THREATENED SPECIES RECOVERY PLAN SERIES NO.15

BAT (PEKA PEKA) RECOVERY PLAN
(*Mystacina, Chalinolobus*)

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RECOVERY PLANS

This is one of a series of recovery plans published by the Department of Conservation. Recovery plans are statements of the Department's intentions for the conservation of particular plants and animals for a defined period. In focusing on goals and objectives for management, recovery plans serve to guide the Department in its allocation of resources and to promote discussion amongst a wider section of the interested public.

After preparing a technical report which was refined by scientists and managers both within and outside the Department, a draft of this plan was sent to the New Zealand Conservation Authority and relevant Conservation Boards for comment. After further refinement, this plan was formally approved by the Director-General of Conservation in April 1995. A review of this plan is due after five years, or sooner if new information leads to proposals for a significant change in direction. This plan will remain operative until a reviewed plan is in place.

The Department acknowledges the need to take account of the views of the tangata whenua and the application of their values in the conservation of natural resources. While the expression of these values may vary, the recovery planning process provides opportunities for consultation between the Department and the tangata whenua. Departmental Conservancy Kaupapa Atawhai Managers are available to facilitate this dialogue.

A recovery group consisting of people with knowledge of bats and an interest in their conservation has been established to review progress in the implementation of this plan and to recommend to the Department any changes which may be required as management proceeds. Comments and suggestions relating to the conservation of these bats are welcome and should be directed to the recovery group via any office of the Department or to the Threatened Species Unit.

CONTENTS

1.0 ABSTRACT

This recovery plan summarises our present knowledge of the distribution and ecology of New Zealand bats, and outlines the priority recovery actions for the next ten years. At present, our knowledge of bats is very superficial; consequently much of the work over the next ten years is directed at determining status, distribution, population trends, developing survey and monitoring techniques, and conducting research relevant to management of the two species. Increasing the public's awareness of New Zealand bats and opportunities for public involvement are also important aspects of the recovery plan.

2.0 INTRODUCTION

Bats are New Zealand's only native terrestrial mammals. Three species belonging to two genera are known from New Zealand. These are the greater short-tailed bat (*Mystacina robusta*), the lesser short-tailed bat (*Mystacina tuberculata*) and the long-tailed bat (*Chalinolobus tuberculatus*). The lesser short-tailed bat is divided into three subspecies (Table 1). New Zealand bats all belong to the sub-order Microchiroptera.

Short-tailed bats belong to the endemic family Mystacinidae. Their phylogeny and place of origin is uncertain (Daniel 1979). Pierson et al. (1986) suggest affinities with South and Central American phyllostomoid bats, with separation of the lineages about 35 million years ago. The lesser short-tailed bat is the only member of this family known to be surviving today.

Long-tailed bats belong to the almost worldwide family of Vespertilionidae and are closely related to six other species of wattled or lobe-lipped bats in Australia, Papua-New Guinea, New Caledonia and Norfolk Island (Daniel 1990).

The Maori refer to bats as peka peka. In Maori proverb bats were associated with the mythical, night flying bird hokioi and foretell death or disaster (Higham 1992).

Distinguishing features and measurements of each species and subspecies of bat are given in Hill and Daniel (1985) and Daniel (1990).

3.0 PAST AND PRESENT DISTRIBUTION AND ABUNDANCE

3.1 Greater Short-tailed Bat

Late Quaternary fossil skeletons of greater short-tailed bats have been found on Stewart Island, in north and south Canterbury, central Otago, Punakaiki on the West Coast, Takaka Hill near Nelson, Hawkes Bay, East Coast and Waitomo (T. Worthy pers comm.). Populations of greater short-tailed bats were present on Big South Cape and Solomon Islands, off Stewart Island until the mid 1960s (Fig. 1). In 1962 or 1963 ship rats were accidentally introduced onto both islands. No confirmed sightings of greater short-tailed bats have been made since 1967 (D. Murphy pers. comm.). Bell (1986)

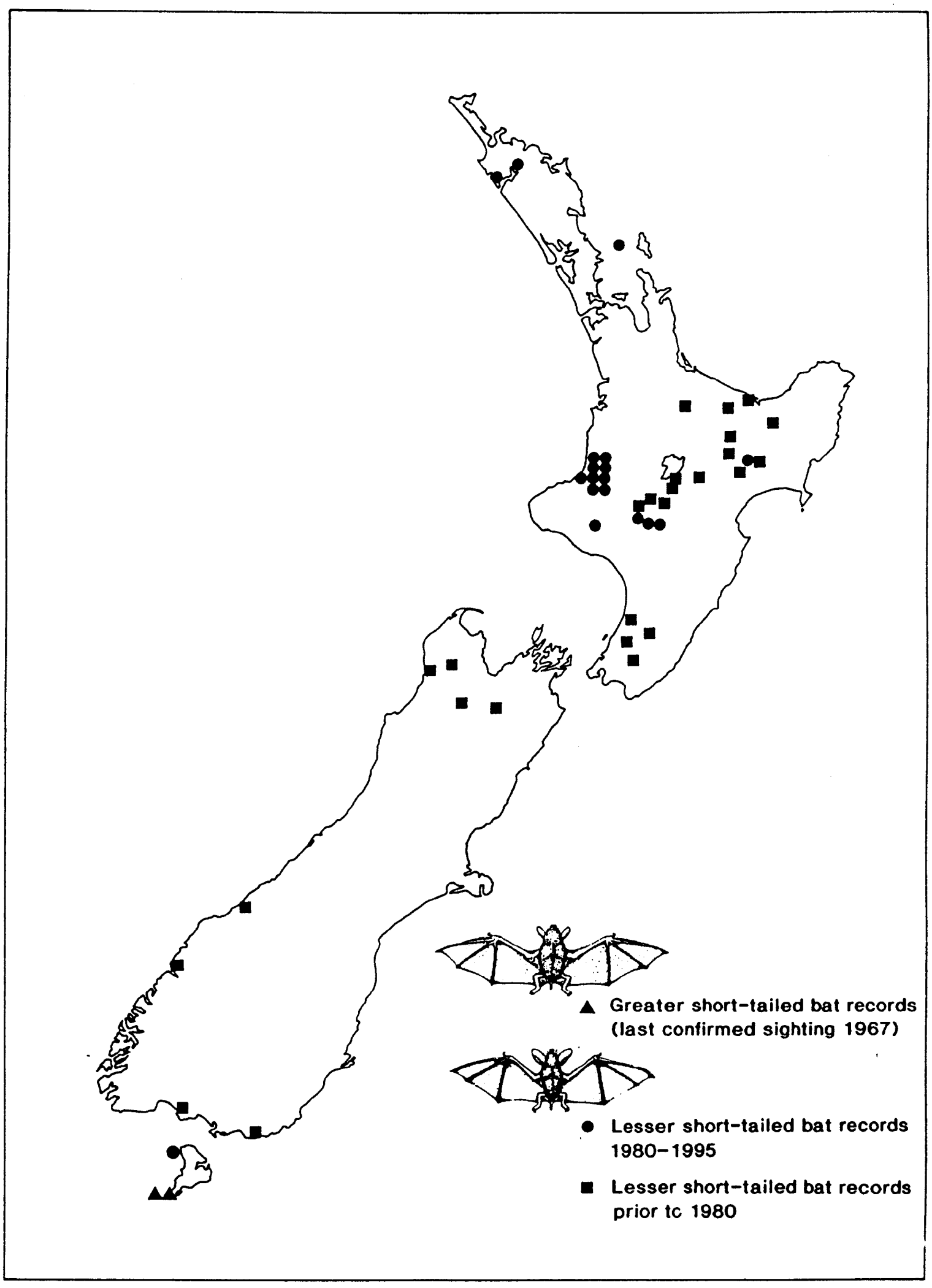


Fig. 1--Location of Records of Short-tailed Bats.

and the IUCN Red List of Threatened Animals (Groombridge 1993) list the greater short-tailed bat as "Extinct". In 1994 DOC listed this species in Category X: "A species which has not been sighted for a number of years but which may still exist" (Molloy and Davis 1994). There is a remote chance that the greater short-tailed bat still persists on one or two of the privately owned islands adjacent to Big South Cape.

Table 1: Common and Scientific Names of New Zealand Bat Species (taxonomy follows Hill and Daniel 1985, Daniel 1990).

Common Name	Scientific Name
Greater short-tailed bat	*Mystacina robusta*
Lesser short-tailed bats	
- Kauri forest short-tailed bat	*Mystacina tuberculata aupourica*
- Volcanic plateau short-tailed bat	*M. t. rhyacobia*
- Southern short-tailed bat	*M. t. tuberculata*
Long-tailed bat	*Chalinolobus tuberculatus*

3.2 Lesser Short-tailed Bat

Historical records and late quaternary fossil distribution suggest that short-tailed bats were once widespread in the North Island (Daniel 1990). In the South Island records exist from north-west Nelson, Fiordland, Codfish Island, Solomon Island and Big South Cape (Daniel 1990). In Canterbury, short-tailed bat fossil remains have been found from one site only in north Canterbury, and are absent from over twenty sites examined in south Canterbury (T. Worthy pers.comm.).

Bell (1986) lists the species as threatened (= vulnerable), the IUCN Red List of Threatened Animals lists the species as vulnerable (Groombridge 1993), and DOC lists all three subspecies (kauri forest short-tailed bat, volcanic plateau short-tailed bat and southern short-tailed bat) in Category A: "Species of highest conservation priority" (Molloy and Davis 1994).

The southern short-tailed bat, which formerly occurred in the extreme s Island, and islands off Stewart Island is now only known from Codfish Island (Fig. 1). The last record of the southern short-tailed bat from the North Island was a dead specimen found in a mountain but in the Tararua Range in 1978 (N.Z. Bat Mapping Scheme, compiled by M.J. Daniel). In the South Island the last records are from the North-west Nelson area; a cat killed short-tailed bat was found at Karamea in 1957 and in 1977 a dead short-tailed bat was found on a fruit lured cyanide bait in the Roaring Lion River area (both records from N.Z. Bat Mapping Scheme, compiled by M.J. Daniel).

The kauri forest short-tailed bat is only known from three widely separated sites. Populations are known to occur in the Omahuta kauri forest and Warawara in Northland, and on Little Barrier Island (Fig. 1). A large burn-off of cut-over kauri forest and the subsequent planting of a pine plantation in the north of Omahuta forest

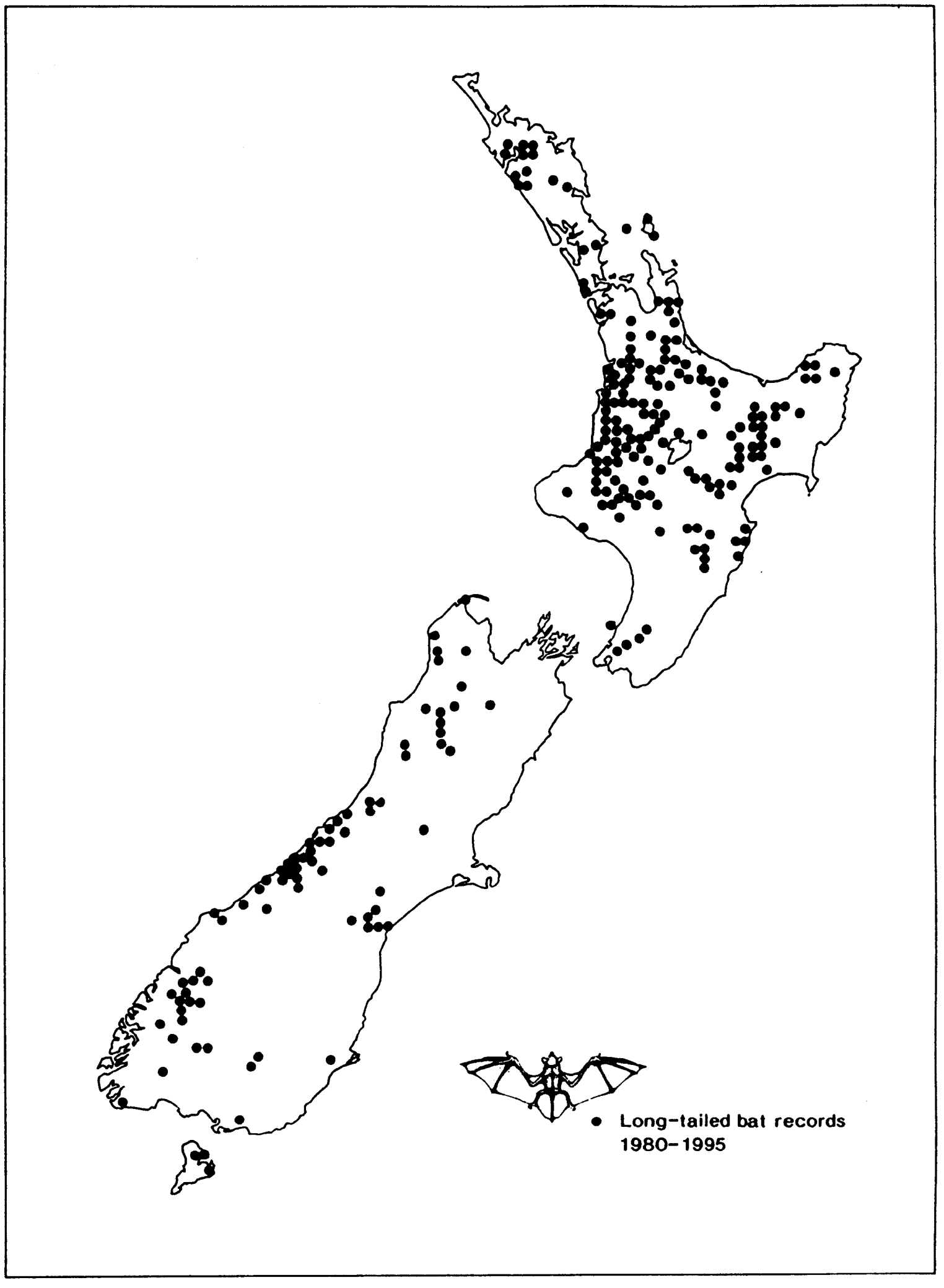


Fig. 2--Location of Records of Long-tailed Bats, 1980-1995.

is thought to have had a serious effect on the bat population in that area. On Little Barrier Island, bats are considered to be abundant. The last record of short-tailed bats on the Coromandel Peninsula was in 1895. Unconfirmed reports of this species have been received from Puketi, and Waipoua forests in Northland.

A recent increase in survey effort in the central North Island has indicated the presence of volcanic plateau short-tailed bats at Waitaanga in north Taranaki, Matemateonga in east Taranaki, Rotoehu in Bay of Plenty, Puketi in Northland, Pureora in the King Country, Urewera National Park and the lower southern flanks of Mt Ruapehu. Confirmed reports prior to 1980 include the northern Kaimanawa Range, and the Mamaku Plateau and Whirinaki forests in the Bay of Plenty (Fig. 1).

3.3 Long-tailed Bat

Long-tailed bats are widely distributed in the North Island, Great and Little Barrier Islands, Kapiti island, South Island (except for much of the eastern side) and on Stewart Island (Fig. 2).

Some information suggests that long-tailed bats are present in lower numbers today than they were earlier this century. Buller (1893) and Cheeseman (1894) reported on the numbers of bats found in four disturbed bat roosts; in each case it was estimated that several hundred bats were present. In most roosts found in recent times, less than a hundred bats have been counted. Recent survey work on the West Coast and around the Nelson Lakes, where long-tailed bats were recorded in the 1960s and 1970s indicates that long-tailed bats may now be very rare at these sites. This species is listed as threatened (= vulnerable) in Bell (1986), and is listed by DOC in Category B "Second priority species for conservation action" (Molloy and Davis 1994).

4.0 ASPECTS OF THE ECOLOGY OF BATS RELEVANT TO MANAGEMENT

4.1 Short-tailed Bats

Short-tailed bats are considered to be a deep forest bat, but have been detected at forest edges. They are invariably associated with old growth indigenous forest and have been found roosting both communally and singly in hollow trees. They usually become active after dark and return to roost before dawn. In the Ohakune area, bats have been observed flying in air temperatures as low as 1° C, with a ground frost of -3.5° C (B. Lloyd pers. comm.). Although the lifespan of short-tailed bats is not known, species of a similar size in other countries have lifespans in excess of ten years (Findley 1993).

Short-tailed bats are thought to be lek breeders; during summer and autumn males compete for traditional singing posts which they occupy for several hours each night. Females are attracted by the singing males, and mating takes place (M. Daniel, pers. comm.). Pregnant females have been recorded on Codfish Island in December and free flying young observed on Little Barrier in February (B. Lloyd pers. comm.)

Short-tailed bats are omnivorous; foods recorded include arthropods, fruit, nectar and pollen (Daniel 1976, 1979, 1990). Short-tailed bats forage in leaf litter on the forest

floor, and on tree trunks. It is not known whether they feed on the wing. Recent observations of short-tailed bats feeding on the nectar of *Dactylanthus taylorii* suggest that they may be an important pollinator of this threatened plant (Ecroyd 1993, 1994).

Short-tailed bat echolocation calls include multiple harmonics (S.Parsons and B. Lloyd pers. comm.); when bats are close they can be detected on the entire frequency range of the Bat Box III bat detector. The calls are loudest around 28 kHz (B. Lloyd pers. comm.); short-tailed bats should be surveyed for at this frequency. Short-tailed bats can be detected with a Bat Box III up to 20 m away when 28 kHz is used (B. Lloyd pers. comm.).

4.2 Long-tailed Bat

Current knowledge indicates that long-tailed bats inhabit forest edges, feeding above the forest canopy, along forest margins, over farmland, and streams and lakes. Roosts have been found in indigenous and exotic trees, caves, and occasionally in buildings. (Daniel 1970, 1981, 1990, Daniel and Williams 1983, 1984). Roost sites located in the Eglinton Valley are used for 1-6 days, with the composition and numbers of bats using a particular roost varying considerably from night to night (C.O'Donnell, pers. comm.). As with short-tailed bats they roost both solitarily and communally. Long-tailed bats begin to leave their roosts within half an hour of dusk, and peak activity appears to be in the first two hours of twilight, with a smaller peak before dawn. Bats in the Eglinton Valley have a home range of 50-70 km^2, and often undertake 10-15 km distance flights (C.O'Donnell, pers. comm.). Bat activity generally ceases in temperatures below 5°C, although some activity has been recorded in temperatures as low as -1.5°C in Eglinton valley (C. O'Donnell, pers. comm.). As with short-tailed bats, longevity is not known.

Little is known about the breeding behaviour of long-tailed bats. Daniel and Williams (1983) reported that long-tailed bats produce only one young each year. In Eglinton Valley bats give birth to young at the beginning of December, and young bats take their first flights from the roosts in the first week of January (C, O'Donnell, pers. comm.).

The long-tailed bat is apparently solely an aerial insectivore, feeding on small moths, midges, mosquitoes (Dwyer 1962; Daniel and Williams 1983), stoneflies, tipulids, caddis flies, beetles and sandflies (C.O'Donnell, pers. comm.).

Long-tailed bat echolocation calls may include multiple harmonics (S. Parsons pers. comm.), which can be detected over the entire frequency range of the Bat Box III detector. The calls are loudest around 40 kHz (C. O'Donnell pers. comm.) and this frequency should be used for survey. Calls at this frequency can be detected with a Bat Box III detector up to 50 m away (O' Donnell pers. comm.). Long-tailed bats echolocation calls include a relatively low frequency (i.e. < 20 kHz) component which can be heard by some people.

4.3 Detecting and Discriminating Bat Species with a Bat Box III Detector

When attempting to detect bats with a Bat Box III bat detector, the detector should be tuned to the frequencies with the loudest calls for the species being surveyed: 28 kHz

for short-tailed bats or 40 kHz for long-tailed bats. Because there is some overlap in the frequency range of echolocation calls of the two species, sighting of animals should be carried out to confirm the identity of the species.

5.0 THREATS TO BATS

It is likely that the factors which have led to the decline of bats are similar to those which have caused the decline of many endemic bird species. These include predation, competition and habitat loss. The relative impact of each of these threats is unknown.

5.1 Predation

It is suspected that predation by rats, stoats and feral cats is one of the major threats affecting bats.

Short-tailed bats may be vulnerable to predation while feeding on the forest floor or on tree trunks. The prolonged singing displays of male short-tailed bats on leks may also attract mammalian predators. The presumed extinction of greater and lesser short-tailed bats on Big South Cape and Solomon Islands after the introduction of ship rats gives an indication of the severity of predation on *Mystacina* species. The frequency of greater short-tailed bat fossils in deposits in Canterbury is inversely proportional to the number of kiore (*Rattus exulans*) in deposits (T.Worthy, pers. comm.).

Both long-tailed and short-tailed bats are vulnerable to predation while in torpor in their roosts during the day. It can take several minutes for bats to raise their body temperature to 39-40°C before they can fly and escape predation. Large roosts are noisy sites at dusk when bats leave en masse, and this in addition to the strong ammonia smell of roosts may act as an attractant to predators.

5.2 Habitat Loss and Disturbance

Massive forest clearance and burning in New Zealand over the last 1000 years has destroyed a vast amount of suitable bat habitat. While the rate of clearance has declined dramatically, ongoing selective logging and deforestation programmes may threaten bat populations in some areas. Both bat species often use the largest and oldest trees in the forest for roosts; these same trees are targeted by selective logging operations. Disturbance by people at roost sites may have an impact on colonies such as the Grand Canyon cave near Te Kuiti.

5.3 Toxins

Cyanide, 1080, phosphorus, and anti-coagulant toxins are used in a variety of forms to control or eliminate browsers and rodents in localities where bats are also present. One case of a short-tailed bat dying as a result of eating cyanide possum bait is documented (Daniel and Williams 1984). Short-tailed bats spend a proportion of their time foraging on the forest floor, and are therefore likely to encounter ground laid poisons baits.

B. Lloyd (pers. comm.) has undertaken trials to assess whether short-tailed bats are susceptible to direct poisoning, by presenting different bait types to captive individuals.

The bats showed no interest in carrot and pollard baits but readily took jam pastes. Although this trial is insufficient in providing a reliable evaluation of the risk, it indicates that short-tailed bats are unlikely to suffer from direct poisoning where pollard or carrot baits are used, but may be at risk when jam paste baits are used. Long-tailed bats are aerial feeders and are therefore not likely to encounter poison baits.

The risk to short-tailed bats through ingestion of anthropods which have fed on 1080 baits is presently being investigated by DOC.

5.4 Competition

While there is considerable overlap in the diet of short-tailed bats and browsers, rodents and wasps, the effect of competition for food on bats is unknown.

6.0 ABILITY TO RECOVER

6.1 Greater Short-tailed Bat

The likelihood of recovering the greater short-tailed bat is very small, in light of the fact that no live specimens have been seen for 27 years. If live bats are discovered in the future, management techniques being developed for lesser short-tailed bats may prove to be applicable to the conservation of greater short-tailed bats.

6.2 Lesser Short-tailed Bat

While no short-tailed bat populations occur on rat free islands, DOC intends removing kiore from both Little Barrier and Codfish Islands. Short-tailed bats appear to be able to survive in the presence of kiore, but the removal of this species may result in an increased food availability for bats at these sites.

Captive breeding and translocation to new island sites, or direct transfer of wild individuals would help secure the species. Establishment of a volcanic plateau short-tailed bat population on predator free islands, and the establishment of second island populations of southern and kauri forest short-tailed bats within their natural range will further secure the survival of these subspecies. Methods for translocating and monitoring short-tailed bats will need to be developed.

Six bats have been successfully held at the Wellington Zoo for two years. The mite infestation problem which was responsible for the death of six bats held in 1981 has been overcome (B. Lloyd, pers. comm.).

Our ability to improve the status of short-tailed bats on the mainland is unknown. At present not enough is known about the relative impacts of the different threats affecting bats or the ecology of the species to effectively manage the species. Protection work will need to proceed on a "research by management" basis. Protection of roosts from predators could be achieved in some instances, but recent research shows that short-tailed bats use a number of roost sites (B. Lloyd pers. comm.) making this option impractical in many circumstances.

6.3 Long-tailed Bat

While there is no accurate information on present trends in long-tailed bat populations, this species is still widespread. An assessment of population trends is essential before management is undertaken. Methods of monitoring long-tailed bats are still in the developmental stage.

As with short-tailed bats, not enough is known about the relative impacts of the different threats affecting long-tailed bats to effectively manage the species. Long-tailed bats also use a number of roost sites (C. O'Donnell pers. comm.) making roost site protection impractical in many circumstances. If rats are removed from Kapiti Island and Little Barrier Island, there will be two populations of long-tailed bats on rat free islands. However, existing information suggests that neither population is very large. A more thorough assessment of these populations is needed.

7.0 OPTIONS FOR RECOVERY

7.1 Lesser Short-tailed Bats

(1) Do nothing - This is not an acceptable option as short-tailed bats are likely to continue to decline and eventually become extinct on the mainland, leaving one population of the kauri forest short-tailed bat on Little Barrier, and one population of southern short-tailed bat on Codfish Island. No island populations of the volcanic plateau subspecies are known to exist.

(2) Establish and maintain populations of each subspecies on predator free islands - Island populations of all subspecies would provide an insurance if mainland protection proves to be impractical. The planned eradication of kiore from Little Barrier will enhance the population of kauri forest short-tailed bat.

(3) Survey and monitor mainland populations - Considerable progress is being made in developing survey and monitoring methods for short-tailed bats. An increased knowledge of the distribution and abundance of this species will enable key sites to be selected for protection. Once monitoring techniques are developed, the status of populations and their response to management can be determined. This is an important element of bat conservation.

(4) Maintain mainland populations - Short-tailed bats were once widespread throughout New Zealand and were a significant element in forest ecosystems. Our long-term goal therefore should be to not only conserve short-tailed bats on offshore islands but also at key sites through out their present range on the mainland. Very little bat protection work has been attempted in New Zealand. Research into the most effective means of protecting bat populations is needed, before full scale management can be undertaken.

(5) Captive management and research - The ability to keep and breed bats in captivity may be a requirement if new bat populations are to be established in

safe habitats. A captive bat population also offers research opportunities such as non-toxic bait acceptance trials, and development of marking techniques.

A combination of options 2,3,4, and 5 is required for the recovery of lesser short-tailed bats.

7.2 Greater Short-tailed Bat

(1) **Do nothing** - This is not an acceptable option; although greater short-tailed bats have not been seen since 1967, more comprehensive surveys are needed.

(2) **Survey of southern Titi Islands** - Survey of the Titi Islands, south of Stewart Island, will clarify the status of this subspecies.

(3) **Contingency plan** - If greater short-tailed bats are discovered on the Titi Islands, immediate action will need to be taken. Development of a contingency plan will enable staff to act quickly in this event.

A combination of options 2 and 3 is favoured.

7.3 Long-tailed Bats

(1) **Do nothing** - While long-tailed bats appear to be more widespread than short-tailed bats, anecdotal evidence suggests long-tailed bats are less common than they were around the turn of the century. Until we have better information on the population status of this species, the option of doing nothing is not acceptable.

(2) **Establish and maintain populations on predator free islands** - The removal of rodents from Little Barrier Island and Kapiti Island will enhance the prospects for two small island populations of this species.

(3) **Survey and monitor populations** - As with short-tailed bats, survey and monitoring methods for long-tailed bats are presently being developed. An improved knowledge of the distribution, abundance, and population trends of long-tailed bats will enable an assessment of the type of management required, and identification of key sites for protection.

(4) **Maintain mainland populations** - If long-tailed bats are not secure on the mainland, active protection work could be attempted. Research into the most effective means of protecting long-tailed bat populations would be needed.

(5) **Captive management** - Captive management of long-tailed bats has not been attempted to date. Because this species is still reasonably widespread in the wild, development of husbandry techniques and establishment of a pool of captive individuals as an insurance policy against extinction in the wild is not a priority. Limited captive management may be necessary for specific purposes such as research.

A combination of options 2 to 5 is favoured for long-tailed bats. Active protection work and development of captive management techniques should be implemented if long-tailed bats are found to be declining.

8.0 RECOVERY STRATEGY: GOALS AND OBJECTIVES

GOAL:

TO ENSURE THE PERPETUATION OF ALL EXTANT BAT SPECIES AND SUBSPECIES THROUGHOUT THEIR PRESENT RANGES, AND WHERE FEASIBLE ESTABLISH NEW POPULATIONS WITHIN THEIR HISTORICAL RANGES.

PLAN OBJECTIVES:

1. To undertake or promote research on bats which will assist in their management.

2. To evaluate the status of both short and long-tailed bats.

3. To establish populations of short-tailed bats on suitable islands.

4. To select, protect and monitor populations of short and long-tailed bats throughout their geographic range.

5. To raise public awareness of bats and to involve the public in bat conservation.

9.0 RECOVERY STRATEGY: WORK PLAN

OBJECTIVE 1: TO UNDERTAKE OR PROMOTE RESEARCH ON BATS WHICH WILL ASSIST IN THEIR MANAGEMENT.

Explanation

The skills and knowledge needed to manage New Zealand bats do not presently exist. Methods of survey and monitoring are in the early stages of development, and knowledge of bat ecology and threats is limited. Techniques such as captive breeding, translocation, and predator protection have not been developed. A considerable investment in research will be needed during the first phase of the recovery of bats.

Priorities for bat research identified at a bat recovery group meeting held in 1992 were development of survey and monitoring techniques, and assessment of the threats

affecting bats. High priority was assigned to assessment of the effect on bats of toxins used in eradication and control programmes. Other information needs include diet, home range and habitat use.

Taxonomic research of short-tailed bat populations is needed to further clarify their taxonomic status. Similar studies need to be initiated on long-tailed bats.

Current research topics are listed in Appendix 1. At present the work underway deals with the priority research topics, although more focus on short-tailed bats is required.

Work Plan

1. Priority One: Short-tailed bats

(i) Develop survey and monitoring techniques.

(ii) Assess the threats affecting short-tailed bats.

(iii) Assess the impacts of toxins used in pest eradication and control programmes on bats.

(iv) Develop methods to protect short-tailed bats in mainland forest areas.

(v) Assess breeding ecology, population dynamics, home range size, diet, and habitat use of short-tailed bats.

(vi) Develop captive management and translocation techniques.

(vii) Undertake taxonomic studies.

2. Priority Two: Long-tailed bats

(i) Develop survey and monitoring techniques.

(ii) Assess the threats affecting long-tailed bats.

(iii) If long-tailed bats are found to be declining, determine causes and develop methods to protect populations on the mainland.

(iv) Assess breeding ecology, home range size, diet, and habitat use of long-tailed bats.

(v) Undertake taxonomic studies.

Outcomes

The research listed will provide the necessary skills and knowledge to carry out management actions to recover short-tailed bats, and to provide information on the distribution and population trends of both species.

Key Personnel

- Science and Research Division, DOC
- Landcare Research
- Universities
- Conservancy staff

OBJECTIVE 2: TO EVALUATE THE STATUS OF BOTH SHORT AND LONG-TAILED BATS.

Explanation

Until recently, only limited systematic survey has been undertaken for either short or long-tailed bats. Our knowledge of the distribution of the different bat species stems mainly from anecdotal reports.

The recent importation of bat detectors (which detect bat echolocation sounds) and the development of a system to automatically record bat calls (O' Donnell and Sedgeley 1994) has created considerable interest in bat survey work in New Zealand. Our knowledge of the distribution of both short and long-tailed bats is increasing as a result. Involvement of members of the public in bat survey work should be fostered.

An improved knowledge of the distribution of bats will enable sites to be selected for ongoing management, monitoring and advocacy.

This objective is dependent on development of standard methods for surveying bats; this is a priority research task (Objective 1).

Although no confirmed sightings of the greater short-tailed bat have been made since 1967, there is a chance that this species may still be surviving on one or more of the Titi Islands, southwest of Stewart Island. Survey of these sites is required.

Work Plan

Priority One: Short-tailed bats

(i) Search for surviving populations of greater short-tailed bats on the Titi Islands, southwest of Stewart Island. Possible locations include Kaimohu, Tamaitemioka and Pohowaitai Islands.

(ii) Using survey methods developed in the research programme (Objective 1), survey forests where lesser short-tailed bats may still occur. Elicit reports of short-tailed bats from the public through a publicity campaign, and encourage conservation groups and others to assist with surveys. Priority areas identified to date include:

- Forests where 1080 poison operations are planned, and where historical records of bats exist.

- Kauri forest short-tailed bat: Omahuta, Puketi, Waipoua and Warawara Forests.

- Volcanic plateau short-tailed bat: Waitaanga, Pureora, Urewera National Park, Whanganui National Park, Matemateonga, Tongariro National Park, Egmont National Park, northern Kaimanawa Range, Mamaku Plateau, Whirinaki Forest.

- Southern short-tailed bat: Tararua Ranges, Kahurangi National Park, Karamea.

Priority Two - Long-tailed bats

(i) Using methods developed in the research programme (Objective 1), survey habitat where long-tailed bats may still occur. Elicit reports of long-tailed bats from the public through a publicity campaign, and encourage conservation groups and others to assist with surveys.

Outcome

A knowledge of the conservation status of greater and lesser short-tailed bats, and long-tailed bats and improved knowledge of their distribution.

Key Personnel

- Conservation Officers, Protection, all conservancies
- Science and Research Division
- Informed public

OBJECTIVE 3: TO ESTABLISH NEW POPULATIONS OF SHORT-TAILED BATS ON SUITABLE ISLANDS.

Explanation

The threats to bats and their relative impacts are presently unknown, but are likely to be predation, competition and habitat loss. Research presently being undertaken will assist in clarifying this. If predation and competition with introduced mammals are found to be having a major impact on bats it will be important to establish secure island populations of each subspecies. If kiore are removed from Codfish and Little Barrier Islands, the southern and kauri forest subspecies will be secured on one predator-free island each. At present the volcanic plateau short-tailed bat does not occur on any islands, and is the highest priority for island establishment.

If greater short-tailed bats are located, actions will need to be urgently taken, to secure the survival of the species.

Work plan

Lesser short-tailed bats

(i) Determine the habitat requirements of short-tailed bats, and identify suitable island(s) for the establishment of bats.

(ii) Assess the options of a direct transfer or transfer of captive bred bats. If the latter is the favoured option, develop and implement a captive breeding plan, using the skills developed under Objective 1.

(iii) When bats are available for release, undertake the transfer using the methods developed under objective 1. Monitor the success of the release.

Greater short-tailed bats

(i) Develop a contingency plan which details the actions which will be taken if greater short-tailed bats are located.

Outcome

The establishment of populations of all short-tailed bat subspecies on predator free islands (and the greater short-tailed bat if located).

Key Personnel

- Conservation Officers in relevant conservancies
- Captive breeding institutions
- Science and Research Division
- Kaupapa Atawhai Managers

OBJECTIVE 4: TO SELECT, PROTECT AND MONITOR POPULATIONS OF SHORT AND LONG-TAILED BATS THROUGHOUT THEIR GEOGRAPHIC RANGE.

Explanation

Very little bat protection work has been undertaken in New Zealand. Identifying effective ways to protect bats on the mainland will need to occur through management trials. Possible techniques could include roost site protection and predator control at key forest sites. Overseas experiences in bat protection work may provide some guidance.

Promoting the legal protection of forest inhabited by short and long-tailed bats may be warranted in some cases.

Ongoing monitoring will be required to assess the effectiveness of management, and to determine population trends at unmanaged sites.

Work Plan

First Priority - Short-tailed bat

(i) Using information obtained through survey work (Objective 2), select key sites for each subspecies, where bat protection trials and long-term monitoring will be undertaken. Monitoring should be undertaken at both managed and unmanaged sites.

(ii) Identify sites which are legally unprotected, but which support short-tailed bat populations. If the sites are at risk, initiate the most appropriate protection mechanism for the site.

Second Priority - Long-tailed bat

(i) Using information obtained through survey work (Objective 2), select key sites where long-term monitoring will be undertaken. If long-tailed bats are found to be declining, implement similar protection programmes as for short-tailed bats.

(ii) Identify sites which are legally unprotected, but which support long-tailed bat populations. If the sites are at risk, initiate the most appropriate protection mechanism for the site.

Outcome

This work will result in improved knowledge of population trends of both long and short-tailed bats, development of management techniques for protection of mainland populations, and protection of key sites.

Key Personnel

- Conservation Officers, Protection, all conservancies
- Science and Research Division, DOC
- Landowners
- Local authorities

OBJECTIVE 5: TO RAISE PUBLIC AWARENESS OF BATS AND TO INVOLVE THE PUBLIC IN BAT CONSERVATION.

Explanation

The public profile of bats is generally low, despite their interest value. A greater understanding of New Zealand's bats by New Zealanders will help build support for their conservation. In particular there is considerable opportunity for back country users and conservation groups to assist in increasing our knowledge of bat distribution.

Work Plan

(i) Prepare a brief communication plan which outlines the main objectives of bat publicity (e.g. to elicit bat reports, stimulate survey work, encourage protection of bat habitat), identifies important groups (e.g. landowners, iwi, trampers, hunters, fishers, DOC staff), and describes the advocacy needed to achieve the objectives.

(ii) Implement the communication plan.

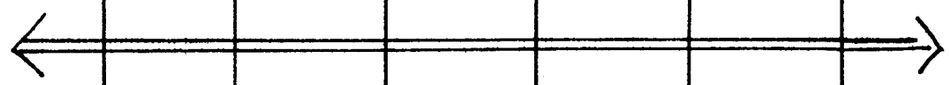
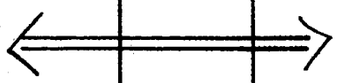
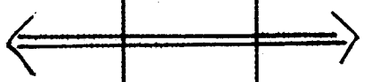
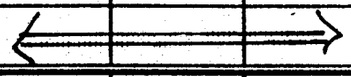
Outcome

A targeted advocacy programme which will meet the objectives specified.

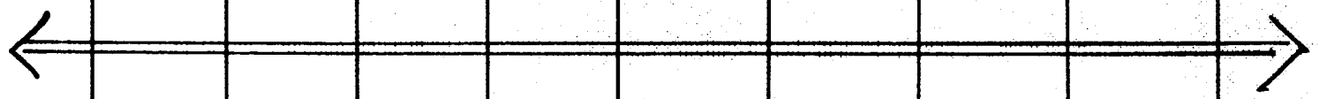
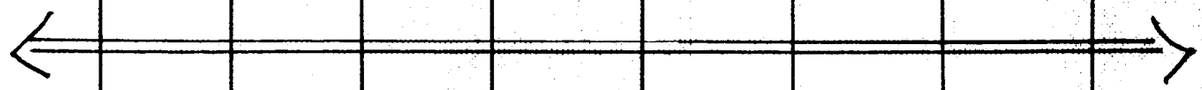
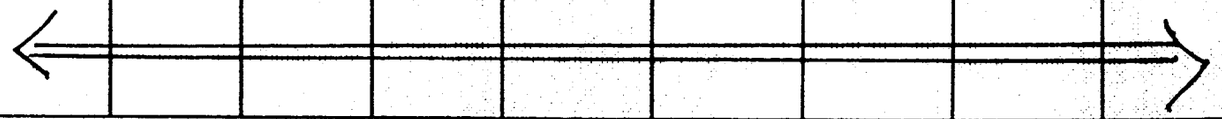
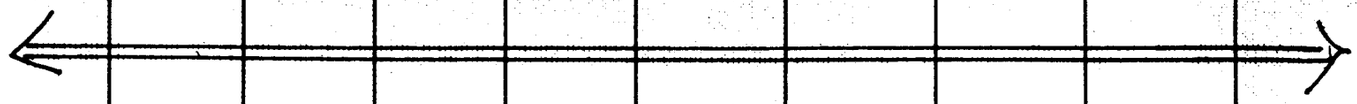
Key Personnel

- Conservation Officers, Protection, all conservancies
- Conservation Officers, Advocacy, all conservancies
- Public Awareness Unit, Head Office
- Science and Research Division, DOC
- Bat Recovery Group
- Interested public

Table 2; Critical Path for Recovery of Bats.

FINANCIAL YEAR	94/5	95/6	96/7	97/8	98/9	99/01	01/02	02/03	03/04	04/05
UNDERTAKE PRIORITY RESEARCH										
- develop survey and monitoring techniques for short and long-tailed bats										
- assess the threats affecting mainland populations of short-tailed bats										
- assess the impacts of toxins used in eradication and control programmes										
- develop methods to protect short-tailed bats in mainland forest areas										
- assess breeding ecology, home range site, diet and habitat use of short-tailed bats										
- develop captive management techniques for short-tailed bats										
- clarify taxonomy of short and long-tailed bats										
- develop translocation techniques										

FINANCIAL YEAR	94/5	95/6	96/7	97/8	98/9	99/01	01/02	02/03	03/04	04/05
EVALUATE THE STATUS OF SHORT AND LONG-TAILED BATS										
- search southern Titi Islands for greater short-tailed bats	⟺									
- survey mainland forest sites for short and long-tailed bats, with priority on sites where short-tailed bats have been recorded historically	⟺	⟺	⟺	⟺	⟺	⟺				
ESTABLISH POPULATIONS OF SHORT-TAILED BATS ON SUITABLE ISLANDS										
- identify suitable islands for the establishment of bats	⟺	⟺	⟺							
- when bats are available for release (either captive bred or from the wild) undertake transfers	⟺	⟺	⟺							
- monitor releases	⟺	⟺	⟺	⟺	⟺	⟺	⟺	⟺		

FINANCIAL YEAR	94/5	95/6	96/7	97/8	98/9	99/01	01/02	02/03	03/04	04/05
SELECT, PROTECT AND MONITOR POPULATIONS OF SHORT AND LONG-TAILED BATS										
- identify sites which support short and long-tailed bats, but which are unprotected, and initiate protection where the sites are at risk										
- undertake bat protection trials for short-tailed bats, and monitor both managed and unmanaged sites										
- establish a monitoring programme for long-tailed bats										
RAISE PUBLIC AWARENESS AND INVOLVE PUBLIC IN BAT CONSERVATION.										
- prepare and implement communication plan.										

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APPENDIX 1: CURRENT BAT RESEARCH PROJECTS

- Development of survey and monitoring techniques for long-tailed bats, establishment of a bat distribution database, population ecology of long-tailed bats at their roost sites, habitat use patterns, foraging, hibernation and activity patterns of long-tailed bats and the effects of predators.
  C. O'Donnell, DOC, Christchurch.

- Development of conservation methods for short-tailed bats (captive breeding, translocation, supplementary feeding), assessment and reduction of the risk to short-tailed bats of rat eradications and 1080 control programmes, determination of the status, home range size, diet and seasonal changes in behaviour of short-tailed bats in central North Island forests, and development of monitoring methods.
  B. Lloyd, DOC, Wellington.

- Development of a possum/short-tailed bat attractant based on Dactylanthus nectar.
  C. Ecroyd, NZ Forest Institute, Rotorua.

- Impacts of anti-coagulant poisons and 1080 on short-tailed bats.
  B. Lloyd, DOC, Wellington.

- Long-tailed bat roosts and predation in the Kaweka Forest Park.
  T. McCann, Landcare Research, Havelock North.

- Impact of predation on bats in Te Urewera National Park.
  J. McLennan, Landcare Research, Havelock North.

- Bioacoustics of New Zealand bats (description of acoustic signals, development of acoustic census techniques, evaluation of behavioural and ecological significance of bioacoustics).
  Stuart Parsons, Otago University.

- Seasonal breeding activity and population structure and variations in call rates of northern lesser short-tailed bats on Little Barrier Island.
  Chris Smuts-Kennedy, DOC, Auckland.

- The behaviour of the long-tailed bat in the Grand Canyon Cave, Pio Pio (home range sizes, flight paths and distances, foraging and roost sites, seasonal food preferences).
  Nick Gillingham, Massey University, Palmerston North.

- Food and lure response trials on captive short-tailed bats.
  Jay McCartney, Massey University.

- Ecology of a remnant long-tailed bat population in a fragmented landscape, Geraldine, South Canterbury.
  Richard Griffith, Lincoln University.

- Foods of short and long-tailed bats on Little Barrier Island.
  Alina Arkins, Auckland University.

- Mating system and genetic variability of short-tailed bats.
  Andrew Winnington, Auckland University.

PUBLISHED RECOVERY PLANS

Bat (Peka peka) ($15) . . . . . Approved 1995

Otago and grand skinks ($15) . . . . . Approved 1995

Giant land snail ($15) . . . . . Approved 1995

South Island saddleback ($15) . . . . . Approved 1994

Takahe ($15) . . . . . Approved 1994

Dotterel ($15) . . . . . Approved 1993

Tuatara ($15) . . . . . Approved 1993

Mohua ($15) . . . . . Approved 1993

Subantarctic teal ($15) . . . . . Approved 1993

Kowhai ngutukaka ($15) . . . . . Approved 1993

Chevron skink ($15) . . . . . Approved 1993

Black stilt ($15) . . . . . Approved 1993

Whitaker's and robust skinks ($15) . . . . . Approved 1992

North Island kokako ($15) . . . . . Approved 1991

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Yellow-eyed penguin . . . . . Approved 1991

Available: from Otago Conservancy,

Department of Conservation, Dunedin

Blue duck ($10) . . . . . Approved 1991

Available: *Science & Research Internal Report No.30*

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