STOATS

1. Description of the problem

(a) Location of the case-study

New Zealand's mainland and some islands.

(b) History (origin, pathway and dates, including time-period between initial entry/first detection of alien species and development of impacts) of introduction(s)

Stoats, ferrets and weasels were brought here in the 1880s in a desperate attempt to halt the rocketing increase in rabbit numbers, despite the protests of bird experts.

Stoats were implicated in the decline of some native bird species soon after their introduction, and understanding is continuing to grow about the extent to which they contribute to the decline of native birds.

Their introduction is commonly regarded as one of the worst mistakes ever made by European colonists in New Zealand. Stoats are now by far the most common of the mustelids and are widespread in forest and on farmland. They are widely regarded as the most significant predator of a number of New Zealand's most threatened and endangered native bird species. For example, the extinction of the kakapo from the Mainland and the probable extinction of the South Island kokako are attributed to stoats.

(c) Description of the alien species concerned: biology of the alien species (the scientific name of species should be indicated if possible) and ecology of the invasion(s) (type of and potential or actual impacts on biological diversity and ecosystem(s) invaded or threatened, and stakeholders involved)

Stoats (*Mustela erminea*) are one of three mustelids introduced to New Zealand. The other two are ferrets (*Mustela furo*) and weasels (*Mustela nivalis*).

Stoats are slender-bodied carnivorous mammals that naturally occur throughout Asia, Europe and North America. Their arrival did help knock rabbit numbers, but native birds, insects and bats were easier to catch. It was not long before the stoats' impact became obvious. Its effect on indigenous species has been described as overwhelming carnage. New Zealand's flora and fauna evolved in the absence of mammalian predators and are poorly equipped to survive in their presence. Forty-four birds have become extinct since human colonisation brought pests, such as stoats, to New Zealand.

Stoats live in any habitat in which they can find prey. In New Zealand they can be found from beaches to remote high country, at any altitude, up to and beyond the tree line; in any kind of forest - exotic or native; in scrub, dunes, tussock, and farm pasture. They are even known to occur near human settlements. In open country they are less common than ferrets, but in the forest they are much more common.

One reason stoats are so successful is that they are very mobile. Even on short legs, one individual, tagged and recaptured, was found to cover more than 60 kilometres as a crow flies in a month. This mobility makes localised control very difficult.

Their impact on threatened and endangered species is of particular concern, especially nesting birds and chicks. Stoats are extremely agile climbers and have a devastating effect on native birds by preying on adult and young birds and raiding nests for eggs. At Kowhai Bush, Kaikoura, a two-year study in the late 70s showed that mustelids, mostly stoats, had robbed over 50% of 149 nests of native and introduced birds. Part of the problem is that stoats are 'surplus killers' – they kill everything they find and stash the surplus as insurance for lean times. They do not just kill enough to eat at that time.

Predation of young kiwi, chiefly by stoats, is the most important factor contributing to the continuing decline of mainland kiwi populations. Stoats kill an average of 40 North Island brown kiwi chicks per day – this adds up to 15,000 per annum and accounts for 60 per cent of North Island brown kiwi born. Stoat numbers can be extremely low and yet can still make a substantial difference to kiwi survival. Often current trapping regimes do not reduce densities sufficiently to protect young kiwi.

The few remaining kaki (black stilt) of inland Canterbury are also under constant threat from mustelids.

(d) Vector(s) of invasion(s) (e.g. of deliberate importation, contamination of imported goods, ballast water, hull-fouling and spread from adjacent area. It should be specified, if known, whether entry was deliberate and legal, deliberate and illegal, accidental, or natural.)

M. erminea were deliberately imported to New Zealand to establish self-sustaining feral populations.

(e) Assessment and monitoring activities conducted and methods applied, including difficulties encountered (e.g. uncertainties due to missing taxonomic knowledge)

See 2(c).

2. Options considered to address the problem

(a) Description of the decision-making process (stakeholders involved, consultation processes used, etc.)

When stoats, ferrets and weasels were first introduced to New Zealand they were granted legal protection. The government changed its policy on mustelids in 1903 but it was not until 1936 that all legal protection was removed.

Multi-agency research to enhance and improve stoat control is underway, and involves both public and private organisations. Research needs have two main drivers:

- The short-term needs of field operators involved in stoat control; and
- The need for long-term, sustainable, cost-effective control methods.

The latter is because eradicating stoats is probably impossible, which means control will have to be ongoing if endemic species are to survive on the mainland.

Research priorities for stoat control were set following discussions with representatives from universities, non-government organisations, the Royal New Zealand Society for the Prevention of Cruelty to Animals, crown research institutes, Australian research institutes, private consultants and industry.

DOC staff have been asked for their advice on which areas of stoat control require further research to improve operational practice. Staff also contribute information about their current or planned stoat control operations to a national database which then provides a benchmark to test the efficacy of new techniques and helps ensure current practice is shared between people involved in stoat control programmes.

(b) Type of measures (research and monitoring; training of specialists; prevention, early detection, eradication, control/containment measures, habitat and/or natural community restoration; legal provisions; public education and awareness)

At present, stoat control relies largely on labour-intensive trapping and the use of poisoned hen eggs.

The main control method is the manual Mark IV and Mark VI Fenn trap, a powerful and effective kill trap. Traps are baited with fresh meat or hen eggs. While Fenn traps are very effective at killing stoats, they are labour-intensive and therefore not cost-effective. The traps must be set at regular intervals along lines and regularly checked. This is difficult and costly in large and/or remote areas, and rugged terrain.

Currently, sodium monofluoroacetate (1080), injected into hen eggs is the only toxicant registered with the Pesticide Board for the control of stoats. Tests have been carried out by Landcare Research using three toxicants (1080, diphacinone and cholecalciferol) to determine how each could be used and how it is.

DOC has put in place a series of training modules on ecological systems and processes for its field staff, and these include training in animal pest control techniques and methods.

Research into stoat movement and biology, including the use of transmitters on feral animals, is informing development of new methodologies to control them.

(c) Options selected, time-frame and reasons for selecting the options

See 2(b).

(d) Institutions responsible for decisions and actions

The Department of Conservation (DOC) is the largest agency involved in stoat control for conservation objectives.

Research into stoats and stoat control is undertaken by DOC, universities and crown research institutes. As well, a relationship has been set up with the Pest Animal Control Co-operative Research Centre in Australia, to expand New Zealand's research expertise and ensure co-operation and collaboration.

3. Implementation of measures, including assessment of effectiveness

(a) Ways and means set in place for implementation

DOC apportions part of its annual Vote Conservation budget to animal pest control, which includes stoat control. As well, in 1999 a five-year multi-agency stoat research programme was funded by the government. A stoat technical advisory group involving representatives from DOC, Lincoln University and Auckland University, has been set up to develop and oversee the new research programme.

(b) Achievements (specify whether the action was fully successful, partially successful, or unsuccessful), including any adverse effects of the actions taken on the conservation and sustainable use of biodiversity

The efficiency of Fenn trapping was tested during predicted stoat irruption, using two techniques. Results indicate that perimeters enclosing up to one square kilometre with trap tunnels at 100 metre spacing significantly reduced stoat numbers. As well, low intensity stoat trapping (200 metre intervals along a 45 kilometre line along the length of a valley, and a short line across the valley's top and bottom) provides enough protection to markedly reduce stoat predation during breeding of two native bird species.

Existing techniques for stoat control have successfully supported the creation of off-shore island sanctuaries as refuges for mainland species. As well, a number of 'mainland island' sanctuaries have been successfully established where intensive predator control (including stoats) is carried out to provide safe havens for endemic species. One way to create a mainland sanctuary is to build a stoat-proof fence, another is to maintain a dense ring of traps and poison bait stations on the periphery of the protected area. Traditionally fences have been electrified, but a low cost fence design has recently been developed that is an effective barrier to many vertebrate pest species. Research is currently underway to provide a scientific rationale for deciding when and where exclusion fences are a cost-effective option for stoat and other pest control.

(c) Costs of action

Each DOC conservancy sets aside baseline funding for its annual animal pest control programmes, which includes work on stoat control. The department's annual in 1999/2000 was about NZ$176.9 million, and about 50% was spent on ecological management, which includes expenditure on animal pest control, including stoats.

As well, in 1999 the New Zealand Government set aside an extra NZ$6.6 million over five years to fund an integrated stoat control research programme. The yearly allocation is:

- 1999/2000 – NZ$338,000
- 2000/2001 – NZ$1.406 million
- 2001 - 2004 – NZ$1.631 million in each of the three years

4. Lessons learned from the operation and other conclusions

(a) Further measures needed, including transboundary, regional and multilateral co-operation

In 1999 the New Zealand government assigned money to a five-year research project to develop an integrated stoat control research programme. The aim is to develop more cost effective, long-term and sustainable approaches to controlling stoats, as this work must be ongoing for some endemic species to survive on the mainland.

The four objectives of the stoat research programme are to:

- Make stoat control more cost effective where it is already successful;
- Develop new techniques so that control can realistically be undertaken in more and larger areas;
- Expand the arsenal of methods to ensure sustainability of control; and
- Seed new, longer-term projects for their potential to dramatically increase control effectiveness.

In the first year of the five-year stoat research programme 10 projects were funded. Several of these were literature reviews to gather information to help the stoat technical advisory group decide the direction of the programme and assess future research proposals. Another, by the CSIRO, Wildlife and Ecology, Australia, looked at the feasibility of immunocontraception for managing stoats – it was considered that biocontrol has potential and should be considered as a longer-term strategy.

In its second year, the research programme has concentrated on improving baits, lures and traps, as improvement in these areas will bring quick gains in the short-term. Some longer-term higher-risk projects were also funded, as a variety of methods is needed to help make long-term control sustainable. One of these is to model the immigration rate of island stoat populations – to try and predict when and why stoats re-invade islands and the distances they can travel.

Other research includes:

- New traps and toxins;
- Tests to see whether stoats have a sensory bias toward a particular colour;
- The optimum density of control stations (bait stations and traps) and monitoring stations (tracking tunnels) in two different habitat types;
- Which monitoring techniques will provide robust information to compare managed and unmanaged sites;
- Expanding our knowledge of stoat ecology to a range of habitats – such as podocarp/broadleaf forest, braided river systems and alpine beech forest;
- Modelling the dynamics and control of stoats;
- Assessing the cost effectiveness of exclusion fencing; and
- Stoat reproductive biology.

(b) Replicability for other regions, ecosystems or groups of organisms

(c) Information compilation and dissemination needed

Continuing dialogue between scientists and managers is important to make sure research is targeted to meet operational needs. It provides the opportunity for scientists to hear about management needs, and for operational staff to understand some of the scientific challenges faced in this area of research.

Because public support and understanding is needed for techniques to be used into the future, social science research is underway to look at the social acceptability of new stoat control techniques, as well as the acceptability of existing trapping and poisoning techniques. The findings from this research will enable DOC to assess the level of public knowledge of stoats and their impact on New Zealand's environment, and public knowledge of current stoat control strategies. This information will help DOC and other researchers in their decisions on, and marketing of, stoat control strategies.

A project for use in schools is being developed and trialed. Its aim is to increase public awareness and to provide an opportunity for young New Zealanders to take part in determining stoat distribution patterns.