POSSUMS

1. Description of the problem

(a) Location of the case-study

Nearly all of New Zealand's mainland (98%), except for a small area in the South Island high country and the southern West Coast.

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

Possums were introduced to New Zealand in 1837 in a deliberate attempt to establish a fur trade and 'enrich' the local fauna. It took several attempts before self-sustaining populations established. About 1911 the government allowed farmers, orchardists and horticulturalists to hunt the animals because of the damage done to crops and orchards. However, they were still protected in native forest areas where their damage was considered negligible. Possums were released into new areas and licences issued to trappers. The licences and a levy on all skins traded provided a good source of revenue.

Conservationists began to complain about the impacts of possums throughout the 1920s and '30s, and from 1922 official liberations were no longer permitted. Not until the 1940s was the first scientific evidence of the impacts of possums on native forest collected. After this, the government's policy changed dramatically and New Zealand has since then been fighting to control the possum. Illegal liberations into possum-free areas were reported up until the 1970s.

(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)

The common brushtail possum, *Trichosurus vulpecula*, is a relatively small animal, the size of a cat. It is a solitary, nocturnal, arboreal marsupial that has a wide natural distribution in its native Australia and Tasmania.

Its impacts on New Zealand's ecology have been huge. Estimates vary, but some put the number of possums at 70 million animals. It is an opportunistic feeder, feeding on foliage, flowers and fruits, insects, bird eggs and fungi. It has no natural competitors for food and shelter, and no natural predators or parasites that significantly affect its numbers are in New Zealand. Given that New Zealand forest ecosystems are generally more productive than those in its home, Australia, possum densities here rise to 10-12 animals per hectare. In Australia these are often less than one per hectare.

The possum is considered the primary wildlife reservoir of tuberculosis in farmed cattle and deer in New Zealand, and the single greatest barrier to eradication. The first report of a free-ranging possum with Tb was in 1967. Possum populations infected with Tb now occupy about 24 per cent of New Zealand.

These areas correlate to where 75 per cent of the reactor herds and Tb-infected cattle are found.

(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.)

Possums were deliberately and legally introduced to New Zealand to try and establish a fur trade. The first successful introduction was in 1858, in the south of the South Island.

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

A number of techniques have been developed to monitor possum impacts on forest canopies. These include descriptive accounts, permanent (20m x 20m) forest plots, point-height intercept, photopoints, hemispherical (fish-eye) photography, direct observation, and the visual or remotely sensed interpretation of aerial photographs, videotape or satellite images.

The most common method is the recently developed Foliar Browse Index, a qualitative scoring method that combines direct observation with the use of indicator species to provide an assessment of possum damage to forest communities.

Monitoring of possum numbers takes two forms – operational monitoring to determine the direct impact that management has on possum numbers; and outcome monitoring to measure how effective the management is in protecting the resource.

Operational monitoring has been routinely carried out since possum control began in the mid-1950s but outcome monitoring is a relatively new concept.

Population monitoring is an essential part of possum management because it provides managers with information on the effectiveness of individual control operations and on the responses of the population over time.

2. Options considered to address the problem

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

There are two separate management strategies relevant to possum control – one aims to control bovine Tb and the other aims to limit damage to native fauna and flora. Decisions on the management of possums are influenced by the desired end goal, which agency is in charge of the operation and whether the operation is on public or private lands.

Various support systems have been developed to help decision-makers. These aim to enhance the efficiency of possum management either by improving how

control activities are targeted or by identifying the most cost-effective alternatives for control. There is still a need for comprehensive and robust systems that allow managers to simulate and compare alternative control strategies.

In the Department of Conservation, there is also a trend toward ecosystem management rather than single species management. This is likely to influence future decisions about possum control strategies.

(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)

A great deal of research has been done, and is being done, on possum biology, social behaviour and diseases, impacts, types of control, monitoring and the benefits of control. Methodologies are continually updated as new or improved information becomes available.

Many agencies involved in control have standards and procedures governing how the work will be carried out and any training required by practitioners. For example, DOC has procedures governing the safe handling of pesticides and assessing the environmental effects of control operations. It also provides ecological management training for relevant field staff – this includes control techniques.

The laws of New Zealand govern the use of firearms, some vertebrate pesticides such as cyanide and sodium monofluoroacetate (1080) and animal ethics.

Public information campaigns happen when operations are controversial, and often centre on the use of 1080.

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

Because New Zealand has more than 40 years of possum control experience, there is usually a wealth of knowledge, experience and research about the best option in any given situation. Often the preferred type of control will be based on factors such as the location, difficulty of the terrain, remoteness and reasons for control. However, decisions are also influenced by which agency is carrying out the work and feedback from any consultation that may have taken place before the operation.

(d) Institutions responsible for decisions and actions

The main funding bodies for possum control are the Animal Health Board (AHB), Regional Councils and the Department of Conservation (DOC).

The AHB's control strategy aims to reduce bovine Tb with the long-term goal of official freedom from the disease by 2011. So far it has achieved a 60% reduction. Many of the AHB funded operations are managed under contract by New Zealand's 16 Regional Councils.

DOC has a comprehensive ten-year National Possum Control Plan (1993 – 2002) which aims to achieve sustained control in critical areas, and to protect high-ranking environmental values most at risk from the marsupial. DOC uses both staff and contractors to carry out its animal pest control operations.

Regional Councils run operations for both reasons, to control bovine Tb and to protect natural values on land they manage.

In all operations using pesticides, other agencies may also have decision-making powers and the ability to set conditions on the work. These include Medical Officers of Health (such as when public water supplies are in the operational area) and local territorial authorities (such as where an operation's area includes public roads).

3. Implementation of measures, including assessment of effectiveness

(a) Ways and means set in place for implementation

Government funding for possum control is channelled through either the Animal Health Board, Department of Conservation and the country's 16 territorial Regional Councils. Sometimes Regional Councils and DOC share the costs of an operation when it covers both public and private lands. And sometimes the Animal Health Board picks up the costs for possum control in buffer zones on public lands when these lie adjacent to a Tb control operation on private land.

(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

Possums' impact in native forests was not measured in any systematic way until the 1940 and 1950s, and only in recent years has it been measured quantitatively. While the complete removal of possums from areas where endangered species exist generally results in a remarkable recovery in these populations (e.g. eradication from islands), the benefits for a native forest ecosystem where possum numbers are reduced but not removed sometimes take some time to become evident. This may be because of a number of reasons. For example, some plants tend to grow more slowly or remain affected by possums at even very low possum densities, or other pest mammals (such as goats or deer) may be present and compromise recovery of affected species, or site-specific characteristics such as soil and climate may influence the recovery.

Possums' impact on forestry can have economic consequences making it economic to control possums at specified stages of the forest's growth. Impacts on agriculture, however, have rarely been measured except in qualitative terms. This means it is difficult to assess whether some control operations are succeeding in their goals. However, the current AHB bovine Tb control strategy has achieved a 60% reduction in the number of Tb infected deer and cattle herds over the past five years.

(c) Costs of action

Indicative costs of possum management range from:

- NZ$5 - $10 per hectare for annual culling operations at low densities;
- NZ$20 - $30 per hectare for knockdown of high possum densities; and
- More than NZ$61 per hectare for eradication of possums from islands.

In 1997/98, the control of Tb vectors cost NZ$24.7 million. This was three times more than seven years earlier. Research costs for possum/Tb control research reached NZ$15.5 million in 1998/99. At present New Zealand spends a total of about NZ$50 million on control.

However, if New Zealand decided to aim to eradicate possums from the highest priority areas for conservation protection and Tb management, this cost has been estimated at NZ$1 billion.

4. Lessons learned from the operation and other conclusions

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

Biological control of possums is considered the way of the future. First, because of the prohibitive cost of maintaining other methods over the long-term. Second, because it is generally undesirable to put animal pesticides into the environment as a long-term strategy.

A New Zealand scientific research agency, Landcare Research, is co-operating with the Australian-based Marsupial Co-operative Research Centre (CRC) to investigate biological control options for possums.

The Marsupial CRC's objective is to develop tools for managing problem marsupial populations through fertility control. This is complementary to existing New Zealand possum research programs. In addition, it brings Australian resources and expertise to bear on the problem. The Ministry of Agriculture and Forestry (MAF) has recognised the promise of this trans-Tasman collaboration with more than NZ$1.3 million in funding for possum-orientated Marsupial CRC projects.

The research is looking at three ways to manipulate fertility in mammals: surgical, chemical and immunological. The latter is the most likely option for New Zealand.

It appears likely that any immunocontraceptive developed in the next 5 – 10 years will be dispensed in a bait because of the difficulty in finding or developing a delivery agent such as a possum-specific sexually transmitted disease. The advantage of a marsupial immunocontraceptive delivered by a biodegradable bait is that it is likely to be highly population-specific.

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

New Zealand's experience with large-scale animal pest control operations has been used by other countries including the Seychelles and Mauritius.

(c) Information compilation and dissemination needed