds in braided rivers. Eggs and chicks are particularly vulnerable to predation and nesting adults are occasionally preyed on.

Black stilt management began in 1981 to help recovery of the species by improving breeding success. Eggs were taken for artificial incubation and some nest sites were surrounded by a ring of traps to remove local predators.

Two management techniques are used to reduce the effects of predation.

1. Egg Manipulation Nesting pairs are located, the date of laying ascertained and the full clutch removed and placed in an incubator (Table 1). Dummy eggs are placed in the nest to keep the parents sitting. Eggs are returned to the nest when hatching begins, usually about 23 days from the start of incubation. If the parent nest is lost during incubation the eggs are given to foster parents or aviary reared for later release to the wild.

TABLE 1: Hatching success of eggs artificially incubated

SEASON	WILD PAIRS	EGGS LAID	EGGS LEFT IN WILD	ARTIFICIALLY INCUBATED EGGS ONLY		
				INCUBATED	NOT HATCHED	HATCHED
1985/86	14	65	1	64	26	38
1986/87	9	41	2	39	o	30
1987/88	9	50	3	47	10	37
1988/89	11	59	2	57	27	30
1989/90	13	63	0	63	10	53
TOTALS		278	8	270	82	188

Artificial incubation almost eliminates predation of eggs. Some eggs may still be preyed on during the laying period and some during hatching. If the parent nest is lost due to predation of the dummy eggs, secondary management options are necessary for chick rearing.

2. Predator Trapping Trapping to reduce predator numbers is carried out around some nests during the incubation and chick rearing period. Leg hold, Fenn and cage traps have been used. Leg hold traps are the most effective type as they have the ability to catch and hold all predator species. Traps are set at approximately 20 metre intervals and trap numbers vary from 5 to 50 depending on various factors. Traps are baited with fresh meat,

mainly rabbit, and are replaced as required. Traps are checked daily and old baits and trapped animals are removed from the area. Details of the numbers of animals caught are in Table 2.

TABLE 2: Predators removed from around black stilt nest sites.

SEASON	TRAP NIGHTS	CAT	FERRET	STOAT	HEDGE HOG	RAT	HAWK	TOTAL	ANIMALS /100/TN
1985/86	13151	62	197	3	245	9	316	832	6.33
1986/87	9757	46	105	1	193	0	329	674	6.91
1987/88	2942	24	47	2	65	5	85	228	7.75
1988/89	1770	5	32	0	44	0	69	150	8.5
1989/90	2310	20	80	1	69	3	55	228	10.0

The number of chicks fledged in trapped areas is compared to those in untrapped areas in Table 3. One statistical analysis of these data showed that predator trapping had a significant benefit on the survival of chicks, d=1, x=7.17, $P<0.01$. Another analysis of the same data showed no significant benefit. The data and the analysis of it will always be questionable because:

(i) It is difficult to assess the effect of the skill of the operator.
(ii) It is seldom possible to be completely sure of the cause of chick loss.
(iii) There are many unquantifrable variables involved e.g. weather, topography, predator and prey densities, etc.
(iv) The data may be extremely variable from year to year.

TABLE 3: Survival of black stilt eggs and chicks in trapped and untrapped areas.

SEASON	NUMBER OF NESTS	NEST AREA TRAPPED		NEST AREA NOT TRAPPED	
		Eggs Hatched	Chicks Fledged	Eggs Hatched	Chicks Fledged
1985/86	14	29	16 (55%)	11	3 (27%)
1986/87	10	23	13 (57%)	10	3 (30%)
1987/88	7	15	8 (53%)	4	2 (50%)
1988/89	9	8	1 (12%)	15	7 (47%)
1989/90	12	15	7 (47%)	23	3 (13%)
TOTALS	52	90	45 (50%)	63	18 (29%)

The management techniques used have significantly improved the breeding success of black stilts. Prior to 1986 Ray Pierce recorded a fledging rate of only 7% at unprotected nests.

As a management technique predator trapping is very labour intensive and costly it provides seasonal protection only with no follow on effect. It is believed to be biologically, if not statistically, effective as a short term boost to chick production in a species so rare that every chick counts. In the long term other methods of eliminating or excluding predators are required.

CONTROL OF MUSTELIDS AND CATS TO PROTECT YELLOW-EYED PENGUINS

Henrik Moller*, Bruce McKinlay, Nic Alterio* and Hiltrun Ratz-
-University of Otago

A four year research programme, commenced in 1991, aims to provide advice on which predators are killing yellow-eyed penguin (YEP) *(Megadyptes antipodes)* chicks; what is the cost effectiveness of trapping to protect chicks; methods to improve efficiency of trapping and poisoning of predators; goals for the required degree of protection from predation; predator ecology and behaviour. The ongoing studies are being funded principally by the World Wide Fund for Nature (New Zealand) in association with the NZ girl Guide Association. Additional funds have been provided by the University of Otago, the Lottery Science Board, and the Yellow-eyed Penguin Trust.

Protecting YEPs from predators illustrates many of the formidable challenges facing managers who attempt to conserve widespread and sparse individuals of threatened species on the mainland. YEPs breed in at least 40 areas scattered over 250 km of coast (excluding the isolated Banks Peninsula birds). Most of the breeding areas have fewer than ten nests in them. Nearly as much effort and expense has to go into clearing predators from each of these small areas, as from the few large sites remaining (mainly on Otago Peninsula). Trapping will have to become enormously more cost effective, or effective poisoning techniques will have be developed, before widespread protection of YEPs can be mounted as a routine management strategy for the species recovery.

Trapping was carried out in ten-day sessions in September and November at five breeding areas in 1991. Traps used were: cage traps; two soft jaw Victors under wooden tunnels; "open sets" of Victors and Timms traps. The latter two trap types are set on surrounding land away from penguins to minimise the chance of penguins being caught in them. Fish bait is used and is renewed every 5-7 days.

The University team autopsied the captured predators for diet, age and reproduction studies. They also mark and recapture, and radio track mustelids and cats *(Felis catus)* in two YEP breeding areas. Disappearance rates of chicks are compared in trapped and non-trapped areas. Nests are being filmed at night under infra-red light to identify the predators killing chicks, and the sign left in the nests and on dead chicks is being carefully studied to try to identify the "signature" of each type of predator.

Predation is sporadic. Earlier work by Darby & Seddon showed that from 4% to 62% of the chicks are lost to predators in different years. Similarly some breeding areas are hit much harder than other sites in the same year. Only 1 of 66 YEP chicks from Ryans Beach and Pipikaretu Beach, Otago Peninsula, was preyed on even though mark and release and radio-tracking showed that over 13 ferrets *(Mustela furo)* and 13 cats lived in the area.

The sporadic nature of predation may result from the chance appearance of "rogue animals", but this may also reflect ecological conditions prevailing at different breeding areas. This research will attempt to identify predictors of predation risk so as to allow advice on where to target future control programmes. These predictors are important because there is little time to respond to an out-break only when and where it is detected. Several chicks can be killed each day, and it requires at least a week to remove the predators by trapping.

Predation slowed or stopped once stoats *(Mustela erminea)* were trapped. Large (some over 5kg) chicks were killed at Boulder Beach, Otago Peninsula, in January 1992, probably also by stoats. Earlier research shows that ferrets undoubtedly kill YEP chicks, but it is still unknown whether feral cats also prey on them.

The predator guild present at Catlins sites was dominated by stoats, but two weasels (*Mustela nivalis)* and one cat were also caught there. In contrast, ferrets and cars predominate in the predator communities existing in YEP breeding areas on the Otago Peninsula and the Moeraki area. If these differences persist, different predator control strategies may have to be mounted in the Catlins compared to more northerly sites.

Trapping can be effective. The Department of Conservation's predator control programme removed between 70% and 82% of the predators inhabiting the Boulder Beach area. Reduction in rates of predation of chicks coincided with the onset of trapping of stoats in the Catlins sites, and at Boulder Beach in January 1992. Other trappers report large reductions in chick losses when trapping was done in the mid 1980s on Otago Peninsula.

"Open set" Victors (trap buried against root or tree trunk, baffled on sides with sticks to guide the predator over the trigger plate) were more successful than cage traps in catching cats. Timms traps were the most successful trap type for stoats, and these traps also caught weasels. Open Victors and Timms have to be set in sites well away from penguin nests, and this different trap placement may have influenced the relative probability of each trap type being encountered by each type of predator.

Predator capture rates declined throughout each 10 day trapping session and we suggest a rough "rule of thumb" that it will require 2-3 weeks of trapping to remove the majority of predators from each breeding area. Further research will attempt to formulate a sensible "stopping role" i.e. trapping should be discontinued once capture rates have declined to less than some threshold number of captures in the last four days.

New cats and ferrets (probably immigrants) were trapped in the control areas within a month of removal of previous residents. This suggests that control operations should be delayed until as late as possible, while still ensuring that the predators are removed in time to protect the first bom chicks (end of October). A second trapping session (late November) midway through the chick guard stage seems advisable to remove immigrants or newly independent young born near to the penguin breeding areas.

Habitat modifications to create natural "biological controls" of predation are potential tools. One example is "vegetation buffers" of long grass fostered to create a "grass wall" to reduce predator access to the chicks. Radio-tracking studies in winter suggest that cats and ferrets may be attracted to the fringes of the buffers rather than avoiding using them. Cat seats were found along penguin trails through the buffers. Predation of chicks did occur deep within areas of long grass this year. Therefore trapping should be maintained even in "buffered sites" to minimise predation of chicks. Future research will attempt to find ways to protect the efficacy of vegetation buffer strips as natural biocontrols to protect chicks.

MUSTELID WORKING GROUPS

Participants broke into six working groups to discuss the topics summarised below. In these summaries recommendations or suggestions are shown in bold type.

1. MONITORING AND DETECTION OF MUSTELIDS

In New Zealand mustelids are generally at low densities and are wide-ranging. This can make monitoring or detecting them difficult.

We currently monitor mustelid populations by using kill-traps in index lines. This method provides a static sample at a given time in a limited area, and if repeated in the same area a second time, may not provide an accurate sample of the wider population (e.g. could give a locally-biased age sample; if initially the older resident animals are killed, juveniles may move-in to replace them). In a low density population, kill-trapping is probably also affecting the abundance of the population you are trying to sample.

In some experimental situations e.g. if you are trying to determine what effect predators are having within a system, then by removing some, you will alter the very system you are studying. In these situations, the use of tracking tunnels would be better for monitoring. Currently however, tracking rates of mustelids are so low that they make results hard to interpret or compare.

There needs to be further development of tracking tunnels for mustelids. A better lure is needed and smell, sound and sight lures are all suggested as avenues for research.

For detection of mustelids on islands, we need to think laterally and come up with a greater range of methods. Two suggestions were to use wax eggs to look for teeth imprints, and to monitor the abundance of a vulnerable prey species. It was even suggested that a vulnerable prey species such as quail or saddlebacks, be introduced to islands to act as indicators of mustelid arrival/presence.

Tracking dogs need to be tried to see whether they can readily locate mustelids in low numbers and to see how well they hunt them. **The use of a dog to track mustelids needs to be tested.**

The scent of a female mustelid in oestrus may be useful as a lure for detecting low numbers of mustelids. Another suggested attractant was a stuffed model of a mustelid, however, as with the smell of an oestrus female, this may only attract some animals e.g. territorial adults.

We need improved lures to assist in the detection of mustelid arrival on islands.

When mustelids which are newly arrived on islands are trapped, we should retain these specimens for further analysis; information on age structure, diet, etc. will assist with our future work on early detection and control strategies.

2. NEW BAITS, LURES AND POISONS FOR MUSTELIDS

Existing lures generally rely on fresh products: meat, eggs, fish, even live mice. Both ferret and stoat scent glands have been tried with variable results. We need baits that are long lasting and preserved in some way so that they can be stored, as well as being long lasting in the field.

More comprehensive work is needed on developing mustelid baits and lures. This should include the role of sight, sound and smell in food-location by mustelids. It must be borne in mind that a) it is very unlikely that any one bait or lure will work for all three mustelid species and b) different ages and sexes of each species may well respond to different baits and lures.

Currently, there are no poisons registered for use on mustelids. In 1961, DSIR undertook preliminary trials with five ferrets and found that 1.0 mg/kg 1080 was about the minimum lethal dose, however we know of no follow-up work. Anecdotal evidence exists that some stoats have been poisoned after 1080 operations for possums, and also on flour cyanide baits for possums. Ferrets have been poisoned with alpha-chloralose.

The susceptibility of mustelids to 1080 and alternative toxins needs to be determined.

In some situations it would be good if the poison was quick acting, especially if we need to know where the animal was killed. In most situations however, slower acting poisons would be acceptable. Application methods for the poison will also need to be developed.

A pelleted form of poisoned bait with a specific long-lasting lure should be developed particularly for stoats, but also for ferrets. The poisons will have to be fully registered for use on mustelids.

Improved advocacy is needed to emphasise the detrimental effects that mustelids are having in some parts of the country and to support the methods used to control or eradicate them.

3. TRAPS, TRAPPING AND TRAP TRIALS FOR MUSTELIDS

With the wide experience of predator trapping amongst the various conservancies, there is a need for occasional workshops for field staff to share their experiences and to bring staff up to date on newer techniques. Predator trapping instruction could also be included as part of a certificate of proficiency. It was felt that the use of videos for demonstration of trap sets and other aspects of predator control work would be useful.

There is a need for collapsible or lighter covers and tunnels for Fenn and other kill traps. **DOC should compile a list of the traps and cover types available, their weight, size, cost, durability and advantages and disadvantages.** There should be a watching brief on trap development overseas.

If field staff carry out *any* trapping operations, or bait or lure trials, these should be written up to provide information to other conservancies. **A standard procedure should be developed so that field staff know how to set up a trial correctly, collate the data and write up a brief report.**

Several field staff stated that predators often visited trap sites without being caught. **It was suggested that behavioural studies of mustelids about trap sites may be worthwhile. The use of a remote video recording system would be ideal.**

It has been suggested that human scent may deter mustelids from entering traps but the little evidence available is inconclusive. **Trials are recommended for assessing the impact of human scent on and around traps on the capture rate of mustelids.**

4. BARRIERS OR REPELLENTS FOR MUSTELIDS

The benefits of barriers are that they are one-off, are effective in the long term, are site specific, environmentally friendly, and may well exclude several or all ground predators if adequately designed. Poison and trapping operations on the other hand, are on-going, often labour intensive and their benefit to the area concerned is relatively short term.

One of the possible advantages of barrier techniques is that outside the protected area, there are likely to be no perturbations of predator-predator and predator-prey relationships.

Barriers could be natural like cliffs and water, or they could be fences made of mesh, tin or electric wires. The tinning of trees is a technique already in use. **The use of physical barriers for excluding mustelids should be explored.**

Sonic barriers may be effective although research into the frequency for such barriers is needed. The presence of light may be a barrier to nocturnal animals (but could attract others), and other visual signals may also act as a deterrent. Substances such as hotfoot (which is used to keep birds from roost sites) may be effective for some predators. The repellent scent could be applied by a spray, an impregnated tape, pellets or vaseline smear. **Chemical barriers in the form of repellent scents is an area that requires research.**

5. MUSTELID INTERACTIONS WITH OTHER SPECIES

Little is known about the interaction of predator species in New Zealand or the response of predator populations to various perturbations. Studies on mustelids are scattered and selective in the habitat types they refer to; e.g. Mackenzie Basin (Canterbury), Mapara kokako area (central North Island), Eglinton Valley (Fiordland), and Adele Island (Nelson). There is a need to **collate the existing knowledge of community ripple effects that have been observed after control operations**, to help identify areas for future research.

To understand how mustelids interact with other species, we need to know more about the mustelids themselves. **We need to understand the behaviour, movements and population**

dynamics of mustelids in different habitats, particularly those that are of greatest importance to threatened and endangered fauna.

One particular concern is how mustelids respond to control operations on their prey species such as rabbits or rats. We may need to include other agencies, e.g. MAF, to help establish what interactions there are with other species. We need to know what the behavioural response of one prey species is when the density of another is changed, and how this affects all members of the predator guild.

Two important operational considerations are the order in which species are removed or controlled in any given habitat, and an understanding of the secondary effects of this sequence of removals. It is recommended that MAF be asked to take aboard both concerns, and to look at long term rabbit reduction with the help of DOC.

Large-scale aerial 1080 poisoning is now used routinely to control possums and ship rats in forests but little is known of the knock-on effects on stoats (or cats). In view of the regularity of these operations in many parts of the country, it is of particular importance to gain an insight into predator-prey relationships in these areas as soon as possible. This will enable a more accurate assessment of the benefits or dangers, particularly to threatened species, of undertaking such operations.

We need to develop a better understanding of the interactions between mustelids, their prey and their predators, and how all these species respond to perturbations (such as poison or trapping operations) .

6. MANUAL ON MONITORING AND CONTROL OF MUSTELIDS

A manual on mustelid detection, monitoring and control methods is needed as a means of bringing together existing data, sharing information and improving skills. Caroline Miller King has a contract from DOC to produce such a manual, which is almost complete.

It was decided at the workshop however, that **it would be useful to have a short field guide** as well as the manual King is writing. The field guide should concentrate on the practical aspects of siting and setting traps and evaluating results. It should be similar in format to Cunningham & Moors, `A guide to the identification and collection of New Zealand rodents'

It was suggested that the field guide be written by people with recent field experience in mustelid control.

WORKSHOP- DETECTING AND MONITORING PREDATORS AND MANAGEMENT RESPONSES.

Facilitators: John Innes and Elaine Murphy

There are two main situations for which predator monitoring is required. The first is when a predator may have just arrived on an island or when an eradication there is nearly - or is believed to be - complete. In this situation the presence of one individual is of concern. At present there is little evidence suggesting that any one monitoring technique is better than others for this role, for any of the predator groups. Currently, all that can be justified is to use as many different techniques as possible. **However some new techniques which should be trialled include tracking tiles for cats, remote video photography for all species, trained dogs for mustelids and a captive, vulnerable introduced species as an indicator prey**. A comparison of the effectiveness of different monitoring systems could be made on an 'experimental island' (see pp. 40-41).

The second monitoring situation is that of predator abundance (not presence/absence), the usual situation on the New Zealand mainland. Present abundance monitoring techniques are poor for stoats and cats, but better for rodents. It is always advisable to use more than one technique if possible, especially if indices only are being used. Problems lie more with getting stoats and cats to visit devices (traps, tracking stations etc), rather than with the devices themselves. **Especially, effective lures are required for cats-and stoats. All of the lures we currently use are attractive smells, but sight and sound lures should be tried as soon as practicable.**

There are problems with the use of kill traps to monitor mustelids and rodents as these remove a portion of the population. Aging of trap-caught stoats shows that kill traps alter the age structure of the population but possibly not the density.

There is some evidence that traps from which human odours have been removed are more successful at catching stoats. **Removal of human odour from traps could be tried more seriously in New Zealand.**

Large scale field experiments ('research-by-management' programmes) can be valuable techniques for exploring predator impacts, although they need to be interpreted carefully. In the absence of non-treatment blocks, replication, or pretreatment data, monitoring of prey alone doesn't prove-that predator control has caused an increase in prey numbers. Ideal requirements to assess the importance of predation are prey numbers, predator number and the kill rate.

It is always useful to note the age and gender of trapped predators, especially those which have managed to reach an island or those which have survived a control operation.

Why do some predators choose to leave the mainland to cross water bodies to invade islands? **It would be valuable to explore the situation which facilitates island invasions by small mammals. This may allow predictive monitoring on mainland areas adjacent to vulnerable islands so that the chances of invasion are reduced significantly by action on the mainland rather than the island.**

Stopping predatiion is not the same as killing the predators. Barriers which keep predators out may be effective for small and confined populations. Community manipulations such as removing a major prey species (e.g. rabbits in the McKenzie Basin) may release a valuable prey (black stilts) from predation by a predator (cats) but perhaps increase predation by another predator (stoats). However these, and habitat manipulations, are possible alternative approaches to predation reduction.

Good monitoring methods are required regardless of the predator control method.

WORKSHOP: TRAPS AND POISONS - LEGAL, ETHICAL AND OTHER CONSIDERATIONS

Facilitators: John Holloway, Graeme Taylor, Bruce Warburton

The Animals Protection Act is proposed for change. These changes will bind the Crown. For example, we will only be allowed to use approved traps, and the daily checking of traps will be enforced. However, if the trap can be shown to consistently kill the captured animal then approval can be given to allow the traps to be left for a greater period of time before being checked. **The Department should closely monitor this and other animal welfare legislation, and the likely impact on pest management**. Development of trap types and trapping methods should still be possible through an experimental licence process. The impact of the Resource Management Act on our use of poisons and traps is largely unknown, but we may be required to make environmental impact assessments for either individual operations or particular methodologies.

All users of toxins must be aware of the current registered uses for each toxin (see Appendix 3). If a toxin is to be used outside the current restraints of registration, then an experimental use permit must be obtained. 1080 poison is currently not licensed for use on rodent control programmes, although application is under way for this. The continued availability of 1080 poison is fundamental to the New Zealand economy but we must care for its public image if we intend to keep it as an effective and efficient management tool. The environmental impacts of "new" toxins, such as Talon, are less understood than 1080 and **careful consideration of potential impacts must be made before the toxin is used.** We are breaking new ground with the use of Talon and we are not using it the way in which it was originally intended. We therefore need to be very cautious about our approach and application to use it in this way.

Outcomes of the Animal Ethics Committee's (AEC) meetings should be circulated to animal management staff. The relationship between staff and the Animal Ethics Committee seems to be antagonistic because AEC members are sometimes ill informed and show a lack of practical knowledge and understanding. We, perhaps, should give greater consideration to the selection of appointees to the Animal Ethics Committee to ensure that their collective experience and background is appropriate, or we could give members a wider practical experience by offering them time participating in field work. Proposers of the use of traps or poisons should be encouraged to present a better case to the committee than has sometimes been the case in the past. The committee could probably benefit from selected circulation of draft decisions to appropriate experts for comment.

WORKSHOP: PREDATOR MANAGEMENT - WHERE TO FROM HERE?

Facilitators: John Holloway, Mick Clout, Richard Sadleir

A national predator management strategy is required. This should recognise current and likely legislation changes, include priorities for work such as eradication of animals from islands, and possibly include weeds and other non-mammal species. **An advocacy strategy is also needed** to help us to retain access to the key control methods which we now have, such as poisons and traps, and to raise public awareness of the problems caused by predators.

The recording and dissemination of results of predator management work needs to be greatly improved, perhaps with the development of a standard format for reporting. There is a need to develop and adhere to operational protocols on the collection of data both for planned and unexpected information that may be found. Managers don't collect good data without research assistance; it is noted that much data has been collected in the past and not used because it was inadequate. Science and Research is to develop a format for write-ups and conservancies are to do these. Advocacy and Information is to be involved in the write-ups. One suggestion was the need to have our own publication, a technical bulletin, to enhance dissemination of information.

There needs to be a collation of existing methods, possibly in the form of a manual, and perhaps this should include clear indications of the benefits of predator management to our protected and threatened species.

Links with supporters such as conservation groups need positive encouragement. It would be very easy for us to lose our capability to do work if we lost these links. We need to encourage other groups of people to carry out predator control work in their own back yards and in priority areas. We must be helpful to ensure that they are successful.

The development of new techniques, such as lures, baits and biological control, is a priority. We need to pursue the acceptance and legal registration of useful poisons, baits and traps.

Research and monitoring of non-target effects of poisons on our indigenous fauna and unplanned effects of operations on predators, such as changes in predator/prey relationships, needs to take place. There is increasing use of poisons, but we still don't have basic data on the eventual fate or the cumulative effects. We could check this out by 'research-by-management'; collecting relevant biological samples and recording observed effects. A targeted research project on one island such as Red Mercury may begin to address this, although there are some trials that can be done in the laboratory.

There is a need to research the best sequence of attack on predators such as rats before or after cats or other multiple hit operations. The efficiency of tapping methods also needs to be tested in management operations. Understanding of ecosystems for a more ecosystem related approach is a long way off. Science and Research should be the leaders of research into effects on non-target species and the development of protocols for poisons and tapping methods.

Is the Department of Conservation's balance of financial allocation adequate or correct? We find allocation of monies is improving but still some projects are taking the bulk of the pool money. There is however a relationship between monitoring operations and bids for new projects. **Conservancies that do good monitoring deserve financial bid support.**

WORKSHOP SUMMARY

Alan Saunders

Have we achieved the goals and objectives of this workshop? Yes, I believe we have. There is a pressing need for communication and information sharing between managers within projects, between conservancies, between agencies and internationally. This can be achieved by using all the media transfer mechanisms that are available to us and endeavouring to share skills locally, nationally and internationally. We need to share information more with the stake holders - tangata whenua, landowners and others. We have a clear need to maintain public support and to attract sponsors to the predator control and eradication area through improved advocacy. Much of this can be achieved through an improvement in coordination and integration between scientists, managers, advocates and decision makers. At the end of the day no project is complete until the methods and results are written up and that is a task for everyone to do.

There has been a strong undercurrent here that the momentum of predator management needs to be maintained but that it needs to be balanced with much more intensive monitoring, not just of predators but of their prey, the ecological responses and environmental impacts.

The experimental island approach is seen as a good opportunity to assess and monitor impacts of management. There is also an urgent need to develop new monitoring techniques. We should certainly discuss modelling further. It is very important the we develop detection techniques not only for invading species, but also to determine the success of eradication programmes.

There is strong support for the 'research-by-management' approach, to guide us in such things as the development of more effective or appropriate poisons, traps and barriers and research into the understanding of ecological impacts.

There are clearly some long term priorities such as the monitoring of cats and stoats on the mainland. We need to develop a poisons data base. Priorities for island eradication need to be clearly set and we need to encourage the development of interesting ideas such as the "rodent terminator" - a mythical robot-like device which recognises and terminates rodents!

The revision of the Animals Protection Act has implications for managers and the use of poisons and traps which need to be addressed. The Animal Ethics Committee has an important role in vetting animal management practices, including legal and advocacy issues and it is very important for DOC's public image that we maintain a positive relationship with the Animal Ethics Committee. A review of the Act and the development of policies and strategies must not be done in isolation from managers. A more proactive approach to the development of new opportunities to manage predators is needed. This may take the form of lures, deterrents or barriers and all can be included in research-by-management projects.

Workshop participants will now be going home and will hopefully apply what they have learned at this gathering. Keynotes have been innovation and adaptation, so please keep on being successful in your work. I hope this conference has also developed new networks which will result in improved skill-sharing, information-sharing and co-ordination through the development of priorities and strategies, better integration between work groups and between projects.

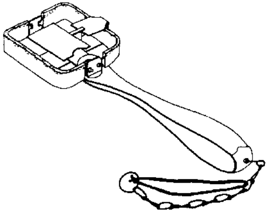
APPENDICES

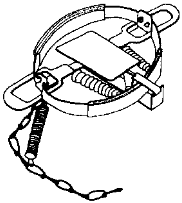
DEMONSTRATION OF PREDATOR MANAGEMENT METHODS

Dave Harding and Dick Veitch

Workshop participants demonstrated and discussed trapping, poisoning and monitoring devices in a half day field session. The purpose of this session, and the illustrations provided here, is to stimulate discussion and, perhaps, new or improved designs of devices for predator management. It should be noted that Department of Conservation staff should use these and other management devices only in accordance with the approvals given by the Department of Conservation Animal Ethics Committee. Approvals to 15 September 1992 are listed in Appendix 4.

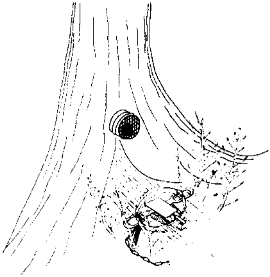
The Lanes Ace leg-hold trap modified by Paul Jansen by the addition of rubber padding on the jaws and bungy cord on the chain to make it ethically acceptable for cat capture. The number two channel rubber and the bungy cord cost approximately $3.00 per trap. See Appendix 2 for details.



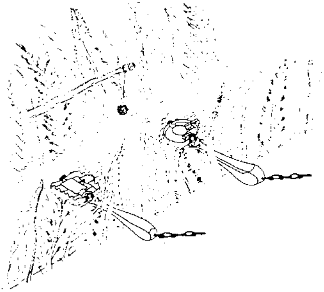


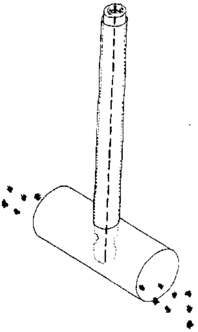
The Victor 1.5 Soft-Catch trap (shown to the left) was demonstrated by Paul Jansen. The jaws are polymer padded and the chain is fitted with a spring to reduce the impact when the trapped animal pulls on the chain: The chain is attached to the centre of the underneath of the trap so that the pull of the chain is in a more direct line with the leg being held.

The Victor 3 Soft-Catch (shown to the right) is essentially the same as the Victor 1.5 shown above, just larger. The setting by Rex Page shown here is a typical cat-catching set with the bait in a rodent-proofed container. Note that the trap is set a handspan away from the bait to ensure that the cat must walk on it to sniff the bait and this distance also reduces the chances of rats springing the trap. This set would be completed by securely attaching the trap chain to the tree and a light sprinkling of forest litter to camouflage the trap.

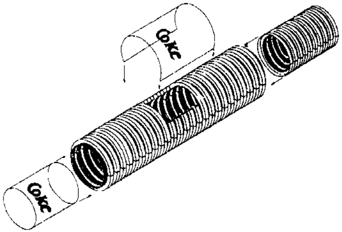


The double walk-through cat trap setting (shown to the right) by Les van Dijk also includes a bait to enhance the chances of success. Great care must be taken to use such settings only in areas where there is little likelihood of catching non-target species. The traps shown here are an unpadded Lanes Ace on the left and an unpadded Victor 1.5 with a long spring. This set would be completed by light sprinkling of forest litter to camouflage the traps.



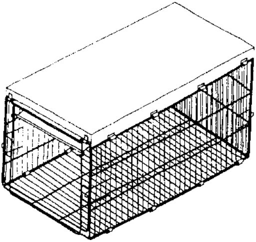


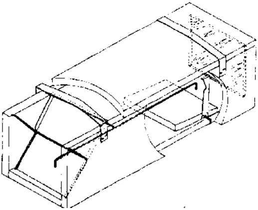
This rat bait dispenser (to the left) reduces the quantity of bait the rat can carry away. The Ridrat (bromadialone) candle bait is threaded onto a wire inside the vertical polythene pipe. As the bottom end of the bait is eaten the candle of bait drops down. The small aperture of the horizontal pipe reduces access by non-target species. This device is only field trialled so far. It needs some support to ensure that it stays upright.



The standard Breaksea-type novacoil bait tunnel (to the right), demonstrated by Bruce Thomas, is lengthened to reduce access by non-target species with the use of smaller novacoil pipe or plastic drink bottles. The previously used novacoil hatch is replaced with a section of clear drink bottle to allow operators to see the bait.

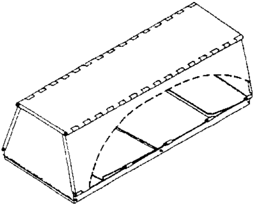
This cage trap from Greave Wire Works, demonstrated by Rob Mills, is a collapsible model. A mouse trap mechanism trips the gravity drop door from its open position which is inside the trap cage. This door location is good but the functioning of the mechanism is slow. This trap may be good for ferrets but is too small for effective cat capture. As with other cage traps, this trap should be used on flat ground and securely tied down. If tipped over the door will fall open.

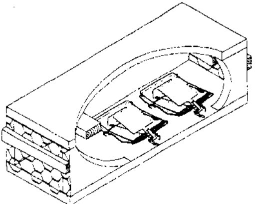




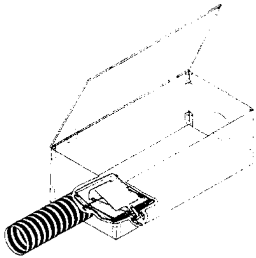
The Edgar trap (to the left), demonstrated by Kim King, was designed specifically to live trap stoats. The cutaway view printed here shows the drop-down door which is tripped by a treadle. The bait is placed between the treadle and the glass end of the box.

The Elliot trap (to the right), demonstrated by Rob Mills, may be used for rodents or mustelids. The collapsible sheet metal design makes it very portable but this metal also has the potential to be hard on trapped animals when there are extremes of temperature. A treadle mechanism operates a flip-up door. Once tripped the operator cannot see into the trap. A perspex end wall could be an advantage.



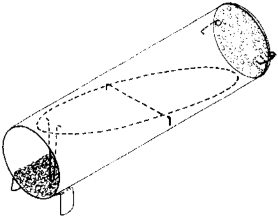


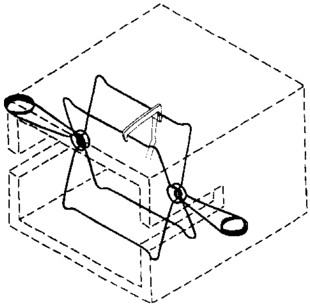
Fenn traps (shown to the left in a cut away view of a trap box) are kill traps designed for small mustelids and rodents. In New Zealand the mark 4 has commonly been used for stoats and the mark 6 for ferrets. These traps should always be set on a firm and level base in a tunnel or box and may be used with or without lures. The box illustrated would exclude larger animals depending on the mesh size of the netting box ends.



This prototype aluminium box being developed by Bruce Thomas can be used in a variety of ways. Rat, mouse or Fenn (as shown here) traps may be set inside it and pipe extensions to the entrances can reduce non-target species access or improve species selectiveness. This tunnel is far lighter and easier to transport than wooden tunnels but is more labour intensive and expensive to make.

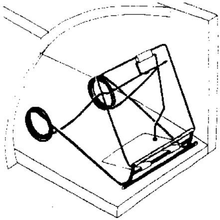
Gimpex traps (plastic model shown to right), demonstrated by John Innes, can be purchased ready-made, as illustrated, or made from wool or plastic drain pipe. The trap is basically a tunnel with mesh at one end. Animals walk in and tip the treadle which usually extends for more than half the length of the tunnel. A locking device then holds the treadle in the position shown here. Getting bait into and out of the trap shown is facilitated by a removable end but similar access to the baiting area was not provided in the wooden equivalent of this trap.

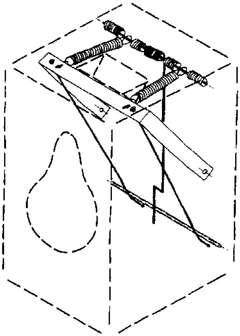




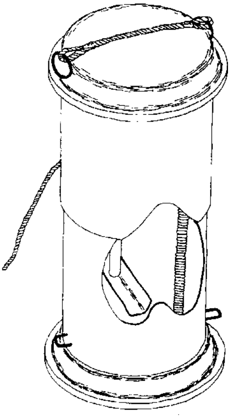
The Connibear (to the left), demonstrated by Bruce Warburton, is a kill trap designed to be set in a tunnel or enclosed space. It is available in three sizes, with the larger size needing some skill and a pair of purpose-built tongs to set. The larger size is possibly large enough for cats and the medium size may be better than Fenn traps for ferrets.

The Gadbrey Challenger (shown to the right), demonstrated by Bruce Warburton, is a treadle triggered trap which is designed to be set in a tunnel. While not commercially available in New Zealand it does have the potential to be better than Fenn traps for ferrets.



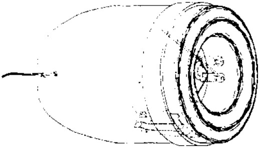


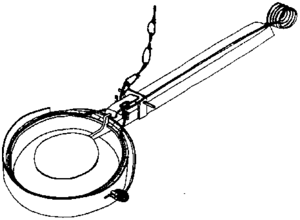
The Timms trap (shown to the left), demonstrated by Paul Jansen, is specifically designed as a kill trap for possums although in some parts of the country the entrance hole, which should be large enough for a possums's head, is too small. As shown here the trap is in the "set-off' position; when set the bar is below the entrance hole. While the lure used can be reasonably target specific, the size of the entrance hole makes it difficult to exclude curious non-target species such as weka.



The Patter Trap for Possums (shown to the right) is a prototype demonstrated by Bruce McKinlay. As shown here the trap is in the "set" position. When triggered the entire top half is pulled down by internal springs.

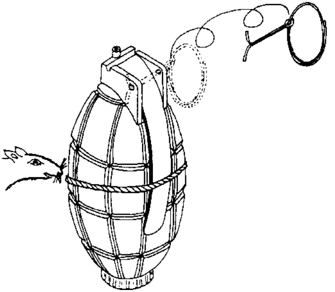
The egg trap (to the right), demonstrated by Bruce Warburton, is a small and simple leg-hold trap designed to capture small animals such as squirrels that naturally reach into cavities and manipulate food with their paws.





This snare trap (shown to the left), demonstrated by Derek Greenwood, is designed to catch dogs or cats by the leg. It is potentially dangerous to set and would normally require two people. This trap is not available in New Zealand.

The grenade trap demonstrated by Paul Johnson was awarded a prize as the trap "least likely to get Ethics Committee approval." Setting instructions to kill rats are: "soak the encircling string in wax, pull the pin and leave the area quickly." This eradication method is portable and flexible.



MODIFYING THE LANES ACE LEG HOLD TRAP TO CONFORM TO HUMANITARIAN NEEDS

Paul Jansen

The Lanes Ace leg hold trap has been a popular trap in New Zealand and overseas for catching and effectively holding small mammals. Recent policy has supported a trend toward humane capture devices which reduce physical trauma to animals. The serrated steel jaws of the Lanes Ace trap do not meet with these requirements and are likely to be banned for the capture of all species in the near future.

The following information details a cost effective method ($3.00 per trap at retail prices) to modify Lanes Ace traps currently owned by the Department of Conservation to meet "soft catch" requirements at a minimal cost and result in a trap which is approved by the Department of Conservation Animal Ethics Committee for the capture of cats.

Victor Soft Catch traps are now commercially available and these should be obtained if extra traps are needed or as a replacement for worn or broken traps. Retail prices at the time of writing are $19.30 each for Victor Soft Catch PA and $28.00 each for Victor Soft Catch 3.

For the modification to the Lanes Ace trap the following is required:

- 2 x 160mm lengths of Skellemp extruded rubber channel strip No 2 (PCA002) per trap
- 400mm of 6mm shock (bungy) cord per trap
- A ruler and a sharp knife
- If large numbers of traps are to be modified, hand tools and a small quantity of wood to fashion a jig for easier cutting of the channel and shock cord

And the following work should be done:

1. Inspect each trap and rigorously test that the jaws close parallel and that there is no wear of the jaw pivots opposite the spring. Reject any trap which does not pass inspection and replace the unit with a commercially made "soft catch" of an appropriate size.
2. Cut two lengths of No 2 channel, each one 160mm long.
3. Hold the two pieces of rubber parallel with the top flat faces of the rubber together and cut the two outside comers off one end of the two pieces of rubber (this allows for free travel of the spring over the jaws). Make sure not to cut too much. As a guide 2-3 mm of the inside channel of the rubber should remain.
4. Open the jaws of the trap and hold them open by clamping the spring with your foot or a suitable device.
5. Starting from the spring end, and with the cut comer of the rubber at that end, push the rubbers onto the jaws. Once both rubbers are in place close the jaws making sure that the rubber is well home and not twisted in any way.

6. Cut a 400 mm length of shock cord and tie a good non slipping knot in one end.

7. Thread the open end of the shock cord through the swivel or first link of the traps chain at the spring end and through the last link in the chain where you would normally fasten the trap.

8. Tie off the shock cord so it is shorter than the length of the chain and the shock cord requires 5-7 kilo of tension before the chain becomes tight.

Explanation of modification.

The rubber on the jaws minimises the physical trauma to the animal by covering the hard serrated surface of the steel jaws. The shock cord acts to reduce shock loading to avoid physical trauma and the possibility of the animal pulling out of the trap.

Materials and cost per 100 traps:

Item	Quantity	Cost per 100 traps (retail + GST)
No. 2 channel	32 metres	$158.40
Shock cord	40 metres	$100.00
Labour ® $10/hr	5 hours	$50.00
TOTAL		$308.40

Product suppliers:

Standard extruded rubber channel strips No 2 PCA002

Skellerup Industrial Limited
16-18 Bowden Road, Mt. Wellington, AUCKLAND, (09) 573 1548.

Shock cord 6mm

Hawkes Bay Manufacturing Limited
P.O. Box 3175, NAPIER

Small quantities of these products can be purchased from the Para Rubber chain of stores at the retail price as quoted above. Large quantities should be obtained from the manufacturer where a considerable financial saving can be realised.

TOXIN REGISTRATION

John Holloway

The use of toxins for vertebrate pest control is regulated by the Pesticides Act 1979. The controls under this Act were introduced to ensure that the use of toxins did not adversely affect human health or damage the environment. However, despite the tight controls on toxins, there is still a section of the community that strongly opposes their use generally and/or on conservation lands in particular. Because of this opposition the Department must be able to demonstrate that its use of toxins is above reproach on legal, ethical and management grounds if it is to retain its position of being able to relatively freely use a range of compounds for animal control work.

Estate Protection Policy Division is reviewing the Department's use of toxins in animal control. This has come about as a result of both the influx of new compounds onto the vertebrate pest control market, and increased national and international pressure to tighten controls on, and reduce the use of, pesticides.

The objective of the review is to formulate both a toxin manual and associated policy that achieves the safe use of approved toxins by the Department, or by other persons or bodies wishing to apply toxins on lands managed by the Department.

This statement is the first part of that process. Its purpose is to inform on what compounds are currently registered for vertebrate pest control (Table 1) and to give some initial guidance on the use of brodifacoum based compounds.

The Table of Registered Toxins (Table 1) should be consulted before any eradication / control / research programme is undertaken. When doing so please note the following:

1) Make sure that not only is the compound you intend to use on this list, but that the label instructions are followed implicitly. To assist, a note on compliance with the label instructions for the use of brodifacoum and pindone based products is included. Any breach of either the registration or the label instructions could bring the Department into disrepute, expose it to legal actions and/or jeopardise its ability to successfully use toxins.

2) This list does not include compounds with experimental use permits (EUPs). Compounds with EUPs can only be used in bone-fide research (i.e., research approved by the Science Advisory Board or Science and Research Division, or research conducted by another agency that the Department has decided to participate in). At present, some control and eradication operations are being conducted using compounds with EUPs under the guise

of research work. This practice, which will undermine full registration of compounds, is not to continue.

3) There are NO compounds currently registered for use on cats *(Felis catus)*.

4) There are NO compounds currently registered for use on mustelids.

5) 1080 is not currently registered for use on rodents, mustelids or cats.

The Notes on Brodifacoum and Pindone Based Products overleaf set out the uses and limitations on the use of brodifacoum and pindone based products set by the registered label instructions for each product.

Further information on toxin use will soon be sent out for comment, including a draft standardised "application to use 1080" form. In the meantime, all communication with toxin manufacturers, the Pesticides Board, and the Agricultural Compounds Unit at Wallaceville that impinges on policy, legal or registration matters is to be directed through EPPD. If you are uncertain about the use or registration of any toxin, contact Kurt Janson in Animal Control.

Please note that this statement is advisory in nature and is not intended to be interpreted as an authorisation to use any product listed on the Table of Registered Toxins outside of any other guideline, instruction or legal requirement that may currently apply to it.

NOTES ON BRODIFACOUM AND PINDONE BASED PRODUCTS

Brodifacoum

At present there are three brodifacoum based products on the market. These products must be used strictly in accordance with their label instructions.

1) Talon 20P (Pellets)
   * can only be used against rabbits *(Oryctolagus cuniculus)*
   * can only be used on non-grazed areas and livestock must not be allowed access to land where baits have been laid
   * can be distributed aerially on unstocked offshore islands only by DOC
   * must be used in bait stations on the mainland or on stocked offshore islands.

2) Talon 50WB (Blocks)
   * can only be used against commensal rodents
   * can only be used in bait stations
   * bait stations must be placed so as to be inaccessible to children, pets, domestic animals and wildlife

3) Talon Possum Bait (20ppm Pellets)
   * can only be used against possums *(Trichosurus vulpecula)*
   * can only be used in bait stations
   * bait stations must be placed so as to be inaccessible to children, domestic animals and grazing animals.

Pindone

At present there are two pindone based product that are fully registered. These must be used in accordance with the following conditions:

1) Pindone RS5 Rabbit Pellets (25ppm)
   * can only be used against rabbits
   * can not be used in areas where stock have access
   * stock can not be returned to treated areas until 4 weeks after application of the bait.
   * can be used aerially and in bait stations.

2) Pindone Possum Pellets (50ppm)
   * can only be used against possums
   * can not be used in areas where stock have access
   * stock can not be returned to treated areas until 4 weeks after application of the bait.
   * can be used aerially and in bait stations.

There are other brodifacoum and pindone based products that have Experimental Use Permits. These products are not mentioned here as they can only be used as part of bone-fide research programmes and, therefore, do not form part of normal animal pest control work.

Table 1: Registered toxins for mammal control.

TOXIN	TARGET SPECIES				
	Deer	Possum	Rabbit	Rodents	Wallaby
1080	10% Gel	0.15% Pellets	Mapua Rabbit Bait		5% Gel
		0.08% Paste	0.06% Paste		0.2% Pellets
		0.06% Paste	0.04% Pellets		10% Gel
		1080 Solution	1080 Solution		
		0.08% Pellets	0.06% Pellets		
		Forest Service Solution	1080 Stock Solution		
		0.06% Pellets			
		1080 Stock Solution			
Cyanide		Cyanide Paste			
Phosphorus		Phosphorised Possum Paste	Phosphorised Rabbit Paste		
Brodifacoum		Talon Possum Bait	Talon 20P	Talon 50WB	
Pindone		Pindone Possum Pellets	Pindone Rabbit Pellets		
Warfarin				Rodent Contact Dust	
				Wonderbait	
				Hygex SDTR Rat Bait Meal	
				Hygex SDTR Rat Bait Tablets	
				Toxa Rodenticide	
Diphacinone				Pest-gone Rodent Bait	
				Zaz	
Bromadiolone				Rid-rat Super	
				Rid-rat Super Wax Baits	
				Bromatrol	
				Squeak Super	
Coumatetralyl				Waxy pack	
				Rodent Bait	
				Racumin	
				Racumin Ready Made Bait	
Flocoumafen				Storm	
Red Squill				Eradirat	

ANIMAL ETHICS COMMITTEES

Janice Molloy

This appendix:

- describes the role of Animal Ethics Committees;
- provides information on the Department of Conservation's Animal Ethics Committee;
- outlines the procedure to be followed by Departmental staff for obtaining animal ethics approval for management and research techniques.

Code of Ethical Conduct

In 1987 the Animals Protection (Codes of Ethical Conduct) Regulations were passed. These Regulations require all organisations, institutions or individuals that carry out research, experimental work, or teaching involving the manipulation of live animals to establish codes of ethical conduct. Such codes are approved by the Minister of Agriculture.

The term "manipulation" is defined as interfering with the normal physiological, behavioural or anatomical integrity of an animal. This includes euthanasia.

Animal Ethics Committees

The Animal Ethics Code must provide for the establishment of an animal ethics committee, whose function is to review research or teaching projects undertaken by the staff or by individuals affiliated to the organisation. Ethics Committees are usually made up of the following people:

- a vet
- RSPCA represenative
- one or more representatives from the organisation
- a layperson

At least three members of the committee are from outside the organisation. The fact that the Committee is composed principally of independent people can be very useful for an organisation which may face public criticism of its research methods.

Research Methods versus Management Methods

By law only research methods must comply with a code of ethical conduct. However when the Department of Conservation's code was drafted, a policy decision was made that all research and management techniques would be reviewed by the Department's Animal Ethics Committee. This includes wild animal control techniques, and management techniques used in species recovery programmes.

The approval process for research and management projects varies slightly. While research projects are considered on a case by case basis, management techniques are given blanket approval for use by all Departmental staff once they have been approved by the Committee. These approvals usually last for three years. An updated list of approved management methods is distributed to conservancies after each meeting (Table 1). Research projects are usually approved for the duration of the project.

The Department's Committee reviews research and management carried out on all vertebrates, and invertebrates listed as Protected in the Wildlife Act 1953.

The Department's Committee is made up of the following people:

- Neil Wells - Regional Director for the South Pacific Region of the World Society for the Protection of Animals (Chairperson)
- Gabrielle Deuss - N.Z. Veterinary Association
- Peg Loague - RSPCA
- Burton Silver - layperson
- Don Newman - Science and Research Division, DOC
- Graham Adams - Estate Protection Policy Division, DOC
- Janice Molloy - Protected Species Policy Division, DOC (Secretary)

Committee Meetings

The Committee meets three times a year in February, August, and November. Exact dates are set at the previous meeting. Conservancies and Science and Research Division are informed of meeting dates through the minutes. A reminder is also sent out one month before the Committee meets.

Staff have attended a number of meetings and demonstrated techniques under consideration. The Committee has found this to be particularly helpful. The Committee has also expressed an interest in seeing some of the research and management techniques used by the Department in operation on site. The cost of travel and busy schedules of Committee members has prevented. this occurring to date. Site visits will be considered for the future.

Approval Process:

1. Applicant fills in an application form (see Appendix 2). Copies of the form are held by conservancy offices, Science and Research Division, and Protected Species Division.

2. Applications, which must reach the Secretary two weeks before the meeting date, for Animal Ethics Approval are sent to:

   The Secretary
   Animal Ethics Committee
   Protected Species Policy Division
   Department of Conservation
   P O Box 10-420
   WELLINGTON

3. Committee meets and considers application. The following factors are considered by the Committee:

   - the likely stress or pain which the animal will experience;
   - the existence of alternative techniques;
   - benefit of the research or management to the species or ecosystem.

4. The decision of the Committee is recorded in the minutes. Applicants are informed of the decision in writing. A copy of the minutes is sent to all applicants, Committee members, conservancy offices, and Science and Research Division.

5. If due to unforeseen circumstances, a research or management technique which has not been approved needs to be used urgently, there is a procedure in place whereby the Chairperson and one other member of the Committee can give interim approval, outside the full Committee meeting. This procedtire is only used in emergency situations.

For further information on animal ethics issues in general, contact:

Ms Julie Collins
Management Support Officer
Animal Welfare
MAF Policy
P.O. Box 2526
WELLINGTON

For more information on the Department's Animal Ethics Committee contact the Secretary, Janice Molloy

Table 1: Management methods approved for use by Department of Conservation staff as at 12 November 1992

Management Methods	Species	Comments
Methods of Destruction		
Aerial Shooting	Deer, goats	
Ground Shooting	Deer, goats, cats, sheep, stoats, weka, black-backed gulls, cattle, pigs, kea, harriers, pied stilts, horses, possums, hybrid forbes parakeets	
Capture & Dispatch by Dogs	Weka, cats	
Live Capture	Deer	
1080 Poison	Possums, rabbits, wallabies, wasps	
Cyanide	Possums	
Brodifacoum	Rodents, rabbits	
Fenn Trapping	Mustelids	Traps must be checked at least every 24 hours
Cage Trapping	Cats, kea, weka	Traps must be checked at least every 24 hours. Cats must be dispatched by shooting.
Timms Traps	Possums	Traps must be checked at least every 24 hours.
Victor Soft Catch & Victor Unpadded Traps	Possums	Traps must be checked at least every 24 hours.
Victor 1½ & 3 Soft Catch traps, 'Jansen' soft-catch modification to Lanes Ace trap	Cats	Traps must be checked at least every 24 hours.
Neck Dislocation	Birds the size of pigeons and smaller	

Management Methods	Species	Comments
Capture Techniques		
Mist-netting	Kokako and other forest birds	
Clap-trapping	Robin	
Manual Capture	Tuatara, kiwi	
Hand-netting	Shore plover, Chatham Island oystercatcher, brown teal	
Box Trapping	South Island kokako	
Handling of Chicks	NZ dotterel, Chatham Island robin	
Netting	Blue duck	
Other Techniques		
Banding	All birds listed in the Bird Banders Manual	
Tibia Banding	Banded dotterel	
Laparoscopy	Birds	Approved with the proviso that Sherri Huntress, Wellington Zoo supervises the operation
Egg Manipulation	Takahe, black stilt, NZ shore plover	
Use of Radio Transmitters with Harness	Blue duck, brown teal, kakapo, kokako, stoats, goats, Chatham Island pigeon, takahe	
Use of Radio Transmitters (affixed by gluing)	Stitchbirds	
Use of Radio Transmitters with a Collar	Goats	
Sterilisation	Male and female goats	Must be carried out under anaesthetic.
Water bioassay	Trout	
Relocation	Kea	
Handling in Burrows	Chatham Island petrel, broad-billed prion	
Handling and Transfer	Lizards and tuatara	Using methods outlined in procedures developed by Towns, November 1992 (available from Secretary).

DEPARTMENT OF CONSERVATION
ANIMAL ETHICS PROCEDURES
(ANIMAL PROTECTION REGULATIONS 1987)

APPLICATION TO MANIPULATE ANIMALS

(Forward to Chairperson, Animal Ethics Committee
Department of Conservation, P O Box 10-420, Wellington)

1. Purpose of Manipulation

(a) If already compiled, attach final copy of either the appropriate research project proposal (blue form), or management project proposal.

OR

(b) Complete the following:

Project Title: ____________________

____

Project Leader: ____________________

DOC Conservancy/Field Centre: ____________________

Project Duration: ____________________

2. Justification for Proposed Manipulation

____

____

____

____

3. Details of Proposed Manipulation

Give:

(a) Species, proposed number, source

____

____

____

____

(b) Any special care given to animals prior to use

(c) Summary of experimental/management techniques

(d) Anaesthetic procedures, if applicable

(e) Surgical procedures, if applicable

(f) Post-treatment recovery, care and assessment, including method of final sacrifice where applicable

APPLICATION TO MANIPULATE - ANIMALS

Explanatory Notes

1. Purpose of the Manipulation

   Section 1(b) need not be filled in if a research project proposal, or management project proposal, has been prepared (a copy of the proposal must be attached).

   The project title (1(b)) must give a clear indication of the purpose of the work, e.g.

   > 'The transfer of North Island saddlebacks from Cuvier to Kapiti Island'.
   >
   > 'Investigation of the habitat requirements of McGregor's skink on Mana Island'.

2. Details of Proposed Manipulation

   The information sought is that required under the regulations. For many projects, certain details will not be available.

   Give the scientific name of the species to be manipulated.

   If the number of individuals to be manipulated is not known prior to commencing the work, estimate the maximum number.

   Indicate as 'source' whether animals to be manipulated are to be collected from the wild, or from captive-breed stock.

ERADICATION OF PREDATORS FROM NEW ZEALAND ISLANDS

Dick Veitch

Table 1: Successful eradications of predators from New Zealand islands (after Veitch & Bell 1990, island areas are from Atkinson & Taylor 1992).

ISLAND	AREA (ha)	DATE INTRODUCED	ERADICATION LEADER	START ERADICATION	METHODS	COMPLETED ERADICATION	REFERENCE
<u>MOUSE</u> (*Mus musculus*)							
Allports	16	c1900	Derek Brown	1989	Poison	1989	Brown 1990
Mana	217	1800s	Phil Todd & Trevor Hook	1989	Poison	1991	Hook & Todd this vol.
Motutapu (by Allports)	2	?	Derek Brown	1989	Poison	1989	Brown 1990
Whenuakura	3	?	Ian McFadden	1983	Poison	1984	Veitch & Bell 1990
<u>SHIP RAT</u> (*Rattus rattus*)							
Awaiti	2	?	David Taylor	1982	Poison	1982	Taylor 1984
Haulashore	6	?	R Taylor, B Thomas	1991	Poison	1991	Rowley Taylor pers. comm.
Kauwahaia	0.7		Graeme Taylor	1989	Poison	1989	Veitch & Bell 1990
Mokopuna (Leper)	<1	c1961	Rod Sutherland	1988	Poison	1990	Veitch & Bell 1990
Somes	.26	c1961	Rod Sutherland	1988	Poison	1990	Veitch & Bell 1990
Tawhitinui	21	?	David Taylor	1983	Poison	1983	Taylor 1984
<u>NORWAY RAT</u> (*Rattus norvegicus*)							
Breaksea	170	1800s	R Taylor, B Thomas	1988	Poison	1988	Taylor & Thomas in press
Hawea	9	1800s	R Taylor, B Thomas	1986	Poison	1986	Taylor & Thomas 1989
Mokoia	135	?	Paul Jansen	1989	Poison	1989	Veitch & Bell 1990
Motu-O-Kura	13.5	c1930	John Adams	1990	Poison	1991	John Adams pers. comm.
Moutohora	173	?	Paul Jansen	1986	Poison	1986	Veitch & Bell 1990
Motutapu (BOI)	<1	?	Don McKenzie	1990	Poison	1990	Don McKenzie pers. comm.
Motuterakihi	0.2	?	David Taylor	1985	Poison	1985	Veitch & Bell 1990
Motiti	<1	?	A. Walker	1990	Poison	1990	Don McKenzie pers. comm.
Noises - David Rocks	0.3	<1960	Don Merton	1960	Poison	1960	Moors 1985
David Rocks B	0.2	<1960	Don Merton	1960	Poison	1960	Moors 1985
David Rocks C	0.2	<1960	Don Merton	1960	Poison	1960	Moors 1985
Maria	1	<1960	Don Merton	1960	Poison	1960	Moors 1985
Motuhoropapa	8	<1962	Phil Moors	1979	Trap & poison	1987[1]	Moors 1985
Motuhoropapa	8	1990	Ian McFadden	1991	Poison	1991	Ian McFadden pers. comm.
Motuhoropapa A	0.2	<1962	Phil Moors	1979	Trap & poison	1987	Moors 1985
Otata	15	c1956	Phil Moors	1979	Trap & poison	1987[1]	Moors 1985
Otata	15	1990	Ian McFadden	1991	Poison	1991	Ian McFadden pers. comm.
Otata A	0.2	c1956	Phil Moors	1979	Trap & poison	1987	Moors 1985
Rotoroa	90	?	Mike Lee	1992	Poison	1992	Ian McFadden pers. comm.
Rotoroa stack	0.6	?	Mike Lee	1992	Poison	1992	Mike Lee pers. comm.
Takangaroa	6	1987	T. Clarkson	1988	Poison	1988	Taylor 1989
Taranaki (BOI)	0.5	?	Don McKenzie	1990	Poison	1990	Don McKenzie pers. comm.
Te Haupa (Saddle)	6	?	Rex Gilfillan	1989	Poison	1989	Veitch & Bell 1990
Titi	32	?	Brian Bell, Don Merton	1970	Poison	1975	Gaze 1983
Wainui (BOI)	2	?	Don McKenzie	1991	Poison	1991	Don McKenzie pers. comm.
Whenuakura	3	c1982	I McFadden, M Wilke	1983	Poison	1984	Veitch & Bell 1990

KIORE (*Rattus exulans*)

Mercury - Double	32	?	Ian McFadden	1989	Poison	1989	Ian McFadden 1992
Korapuki	18	?	Ian McFadden	1986	Poison	1987	McFadden & Towns 1991
Stanley	100	?	Phil Thomson et al	1991	Poison	1992	Towns et al in press
Mokohinau - Burgess	56	?	Ian McFadden	1990	Poison	1991	Ian McFadden, this vol.
Trig	16	?	Ian McFadden	1990	Poison	1991	Ian McFadden, this vol.
Maori Bay	11	?	Ian McFadden	1990	Poison	1991	Ian McFadden, this vol.
Lizard	1	1977	Dick Veitch	1978	Poison	1978	McCallum 1986
Flax	1.3	?	Ian McFadden	1990	Poison	1991	Ian McFadden, this vol.
Arch	1	?	Ian McFadden	1990	Poison	1991	Ian McFadden, this vol.
Stacks B-G,I,J	c10	?	Ian McFadden	1990	Poison	1991	Ian McFadden, this vol.
Motuara	59	?	Bill Cash	1990	Poison	1991	Derek Brown pers. comm.
Motuopao	30	?	Don McKenzie	1989	Poison	1992	Don McKenzie pers. comm.
Rurima	4.5	?	Ian McFadden	1983	Poison	1984	McFadden & Towns 1991

STOAT (*Mustela erminea*)

Maud	309	c1980	Bill Cash	1980	Trapping	1983[1]	Crouchley, this vol.
Otata	22	?	Capt. Wainhouse	?	Shooting	1955	Veitch & Bell 1990

FERRET (*Mustela furo*)

Otata	22	1930s	?	?	?	?	Imber 1979

CAT (*Felis catus*)

Cuvier	170	c1889	Don Merton	1960	Traps & shooting	1964	Merton 1970
Herekopare	28	c1925	Dick Veitch	1970	Traps & dogs	1970	Fitzgerald & Veitch 1985
Kapiti	1970	c1900	Dick Fletcher	?		1934	Wilkinson & Wilkinson 1952
Little Barrier	3083	<1870	Dick Veitch	1977	Traps, poison,dogs	1980	Veitch 1983
Matakohe	37	?	Clapperton & Pierce	1991	Poison	1991	Clapperton et al 1992
Motuihe	195	?	Steve Boyle	?	Shooting	c1981[2]	Veitch & Bell 1990
Putauhinu	141	?	Muttonbirders	?	Not known	?	Veitch 1985
Stephens	150	c1892	Lighthouse keepers	c1910	Not known	1925	Baldwin 1981

Table 2: Incomplete (including all stages of an ongoing operation) or failed eradications of predators from New Zealand. islands.

ISLAND	AREA (ha)	DATE INTRODUCED	ERADICATION LEADER	START ERADICATION	METHODS	STATUS AS AT 1 4 92	REFERENCE
MOUSE							
Haulashore	6	?	R Taylor, B Thomas	1991	Poison	Incomplete	Rowley Taylor pers. comm
Moturemu	5	?	Ian McFadden	1992	Poison	Incomplete	Ian McFadden pers. comm.
Rimariki	22	?	Chris Smuts-Kennedy	1989	Poison	Incomplete	C Smuts-Kennedy pers. comm.
SHIP RAT							
Duffers Reef	2	<1983	David Taylor	1983	Trap & poison	Failed[1]	Veitch & Bell 1990
Fortyseven	1	?	David Taylor	1990	Poison	Incomplete	David Taylor pers. comm.
Harakeke (BOI)	11	?	Dave Taylor	1992	Poison	Incomplete	David Taylor pers. comm.
Little Rat (BOI)	0.5	?	David Taylor	1992	Poison	Incomplete	David Taylor pers. comm.
Moturako (GBI)	0.8	?	Graeme Taylor	1990	Poison	Incomplete	Graeme Taylor pers. comm.
Mouse (BOI)	1	?	David Taylor	1992	Poison	Incomplete	David Taylor pers. comm.
Opakau (GBI)	4	?	Graeme Taylor	1990	Poison	Incomplete	Graeme Taylor pers. comm.
Oyster (GBI)	0.3	?	Graeme Taylor	1990	Poison	Incomplete	Graeme Taylor pers. comm.
Phil's Hat (BOI)	1	?	David Taylor	1992	Poison	Incomplete	David Taylor pers. comm.
Rat (BOI)	2	?	David Taylor	1992	Poison	Incomplete	David Taylor pers. comm.
Saddle (GBI)	2	?	Graeme Taylor	1990	Poison	Incomplete	Graeme Taylor pers. comm.
Wood (GBI)	1	?	Graeme Taylor	1990	Poison	Incomplete	Graeme Taylor pers. comm.
Wood Stack A (GBI)	0.3	?	Graeme Taylor	1990	Poison	Incomplete	Graeme Taylor pers. comm.
NORWAY RAT							
East & West Atoll (BOI)	1	?	David Taylor	1992	Poison	Incomplete	David Taylor pers. comm.
Moturemu	5	?	Ian McFadden	1992	Poison	Incomplete	Ian McFadden pers. comm.
Rakino	147	?		1992	Poison	Incomplete	Ian McFadden pers. comm.
SW Crater Rim (BOI)	1	?	David Taylor	1992	Poison	Incomplete	David Taylor pers. comm.
KIORE							
Red Mercury	225	?	Ian McFadden	1992	Poison	Incomplete	Ian McFadden pers. comm.
STOAT							
Adele	87	<1977	Rowley Taylor	1980	Trap	Failed[1]	Taylor & Tilley 1984
CAT							
Raoul	2941	c1850	Dick Veitch	1972	Traps	Stopped	Fitzgerald et al 1991

Notes which apply to both tables:

1. Re-invaded by swimming.

2. Subsequently re-introduced.

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RODENTS REACHING ISLANDS BUT NOT ESTABLISHING POPULATIONS

Mike Fitzgerald and Dick Veitch

These records of rodents reaching, but not establishing populations on islands is based on Roberts (1991) with additional old and recent records. This emphasises that there is a real risk of populations of rats or mice establishing on presently rodent-free islands, or of new species being added to those already present. Constant vigilance is needed by all visitors to islands.

The sex of the invaders is known in only six cases. More detailed information on the sex, age and breeding condition of these potential colonisers would help to provide a clearer idea of the probability of a population being established.

Table 1: Records of rodents reaching islands but not establishing populations.

ISLAND	RODENT STATUS[1]	POTENTIAL INVADER	DATE	CIRCUMSTANCES	REFERENCE
Big South Cape	Rodent free	*R. rattus*	1955	One female with active corpora lutea trapped near beach.	Bell 1978
Campbell	*R. norvegicus*	*Mus*	<1931	Present at homestead and government depots.	Taylor 1978
Codfish	*R. exulans*	*R. norvegicus*	1984	One male caught in possum trap.	Andy Cox pers. comm.
Kapiti	*R. exulans* and	*Mus*	?	Landed on occasions, failed to establish.	Taylor 1978
	R. norvegicus	*Mus*	1970	Mummified specimen found in whare.	L. Rodda pers. comm. to Ian Atkinson.
Korapuki	Rodent free	*R. rattus*	1988	Trapped after 1986 kiore eradication.	Taylor 1989
Little Barrier	*R. exulans*	*Mus*	?	One brought ashore in stores and killed.	Watson 1961
Mana	*Mus*	*R. norvegicus*	1974/75	One brought ashore in bales of hay and killed.	M.J. Meads pers. comm.
	Mus	*Rattus* sp.	1976-78	Jumped overboard, reached shore & killed.	Veitch & Bell 1990
	Mus	*R. norvegicus*	1978	Partly eaten carcass on shore.	Efford et al 1988
	Mus	*Rattus* sp.	1981	Dead rat found in high tide drift line, about 300m south of jetty.	M.J. Meads pers. comm.
	Rodent free	*Mus*	1992	One female from packed stores killed on boat before reaching island.	Trevor Hook pers. comm.
Mangere	Rodent free	*Mus*	1970s	Adult female and nest of young in equipment brought ashore by dinghy.	Bell 1989
Noises	Rodent free	*R. norvegicus*	1987	Carcass of young female found in old trap.	Roberts 1991
Poutama	Rodent free	*Rattus* sp.	1984	Rat sign reported by muttonbirders and seen by A. Cox. Poison laid, no further sign.	Bell 1989
Raoul	*R. exulans* and *R. norvegicus*	*Mus*	1972	One pregnant female carried ashore in stores and killed.	Veitch & Bell 1990
Snares	Rodent free	*Rattus* sp.	1950s	Rat jumped from boat onto island during landing of scientific party.	Roorda 1981
Stewart	All 3 rat spp.	*Mus*	?	Landed in stores on several occasions.	Taylor 1975
Takangaroa	Rodent free	*R. norvegicus*	1987	Sign reported by owners and seen by G. Taylor. Poison laid, no further sign.	Taylor 1989
Tiritiri Matangi	*R. exulans*	*Mus*	1986	Brought ashore in stores and killed.	Roberts 1991

1. Rodents present on the island at the time of the potential invasion.

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CATEGORIES OF THREAT

The categories of threat which we use, and which jointly make the list of "Threatened" species is based on those used by the Conservation Monitoring Centre of the International Union for Conservation of Nature and Natural Resources (IUCN) in their worldwide survey of threatened species.

Presumed Extinct (P): This category is used only for species which are no longer known to exist in the wild after repeated searches of the type locality and other known or likely places. It includes species extinct in the wild but surviving in captivity/cultivation.

A species may be listed as extinct in one country while surviving in another. Extinction can never be regarded as more than a probability, and rediscoveries are occasionally made.

Endangered (E): Species in danger of extinction and whose survival is unlikely if the causal factors continue. Included are those whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are considered to be in immediate danger of extinction.

We include all species whose populations are so few or small, that loss by natural means, such as inability to breed due to lack of genetic diversity or a natural catastrophe becomes possible. We consider it is useful to include species whose survival in the wild depends on habitat manipulation or continued management.

Vulnerable (V): Species believed likely to move into the Endangered category in the near future if the causal factors continue. Included are species of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat, or other environmental disturbance; those with populations that have been seriously depleted and whose ultimate security is not yet assured; and those with populations that are still abundant but are under threat from serious adverse factors throughout their range.

It is sometimes difficult to draw a line between what is Endangered and Vulnerable on the one hand, and what is Vulnerable and Rare on the other. Vulnerable is essentially a dynamic category implying change and the need for active protection. Rare species may not need urgent protection although they will require monitoring.

Rare (R): Species with srnall world populations that are not at present Endangered or Vulnerable but are at risk. These are usually localised within restricted geographic areas or habitats or are thinly scattered over a more extensive range.

Indeterminate (1): This category is used for species thought to be Extinct, Endangered, Vulnerable, or Rare, but for which there is insufficient information to allow allocation to a category.

Insufficiently Known (K): Species placed here are suspected, but not definitely known, to belong to any of the above categories. There is insufficient information to be certain.