SCIENCE & RESEARCH SERIES N0.24

BIRDLIFE OF NELSON LAKES NATIONAL PARK, SOUTH ISLAND, NEW ZEALAND

By

David Butler

Published by
Head Office,
Department of Conservation,
P O Box 10-420,
Wellington

ISSN 0113-3713
ISBN 0-478-01169-5

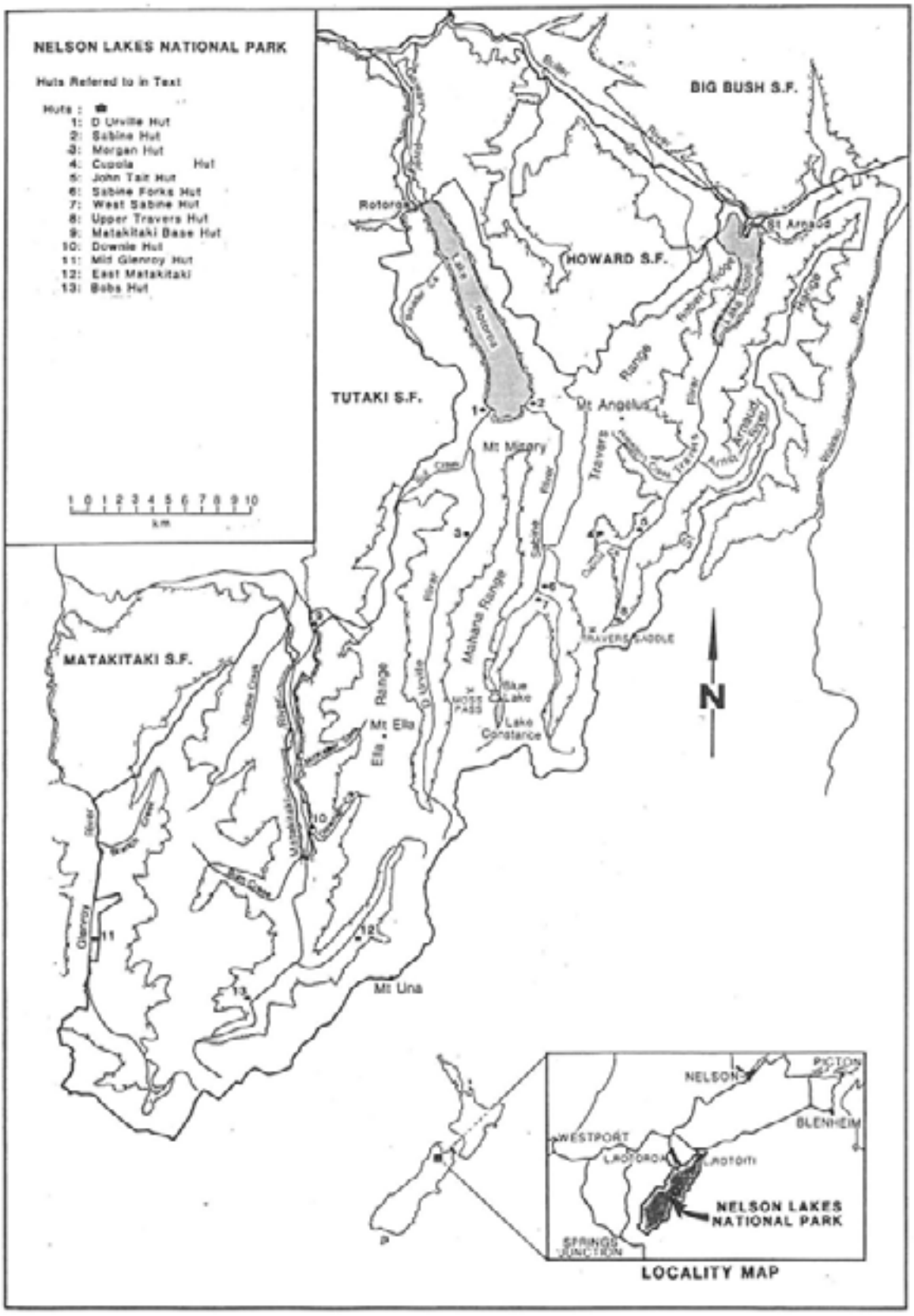
National Library of New Zealand
Cataloguing-in-Publication data

Butler, David.
Birdlife of Nelson Lakes National Park, South Island, New Zealand /
by David Butler. Wellington, N.Z. : Head Office, Dept. of Conservation,
c1991.
1 v. (Science & research series, 0113-3713 ; no. 24)
Includes bibliographical references.
ISBN 0-478-01169-5
1. Bird populations--New Zealand--Nelson Lakes National Park.
2. Nelson Lakes National Park (N.Z.) I. New Zealand. Dept. of
Conservation. II. Title. III. Series: Science & research series;
no. 24.
598.29935

Keywords: birds, bird mapping scheme, Nelson Lakes National Park, sub-fossil birds, Rotoiti, Rotoroa, distribution, management, mammals, research, 46.02, 46.03, 46.05, 46.06, 46.08

CONTENTS

FIGURE 1: NELSON LAKES NATIONAL PARK & ADJACENT STATE FORESTS



BIRDLIFE OF NELSON LAKES NATIONAL PARK SOUTH ISLAND, NEW ZEALAND

by

David Butler

Threatened Species Unit, Department of Conservation,
PO Box 10-420, Wellington

ABSTRACT

A survey of the birdlife of Nelson Lakes National Park was initiated, by the Park staff, in 1978 and concluded in 1985. It was part of the National Parks and Reserves Bird Mapping Scheme, which records birds seen or heard in each 2000-yard grid square of Department of Survey and Land Information topographic maps, NZMS1 series.

The primary aim of the survey was to describe the distributions of all bird species found in the Park for use in Park management and for interpretation to the visiting public. This information is also a baseline against which future changes in distribution might be measured. A secondary aim was to encourage public involvement in the Park through participation in the bird recording scheme.

Survey results are summarised for all species recorded in the Park, and are presented as distribution maps for selected examples. Some of the factors underlying the distributions are examined. Bird species now extinct in the Park are discussed in relation to locations of sub-fossil bones found in the region.

PREFACE

Nelson Lakes National Park (Fig. 1) lies in the mountainous country of the south-east corner of the Nelson Province, based on Lakes Rotoiti and Rotoroa. Constituted in 1956 as an area of 57,470 hectares, its present size is over 101,000 ha after additions that include parts of the Matakitaki and Glenroy Valleys were made in 1983.

This report presents the results of a survey of the bidlife of the Park, initiated by Park staff in 1978, and involving the author since August 1983. For several years the recording system used punched cards designed by Senior Ranger M. Clarbrough, but in 1981 this system was modified and adopted in most other National Parks in New Zealand, following a national seminar (Department of Lands and Survey 1979). This National Parks and Reserves Bird Mapping Scheme, in which birds seen or heard in each 2000-yard grid square are recorded, is described in Appendix 1.

The primary aim of the survey was to describe the distributions of all bird species, for use in Park management and interpretation to the visiting public. This information will also provide a baseline against which any future changes in distribution might be measured. A secondary aim was to encourage public involvement in the Park through participation in the Scheme, and recording

cards were supplied for this at Park headquarters. The nature of the scheme meant that some records were received from unskilled observers. All cards were scrutinised by Park staff and any observations of rarer species were checked with the recorder before being accepted. Although misidentification of common birds may have been undetected, this is a minor problem for two reasons: first, most of the records (83.1%) were received from Park staff with a keen interest in birds, from scientists at DSIR Ecology Division, or from the author, and second, common species were usually recorded from each square by more than one observer. All areas of the Park were surveyed although coverage of the recent major additions on the western side was less complete (see Fig. 2, Section 3.1).

This report is intended for a variety of readers, given the varied backgrounds and interests of those who contributed to the survey. Those involved with wildlife in a professional capacity may find more background information and general remarks than they are used to in a publication in this series. In particular, the introduction that follows does not include references to the sources of its information on individual species. These sources can be found later in the report when these species are dealt with in detail.

1. INTRODUCTION - THE CHANGING SCENE AT NELSON LAKES NATIONAL PARK

(Note: For specific names of organisms mentioned here, see Sections 2.3 (plants), 3.2 (birds), Appendix 4 (mammals) and Index.)

The vegetation and wildlife of the Park today are the product of centuries of slow change followed by periods of rapid change, first with the arrival of the Polynesians and then again with the Europeans. One can trace this process back 8000 years when the last retreat of glacier ice allowed the present dominant cover of beech forest to become re-established. After almost seven millennia of relative stability, the arrival of the first people in New Zealand around 750 AD (Cumberland 1981) started a process that dramatically altered the fauna of the country.

During the following one thousand years, 32 species of bird became extinct (King 1984), many of which would have been once found at Nelson Lakes (Section 3.3). In the Park itself signs of activity during this period include areas on the shores of Lake Rotoroa where forest was burnt for fern cultivation, middens at Kerr Bay, Lake Rotoiti, and fishing huts at the two lakes.

Mammals introduced by the first Europeans probably reached the Park before the people themselves. Norway rats and pigs arrived in the country with the first boats in the 1770s and the former were very abundant in the South Island within a hundred years (King 1984). In the 1840s sheep were driven on to Lake Station adjacent to the Park and in that decade the first written accounts of the birdlife appeared as the exploring parties of Cotterel in 1842-3 (Cotterel 1842), Heaphy (1842), Brunner (1848), Heaphy and Fox (Heaphy 1846), and and Haast (1861) searched the interior for land for settlement. They found the kiwi and kakapo to be very rare and no sign of the takahe and laughing owl. Other species such as the kokako, native thrush and weka were still abundant.

A combination of increased land clearance and hunting saw the New Zealadn quail and brown teal gone by the 1890s. Ship or black rats replaced the brown rats in most forest areas in the South Island by that time (Dingwall *et al.* 1978) and together with the mustelids introduced from 1879,

increased predation pressure on the birds. By the turn of the century the South Island kokako, thrush and saddleback were near extinction in the area, but the avifauna also began to grow with the introduction of European species from 1863-4 and the arrival of silvereye (c.1870s) and kea (1903).

The forests of the Park (Fig. 1) were still largely intact, though burning of river flats and tussock areas for grazing had occurred together with some milling of podocarps. This situation changed with the arrival of red deer and goats in the 1900s, possums in 1920 and chamois in the 1930s. Natural disasters were also recorded such as the wind storm of June 1924 which destroyed about 1000 acres of forest alongside Lake Rotoroa.

The turn of the century marked a change in the attitude of the settlers to birdlife and fewer new species were introduced. Scenic Reserves were created at Lakes Rotoiti and Rotoroa at that time and the National Park was eventually created in 1956. Declines of native species did continue, with the bush wren, yellowhead and probably red-crowned parakeet disappearing in the last twenty years or so. Then the arrival of three trans-Tasman birds, the white-faced heron in 1958, spur-winged plover in 1968, and welcome swallow in the mid-1970s, bring the of Nelson Lakes up the present situation.

2. ENVIRONMENT

2.1 Geology

The Park is dominated by two geological features: the Southern Alps which terminate at the Robert and St Arnaud Ranges, and the Alpine Fault which crosses the main divide here. The fault, marking the boundary of two plates of the earth's crust, runs the length of the South Island on the western side of the Alps before swinging abruptly east-north-east across the head of Lake Rotoroa, down the Speargrass Valley and across Lake Rotoiti. Lateral and vertical movements of rocks have occurred on both sides of the fault and those to the east have been raised significantly higher than those to the west.

The major mountain-forming rocks in the Park are greywackes, deposited as distinct sheets of sediments, then folded. To the east the more deeply buried sheets, subject to greater heat and pressure, became schists which were later uplifted to form the Ella, Mahanga and Matakitaki Ranges. A line of volcanoes once active to the north-west have left their associated granites and basalts at Speargrass Creek, Black Hill and along the western side of Lake Rotoroa.

The five major valleys running south to north in the Park were initially shaped by the intermittent advances of glaciers, followed by deep river incisions. Lakes Rotoiti and Rotoroa were formed by the latest glaciers to occupy the Travers and Valleys respectively. These glaciers overdeepened the valleys and deposited barriers of rock debris as terminal moraines. The moraine on which St Arnaud stands represents the limit of valley ice 12 000 to 20 000 years ago.

The strongly jointed greywackes are susceptible to freeze/thaw action and sediment from this process of erosion is infilling the two lakes. Lake Rotoiti would, in the recent past, have extended 5 km south up the Travers Valley (to the present swingbridge).

The altitude of the Park ranges from 448 metres at Rotoroa to 2339 metres above sea level (masl)

on the summit of Mt Franklin. The geology of the Park is currently being studied by a team from Department of Geology, Canterbury University, under the supervision of Dr J. Campbell.

2.2 Climate

The Park is sheltered by high ranges (over 2000 masl) to the east and south, so its climate is moderate compared to much of the Southern Alps. Most precipitation is carried by northerly and westerly winds and rainfall is thus greater in the west of the Park. A combination of this effect and increasing precipitation with altitude means that there is considerable variation in rainfall within the Park. St Arnaud at 617 masl, has mean annual rainfall of 1550 mm compared to 1800 mm at Rotoroa (448 masl) (Nelson Lakes National Park Board 1977). The highest rainfall falls in the mountains of the south-western part of the Park and is likely to average c.4000 mm annually. Above 1500 masl, most precipitation falls as snow.

Temperatures at St Arnaud occasionally reach 32°C but the mean monthly maximum is 27.4°C (February). Further into the Park, on sheltered river flats, the temperature may be significantly higher; the mean monthly maximum at the D'Urville River mouth was 32.5 °C (January) (Tilley 1984). Mean daily minimum temperature at St Arnaud in mid-winter is -7.7 °C (July) and ground frosts frequently extend to low altitudes from April to September. Soil in alpine areas freezes to several centimetres depth in winter.

The predominant wind direction at St Arnaud is north-westerly but most of the stronger winds are southerlies. Strong winds are more frequent at high altitude.

2.3 Vegetation

The vegetation of the Park is the subject of separate studies by W.D. Burke and M.J. Bulfin. Here it is summarised under seven categories which are used again on the maps of Section 3.2 to indicate the main habitat of each bird species. Aquatic plants are briefly mentioned in a discussion of Lakes Rotoiti and Rotoroa in Section 3.4.
[Note: Nomenclature largely follows Allan (1961) and Moore and Edgar (1970)].

2.3.1 Beech Forest

Beech forest covers most of the Park up to a timberline at between 1450 masl and 1500 masl. In general the different beech species form zones with increasing altitude: red beech (*Nothofagus fusca*) dominant at low levels, then mixed red and silver beech (N. menziesii) to silver dominant, mixed silver and mountain beech (*N. solandri* var. *cliffortioides*), and finally pure mountain beech at timberline. However mountain beech is also found down to low levels on ridges and along stream and river courses. Black beech (*N. solandri*) occurs around Lakes Rotoiti and Rotoroa, but hard beech (*N. truncata*) at Lake Rotoroa only.

The understory contains a wide variety of other trees, shrubs and herbs and is most dense at recently disturbed sites and on gorge sides and stream beds. Widespread species important to fruit and nectar-eating birds include fuchsia (*Fuchsia excorticata*), wineberry (*Aristotelia serrata*), putaputaweta (*Carpodetus serratus*), South Island rata (*Metrosideros umbellata*) and many species of *Coprosma.*

2.3.2 Beech/Podocarp Forest

The only area of forest with significant numbers of tall podocarps is around the sides of Lake Rotoroa. Rimu (*Dacrydium cupressinum*) is the main emergent species, but kahikatea

(*Dacrycarpus dacrydiodes*), matai (*Prumnopitys taxifolia*) and miro (*P. ferruginea*) also occur on the flats of the lakeside fringe.

2.3.3 Kanuka/Manuka
Kanuka (*Kunzea ericoides*) up to 20 m high and manuka (*Leptospermum scoparium*) are largely found on the fringes of the beech forest on recently disturbed sites particularly those associated with past fires, rock slides or changes in river courses. They form an extensive area of forest between the slopes of Mt Robert and the St Arnaud township.

2.3.4 Scrub
The term scrub is used here for the shrub-dominated community typically found just above timberline but occasionally extending down to the valley floor on major rock slides. Characteristic species include flax (*Phormium* spp.), grass trees (*Dracophyllum* spp.), celery pine (*Phyllocladus alpinus*) and mountain ribbonwood (*Hoheria glabrata*).

2.3.5 Subalpine Grassland
The tussock grasslands above timberline are dominated by carpet grass (*Chionochloa australis*) with patches of snowgrass (*C. pallens*) and more rarely red tussock (*C. rubra*). The herbs there include hebes, coprosmas and mountain daisies (*Senecio* spp., *Celmisia* spp.).

2.3.6 Fellfield
Above about 1500 masl is sparse vegetation characterised by plants of squat or cushion-like forms such as the vegetable sheep (*Haastia* spp.).

2.3.7 River Flats
The vegetation of the river flats consists of grassland and divaricating shrubs particularly matagouri (*Discaria toumatou*), weeping matipo (*Myrsine divaricata*) and some of the larger-leaved coprosmas. Manuka and kanuka may also become established. Most of the flats were grazed in the past and the grassland contains many introduced herbs and pasture grasses.

On the northern fringe of the Park there are areas (e.g. Porika area) of recently cleared ground now colonised by bracken. The Buller and Gowan Valleys are largely in pasture stocked with sheep and cattle.
For further reading see Simpson (1977) and Burke (1985).

3. RESULTS

3.1 Coverage of survey
The coverage obtained by the survey is presented here in terms of observer effort and area covered. Observer effort is shown as the number of record cards submitted per month (Table 1). Each card received represents one observer/square/day – i.e. 2 cards would have been submitted if two observers visited the same square on the same day, if one observer visited the same square on two different days, or if one observer visited two different squares on the same day. Observer effort varied with the interest shown in the scheme by Park Staff. It has been led throughout by M. Clarbrough with the author contributing from September 1983. Overall effort has clearly been greatest in spring and summer.

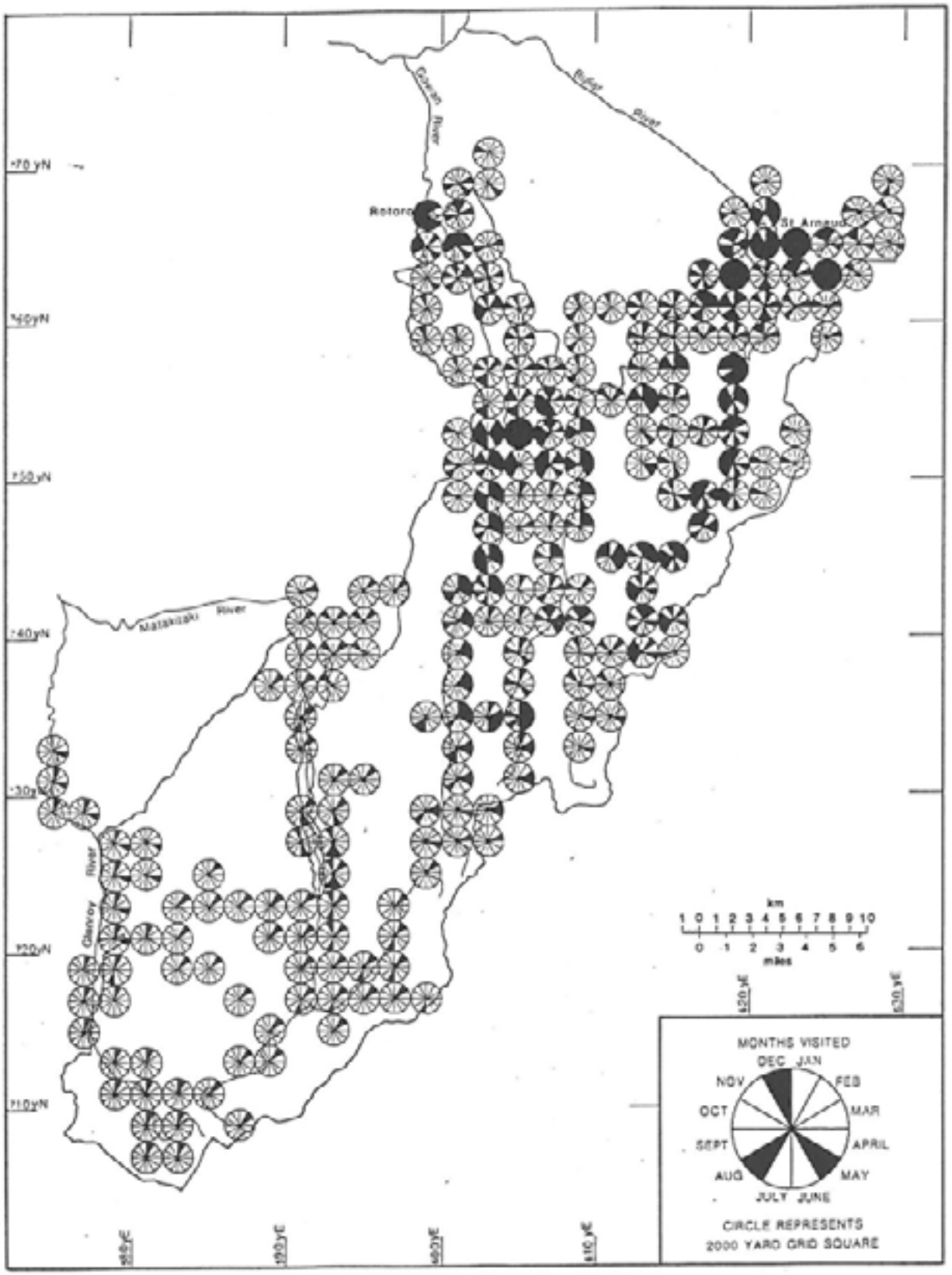


Fig. 2 Coverage of bird mapping survey of Nelson Lakes National Park

Table 1. Seasonal analysis of record card returns

Season	Spring	Summer	Autumn	Winter
Month	Sep Oct Nov	Dec Jan Feb	Mar Apr May	Jun Jul Aug
No. cards received	82 168 81	77 170 137	99 85 29	49 60 84
Seasonal total	331	384	213	193

The area covered by the survey is shown in Fig. 2, which also shows the months in which a square was visited. The Matakitaki and Glenroy Valleys which were added to the Park in 1983 have been visited least. Other gaps in the records are mostly of areas above timberline where distributions of only the three or four species that occur there will have been affected.

3.2 Summaries of Bird Species Records

3.2.1 Interpretation

The species recorded in the park are listed following the order and nomenclature of Kinsky (1970) as amended by Kinsky (1980). Under each specific name its status in the Park is given, the number of records received and the number of 2000-yd grid squares in which it was recorded between 1975 and 1985 are given, as in the following format:

FAMILY NAME

Common Name (*Formal name*)
Status (No. of records) (No. of squares)
An example is:
VERY RARE (2) (1)

Status is described in 6 categories as follows:

1. Extinct in Area - no longer found in Park or surrounding district

2. Extinct -probably extinct nationally

3. Very Rare -less than five individuals recorded during the survey

4. Occasional -five or more individuals during the survey but not recorded every year

5. Resident -present in Park throughout the year and assumed to breed there

6. Spring/Summer Visitor -regular visitor each year in these seasons, some species breeding

No. of Records is the number of cards on which a given species was listed. The number of individuals seen or heard sometimes may not have been recorded or may have been given merely as an estimate: 1-10, 10-100, etc. For rarer species the number of records will be close to the number seen and for common species it will not be close.

No. of Squares together with the number of records gives a quick assessment of how common and widespread a species is. However when comparing species that use different habitats the area of suitable habitat for each needs to be considered, i.e. a species dependent on rivers would have fewer squares available to it than one that used forest.

3.2.2 Summaries and Maps of Bird Species Distributions

3.2.2.1 **FAMILY APTERYGIDAE: KIWI**

Kiwi species (*Apteryx* spp.)
VERY RARE (0) (0)
It is difficult to obtain a clear picture of the past status of kiwi at Nelson Lakes. They were considered extinct in the Tiraumea and Tutaki by 1847 (Brunner 1848), yet Haast (1861) heard his first kiwi at Rotoroa in 1860 and described them as "...abundant in many spots, and judging from their different calls, of various species...". A population decline occurred throughout the region, apparently more marked at first in the east. Kiwi were not included in a list of birds found at Tophouse c.1870-80s (R.E. Win in Newport1962) and had gone from the 'Nelson district' by 1894 (D.W. Win, pers. comm. to G. Lyons). They were 'rather scarce' at Rotoroa around 1900 (D.W. Win in Bull (1977)), though Moncrieff (1925) writing of the same area stated "…of woodhens and kiwis we saw not a sign though they were plentiful two years ago." Further west, kiwi were very abundant in the early days of European settlement and in 1861 it was said that along the east side of the Owen River a man with two dogs could catch 15 to 20 in a night (Skeet in Newport 1962). In the Buller region around the 1890s "...large grey kiwis were visible in the evenings and often seen in daytime…" (D.W. Win in Newport 1962). They were still present at Glenhope until at least 1910, two were seen in the Howard Valley in the 1920's or '30s (A.H. McConochie, pers.comm.), and one was heard in the maud Creek headwaters in the 1930s (M.R. Clarke, pers. comm.).

There have been very few records in recent decades despite experienced scientists having spent long periods in the Park (e.g. studies of NZ Forest Service and DSIR Ecology Division at Cupola Basin, 1962 to 1966, and DSIR Ecology Division at Mt Misery 1975 to 1984). One was heard in Maud Valley in March 1963 (R.H. Taylor, pers. comm.); an observer camped at Rotoroa at Christmas 1970 wrote of hearing kiwi calls on two separate nights which he checked against taped calls (R.C. Vail, in National Park Ranger report); one was heard in the D'Urville Valley above the lower gorge in March/April 1971 (D. Peacock, file note, Department Lands and Survey, Nelson), and one was seen at Rotoiti that same year (Bull 1977). During the present survey, tapes of great-spotted kiwi (*Apteryx haastii*) were played at night from various camps and one possible reply was received from the south or south-west of the D'Urville Hut in October 1983.

The species most likely to occur in the Park is the great-spotted kiwi which is still present in North-West Nelson and the Paparoas (Bull *et al.* 1985). Observers wrote of more than one species of kiwi in the district in the past (e.g. Haast (1861) and D.W. Win in Bull 1977), and little-spotted kiwi (*Apteryx owenii*) may have been present. However identification by calls alone (as Haast's) is

difficult as Wildlife Service has shown that great-spotted kiwi make a variety of calls, some closely resembling those of the last species and others like the South Island brown kiwi's *(A. australis*).

3.2.2.2 **FAMILY PODICIPEDIDAE: GREBES**

Southern Crested Grebe (*Podiceps cristatus australis*)
VERY RARE (3) (1)
Crested grebes were present on both Lakes Rotoiti and Rotoroa according to the early explorers, and Heaphy's sighting at Rotoroa in 1846 was the first published observation of this species in New Zealand (Westerskov 1972). Around 1900 as many as 20 were present on Lake Rotoroa (D.W. Win in Bull 1977) with fewer on Lake Rotoiti, the last pair known nesting at the Buller River outlet of the lake in the 1920s (D.D. Cummings, pers. comm.). Westerskov (1972) considered that breeding ceased at both lakes soon afterwards and records in 1952 and 1967 were of 'stragglers' from further south.

The survey recorded single birds at the head of Lake Rotoiti on 11 and 18 June 1979 and 17 July 1979, all probably the one individual. Westerskov (1972) reported that the range of crested grebes in the South Island is contracting in a southerly direction with a continuing decline in numbers so the species is unlikely to return to breed at Nelson Lakes in the near future. (See Section 3.4 for comparison of the two lakes as habitats for water birds.)

New Zealand Dabchick (*Podiceps rufopectus*)
EXTINCT IN AREA (0) (0)
Heaphy (1846) recorded the presence of both 'divers and grebes' on Lake Rotoroa and the latter name is sometimes used for dabchick. Brunner (1848) caught two in one of the rivers west of the Buller River, but the species soon became very scarce in the South Island and no records were obtained from the South Island during the Ornithological Society's survey from 1969 to 1979 (Bull et al. 1985).

3.2.2.3 **FAMILY PROCELLARIIDAE: FULMARS, PETRELS AND ALLIES**

Hutton's Shearwater (*Puffinus huttoni*)
VERY RARE (0) (0)
A single storm-wrecked individual of this species was found still alive at Lake Rotoiti in autumn 1973 (R.H. Taylor, pers. comm.). It breeds to the east on the Kaikoura Ranges, and at sea it frequents the area from Otago Peninsula to the Wellington west coast (Robertson 1985).

3.2.2.4 **FAMILY PHALACROCORACIDAE: SHAGS**

Black Shag (*Phalacrocorax carbo*)
RESIDENT (63) (34)
The first black shag mentioned in the Park was an unfortunate individual seen to be attacked by two falcons in 1869 (Haast 1861). The species was soon involved in a different kind of conflict after the introduction of trout to the area in 1873. Fishermen complained of serious depredations of fish, and bounties were paid on black shags in different parts of the Nelson Acclimatisation Society's district from 1891 to 1950 (Annual Reports of the Society). The bounty varied between 6d and 1/- per head, the Society recording its concern that it should be enough to encourage the

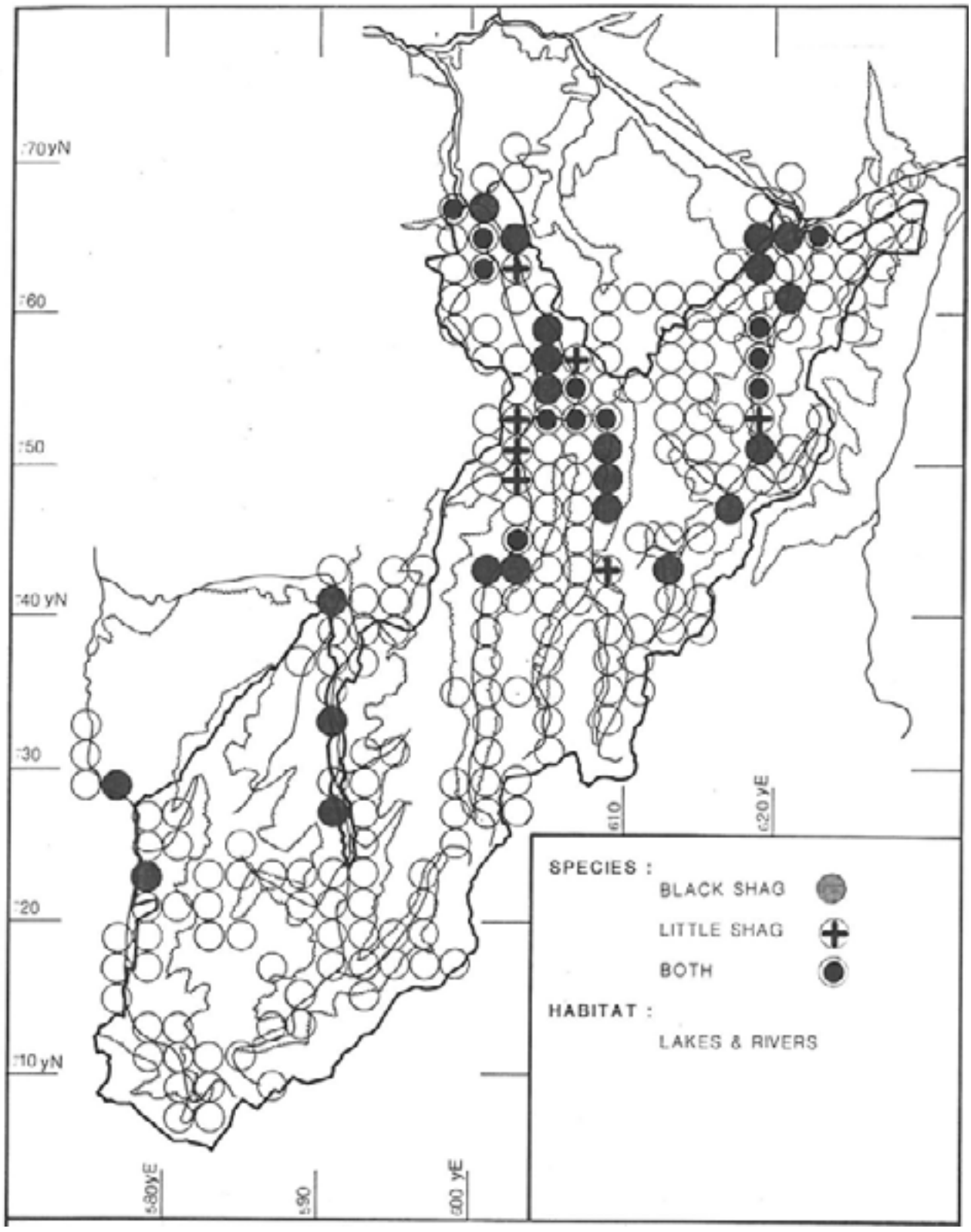


Fig. 3 Distribution of Black Shag and Little Shag in Nelson Lakes National Park

destruction of black shags but not so much as to tempt the shooting of coastal and marine species as well!

In the 1920s and 1930s shaggeries were present along the east side of Lake Rotoroa (Moncrieff 1925), up the Sabine Valley and at Lake Station and Speargrass along the Buller River (D.D. Cummings, pers. comm.). In 1931 there was a lively correspondence in the Nelson Evening Mail under the heading 'Shags vs Trout' discussing the problem of this 'ugly glutton' and its increasing population at Lake Rotoroa. An application to shoot shags there was declined since the surrounds of Lake Rotoroa had been established as a Scenic Reserve in the 19th century. Instead the Nelson Acclimatisation Society organised several culls of populations on rivers in the district, supplying shooters with ammunition. The shaggeries of the Park have since disappeared.

During this survey (Fig. 3), black shags were regularly seen at both major lakes and all river valleys though they did not penetrate above the gorges on the Sabine, or Matakitaki Rivers. Highest numbers were recorded in summer and mid-winter. Nesting has not been observed in the Park and the nearest known sites are in the Upper Buller and the Upper Wairau valleys.

Little Shag (*Phalacrocorax melanoleucos*)
RESIDENT (45) (19)
Little shags were probably never abundant in the Park. They were described as 'rare' in 1931 when a small colony was present with the black shags at Lake Rotoroa (Moncrieff 1925) and a sighting was 'always worthy of comment' (A.H. McConochie pers. comm.). This species escaped the conflicts with fishing interests as it rarely takes trout.

The survey recorded (Fig. 3) little shags throughout the year from both major lakes, the Travers Valley as far up as Hopeless Creek, the Sabine to the Forks, and the D'Urville to Morgan's Hut. None have been seen in the Matakitaki and Glenroy perhaps indicating a preference for the 'narrower' valleys in the Park. All birds that were described were white-throated.

3.2.2.5 **FAMILY ARDEIDAE: HERONS, EGRETS AND BITTERNS**

White-faced Heron (*Ardea novaehollandiae*)
VISITOR (10) (9)
White-faced herons were first recorded at Nelson Lakes in March 1958 according to National Park Ranger reports, seventeen years after they began breeding in the South Island at Otago in 1941. A typical record was of a single bird remaining in one area of the Park for a week or so.

Twelve birds were seen during the survey. They were recorded at both lakes, on the Matakitaki River and well up the West Matakitaki near the end of the forested section of river. All but two were seen in February and March. White-faced heron are early nesters and these records probably represent post-breeding dispersal of young or occasionally adults.

White Heron (*Egretta alba*)
VISITOR (5) (3)
White herons have never been regular visitors to Nelson Lakes but occasional sightings have been noted for many years. In the 1960s for example two birds are recorded in National Park Rangers' Reports, and during the ten years of this survey five individuals have been seen along the edges

of Lakes Rotoiti and Rotoroa. These sightings in February and September-November are likely to represent non-breeding birds.

Cattle Egret (*Bubulcus ibis*)
VERY RARE (0) (0)
Three birds were seen with six white-faced herons in a field south of Murchison while driving to the Glenroy Valley on 9 April 1984. This species may visit other areas of farmland surrounding Nelson Lakes as it is apparently visiting this country in increasing numbers every winter from Australia. A few spend the summer here but do not apparently breed (Heather 1982).

Australasian Bittern (*Botaurus stellaris poiciloptilus*)
VERY RARE (0) (0)
Bitterns have never been plentiful in the area though they can be easily overlooked. Haast occasionally 'met them' in his travels in the Province in 1860 and A.H. McConochie (pers. comm.), a former resident on the edge of the Park for 60 years, would have seen about six in his lifetime. Two sightings were made of this bird in the swamp alongside Black Valley Stream at St in the 1960s but none have been confirmed since then. A feather, and probe holes recently found in McConochie's swamp were probably left by this species.

3.2.2.6 FAMILY THRESKIORNITHIDAE: IBISES AND SPOONBILLS

Royal Spoonbill (*Platalea leucorodia*)
VERY RARE (1) (1)
Only two records have been made from the area, one of a bird shot on the Buller River in 1892 (Buller 1905) and one seen at the head of Lake Rotoiti during this survey, on 8th February 1984. Spoonbills are rarely seen far from the coast and are unlikely to ever become regular visitors to the Park. The total New Zealand population is probably less than a hundred birds, though a partial switch of breeding from Okarito in south to the Wairau Lagoon in Marlborough (Robertson 1985) may result in more birds moving about the top of the South Island in future.

3.2.2.7 FAMILY ANATIDAE: SWANS, GEESE AND DUCKS

Black Swan (*Cygnus atratus*)
RESIDENT (35) (8)
Five black swans were introduced from Australia by the Nelson Acclimatisation Society in its first season 1863/4 (Sowman 1981). The population grew rapidly so that 23 were counted on the Eel Pond in Nelson three years later. Indeed the increase was so swift that it is thought that swans were self-introduced from Australia about the same time. One or two birds invariably have been present on Lake Rotoroa since 1919 (A.H. McConochie, pers. comm.) and breeding has been recorded there in all decades from the 1920s (D.D. Cummings, pers. comm.) onwards. Swans were always less abundant at Lake Rotoiti though they have bred at least once at the head of the lake in the past (A.H. McConochie, pers. comm.).

During the present survey only two sightings have been made on Lake Rotoiti and all others were on Lake Rotoroa. A pair has been present at the outlet of Lake Rotoroa in six of the past eight years, breeding in at least five, and another pair have been at the southern end in four years. Two pairs have bred concurrently for at least two years during the survey, one rearing two broods in 1985.

Black swans are territorial, defending areas of both lake and shore on small waters (e.g. Lakes Rotoiti and Rotoroa) but only lengths of shore on large waters (e.g. Lake Ellesmere) where there are ample feeding areas available (Williams 1980). It may be that Lake Rotoroa is currently able to support two breeding territories and Lake Rotoiti none (see Section 3.4).

Black swans seem to be absent from the Park in most years, from March to June, a time when many gather in large flocks to moult, the nearest concentration being at Farewell Spit (Williams 1980).

Canada Goose (*Branta canadensis*)
VISITOR (20) (7)
The Canada geese seen in the Park probably originate from stock introduced into Canterbury where a population of about 200 birds had been established by 1919 (Sowman 1981). They have been occasional visitors to Nelson Lakes from that time on, typically in small flocks of up to a dozen birds on the Travers and Sabine River flats.

During this survey geese were seen around the two lakes and on the D'Urville and Travers flats. Sightings of one or two birds were made in most months and flocks (the largest being of 24 birds) were seen in June, July, September and October, when they were probably returning to their breeding grounds in the south (Williams 1981).

Paradise Shelduck (*Tadorna variegata*)
RESIDENT (225) (66)
Paradise shelduck were present in the Park during the early explorations but the population has fluctuated and is probably now as large as it has ever been. On the surrounding farmland, numbers increased with changes in agricultural practices and at Lake Station about 1000 can be seen in occasional gatherings where there had been only a pair in the 1930s (A.H. comm.). Very large aggregations occurred on Lake Rotoroa in the years of huge weed growth in the early 1970s (D.D. Cummings, pers. comm.). Up to a thousand birds were seen, probably attracted by the numerous small snails and crustacea on the plants.

Paradise shelduck are now found in suitable habitat throughout the Park where they are the most widespread and abundant duck species (Fig. 4). They breed in all the river valleys and congregate in autumn in moulting flocks on the two lakes, particularly on Rotoroa, in groups of a hundred or so. They have also been seen on the higher lakes of the National Park, Lake Constance at 1340 masl and Lake Thompson at 1710 masl, though breeding is unlikely at these sites.

Mallard (*Anas platyrhynchos*)
RESIDENT (49) (28)
Early attempts to establish this species were apparently unsuccessful but after major efforts by the Nelson Acclimatisation Society in the 1950s it spread rapidly through the district (Sowman 1981). In the Park, mallard are mostly restricted to the two lakes though they do penetrate the lower Travers Valley. Flocks on the lakes usually number twenty to thirty birds including several hybrids formed by matings with grey duck.

Grey Duck (*Anas superciliosa*)
RESIDENT (49) (28)
Grey duck were described as fairly plentiful in the early days of settlement (A.H. pers. comm.), and have probably decreased in the district as they have nationally (Williams 1981) as a result of habitat modification and perhaps competition from mallard. They occur throughout the Park on the two major lakes and in all river valleys almost to the upper limit of the forest. This species undergoes widespread movements and may be migratory, but insufficient sightings have been obtained to identify any pattern of dispersal from the Park. In spring and summer birds tend to favour slow moving sections of rivers, particularly side creeks under forest cover, and a single bird or a pair may be flushed from such sites. They frequently nest in trees away from water (Falla *et al.* 1982), and small groups are present on the lakes through most of the year. Interbreeding with mallard may occur at these lakes but the grey duck of the rivers are invariably pure-bred.

Grey Teal (*Anas gibberifrons*)
VERY RARE (0) (0)
A single grey teal was identified at Lake Rotoroa in 1964 (Zumbach 1965). This species favours shallow, freshwater lakes with extensive marginal cover (Robertson 1985) and it is perhaps surprising to find no earlier references to it in the Park. However the New Zealand population of grey teal is small and has probably only expanded in recent years with the use of nest boxes (Bull *et al.* 1985) and continuing immigration from Australia (Falla *et al.* 1982). It is a species that disperses long distances and is now using the newly created (1984) Bell's Island sewage ponds in the Waimea Inlet (P.D. Gaze, pers. comm.).

Brown Teal (*Anas aucklandica chlorotis*)
EXTINCT IN AREA (0) (0)
Brown teal were noted in Nelson in 1842 (Cotterel 1843) and 'teal' (probably this species) were common on ponds and creeks near Lake Rotoroa about 1900 (D.W. Win in Bull 1977). However this species was not mentioned in the area after that time and its numbers must have declined rapidly. The only South Island brown teal population is now in Fiordland.

Blue duck (*Hymenolaimus malacorhynchos*)
RESIDENT (33) (14)
Blue duck were apparently numerous in the Park last century. Heaphy (1846) was able to kill four for food in a day and a half spent at Lake Rotoroa in 1846, and in 1860 Haast (1861) found them the most abundant member of the family Anatidae, '… very abundant in the district, mainly in the gorges of streams and rivers but also in the plains.' He even found one individual in the stomach of a large eel.

This century the distribution has been of pairs present in the major river valleys and occasional individuals seen on the lakes. Observers recall one or two pairs in the Sabine, one in the Howard (A.H. McConochie pers. comm.), and others in the Travers near Cupola and in the Speargrass Valley (D.D. Cummings, pers. comm.).

During the survey, records (Fig. 5) were obtained from the Travers, Sabine, Glenroy and Matakitaki Valleys, the most individuals being seen in the last. The only recent report from the was of a pair heard calling in 1973 and from Speargrass of seven birds seen by trampers in June 1965 (National Park Ranger's Report). Single birds have been seen twice at the head of Lake Rotoiti and several

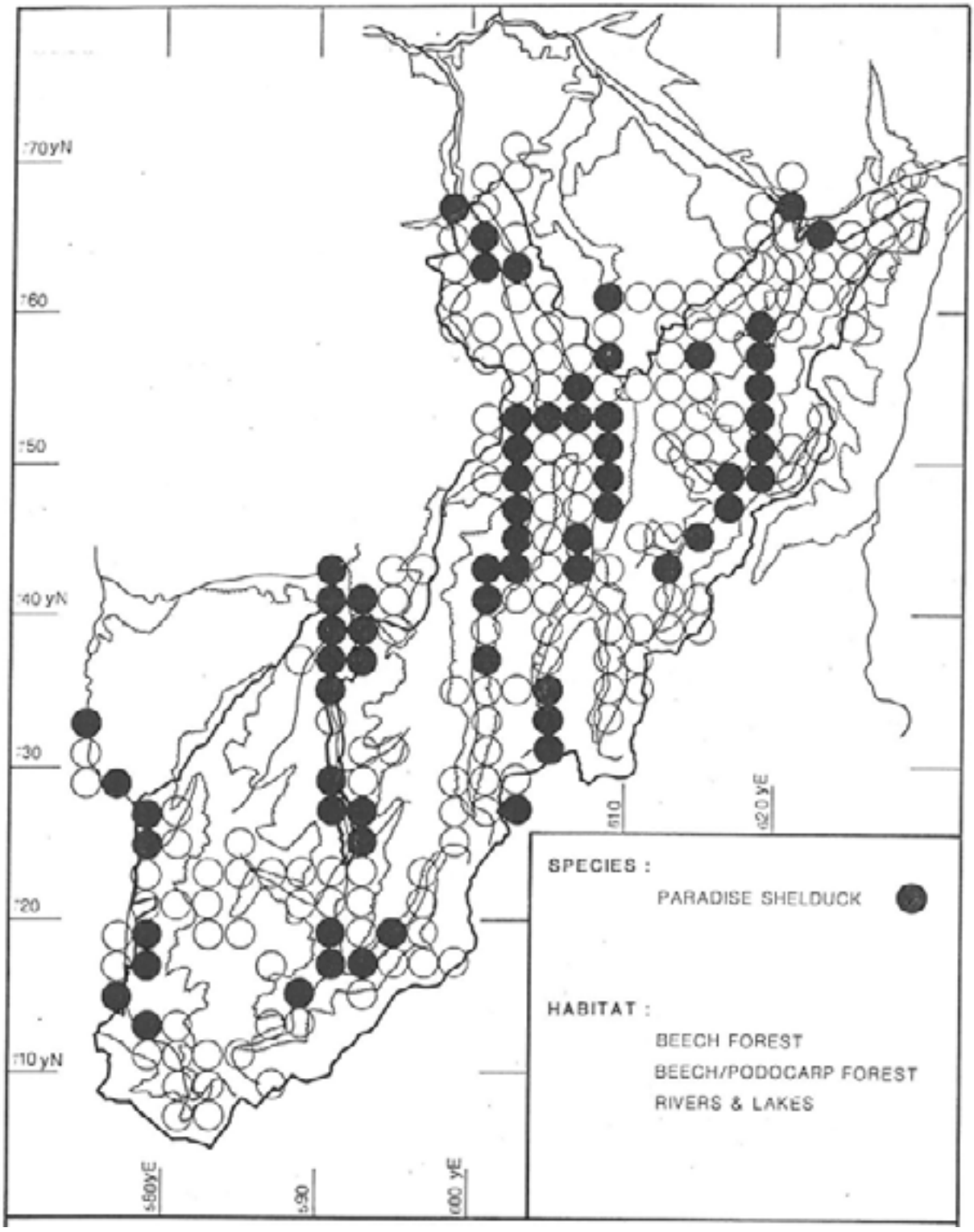


Fig. 4 Distribution of Paradise Shelduck in Nelson Lakes National Park

sightings have been made at Blue Lake at the head of the West Sabine. Breeding has only been confirmed in recent years in the Matakitaki Valley, while in the Travers and Sabine, sightings have been mostly confined to single birds, often in association with one or two paradise shelduck. In February 1985 a blue duck was reported in the Sabine showing aggression to a paradise shelduck female which was feeding close to a shelduck male. These results may indicate that the blue duck population is at a low level in the area so that some individuals have difficulty obtaining a mate.

Despite past sightings of blue duck at Lakes Rotoroa and Rotoiti it is likely that the upper parts of rivers have always been their main habitat, as Haast (1861) indicated, since they are particularly adapted to feeding in fast-flowing water where their main prey are insect larvae.

Blue duck may be slightly more numerous than the survey indicates for they are fairly easily missed being most active at dawn and dusk. In several field trips to the Glenroy Valley no sign of the species was found despite using Williams (1979) technique of searching for faecal remains, and it was only on the fourth evening of patrolling the river by the top hut that calls were heard as a bird flew past. Areas of narrow gorge on all the major rivers and many tributaries (e.g. Arnst) are impossible to survey by foot and these are likely to provide the fast-flowing water that is good blue duck habitat. The Matakitaki seems the most important blue duck river at present and the fate of the few birds on the other rivers needs to be followed by monitoring.

New Zealand Scaup (*Aythyn novaeseelandiae*)
RESIDENT (18) (7)
Scaup have always been concentrated on Lake Rotoroa with a few on Lake Rotoiti and none on the higher lakes. There are differing accounts of past numbers on Rotoroa from 'up to 500' around 1900 (D.W. Win in Bull 1977), 'hundreds' (N. Livingston, pers. comm.) to 'almost none by 1920s' (D.D. Cummings, pers. comm.), and no figures are given in any of the early written accounts. However it seems likely that for most of the century the population has varied between perhaps 10 and 50 birds. Stidolph (1946) counted 16 in 1944 and the National Park Ranger's Report of 1965 records 22 birds, describing these as the largest flock for many years. R.C. Vail noted 30 at the southern end of the lake in December 1970, and during the survey the maximum number there at any time has been close to this last figure.

Of the 18 records obtained during the survey all but one was at Lake Rotoroa, mostly from the southern end and west side. Breeding has been recorded there in 1925, 1965, 1970 and 1984, and is likely to have occurred in other years. One to three scaup were seen at Kerr Bay, Lake Rotoiti, on five occasions between 1969 and 1972 (R.H. Taylor, pers. comm.) and one was recorded there during the survey in October 1978.

3.2.2.8 **FAMILY ACCIPITRIDAE: HAWKS AND EAGLES**

Australasian Harrier (*Circus approximans gouldi*)
RESIDENT (54) (31)
The harrier, often known simply as the hawk, was seen by the earliest explorers of the area. Haast (1861) described it as '...a stupid bird, remaining quietly perched on a branch whilst the traveller approaches...', a behaviour that is rare today after a century of intermittent persecution. Observers have always considered it to be more abundant than the falcon in the Park though this may be because it frequents the lower, open areas like river flats where it is easily seen.

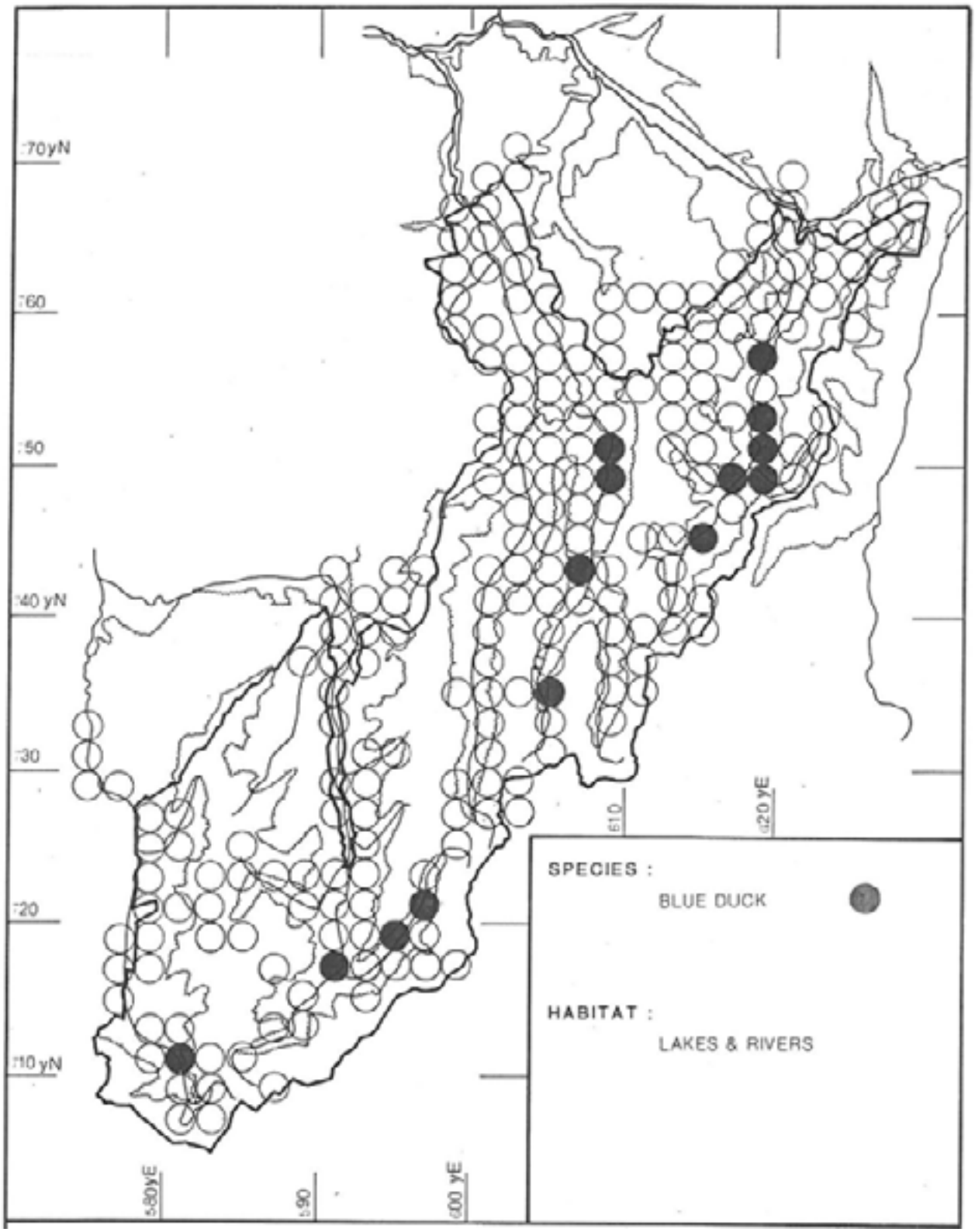


Fig. 5 Distribution of Blue Duck in Nelson Lakes National Park

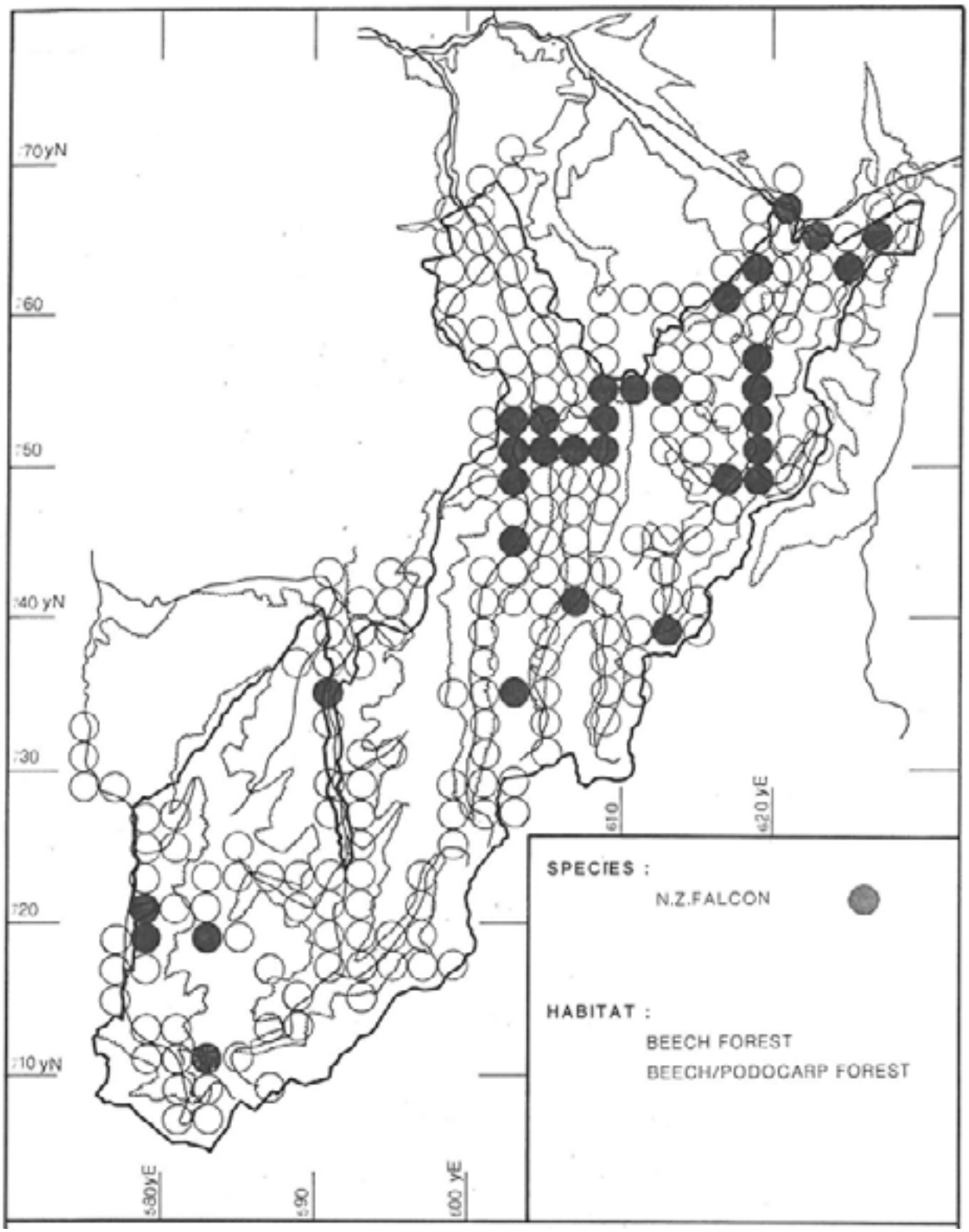


Fig. 6 Distribution of New Zealand Falcon in Nelson Lakes National Park

Protection was removed from harriers in 1916 following Acclimatisation Society submissions on their damage to game birds, and a bounty of 1/- per beak was introduced. The bounty was paid at least up to the 1940s and significant numbers were shot, e.g. in 1934 at least 26 birds in the Nelson District (Reports of Nelson Acclimatisation Society).

During the survey, records were scattered throughout the Park most often in areas adjoining farmland. Harriers were occasionally seen quartering ridge tops and subalpine grasslands and a probable nesting site was identified in a swamp above Pretty Bridge at 760 masl in the Matakitaki Valley. The species will have benefited from land clearance in the district and the introduction of various 'exotic' prey animals particularly rodents, hares, rabbits and frogs.

3.2.2.9 **FAMILY FALCONIDAE: FALCONS**

New Zealand Falcon (*Falco novaeseelandiae*)
RESIDENT (76) (33)
Falcons were frequently encountered in forest areas in the last century and Haast (1861) was one who met them at close quarters, having his hat knocked off by one while walking in the Howard. He also described three attacking a white heron on the Matakitaki plains. This species tends to use the same nest year after year and some sites have become well known as a result, e.g. in the Speargrass below Paddy's Gorge for several years before the survey (D.D. Cummings, pers. comm.).

Recent records (Fig. 6*)* cover all the valleys of the Park, both in the forest and above timberline. Often several sightings were received of pairs defending nesting areas and some near tracks became notorious for diving at trampers.

Falcons studied in Marlborough to the east occupy home ranges approximated as circles of 4km diameter in open country (Fox 1978). This would suggest each valley in the Park valleys could carry up to five pairs. However, this is not the case and the rather incomplete information gained from the survey would suggest that perhaps a pair lives in each valley system with others associated with the forest around each of Lakes Rotoiti and Rotoroa. This would give falcon densities similar to those found in forest areas in Westland (Fox 1978, 1 pair/189 km^2 found, 1 pair/75 km^2 being probably nearer true density).

Falcons were thought to frequently take pigeons in the area in the past, but recent records include only one pursuit of this species together with other observed chases of greenfinch, and paradise shelduck chicks; a bird was also seen with a freshly killed rat at the base of Mt Misery. Aggression was shown to larger bird species, particularly harriers, when they overflew the falcon's nesting areas.

3.2.2.10 **FAMILY PHASIANIDAE: PHEASANTS AND QUAIL**

Chukor (*Alectoris chukar*)
VERY RARE (1) (0)
The first recorded introduction of chukor to New Zealand was in 1926 in the Lake Heron district, South Canterbury (Thomson 1922) and liberations of birds in Marlborough and North Canterbury followed a few years later. A bird put up by dogs in the Howard in 1935 may have been this species, and quite a few were present on Mt Robert in the 1930s (M.R. Clarke, pers. comm.),

though it was in the 1940s and 1950s that chukor were at their most abundant in the Park (D.D. Cummings, AH. McConochie, pers. comm.). In those decades coveys of up to forty individuals were often seen on Mt Robert, typically above the Hut level (1280 m), and occasional birds found down by Lake Rotoiti. By the 1960s the population had declined so that a party hunting from Mt Robert round to Speargrass in April 1964 reported no chukor that trip although they had observed them there three years earlier (R.W. Fleming in National Park Ranger's Report).

During the survey only a single unconfirmed sighting was received from the St Arnaud Range in October 1978 but 'stragglers' from Marlborough are likely to continue to be found occasionally. It seems that the higher rainfall of Nelson Lakes may be one reason for the failure of chukor to become established in the Park, as they appear to thrive in the drier country to the east.

New Zealand Quail (*Coturnix novaezelandiae*)
EXTINCT (0) (0)
This species was abundant in Nelson itself in 1840 (Cotterel 1843) and in the 'grassy plains of the interior' in 1860 (Haast 1861). Buller (1905) recorded as many as 43 brace (pairs) being shot in a single day in 1848 within a few miles of Nelson. It was plentiful around the Park area for a few years after this but was recorded as disappearing from Rotoroa in the 1890s. Buller's last authenticated record for New Zealand quail was 1875 (Falla *et al.* 1982), so, though the date of extinction in the area is unclear, its demise was very swift.

California Quail (*Lophortyx californica*)
RESIDENT (32) (10)
California quail were liberated in the 1860s by the Nelson Acclimatisation Society and increased rapidly during the next decade (Sowman 1981). However they were deemed 'scarce' by 1894, only to increase again soon after that (Annual Reports of Nelson Acclimatisation Society), perhaps as more land was cleared of forest. They are considered to have been in the Park for about a hundred years, generally near Rotoroa and St Arnaud townships and occasionally on the Travers flats.

During the survey, they were only found on open areas at the edges of the Park adjoining farmland at St Arnaud, Rotoroa and Matakitaki except for a single sighting in forest at the foot of Mt Misery in November 1978. The species has gone from the Travers River flats, probably as a result of vegetation changes associated with the removal of cattle.

3.2.2.11 **FAMILY RALLIDAE: RAILS, CRAKES, WEKA, ETC.**

Weka (*Gallirallus australis*)
RESIDENT (23) (8)
Weka were very abundant at the time of the early explorations and they were a major source of food for those expeditions. Heaphy (1846) and Brunner (1848) frequently referred to catching them in the Park, and Haast (1861) wrote of '...no other bird being as numerous as the weka which was everywhere in the grassy plains, forests, as well as near the summits of mountains amongst subalpine vegetation.' By the beginning of this century the species was still common, Buller (1905) writing that the area from the Buller Gorge to the Spenser Mountains '...is the home of the brown wood-hen, which is still by far the commonest bird in this part of the country.'

A dramatic and rapid mortality was recorded in the area of the Park in April 1909. Birds that were seen 'perky' in the morning would be 'drooping' by midday and dead at nightfall (A.H. pers. comm.). The population declined markedly and weka were almost absent from the area through the 1920s and 1930s, only beginning to recover about the time of the 2nd World War (D.D. Cummings, pers. comm.) and the 1950s (A.H. McConochie, pers. comm.). They have never again reached their former numbers. On her visit to Rotoroa, Moncrieff (1925) saw no sign of though she noted that they were plentiful two years before. None was seen by an observer up the Travers to John Tait Hut in 1933 but weka were present on a trip along the same route in 1963 (I.L. Powell in Bull 1977).

Disease has been implicated in dramatic declines of the North Island weka (*Gallirallus australis greyi*) (e.g. in Taranaki, 1918), and of the buff weka (*G. australis hectori*) in Canterbury, 1917 (Falla *et al*. 1982).

Birds of various plumages have been noted, e.g. at Hope Junction, weka with white patches were often seen but all apparently fit within descriptions of the western weka (*G. australis australis*). The buff weka was once abundant from Marlborough to Otago and Oliver (1955) reports obtaining a partial albino of this subspecies from Nelson. It may have occurred in the Park also.

Weka populations in the Park (Fig. 7) seem now to fluctuate about a fairly low level. National Park Ranger reports record a population 'perhaps increasing' in 1963 but then none were seen for a year from October 1964. R.C. Vail heard several at Rotoroa in 1970, but overall numbers in the northern part of the Park and the Howard valley were low right through the period 1963-1973 (R.H. Taylor, pers comm.). During the survey there were only records from 1977 to July 1983, but none from then to the present (1988). The most regular sightings have been at St Arnaud with scattered reports from elsewhere in the northern part of the Park, particularly the lower Valley. Some individuals have been associated with Park huts for short periods. At least one attempt was made to re-introduce birds to St Arnaud, but they died out within a year or so (M.R. Clarke, pers. comm.).

Spotless Crake (*Porzana tabuensis*)
VERY RARE (0) (0)
There was a single record of a spotless crake at the in the Howard Valley adjacent to the Park in the early 1970s (R.H. Taylor, pers. comm.). This secretive species has been shown in recent years to be more widespread in New Zealand than was once thought, through its ready response to taped calls (Robertson 1985). Areas of suitable habitat for crakes exist at both ends of Lake Rotoroa.

Marsh Crake (*Porzana pusilla*)
VERY RARE (0) (0)
A single marsh crake was found in November 1979 at the Rainbow homestead to the east of the St Arnaud Range, and identified by Park staff.

Pukeko (*Porphyrio porphyrio melanotus*)
RESIDENT (10) (3)
Pukeko have obviously increased this century as the areas around the Park have been cleared for farmland. Birds were recorded at two sites adjacent to Lake Rotoroa: disused pasture by the

Braeburn Walk, where a population of over twenty was recorded, and the swampy fringe on the eastern side of the River outlet where a smaller group occurred.

3.2.2.12 **FAMILY HAEMATOPODIDAE: OYSTERCATCHERS**

South Island Pied Oystercatcher (*Haematopus ostralegus finschi*)
SPRING/SUMMER VISITOR (10) (4)
This species has probably increased on the farmland surrounding the Park, where pasture fertility has improved, from the 1930s and is likely to be as abundant in the area now as ever. The survey recorded birds on the shore of Lake Rotoiti near St Arnaud (7 occasions) and on the Travers, d'Urville and Matakitaki river flats, with all sightings between August and December.

Breeding which occurs from September to early January (i.e. first eggs to fledging, Falla *et al*. 1982) has not been recorded in the Park, though the braided areas of the Matakitaki Valley or the shores of the two lakes may be suitable. The birds do breed in the Upper Matakitaki Valley to the north-west where about a hundred pairs were recorded in the 1970s (Morse 1981). Nationally the species is showing an increasing tendency to breed in subalpine areas up to 1800 masl (Falla *et al.* 1982) so this change in habitat is to be looked for in future. In winter the bulk of the breeding population in the district probably moves to the north coast of the South Island.

3.2.2.13 **FAMILY CHARADRIIDAE: PLOVERS AND DOTTERELS**

Spur-winged Plover (*Vanellus miles novaehollandiae*)
RESIDENT (7) (9)
This Australian species became established in Southland around 1940 (Falla *et al.* 1982) and the first sighting in this survey area was at the Rainbow Station just to the east of the Park in 1965 (Bull 1977). It increased rapidly, first appearing at St Arnaud in 1968 and within the Park the following year. Now over 100 can be seen in occasional flocks on the Speargrass and Lake Stations to the north-west.

During the survey birds were seen at both ends of Lakes Rotoiti and Rotoroa and in the Matakitaki Valley as far up as Downie Hut river flats. They seem to favour dry stony ground for nesting, usually near swamps or water, and are likely to breed in the Park in the near future if they are not already doing so. They have been seen at Nelson Lakes at all times of year for, though they tend to flock outside the breeding season, they do not show the large scale movements of most other waders.

New Zealand Dotterel (*Charadrius obscurus*)
EXTINCT IN AREA (0) (0)
Haast (1861) in 1860 '...met with a very shy bird, resembling closely the plover (*Charadrius*) which till then I had never seen..' on the mountain tops of the district. This was very likely the New Zealand dotterel which was also seen by Travers in small flocks on the Spenser Range about the turn of the century (Buller 1905). There have been no further reports from the Park.

This species seems to have abandoned the habit of nesting in mountains, except on bare tops over on Stewart Island, and now favours coastal dune habitats throughout most of its range. It may exist in two breeding populations, one in the north of the North Island and one on the Southland coast

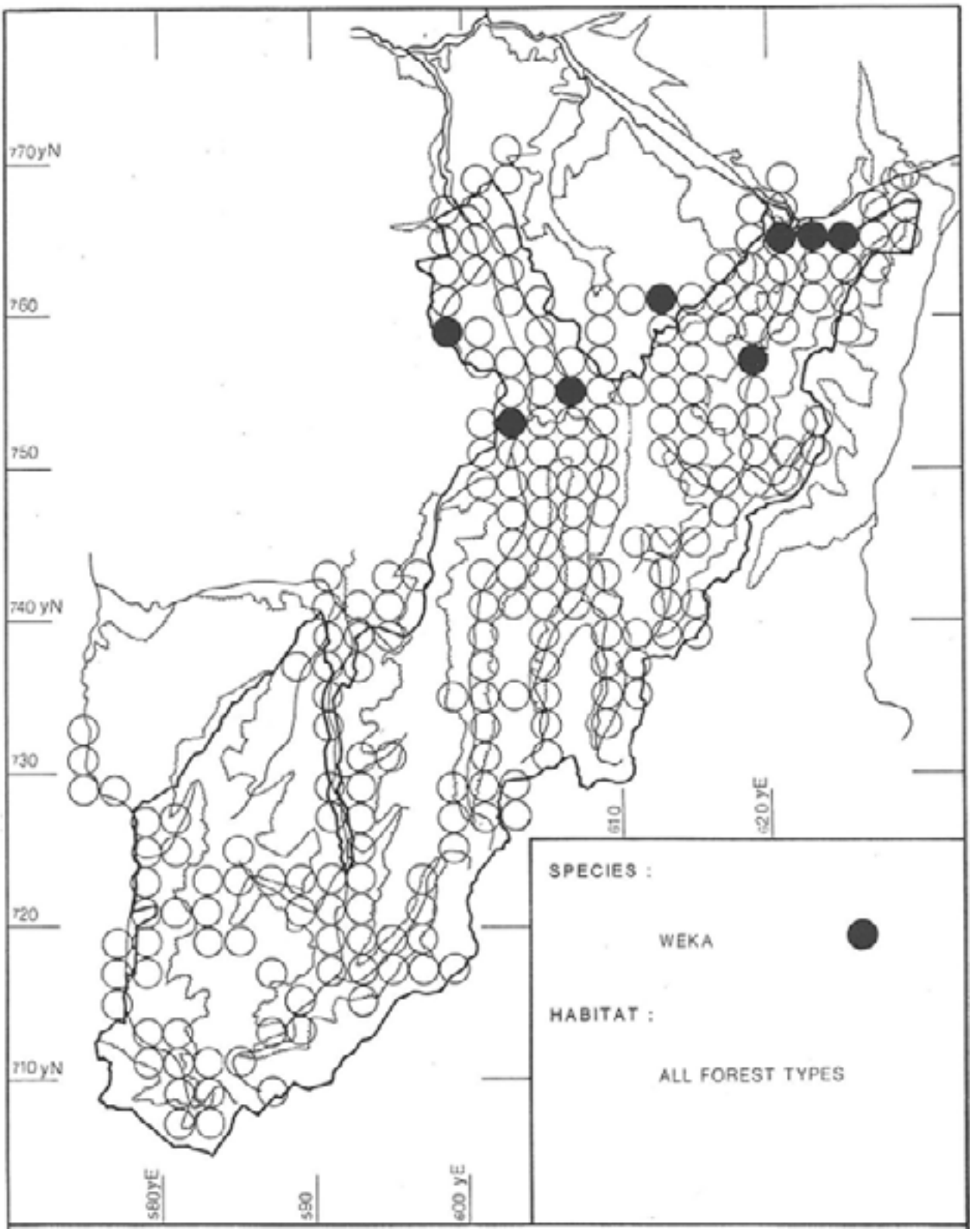


Fig. 7 Distribution of Weka in Nelson Lakes National Park

and Stewart Island. Birds are rarely seen between these areas (Falla *et al*. 1982). However they do occur regularly at Farewell Spit (11 were counted including several in breeding plumage during a recent census in June 1985 (J.M. Hawkins, pers. comm.)) and it is possible that a small population still nests inland in the mountains of this region.

Banded Dotterel (*Charadrius bicinctus*)
VERY RARE (0) (0)
Dotterel arrived on the nearby farmland at Lake Station in the 1930s as pasture fertility improved, and subsequently they became common on the Buller river flats. They were probably more plentiful in the recent past than now (A.H. McConochie, pers. comm.). No sightings have been made in the Park though the Matakitaki and Glenroy Rivers, in particular, provide areas of stable riverbed that are the preferred nesting habitat.

3.2.2.14 **FAMILY RECURVIROSTRIDAE: STILTS AND IBISES**

Pied Stilt (*Himantopus himantopus leucocephalus*)
VISITOR (7) (3)
Like the other waders that use farmland, pied stilts seem to have increased in the area and the National Park Ranger's Report for 1962 records them frequenting Lake Rotoiti '...for the first time in many years'. Most records made during the survey were of small flocks at the township ends of Lakes Rotoiti and Rotoroa. These flocks were seen in August and from October through to February (the breeding season), the largest being 36 birds in August 1979. Nesting has not been recorded in the National Park though it apparently occurs on the Buller river flats nearby. This species tends to winter on the coast (Falla *et al.* 1982).

Black Stilt (*Himantopus novaezealandiae*)
VERY RARE (1) (0)
No past records are available for this very rare species and only a single one was made during the survey, when a bird was seen in the company of 11 pied stilts at Lake Rotoiti on 8th August 1981 by M. Clarborough.

3.2.2.15 **FAMILY LARIDAE: GULLS**

Southern Black-backed Gull (*Larus dominicanus*)
RESIDENT (49) (28)
This species probably has always been a visitor to the Park; the 'sea gull' seen by Brough (1883-4) in the Wairau Gorge to the east in 1883 was most likely a black-backed. They have bred on tarns on the Robert and St Ranges for at least the past twenty to thirty years (D.D. Cummings, pers. comm.). During the survey, sightings were scattered throughout the Park from river valleys, lakes, and mountain areas above bushline, but most were from the Mt Robert/Lake Rotoiti area.

Black-billed Gull (*Larus bulleri*)
SPRING/SUMMER VISITOR (34) (0)
This gull has apparently increased in the farmland surrounding the Park in recent years (D.D. Cummings, pers. comm.). All the records made during the survey were from Lake Rotoiti, mostly at the township end, and flocks were present from July to January, the largest of about 200 birds being in West Bay in January 1983.

3.2.2.16 **FAMILY STERNIDAE: TERNS AND NODDIES**

Black-fronted Tern (*Sterna albostriata*)
SPRING/SUMMER VISITOR (5) (3)
The black-fronted tern breeds only inland and it is regularly seen in the Park in summer. There is no information on numbers earlier this century but it was apparently more abundant in the 1960s than now. Rangers reported in the 196314 season that terns '...stayed around the foreshore of Rotoiti in greater numbers than ever before…' and in 1965 noted '...sixty terns this summer around Lake Rotoiti foreshore for 8-9 weeks, double last year's flock.'

Four records during the survey were of 1 to 10 birds at either end of Lake Rotoiti and the fifth was of a single bird near the Matakitaki Base Hut; all between September and January. The nearest breeding colonies are to the east on the Wairau River and to the north-west on the Buller River. The absence of winter records is associated with a movement of birds to the coast after the breeding season.

3.2.2.17 **FAMILY COLUMBIDAE: FRUIT PIGEONS, PIGEONS AND DOVES**

New Zealand Pigeon (*Hemiphaga novaeseelandiae*)
RESIDENT (58) (22)
Haast in 1860 noted the abundance of the pigeon '...in the lower countries, where the vegetation does not principally consist of Fagus (beech)' and his observation would hold true today. Earlier, Heaphy (1846) records catching six in a day and a half at Rotoroa. Most survey records came from Lake Rotoroa and the lower D'Urville Valley with only a few birds from St Arnaud, farmland adjoining the Matakitaki and one well up the Glenroy Valley.

There are occasional references to fluctuations of pigeon populations at Nelson Lakes and they were apparently in larger numbers in the past (M.R. Clarke, pers. comm.). Certainly large numbers were taken for food by the early settlers and the full protection given to the species in 1921 led to a population recovery.

Research by DSIR Ecology Division suggests that the mixed podocarp/beech forest at the heada of Lake Rotoroa and the kowhai (*Sophora microphylla*) around that lake are important food sources for the Park's pigeon population. Their recent radio-tracking work (Clout *et al.* 1986) has shown that some birds nest at higher altitudes than previously thought and this may explain the Glenroy Valley observation (Fig. 8).

3.2.2.18 **FAMILY CACATUIDAE: COCKATOOS**

Kakapo (*Strigops habroptilus*)
EXTINCT IN AREA (0) (0)
Kakapo had apparently almost disappeared from the area by the 1840s though Buller (1905) considered the species to be fairly numerous in all beech forests from the Maitai south to Milford Sound and on the Maruia Plains. It was probably always more abundant on the western side of the Park. Heaphy (1846) and Brunner (1847) both mention the area between the Tiraumea and Tutaki Rivers as one where the natives used to hunt the species, a waterfall up the Mangles River marking a particularly celebrated kakapo station. By the time of their explorations kakapo were almost extinct there. The Maruia Plains were another past source known to the Maori (Brunner 1847,

Haast 1861). It was only when these early explorers moved further west still that they encountered kakapo, Brunner on the hills bounding the Grey River and Haast on Mt Williams, near Westport.

No sightings have been made in the Park this century. Kakapo were plentiful on Mt Owen to the north until about 1915, Moncrieff (1935) found them on Mt Mackay, near Wangapeka Saddle, in 1934 and more recently they have been reported at the Lewis Pass (1964) and in North-west Nelson, culminating in the location of possible track and bowl systems in the latter in 1985.

Both Brunner and Heaphy report that one probable reason for the destruction of the kakapo was the large number of wild dogs formerly belonging to the natives, but the latter believed that the spread of the 'European' rat was the real cause. Haast (1861) described a retreat of the species to the wild mountain regions, to be unmolested by man and dog. However its range probably always included the species-rich subalpine zone above forests.

3.2.2.19 **FAMILY NESTORIDAE: KAKA AND KEA**

South Island Kaka (*Nestor meridionalis meridionalis*)
RESIDENT (127) (68)
Kaka were abundant during the early explorations and were frequently trapped for food (Brunner 1847, Brough 1895-9, Haast 1861); they could be held captive for several days to be eaten when nothing else was available. Large congregations were noted at particular food sources in the past, up to a hundred at Rotoroa in the 1920s (Moncrieff 1925) and up to twenty on fruit trees at Speargrass in later years (D.D. Cummings, pers. comm.). The population has declined through this century so that groups of more than five or six birds are very rarely seen now.

During the survey (Fig. 9) birds were recorded throughout the Park, mainly from forested low-to mid-slopes. Many sightings were from Mt Misery and the lower D'Urville Valley and also from the Travers and Matakitaki Valleys, of either individual birds or small groups. Up to five birds were regular visitors to Kerr Bay in July 1984 performing aerial displays accompanied by incessant calling. Studies now being carried out by DSIR Ecology Division are providing information on the ranging of the species both inside the Park and in neighbouring forests (see Appendix 3). They also indicate that the population here is not breeding very successfully (P.R. Wilson and J.R. Beggs, unpublished data), perhaps related to competition from wasps.

Kea (*Nestor notabilis*)
RESIDENT (151) (71)
The first recorded sighting of kea in the Park was on Mt Robert in 1903 as the species extended its range north from the Canterbury high country (Marriner 1908). Little information on the population was obtained from then until a study was made at Cupola Basin in the 1960s (Clarke 1970). This suggested a resident density of one bird per square mile, similar to findings at Arthur's Pass, and showed that their altitudinal range varied from 750 to 2100 masl. Through spring and summer they frequented alpine scrub and grassland zones between 1200 and 1600 masl, usually singly or in small groups from October to December and then in larger flocks (6-13) in January and February. These flocks which include young birds tend to be attracted by human activity and may descend on trampers. In the autumn birds moved higher to 1500 to 1800 masl, and by winter the flocks had split into small groups again that returned to the forest on the onset of heavy frosts or snowfall. Their foods were the fruits, seeds, flowers and leaves of many subalpine plants,

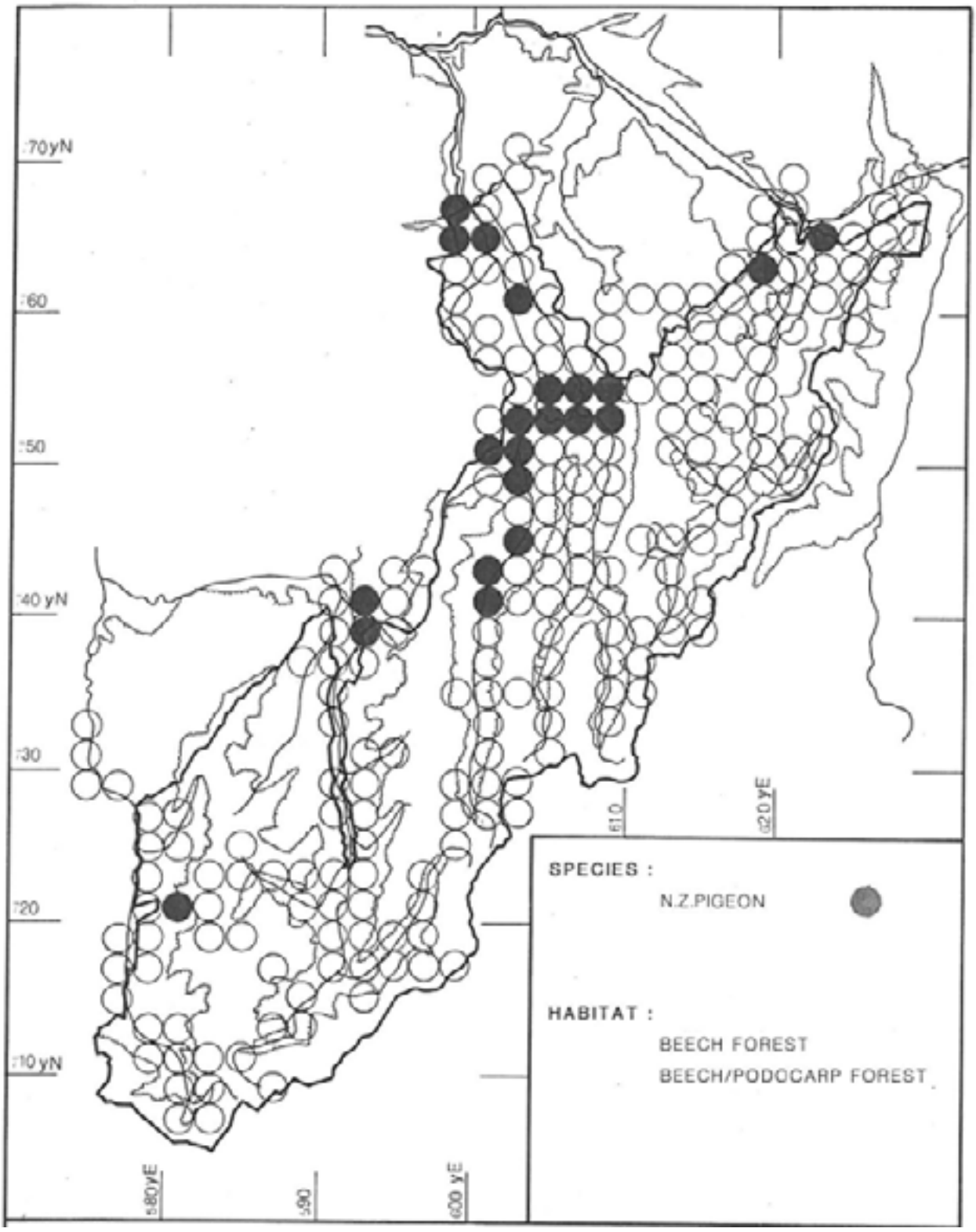


Fig. 8 Distribution of New Zealand Pigeon in Nelson Lakes National Park

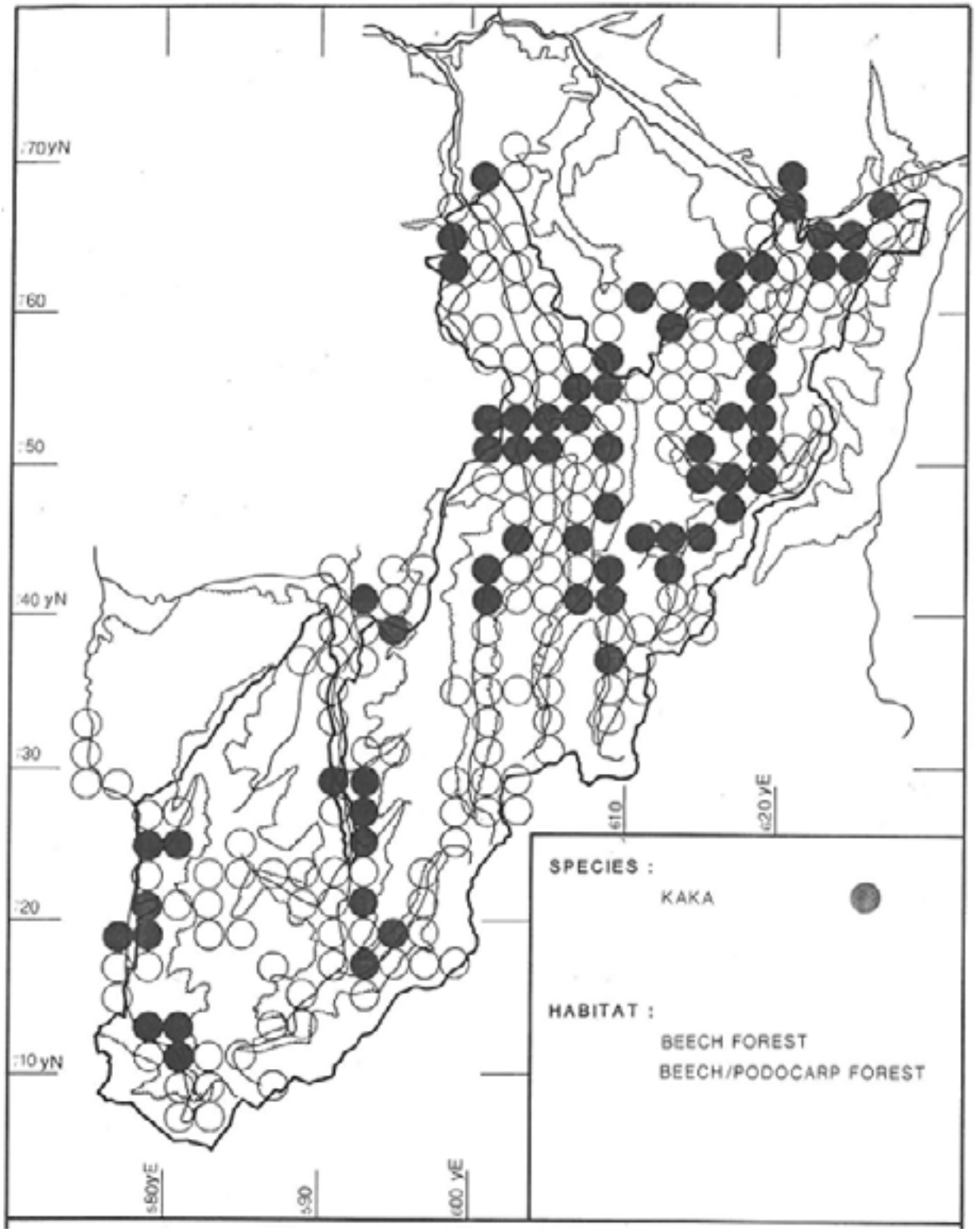


Fig. 9 Distribution of South Island Kaka in Nelson Lakes National Park

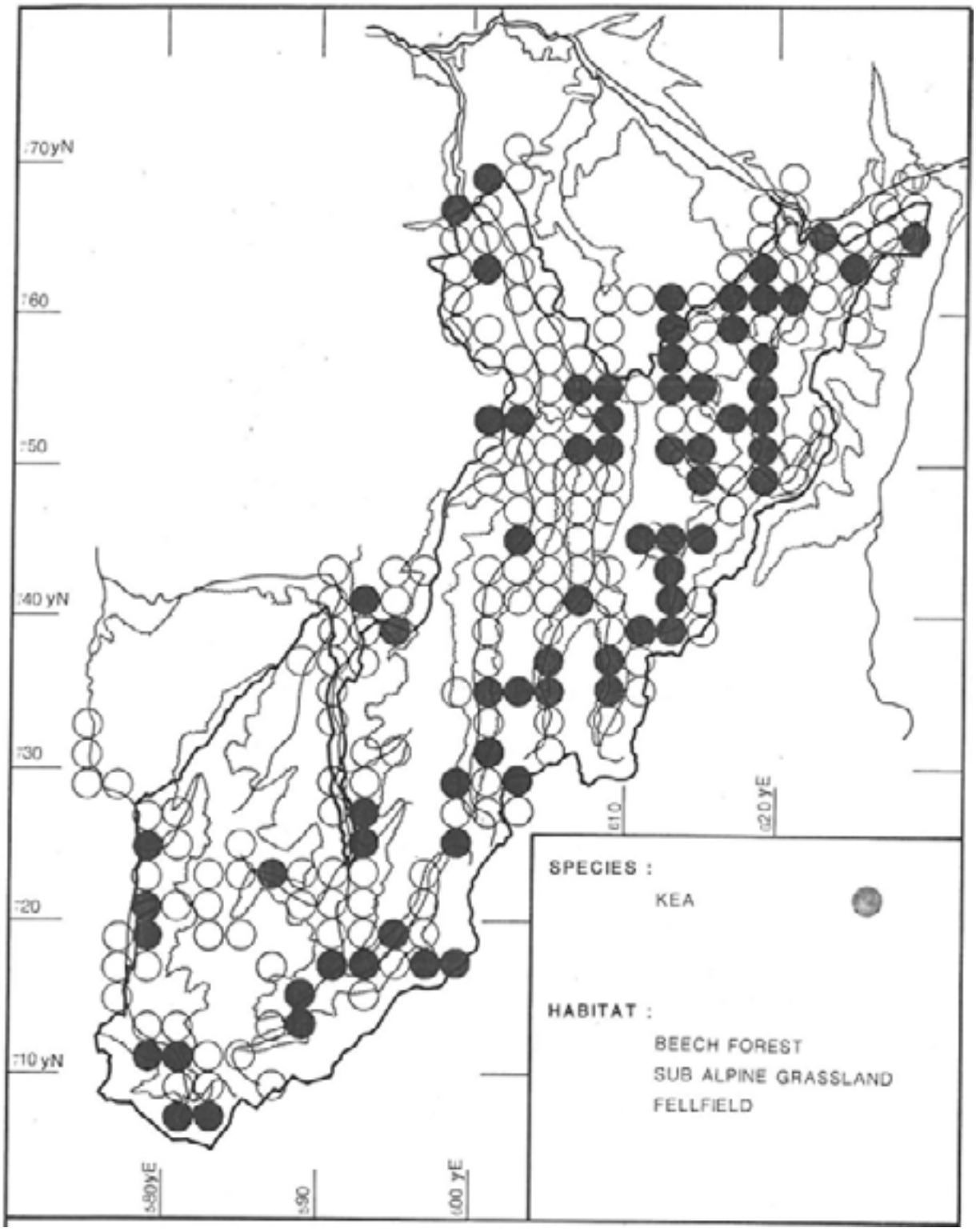


Fig. 10 Distribution of Kea in Nelson Lakes National Park

Coprosma pseudocuneata being the most commonly taken. Kea were probably important in the dispersal of some plant species (Clarke 1970).

Kea were seen throughout the Park during the survey (Fig. 10), most records being of birds flying high over the valleys or encountered above timberline but a few were of birds in the forest or at low levels around Park huts.

3.2.2.20 **FAMILY PLATYCERCIDAE: ROSELLAS AND PARAKEETS**

Red-crowned Parakeet (*Cyanoramphus novaezelandiae*)
EXTINCT IN AREA (0) (0)
Small colonies of red-crowned parakeets were reported at the Travers River mouth and Gowan River before 1890, and one found dead on the road by waggoners about 1905 was stuffed and mounted (A.H. McConochie, pers. comm.), an honour that may indicate its rarity.

Last century this species, together with the yellow-crowned, was reported to have raided crops in large numbers (e.g. Handly 1895) and was the most numerous of the two species. However a dramatic decline must have followed within fifteen or so years of these population increases (Oliver 1955). In 1944 Stidolph (1946) was told of the presence of both red-and yellow-crowned parakeets in the Buller Valley and Falla *et al*. (1982) mentioned Nelson Lakes National Park as one of the last large forest tracts in which they still occurred. However there have been no confirmed sightings from the area for the last few decades despite particular efforts made by the Wildlife Service, DSIR Ecology Division, and myself to identify parakeets using taped calls.

It is difficult to explain the demise of the red-crowned parakeet while the yellow-crowned has apparently flourished. The former may make more use of the fruits of ground plants making it more vulnerable to mammalian predators (Falla *et al.* 1982) or it may have been more susceptible to disease.

Yellow-crowned Parakeet (*Cyanoramphus auriceps*)
RESIDENT (43) (29)
Yellow-crowned parakeets existed in large flocks in the early days and joined in the raiding of crops with the previous species in the 1880s (Handly 1895). In Marlborough the yellow-crowned were not as numerous as the red-crowned in these flocks (Oliver 1955) but the roles were soon reversed. Moncrieff (1925) wrote that parakeets were common at Lake Rotoroa, seeing flocks of up to thirty, and the only one she watched closely was yellow-crowned. She thought that they might increase there as at that time they had done so at several sites including the Dun Mountain near Nelson. A change of behaviour that she had noted since the early years of high numbers was that birds now kept to the tops of trees when once they could have been knocked over with a stick (Moncrieff 1925). Any increase might well have been short-lived, if it occurred, for there were only occasional sightings reported in National Park Ranger reports during the 1950s and 1960s, and the present survey shows them to have a very limited distribution in the Park.

Forty-three records of birds were positively identified as yellow-crowned parakeets during the survey (Fig. 11), the majority being brought in close by taped calls so that their heads could be seen. Neither of the other two species was seen so most, if not all, of the 48 unidentified parakeet reports are probably yellow-crowned also. Their combined distribution takes in all valleys; most birds were in the D'Urville and Sabine, particularly at the head of Lake Rotoroa, and in the

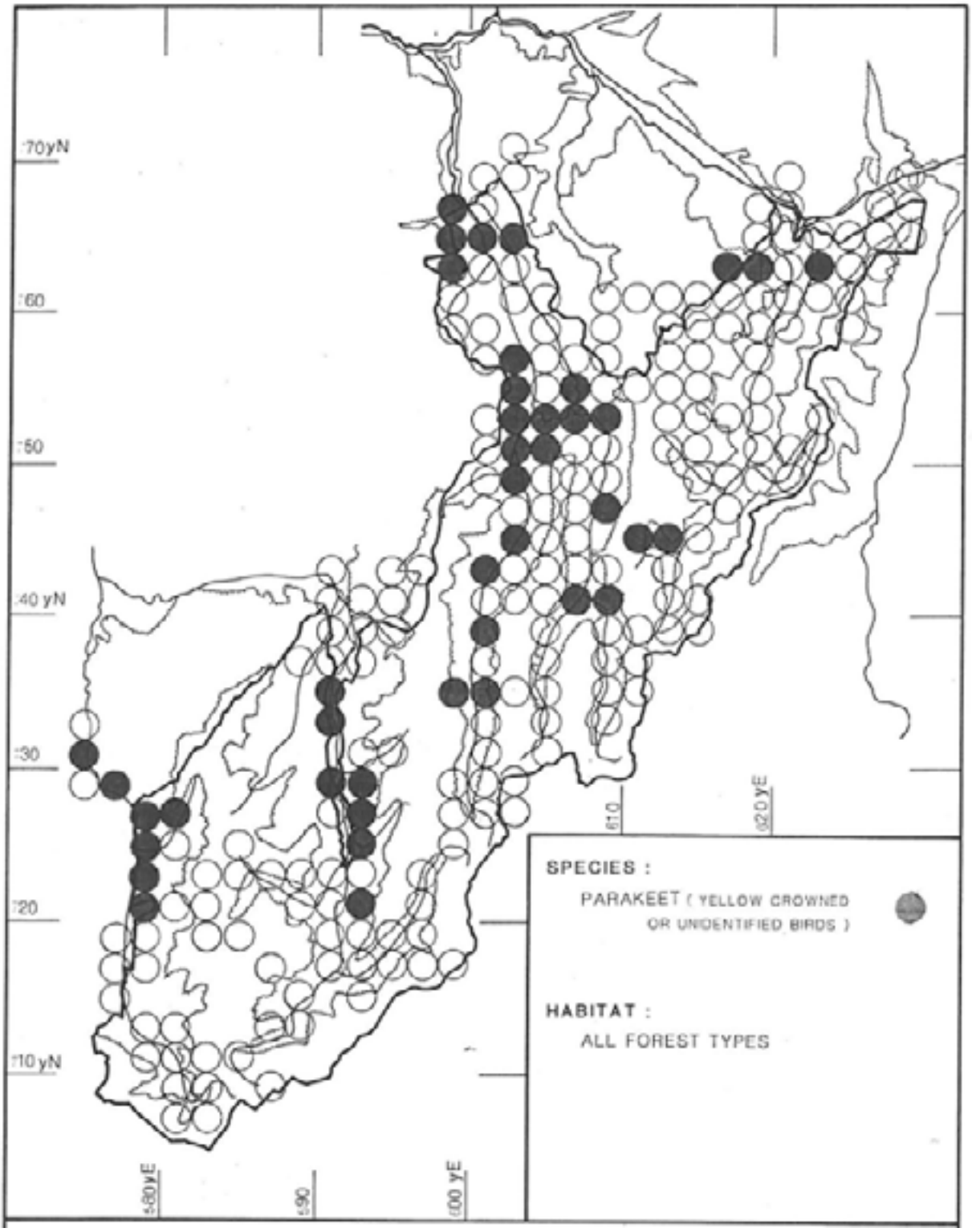


Fig. 11 Distribution of Yellow-crowned Parakeet in Nelson Lakes National Park

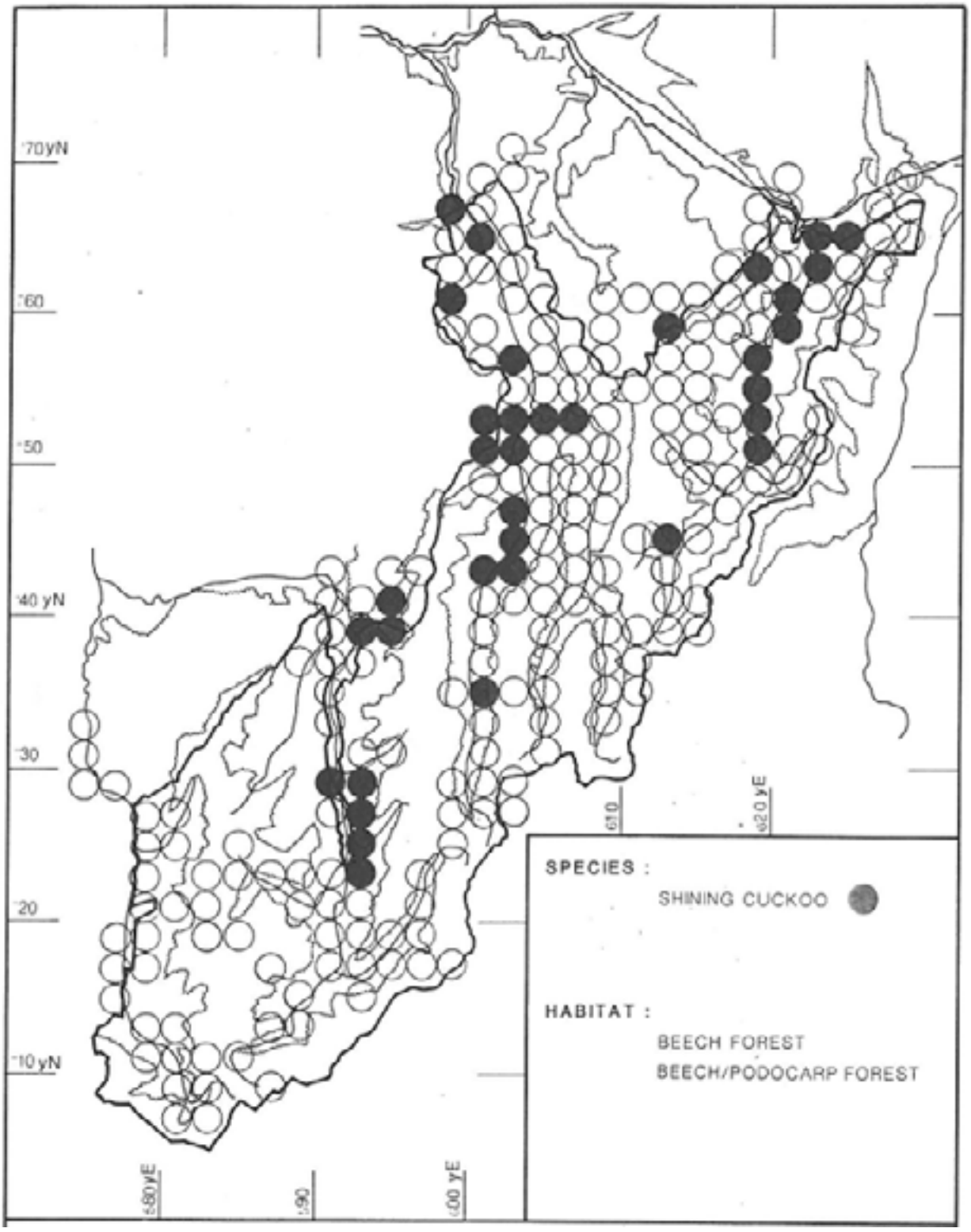


Fig. 12 Distribution of Shining Cuckoo in Nelson Lakes National Park

Matakitaki. The only two records in the Travers Valley were in July 1979 and February 1983, and the others are from the slopes of Mt Robert and Speargrass, an area where birds have been noted for many years. Apart from this last site most records were obtained in forest at low altitudes (see Section 3.5).

Orange-fronted Parakeet (*Cyanorampus malherbi*)
EXTINCT IN AREA (0) (0)
Recent work by DSIR Ecology Division, Nelson, has suggested that the orange-fronted parakeet is not a true species but only a colour morph of the yellow-crowned parakeet (Taylor *et al.* 1986).

Orange-fronted parakeets were frequently seen in the Park early this century, always in small numbers together with flocks of yellow-crowned (D.D. Cummings, A.H. McConochie, pers. comm.). There were no recorded sightings from c.1930 until 1965 when two were seen in the D'Urville Valley by an expedition led by the Wildlife Service. After playing tapes of yellow-crowned calls just 200 m south of the hut on 24 March 1965 they identified that the second bird to respond was orange-fronted. Then on the 30th they called in a flock of five birds near the same spot, one of which was orange-fronted (Adams 1965). These observations suggest that if this species is in the vicinity it will respond to calls of yellow-crowned, though it is considered quieter and more retiring than the latter (Adams 1965). Thus, were it still present in the Park in any numbers, it should have been recorded among those of the previous species called in close to the observer using tapes.

3.2.2.21 **FAMILY CUCULIDAE: CUCKOOS**

Shining Cuckoo (*Chyrococcyx lucidus*)
The only reference to the past status of this overseas migrant in the park is that of D.W. Win who noted 'few' around 1900 (Bull 1977).

During the survey (Fig. 12) it was recorded only between 30th September and 9th January though it was probably still present but silent for several weeks after the latter date. It was most common at low levels in the red beech forest, not penetrating far up the valleys nor up the mountain sides. Results from the DSIR Ecology Division survey of Mt Misery showed that though shining cuckoos were occasionally found up to timberline they were most abundant below 700 m.

Long-tailed Cuckoo (*Eudynamis taitensis*)
SPRING/SUMMER VISITOR (15) (12)
Long-tailed cuckoos, like the previous species, are overseas migrants that come to New Zealand to breed. There are indications that they were more numerous in the past and D.W. Win reported large numbers around 1900 (in Bull 1977). Forest clearance and declines in the favoured foster parents, brown creeper and yellowhead in the South Island, are implicated in a reduction of numbers visiting New Zealand (Oliver 1955).

Sightings have been made between 15th October and 16th February, around both lakes, the Mt Misery Range, the Matakitaki forks and the Upper Glenroy, usually at higher altitudes than the shining cuckoo. DSIR Ecology Division found that it occurred from 900 masl upwards to areas just above timberline. Of the foster parents listed only the brown creeper now occurs in the Park and it tends to favour mountain beech forests.

3.2.2.22 **FAMILY STRIGIDAE: OWLS**

Morepork (*Ninox novaseelandiae*)
RESIDENT (38) (17)
Moreporks were widespread in the past and there is nothing to indicate any change in their status in the Park. Haast (1861) found them everywhere within the forest and Marchant (1938) considered that '..the numerous owls were taking a toll of the birds'.

Records during the survey were widely scattered and mostly represent birds heard calling at night near Park huts and tent camps. They indicate that morepork occur everywhere within the forested areas of the Park, except the very upper reaches of the river valleys, and use a wide range of altitudes up to timberline.

3.2.2.23 **FAMILY ALCEDINIDAE: KINGFISHERS**

New Zealand Kingfisher (*Halcyon sancta vagans*)
RESIDENT (53) (19)
Kingfishers were apparently quite scarce in the past, for a sighting in 1904 was widely reported (A.H. McConochie, pers comm.). They are likely to have increased since as a result of forest clearance for farming in the area. They were recorded during the survey from both lakes, the lower parts of the Matakitaki, and Sabine Valleys, and the Travers Valley up to John Tait Hut. Most reports were in spring with only two in the period between February and August. Taylor (1966) has shown that this species moves from the Park to the coast in winter and the survey results support his findings.

3.2.2.24 **FAMILY XENICIDAE: NEW ZEALANDWRENS**

Haast (1861) observed several species of New Zealand wrens '..in the interior' of the region which he wrote '..will prove to be undescribed'. Rifleman and rock wren still occur in the Park and the bush wren probably became extinct in the last few decades. One observer considers that there were more 'types' of wrens in the past. It should be noted that both extant species are sexually dimorphic with respect to plumage and a lesser extent size and that many colour variations exist (G. Sherley, pers. comm.). However the recent findings of sub-fossil remains of other wren species on the mainland (Appendix 2) leaves the number of species once found at Nelson Lakes open to doubt.

South Island Rifleman (*Acanthisitta chloris chloris*)
RESIDENT (436) (157)
There are no specific references to the past status of riflemen in the Park, though one observer records that they were more common at St Arnaud in the past (M.R. Clarke, pers. comm.). Rifleman were widespread throughout the beech forests of the Park from valley floors to timberline though they are not continously distributed. Few were noted at low altitudes (below 500 m), and the greatest numbers were from about 650 masl upwards where they appeared to be the most abundant species. DSIR Ecology Division's more detailed Mt Misery results showed a similar pattern with most birds between c.525 m (transect station 24) and c.1200 masl (station 64), and a few few up to timberline. This distribution appeared fairly throughout the year and they remain widespread in winter, not moving down from the heads of the valleys as other species may do.

A preference for mid-to high-altitude forest was noted in the valleys as well as up the mountain sides. Riflemen were absent from lower valley areas during this survey, though the grouping of records over several years masks this in the distribution map (Fig. 13). For example, on each of three surveys up the Sabine Valley from Lake Rotoroa, rifleman were not seen until the track climbed away from the river about 2 km from the lake (past the footbridge). The species was rarely seen near the townships of St Arnaud and Rotoroa and only three reports were obtained from each, though their corresponding grid squares were the best covered in the Park, providing 66 and 58 record cards respectively.

An interesting observation was made in the Glenroy in January 1985 of a bird feeding on flax flowers, placing its beak deep within them on several occasions. It was uncertain whether it was feeding on nectar or had found insects trapped in the flowers.

South Island Bush Wren (*Xenicus longipes longipes*)
EXTINCT (0) (0)
In the 1920's, bush wrens were apparently numerous at Glenhope, at all altitudes in the forest, and a colony was also known on the bluffs by the old Sabine Forks Hut (A.H. McConochie, pers. comm.). Moncrieff (1925) described 'green wrens' hawking insects during her visit to Lake Rotoroa, and they were quite common around gold-mining sites on the edges of the Park in the 1930s and 1940s (M.R. Clarke, pers. comm.). However, since that period only a few unconfirmed sightings have been recorded: from the western side of Moss Pass in 1968 and Mt Robert in 1971 (Bull 1977) and from the West Sabine just south of the forks in 1976 (Thomas and Clare 1976). This last report was followed up by two DSIR Ecology Division expeditions that December (Thomas and Clare 1976) and October the following year (Thomas 1977) but no further sightings were made. It was concluded that the bird was possibly a rock wren as the area held many screes with subalpine shrubs more suited to this species.

Bush wrens are probably now extinct in the Park as they seem to be over the whole country, though a few small groups may have been present until quite recently.

Rock Wren (*Xenicus gilviventris*)
RESIDENT (8) (7)
Rock wren are present in small numbers in the subalpine and alpine areas of the Park. A few pairs were known at the head of the Travers Range by the Travers Saddle to twenty years ago, and one pair was seen on the St Arnaud Range more recently (D.D. Cummings, pers. comm.). A pair was seen at about 1700 masl on the east ridge leading to Mt Ella in 1966 (National Park Ranger report).

During the survey (Fig. 14) all the records were obtained from the eastern side of the Park, the Travers and Mahanga Ranges. The earlier sightings noted above extend the species' distribution to include the St Arnaud Range to the east and Mt Ella to the west but not the Emily Peaks -Mt Maling Range still further west. This last area has not been covered as thoroughly but it is of very different geology, the rock fracturing into smaller fragments and not producing the large boulder fields that may provide preferred rock wren habitat.

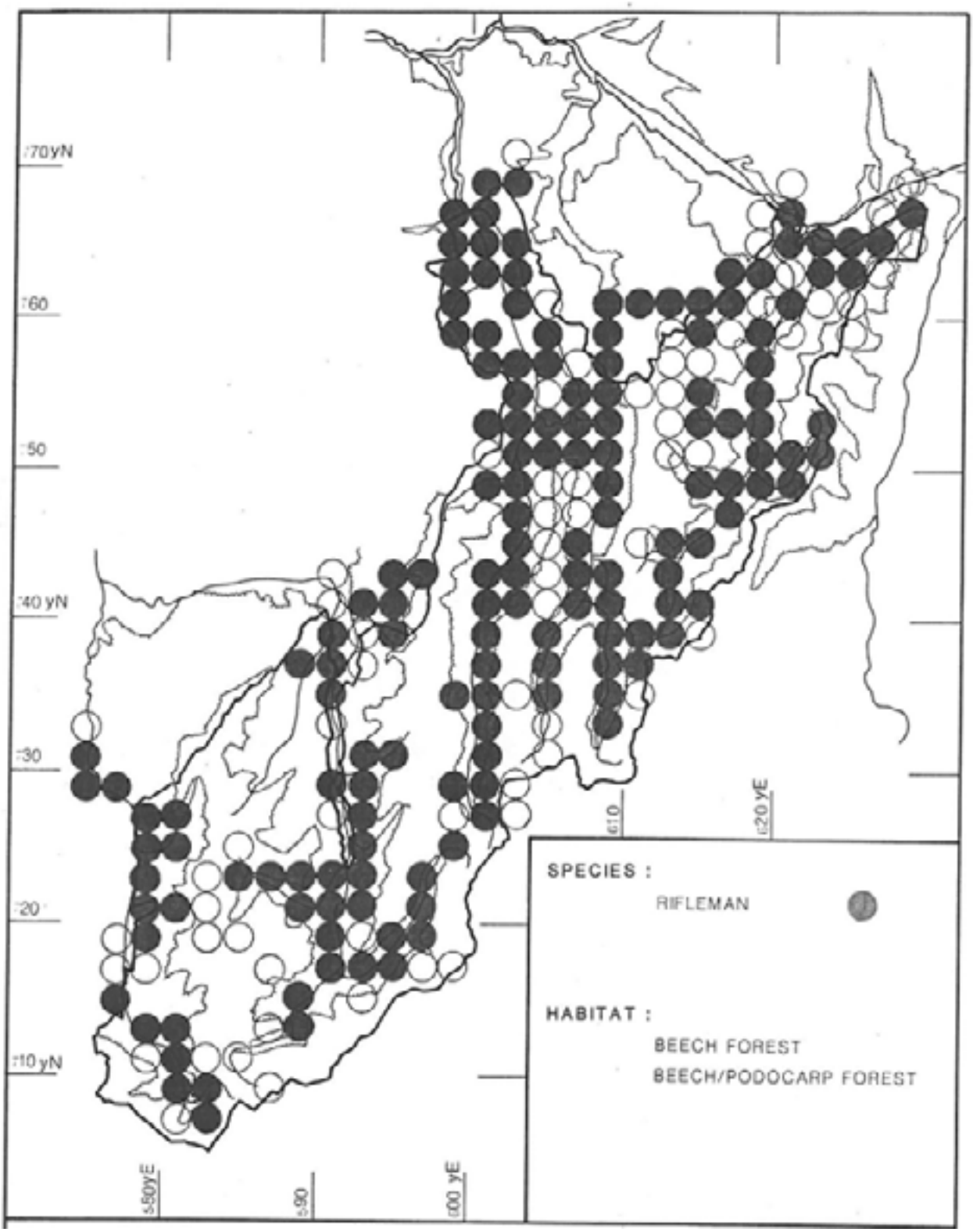


Fig. 13 Distribution of South Island Rifleman in Nelson Takes National Park

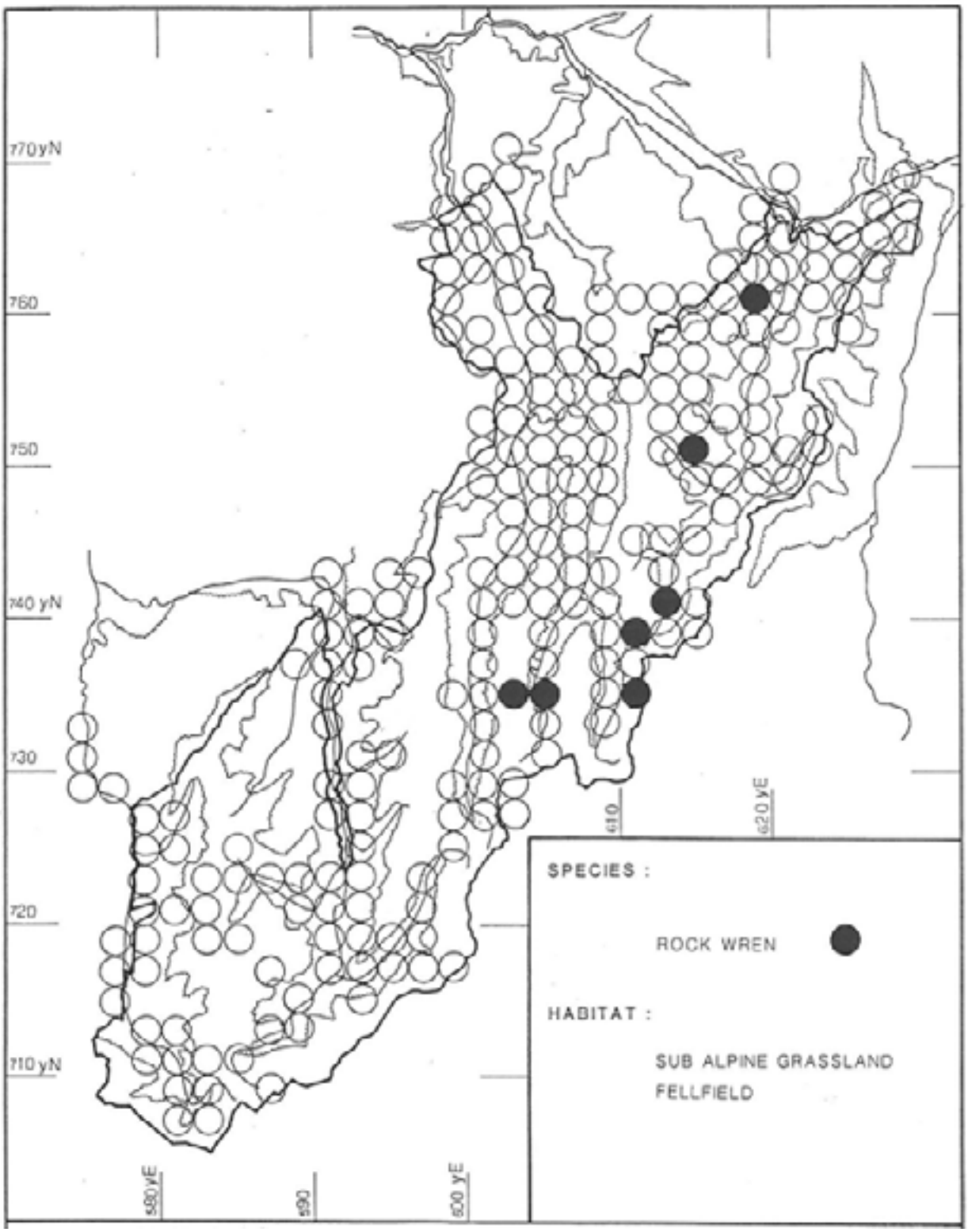


Fig. 14 Distribution of Rock Wrens in Nelson Lakes National Park

3.2.2.25 **FAMILY ALAUDIDAE: LARKS**

Skylark (*Alauda arvensis*)
RESIDENT (38) (26)
Twenty larks were included in the first release of European birds made by the Nelson Acclimatisation Society in 1863/4 at sites from Nelson to Motueka, and fifteen in the second in 1864/5 (Sowman 1981). They were clearly very successful colonists: the Nelson Examiner of 12th November 1870 reported that they had spread so far as to reach the Wairau in Marlborough, nesting in the town there, so it can be assumed that they were probably in the Park by then also. By 1876 they had increased in the district to the extent that they were included in a list of species whose protection was revoked, due to damage being caused to farmers' crops (Annual Reports of Nelson Acclimatisation Society).

Clearance of land for pasture around the edges of the Park will clearly have benefited this species and it is now commonly found in areas of grassland. During the survey it was recorded from low levels around Rotoroa, St Arnaud, and in the Matakitaki Valley almost to Downie Hut. In summer it also occurs on the subalpine grasslands of the St Arnaud, Robert and Misery Ranges in the north of the Park and on the Spenser Mountains above the Glenroy Valley, well to the south. This last observation shows that birds will move a good distance from farmland at that time of year.

3.2.2.26 **FAMILY HIRUNDINIDAE: SWALLOWS AND MARTINS**

Welcome Swallow (*Hirundo tahitica neoxena*)
SPRING/SUMMER VISITOR (11) (3)
Welcome swallows were noted in nelson in 1968, ten years after their first known nesting in New Zealand, and spread rapidly in the district reaching the Park at St Arnaud in the mid-1970s (D.D. Cummings, A.H. McConochie, pers.comm.). These first sightings at Rotoroa was in September 1979 and all subsequent records have come from these two sites, the species not yet penetrating to the flats at the heads of either Lakes Rotoiti or Rotoroa. They are typically seen in small groups of 2 to 10 birds, arriving in September and present throughout the summer. There are two recent records outside this period, in April 1983 and July 1984.

3.2.2.27 **FAMILY APODIDAE: SWIFTS**

Spine-tailed Swift (*Chaetura caudacuta*)
NOT CONFIRMED
A single possible record of a spine-tailed swift from the Mt Robert ski basin was made on 14 June 1982 but the sighting of this rare visitor to New Zealand was not confirmed.

3.2.2.28 **FAMILY MOTACILLIDAE: PIPITS AND WAGTAILS**

New Zealand Pipit (*Anthus novaseelandiae*)
RESIDENT (126) (66)
The pipit may have been more abundant in the area in the past for, though it frequents open spaces, it does not favour improved pasture. Large flocks were noted at St Arnaud in the 1950s but these are not so obvious now, and pipits are mostly found on the river flats, on cleared land covered in fern, or subalpine grasslands above timberline. They are the most numerous species in the last habitat and are found on all the mountain ranges in the Park.

3.2.2.29 **FAMILY PRUNELLIDAE: ACCENTORS**

Hedgesparrow (Prunella modularis)

RESIDENT (99) (45)

No specific mention is made of the introduction of hedgesparrows to this region, though 'sparrows' appear in Acclimatisation Society records from 1863/4 onwards. None of the early writers refer to them. Rather easily overlooked now, as then, hedgesparrows are scattered in small numbers throughout the Park, particularly in areas of dense cover, scrub areas along riverbanks, rock slides and above timberline.

SUBFAMILY SYLVIINAE: WARBLERS

South Island Fernbird (*Bowdleria punctata punctata*)

RESIDENT (2) (1)

In the past there have been a few scattered reports of fernbird in areas adjoining the Park, namely the Howard Valley (Bull 1977), Tophouse, and swamp near St Arnaud (R. Frost pers. comm.). However only during the author's survey have they been found within the Park. Birds were seen in November 1983 and May 1984 in the scrub at the edge of the flooded pasture by the Braeburn Walk, Rotoroa. There were only three or so pairs present and whether this population will be a permanent feature is doubtful.

SUBFAMILY MALURINAE: AUSTRALIAN WARBLERS

Brown Creeper (*Finschia novaeseelandiae*)

RESIDENT (69) (43)

Apparently brown creepers have never occurred in very large numbers in the park (D.D. Cummings, pers. comm.), though the species is unfamiliar to many people and thus likely to be under-recorded. In the 1960s and 1970s it was common in the mountain beech of the Cupola Basin and the head of Speargrass and recorded in the manuka scrub of Black Hill and the Buller Valley in winter (R.H. Taylor, pers. comm.). The records obtained during the survey were widely scattered and usually of flocks moving rapidly through the forest. The species was most abundant in manuka/kanuka scrub on valley floors and shingle sides (e.g. those north of the Mid-Glenroy Hut). In the beech forest it favoured the mountain beech zone near timberline. DSIR Ecology Division found it quite common on Mt Misery above about 1100 masl.

Yellowhead (*Mohoua ochrocephala*)

VERY RARE/ EXTINCT IN AREA (0) (0)

Yellowheads were not mentioned by the early explorers to the Park last century, but were clearly common earlier this century before declining to the point at which they may now be extinct in the area.

Moncrieff (1925) visiting Rotoroa in 1925 found yellowheads abundant though she saw no signs of nesting. (She also noted that they had gone from Nelson City by that date.) Flocks of 30-40 birds were common behind the boatsheds of Kerr Bay, Lake Rotoiti in 192718, but the species began to decline during the 1930s (M.R. Clarke, pers. comm.). In 1944 six were recorded in an area of forest of 350 acres near Bridge (Stidolph 1946) and in 1959 rangers reported them at Lake Rotoiti. Since then the only records have been from the D'Urville river flats by D. Zumbach in 1965 and the Sabine Forks by B. Enting in 1977. No yellowheads were seen during the present survey and two reports from outside the park about 1980-81 may be the last for the area: one at the northern edge

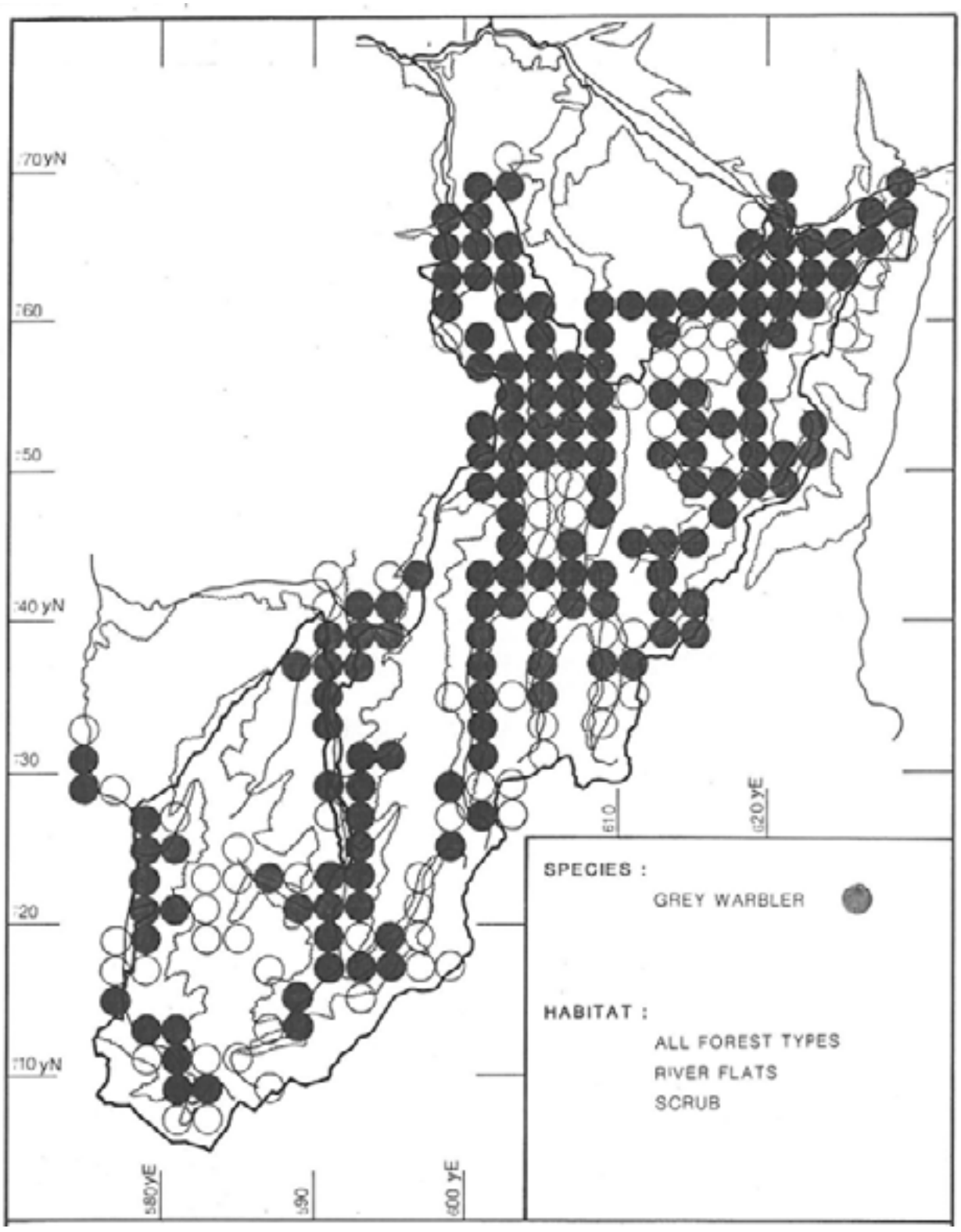


Fig. 15 Distribution of Grey Warbler in Nelson Lakes National Park

of the Park near Lake Station (AH. pers. comm.) and the other at Teetotal Creek in Big Bush Forest (M.R. Clarke, pers. comm.).

Though present in North-west Nelson and Arthur's Pass, and recently 'rediscovered' in the Marlborough Sounds, yellowheads are now found in large numbers only in parts of Fiordland and Southland (Gaze 1985).

Grey Warbler (*Gerygone igata*)
RESIDENT (586) (159)
Now one of the most abundant birds in the Park, the grey warbler seems not to have been worthy of note to early visitors to the area and no information on its past status is available. It is found today (Fig. 15) at all levels in the beech forest from valley floor to timberline, from the two lakes to the limit of the forest in each valley, and in scrub areas on river flats and the edges of the park. On Mt Misery, warblers were most abundant in the red beech-dominated zone between 470 and 900 masl (DSIR Ecology Division).

3.2.2.30 **FAMILY MUSCICAPIDAE: WARBLERS, FLYCATCHERS, THRUSHES, etc.**

SUBFAMILY MUSCICAPINAE: FLYCATCHERS
South Island Fantail (*Rhipidura fuliginosa fuliginosa*)
RESIDENT (365) (120)
Noted in the Park during the early explorations (e.g. Haast 1861) the fantail remains one of the most abundant species in forest and scrub. It is found throughout all forested areas though most often at low to mid-levels below 900 masl. Proceeding south up the valleys of the West Sabine, East and West Matakitaki and Glenroy, fantails ceased to be seen above altitudes of 825 to 850 masl, though there have been isolated records between 1000 and 1300 masl elsewhere in the park, in the D'Urville, by Blue Lake and near the Upper Travers Hut. The occasional sightings at timberline were all made in summer. Fantails also occur in matagouri and manuka/kanuka associations on the river flats (Fig. 16).

According to DSIR Ecology Division's results on Mt Misery there is little seasonal change in fantail distribution. Numbers dropped off sharply above about 725 masl in all seasons except in the post-breeding period (May-June). Then fantails were found at all levels and were at their most abundant.

The pied form is more common than the black in the Park. A proportion of 86.9% pied (n=92) in birds observed by the author is very similar to the 86.5% (n=372) recorded in a survey of the St Arnaud region (Taylor in Craig 1972).

Yellow-breasted Tit (*Petroica macrocephala macrocephala*)
RESIDENT (496) (156)
There is no information on past changes in the status of the yellow-breasted tit, or tomtit, in the Park but it is now one of the most widespread species throughout forest and scrub. Unlike the fantail it is found right up to the ends of the forested sections of each river valley. The tomtit is probably most abundant at mid-levels of the mountain sides where it and the rifleman are the common birds.

On Mt Misery tomtits were fairly abundant at all levels up to timberline. A mid-slope (c.480 to 800 masl) peak of numbers was noticeable in May/June and August/September counts, but no altitudinal preference was clear at other times of year (DSIR Ecology Division, Nelson, pers. comm.).

South Island Robin (*Petroica australis australis*)
RESIDENT (353) (116)
The proverbial tameness of this species led to its mention by the early explorers (Haast 1861) and it was then apparently abundant. It is considered to have declined generally in the Park this century (D.D. Cummings, pers. comm.), and particularly noticeably at St Arnaud.

The robin is a difficult species to census with only a limited number of visits to an area, as its responsiveness to humans and its calling are variable; it may be conspicuous at a site one day and apparently absent the next. However there are clear discontinuities in its distribution in the Park (Fig. 17) which probably relate to differences of forest type, altitude or slope. Primarily it is most abundant at low levels (500-600 masl), not penetrating to the southern ends of the valleys or far up valley sides. It may also occupy a zone just below timberline but only in a few areas (records from Mt Misery, Peak Creek in the Matakitaki, and towards Mt Una in the East Matakitaki).

At low levels it appears to favour sites with slight slope and large mature trees (e.g. at Downie Hut or Mid Glenroy Hut) and moist, poorly drained areas supporting denser undergrowth (e.g. kanuka/manuka swamp east of the river above Windfall Flat, Matakitaki).

SUBFAMILY TURDINAE: THRUSHES

Song Thrush (*Turdus philomelos*)
RESIDENT (233) (94)
Five thrushes were introduced by the Nelson Acclimatisation Society in 186314, probably followed by others and they spread rapidly (Sowman 1981). By 1900, D.W. Win described them as 'quite numerous' at Rotoroa (Bull 1977). Now found throughout the Park (Fig. 18), thrushes are most abundant in open areas, river flats and gravel slides, but do occasionally occur in the forest even up to timberline. DSIR Ecology Division at Mt Misery found most thrushes on the flat at the base of the slope and a few up to but not above timberline.

Flux (1966) found a population density of 25 pairs/50 hectares on the Travers River flats and St Arnaud Range. Matagouri shrubs were the preferred nest sites but nesting success was low, many clutches being destroyed by stoats.

Blackbird (*Turdus merula*)
RESIDENT (396) (136)
Also introduced to Nelson in 1863/4 from a first shipment of 26 birds (Sowman 1981), blackbirds were apparently slower to establish than thrushes, being described as 'rare' at Rotoroa in 1900 (D.W. Win in Bull (1977)) and 'not numerous' there in 1925 (Moncrieff 1925). However a rapid increase may have occurred, for one observer recalled them in 'terrific numbers' in the bush during deer hunting in the 1930s (M.R. Clarke, pers. comm.), and they are now (Fig. 19) more common than thrushes (Fig. 18). They are concentrated also in open areas throughout the Park but show greater use of beech forest at all levels. In summer and autumn they were also seen in the shrub zone above timberline.

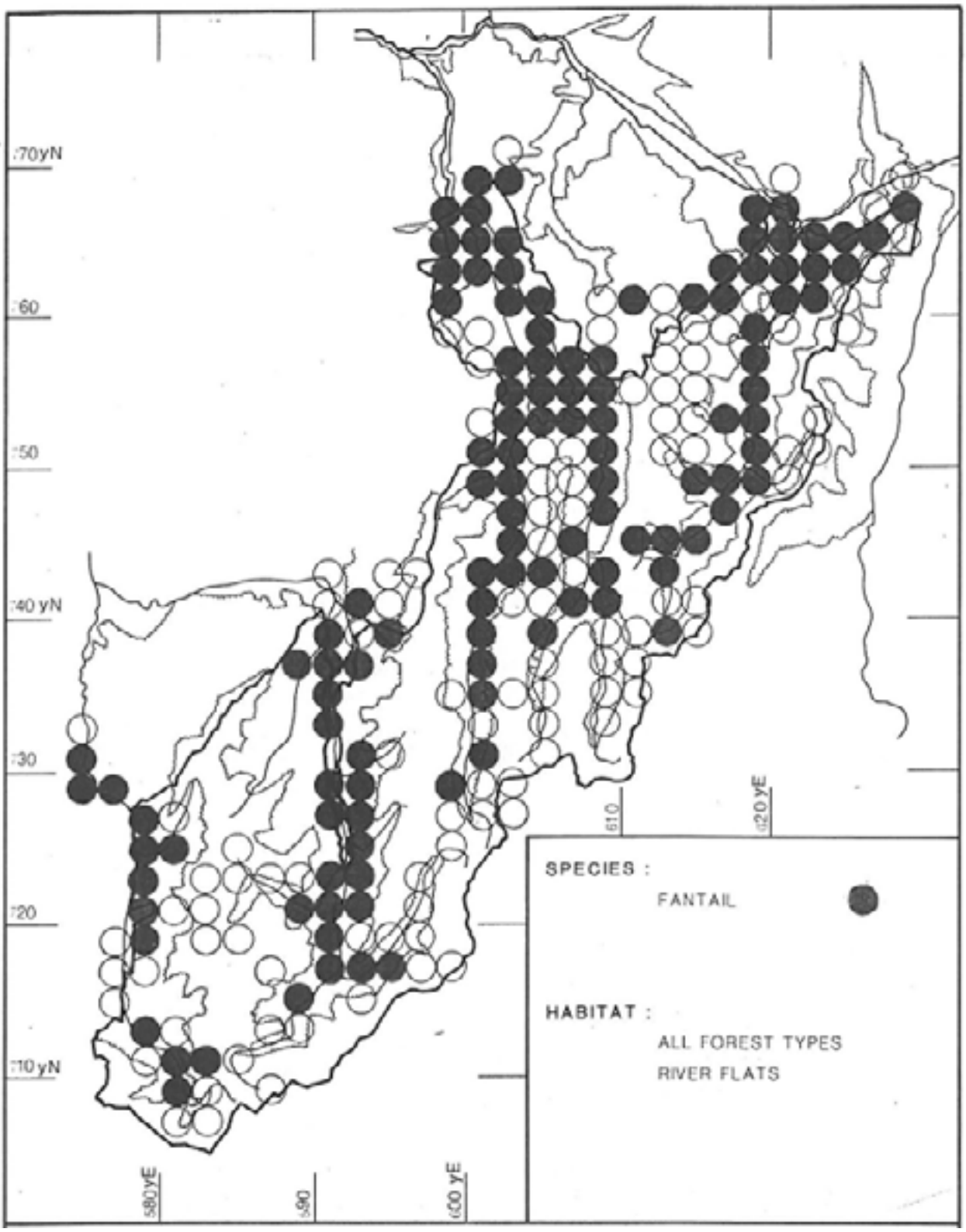


Fig. 16 Distribution of South Island Fantail in Nelson Lakes National Park

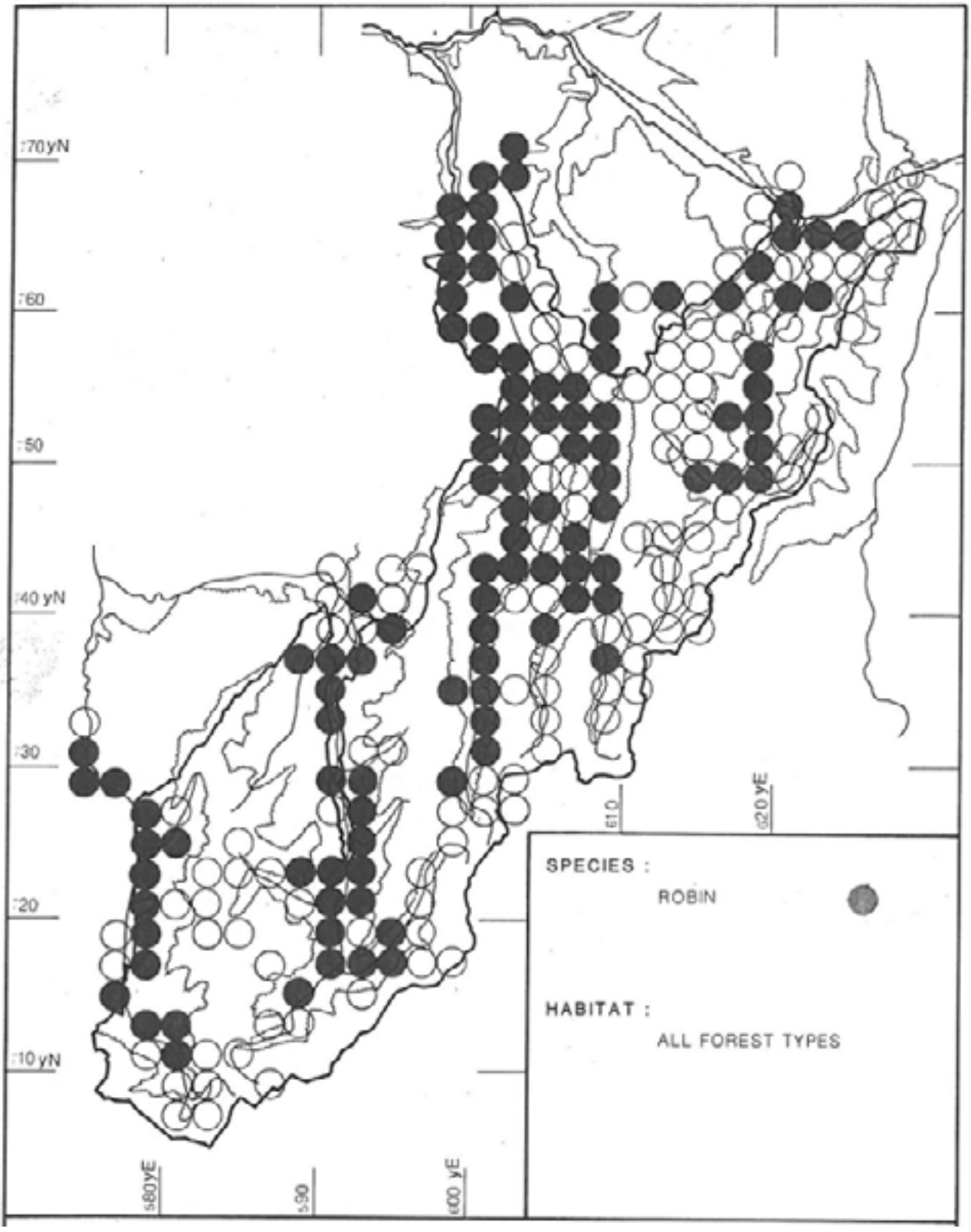


Fig. 17 Distribution of South Island Robin in Nelson Lakes National Park

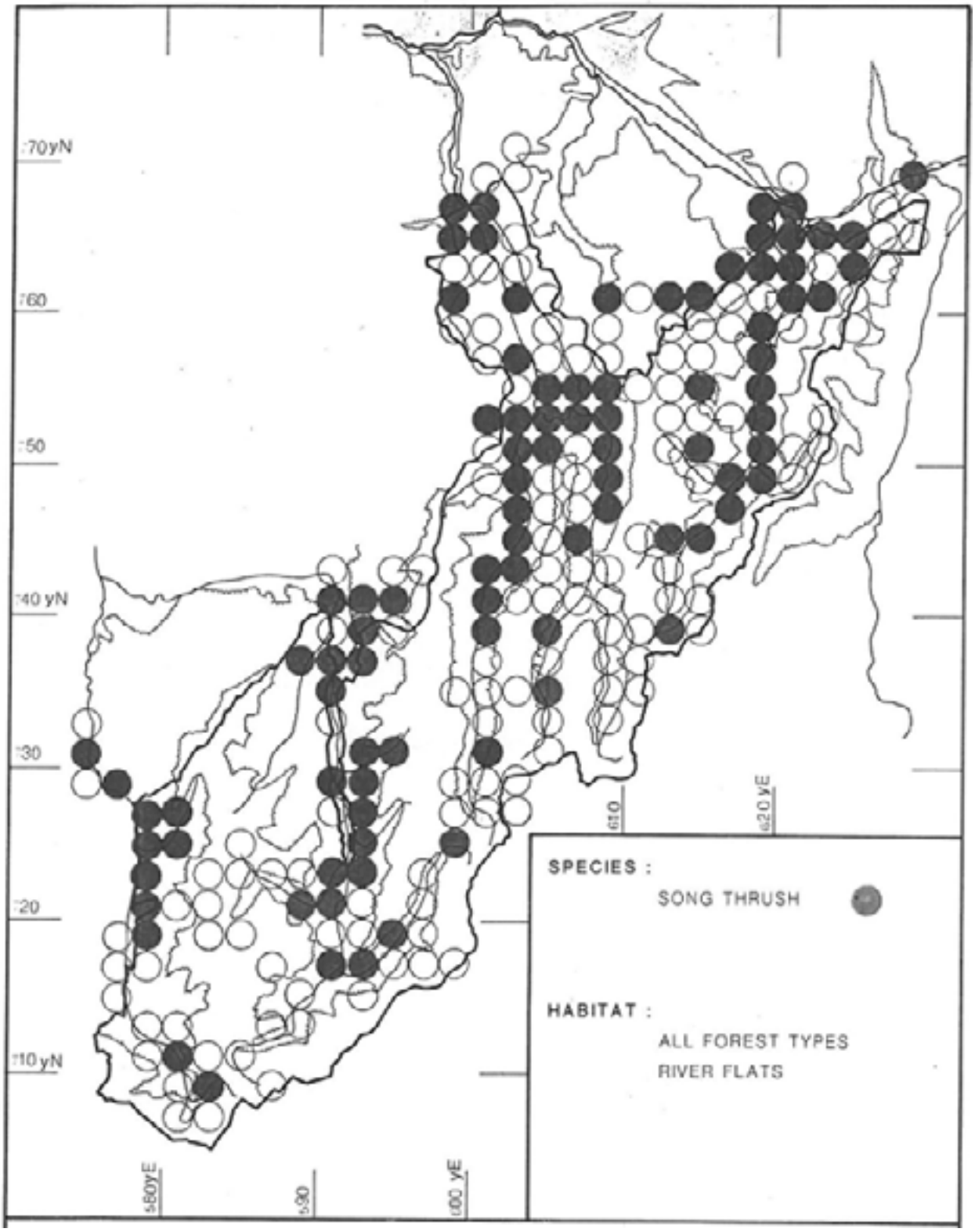


Fig. 18 Distribution of Song Thrush in Nelson Lakes National Park

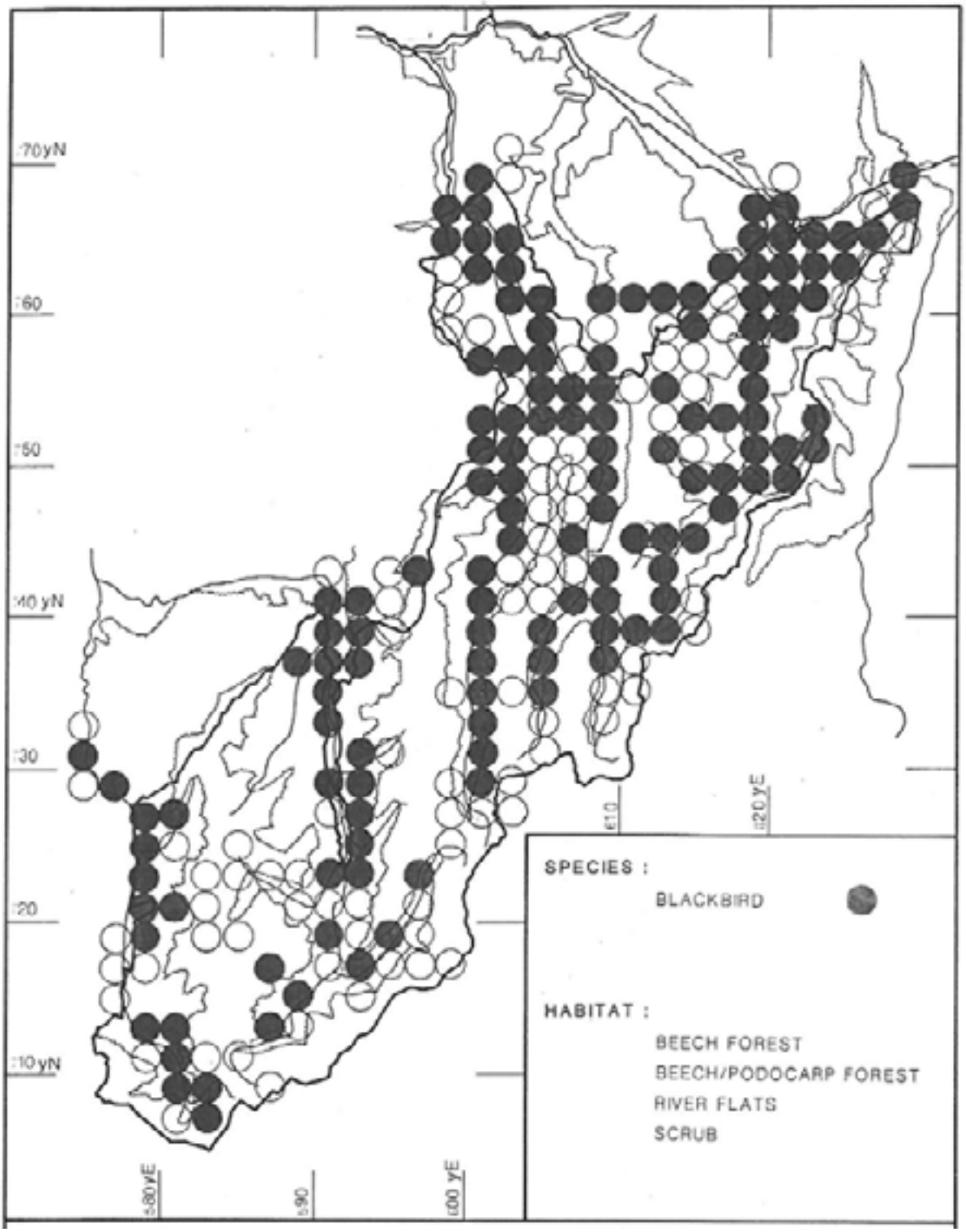


Fig. 19 Distribution of Blackbird in Nelson Lakes National Park

The Travers/St Arnaud study (Flux 1966) found 6 pairs of blackbirds in 50 hectares and, like the thrushes, these had very poor nesting success. The two species nested about a month later than in Auckland, as perhaps would be expected from the more severe climate of St Arnaud.

3.2.2.31 **FAMILY ZOSTEROPIDAE: SILVEREYES**

Silvereye (*Zosterops lateralis*)
RESIDENT (423) (132)
Silvereyes first appeared in Nelson in 1856, arriving at the start of winter and leaving again as soon as it became warmer in spring, a pattern they followed for several years. By 1860 they were described as 'numerous' in Nelson (Buller 1870) and, though Haast (1861) did not report seeing them in the Park itself at that time, they probably spread there soon afterwards.

They are now abundant throughout the Park, typically encountered in small flocks moving rapidly through the forest. They seem to favour the lower altitude beech forest but use areas of shrubs right up into the subalpine zone. DSIR Ecology Division found numbers on their Mt Misery transect to be very variable. There was a noticeable peak at low levels but also large numbers above about 1100 masl in February/March. They occurred at timberline there in all seasons.

Casual observations suggest that insects and honeydew are their most important food sources in the Park. Silvereyes were observed to spend about a third of their total time foraging on honeydew in beech forests further west (Gaze and Clout 1983).

Note: Silvereyes may have been in New Zealand prior to the influxes of last century as their bones have been found in caves along with extinct species (R. Scarlett, pers. comm.) (Appendix 2). Dating of this bone material could provide an answer to their arrival.

3.2.2.32 **FAMILY MELIPHAGIDAE: HONEYEATERS**

Bellbird (*Anthornis melanura*)
RESIDENT (670) (164)
Bellbirds were noted in the Park by the early explorers (Haast 1861) and are the most widespread and conspicuous native bird in its beech forest today. Nationally the species suffered a sharp decline between c.1860 and 1910 (Falla *et al.* 1982). This probably occurred at Nelson Lakes too for an increase of bellbirds was noted here between 1929 and 1938 (Marchant 1938), about the time the population would have been recovering.

During the survey (Fig. 20) they were found in every forested area of the Park visited, from valley floor to timberline, and occasionally in the shrub zone above the timberline (records from four sites).

Records were kept of feeding behaviour and the major food sources were insects, honeydew and nectar. The insects were taken at all times of year by flycatching like a fantail, or searching through foliage. Honeydew was also taken throughout the year and is known to be a very important food as bellbirds are more numerous in beech forests where it is abundant (Gaze and Clout 1983). Nectar is a seasonal resource. Fuchsia which flowers for at least six months from September to February (M.N. Clout, unpublished data) was seen to be visited in October, November and February. South Island rata flowers from November to January, some years through to March, and groups of

bellbirds were recorded feeding on it in February. Other species such as flax provide nectar over shorter periods. One unusual observation was made in October 1983 of an individual taking liquid from inside the leaf buds of wineberry. The tightly overlapping leaves of the bud formed a cup in which a large droplet of a sweet, rather sticky solution had collected.

Tui (*Prosthemadera novaeseelandiae*)
RESIDENT (357) (109)
Tui were present at Nelson Lakes when Haast (1861) visited in 1860 though they are considered by several to be less abundant now than earlier this century. They are found (Fig. 21) throughout most of the Park on the lower slopes of the forest but do not penetrate to the upper ends of the valleys. Their usual range extends from the valley floor to about 650 masl, though one was recorded in forest above that at 710 masl, and they were occasionally seen feeding in the shrub zone above timberline (records from Mt Misery and Speargrass). DSIR Ecology Division found that tui numbers dropped off sharply above about 700 masl on Mt Misery throughout the year. In winter no birds were found above about 950 masl but in the other seasons a few occurred up to timberline. Only in spring and summer were they seen above timberline. Tui show evidence of movement to lower areas in winter and retreat north down the valleys (Section 3.6, Fig. 24).

The food of tui in the Park is similar to that of bellbirds though they were not recorded to be feeding on nectar to the same extent. Tui were seen feeding in wineberry buds in October just as the did, hawking high above the rivers for insects particularly in late spring, and taking honeydew at all times of year. A possible relationship between the distributions of tui and honeydew is discussed later (Section 3.5).

3.2.2.33 **FAMILY EMBERIZIDAE: BUNTINGS**

Yellowhammer (*Emberiza citrinella*)
RESIDENT (52) (23)
Introduced into Nelson in 1863/4 by the Acclimatisation Society (Sowman 1981), yellowhammers must have increased rapidly as by the 1920s and 1930s they were a notable pest of the oat crops grown by smallholders on the edge of the Park (D.D. Cummings, pers. comm.). They are largely restricted to river flats and cleared areas in the Park itself though DSIR Ecology Division recorded a few at low levels in the forest at Mt Misery. Yellowhammers do not penetrate as far up the valleys as the chaffinch and redpoll do.

3.2.2.34 **FAMILY FRINGILLIDAE: FINCHES**

Chaffinch (*Fringilla coelebs*)
RESIDENT (656) (172)
Twenty three chaffinches were liberated in Nelson in 1863/4 and were recorded breeding the following season (Sowman 1981). They have successfully occupied a wide range of habitats and are now (Fig. 22) probably the most abundant species in the Park for most of the year.

In spring and summer, chaffinches are found from the river flats right through the forest to timberline and occasionally in the subalpine shrub zone. After the breeding season most form flocks and move to lower levels, so that in winter they are absent from the interior of the Park no birds on Matakitaki River flats at Downie Hut (June) or Glenroy flats at Mid-Glenroy Hut (April)).

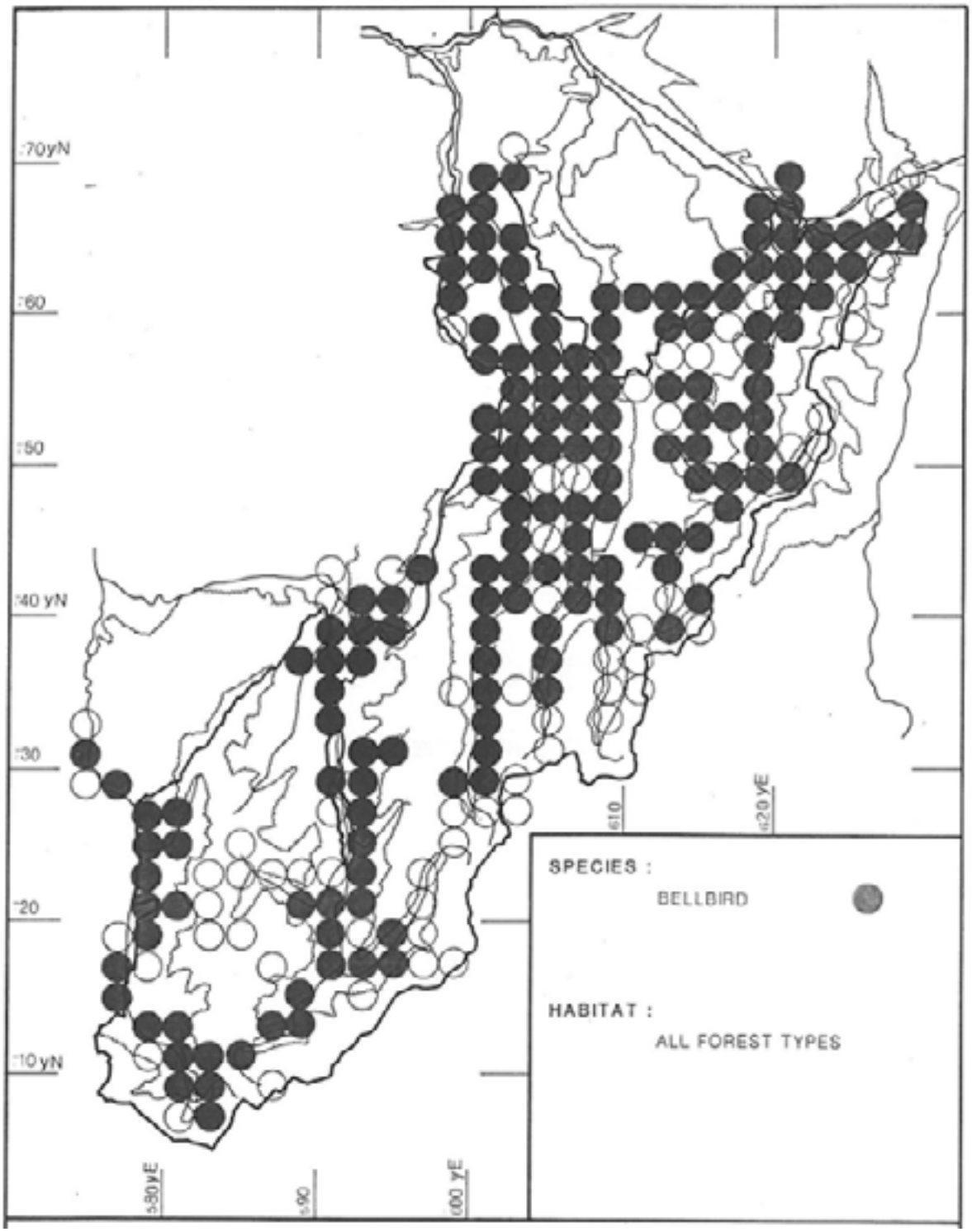


Fig. 20 Distribution of Bellbird in Nelson Lakes National Park

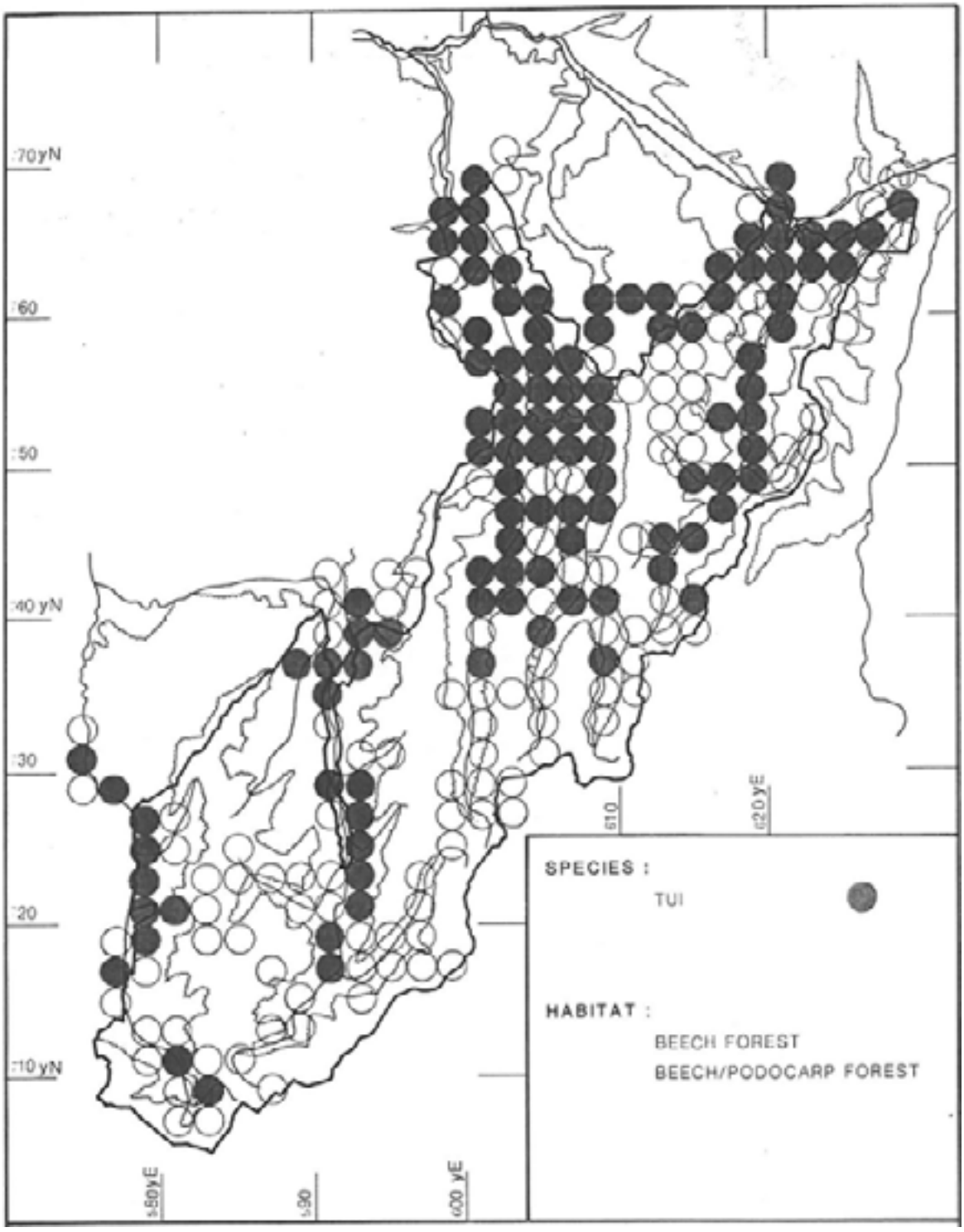


Fig. 21 Distribution of Tui in Nelson Lakes National Park

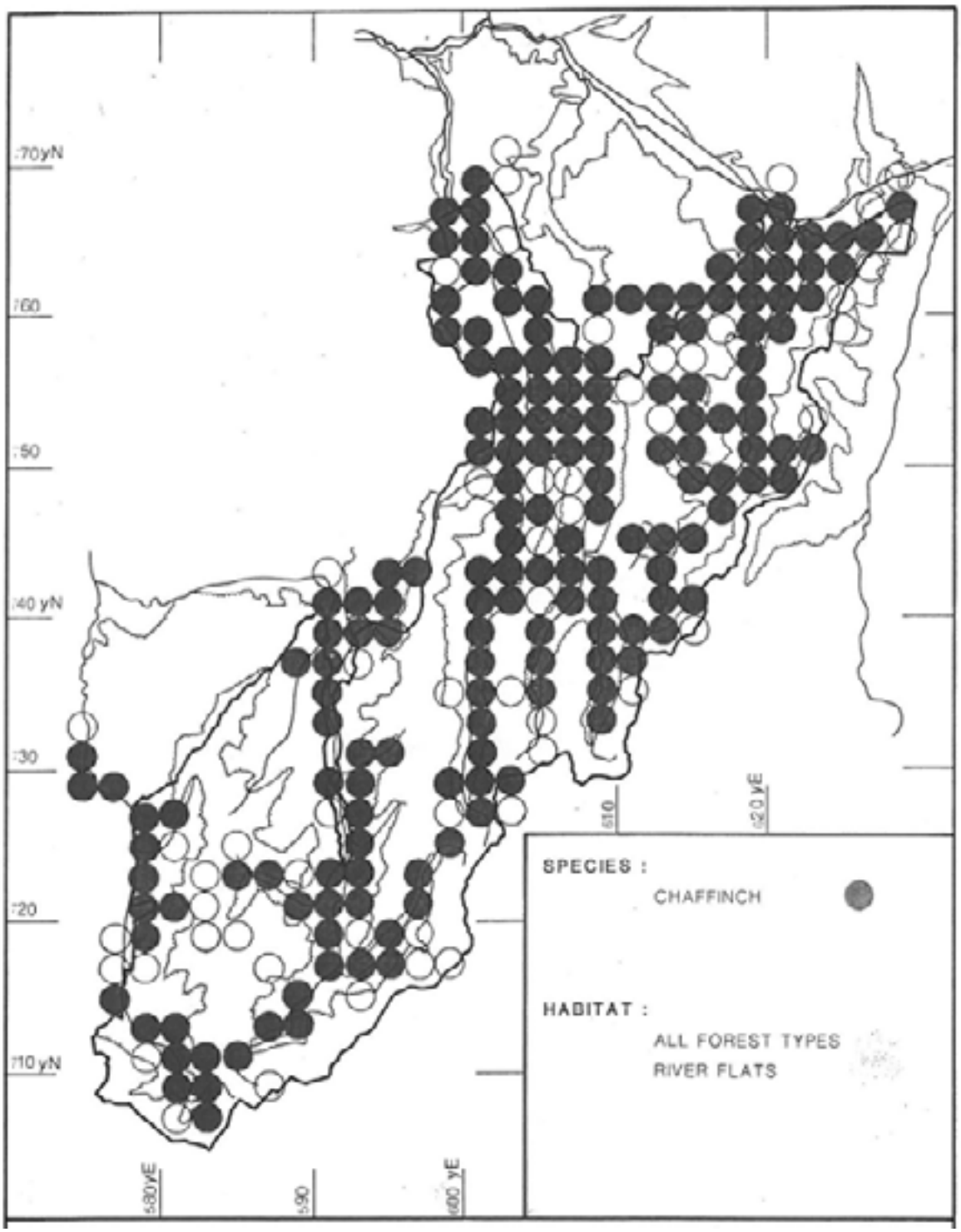


Fig. 22 Distribution of Chaffinch in Nelson Lakes National Park

A few birds remain in the forests but being mostly silent at this time they are not obvious to the casual observer.

DSIR Ecology Division counted most chaffinches on Mt Misery below 900 masl or above 1300 and that the birds used areas above timberline there at all times of year.

Greenfinch (*Carduelis chloris*)
RESIDENT (36) (15)
Five greenfinches were introduced to Nelson in 1863/4 by the Nelson Acclimatisation Society and the population grew rapidly so that by 1876 this species was one whose protection was revoked by statute (Annual Reports of Nelson Acclimatisation Society). However it was probably slow to colonise forested areas.

The greenfinch is the rarest finch in the Park, found widely scattered in open areas particularly river flats and occasionally subalpine scrub. It is locally abundant at St Arnaud and forms small flocks of 20 to 30 birds in winter in areas surrounding the Park. It was recorded in the forest at Mt Misery, at mid-slope in autumn, and at low levels in spring, and that it visited subalpine areas there in summer and autumn (DSIR Ecology Division, Nelson, unpublished data).

Goldfinch (*Carduelis carduelis*)
RESIDENT (43) (19)
Ten goldfinches were introduced to Nelson in the Acclimatisation Society's first shipment in 1863/4 and later releases followed leading to the rapid establishment of this species in the province (Sowman 1981).

Goldfinches recorded in the survey were scattered throughout the open areas of the Park, particularly the river flats, and a few occur at all levels in the forest according to DSIR Ecology Division, Nelson, counts on Mt Misery. However in winter and spring they form flocks moving down to the northern ends of the valleys and into the surrounding farmland. Up to a hundred birds are seen at St Arnaud during these seasons.

Redpoll (*Carduelis flammea*)
RESIDENT (66) (50)
A few redpolls were released in Nelson in 1863/4 but the main shipment of thirty-five birds arrived in the 1865/6 season (Sowman 1981). They use a wider range of habitats in the Park than the greenfinch and goldfinch, being regularly heard in the forest as well as in the river flats and open scrub communities. They also make more use of subalpine areas throughout the year than the other finches, one flock of about 200 birds being noted above timberline on Mt Misery.

3.2.2.35 **FAMILY PLOCEIDAE: WEAVERS**

House Sparrow (*Passer domesticus*)
RESIDENT (59) (7)
The early introduction of house sparrows to Nelson was somewhat slow, a single bird being released in 1863/4 and a second the following season, and it was the only survivor of a shipment of 48 (Sowman 1981). However rapid establishment of the species did follow and its protection was revoked in 1876. In the 1890s the Acclimatisation Society was approached by the Stoke Road Board, Nelson, for a contribution to help in the destruction of sparrows which were destroying

grain crops and 'Sparrow Clubs' were formed with this aim. Over the next 20 to 30 years bounties were paid on small birds, mostly sparrows, trapped or 'limed' by schoolboys and poisoning was also carried out (Annual Reports of Nelson Acclimatisation Society).

In the Park itself, sparrows were probably never abundant and their distribution reflects a close relationship with man. They have been recorded at Rotoroa, in the Matakitaki Valley adjacent to farmland, at the head of Lake Rotoiti, and at St Arnaud where they are abundant in the township itself.

3.2.2.36 **FAMILY STURNIDAE: STARLINGS AND OXPECKERS**

Starling (*Sturnus vulgaris*)
RESIDENT (30) (11)
Starlings were introduced to Nelson in 1893 (Sowman 1981) but did not apparently reach the Park until soon after 1900 (D.W. Win in Bull1977). In 1925 flocks were noted at Rotoroa (Moncrieff 1925) and the population in the area probably reached its peak in the next decade. Huge roosts were present at Lake Station and along the Buller River (D.D. Cummings, pers. comm.). A major decline followed, thought to coincide with changes in agricultural practice (A.H. McConochie, pers. comm.).

Their distribution in the Park is now very restricted, resembling that of the house sparrow though, in addition to St Arnaud, Rotoroa and the head of both major lakes, starlings are found along the and Matakitaki river flats. At these last two sites they only occur in partly cleared areas where a large number of dead trees are still standing.

3.2.2.37 **FAMILY CRACTICIDAE: BELL-MAGPIES**

White-backed Magpie (*Gymnorhina tibicen hypoleuca*)
VERY RARE (1) (0)
Six magpies were released in Nelson in 1865/6 but the birds in the vicinity of the Park are likely to have spread from the more successful liberations in Canterbury or Marlborough (Sowman 1981).

The single sighting on the Park during the survey was very unusual, of a bird seen above timberline near the summit of Mt Misery in November 1975. Magpies are now established on farmland adjacent to the Park, e.g. Oxnam's plains in the Matakitaki, and are apparently increasing in this area. They are often seen on farms along the Motueka and Motupiko Rivers to the north and may be spreading towards Nelson.

3.2.2.38 **FAMILY CALLAEIDAE: NEW ZEALAND WATTLEBIRDS**

South Island Saddleback (*Philesturnus carunculatus carunculatus***)**
EXTINCT IN AREA (0) (0)
Writing from Marlborough, Handly (1895) described the range of the saddleback '...becoming more circumscribed, and (it) is now confined to a few out of the way localities, such as Tophouse, on the road to Nelson and the Sounds District'.

Apparently they were quite numerous in the Park in the 1870s but scarce by 1900 (D.W. Win Bull 1977) and they disappeared a few years later. There have been no reported sightings in recent years and the species is now confined to offshore islands.

South Island Kokako (*Callaeas cinerea cinerea*)
EXTINCT IN AREA (0) (0)
Kokako were still numerous in the district at the time of the early explorations (Brunner 1847), usually being encountered as pairs and remaining in lower areas (Haast 1861). By 1900 they were very scarce, a settler at Rotoroa then seeing only one in his lifetime (D.W. Win in Bull 1977), and their decline seems to have closely matched that of the saddleback. They were recorded later further west, e.g. Moncrieff (1935) found a feather on Mt Mackay in North-west Nelson in 1934.

There have been no confirmed sightings in the Park in recent years. A gold-miner camped at the mouth of Boulder Stream, Lake Rotoroa in 1935, reported regular visits of a kokako in 1935, and further possible sightings there in 1963 and calls around the same lake in 1973 led DSIR Ecology Division to survey the area. No traces of kokako were found though a tui was heard to make a call resembling that of a kokako (Taylor and Thomas 1973). The ability of tui to mimic other birds is well known and this call could indicate that kokako were present to be mimicked in the recent past if they are not still there today. A recently (1987) reported sighting of birds in the Howard Valley on the edge of the Park has lead to further investigations in the area but no confirmation of their presence has been obtained.

3.2.2.39 **FAMILY TURNAGRIDAE: NEW ZEALAND THRUSHES**

South island Thrush (*Turnagra capensis capensis*)
EXTINCT (0) (0)
The thrush or piopio was numerous in the distrtict in the 1860s (Haast 1861) and 1870s (D.W. Win in Bull 1977) but had apparently disappeared by 1900, mirroring the declines of saddleback and kokako. Haast (1861) records them as very inquisitive and social during his visits to the area. There have been no reports of the species in the Park this century.

3.3 Sub-fossil Birds of the Region

This section considers the species listed by Kinsky (1970) as '...extinct before about 1800 AD and known only from sub-fossil remains.' Also included are the South Island takahe, South Island laughing owl and several seabirds which have not occurred in the Park in living memory but are known from bones in the region. (Note: scientific and common names for birds referred to in this section are given in Appendix 2.)

No sub-fossil bird remains have been found in the Park because its geology does not favour cave formation, and information on its early bird fauna has had to be derived from other sites. The nearest find of bird bones to Nelson Lakes was in potholes in the Red Hills, Mt Richmond State Forest Park, c.10 km to the north-east of St Arnaud. One hole contained bones of the extinct owlet-nightjar (*Megaegotheles novaezelandiae*) and the other, remains of the moa, *Anomalopteryx didformis,* several little spotted kiwi, a brown or great spotted kiwi and a weka (R. Frost, T.H. Worthy, pers. comm.).

Other sites throughout the region have yielded moa bones but only in recent years have the remains of many smaller species been found, particularly in two limestone caves of the West Coast.

At Honeycomb Hill Cave in north-west Nelson (Appendix 2, Figure 25), all native Passeriformes present in the Park have been found with the exception of and silvereye. These two were among those located in Metro Cave further south near Westport (Appendix 2, Table 1). However it is not sufficient to conclude that because most of the extant birds found in these caves occur in the Park that all the extinct species found there would also have done so. A review of a wider range of sites was carried out (Appendix 2) with the following results.

3.3.1 Moa

The moa are currently thought to have consisted of twelve species (Cracraft 1976, 1982) and, of these, nine have been found in the Nelson region representing all but one of the South Island species. Which of these were likely to have occurred at Nelson Lakes is assessed in Appendix 2 (Table 2). Of the six lesser moa, *Anomalopteryx didiformis, Megalapteryx didinus, Pachyomir elephantopus and Euryapteryx geranoides* were probable Park residents as all were found a wide variety of sites in the region both on the coast and inland. Of the three greater moa, *Dinornis giganteus* and *D. torosus* were probably present.

Dinornis spp. and *Pachyomir elephantopus* are thought to have declined throughout the South Island before the arrival of man because of climatic changes (Scarlett 1974). *Anomalopteryx didformis,* the northern bush moa, probably existed in the Nelson/Golden Bay region until less than 200 years ago (Scarlett 1974) and *Eurapteryx geranoides,* once the predominant species in the South Island, is dated to just one hundred years earlier (Fleming 1962). Perhaps the last moa to go from the Park was *Megalapteryx didnus,* whose genus was considered to have been alive in the southern West Coast area until late last century (Scarlett 1974).

3.3.2 Other Species Extinct Before 1800

Based on the table of sub-fossil sites in Appendix 2, many other extinct species had a wide distribution and were probable residents of Nelson Lakes. Waterfowl could have included the extinct goose, coot and Finsch's duck though not the extinct swan which may have been confined to the coast. Extinct rails were *Aptornis,* Hodgen's rail and the small weka; birds of prey were the harrier and giant eagle; and forest birds were the extinct crow, small kaka, owlet-nightjar and one or more species of extinct wren. No remains of the extinct goose, duck, coot or crow are known after 1200 AD and no *Aptornis* after 1350 AD (King 1984).

3.3.3 Seabirds

Bones of several petrel and shearwater species have been found at inland sites in the region (Appendix 2). Some still breed inland, the black petrel and shearwater in mountains to the west (Paparoas) and east (Kaikouras) of the Park respectively, and the sooty shearwater and perhaps the mottled in the south of the South Island (Robertson 1985). Nelson Lakes National Park may have once supported breeding colonies of one of these species still breeding inland or others that once did so but are now confined to offshore islands. The Park's distance from the coast however makes this less likely.

3.3.4 Laughing Owl and takahe

The laughing owl is known from bone remains at four sites in the region (Appendix 2), from an individual killed at Tadmor in 1880s, sightings at Gouland Downs (1918), Mt Maud (1939) (Williams and Harrison 1972), and one heard at the Mokihinui River in 1935 (Moncrieff 1935). In European times its main range was the eastern foothills of the Southern Alps from Dunedin

northwards to Nelson/Marlborough (Williams and Harrison 1972) and it was probably present in the Park.

Takahe remains are widespread in the region (Appendix 2) and it is believed to have survived for longer in the Nelson area than anywhere else except Fiordland (Reid 1978). Sightings were recorded near Motupipi in Golden Bay in 1866 and the 'Nelson hills' in 1934 (Reid 1978) and its past presence at Nelson Lakes was highly likely.

3.4 Lakes Rotoiti and Rotoroa - A Comparison of their Waterfowl

This section examines the of the Park's two major lakes, Rotoiti and Rotoroa. Today their surfaces seldom '...swarm with birds…' as Haast (1861) described and the waterfowl present show a marked preference for Lake Rotoroa. Questions addressed are: What is the explanation for the current distribution of waterfowl? Has a definite decline in numbers occurred and for what reasons?

3.4.1 Morphometry of the Lakes -from Brown (1979)

Lake Rotoiti in the east is the smaller of the two (9.5 km^2) and lies at a significantly higher altitude (617 masl) than Lake Rotoroa (24.1 km^2, 448 masl). This altitudinal difference has important consequences for the plant and animal life that the lakes support. It results in the surface waters of Lake Rotoiti being on average 1 to 1.5 ^{o}C colder and subject to higher rainfall, higher winds and consequently greater wave action than the surface waters of Lake Rotoroa. Lake Rotoiti is the shallower of the two (max. depth of 82 m, cf. 152 m, Lake Rotoroa) but it shelves more steeply so that the surface area of lake with water less than 10 m deep is only half that of Lake Rotoroa (cf. 87.9 ha to 178.6 ha respectively - measured by the author from the maps of Irwin (1976) and Del Main (1976) in Brown (1979)).

Beech forest extends to the shores of both lakes, except for cleared areas at St. Arnaud, the Travers River flats and Rotoroa township, and for an extensive area of manuka/kanuka scrub below Mt Robert.

3.4.2 Bird Populations

Waterfowl dependent on the lakes are the black swan, New Zealand scaup, mallard and, in the past, southern crested grebe and possibly New Zealand dabchick. Paradise shelduck and grey duck also use them frequently and black and little shags are regular visitors. The swan (p. 12) and scaup (p. 16) show a marked preference for Lake Rotoroa, the grebe (p. 9) used to do so and the large moulting flocks of paradise shelduck (p. 13) also occur there.

3.4.3 Vegetation -from Brown (1979) and Taylor (1971)

The aquatic vegetation of the two lakes changed markedly with the introduction of the Canadian pond-weed (Elodea sp.) in the late 1950s. It has largely displaced the native weeds in shallower water, now forming a near-continuous dense cover right around Lake Rotoroa from 0.8 to 8-10 m depth, and a narrower belt around Lake Rotoiti between 2.4 and 7.5 m depth. In areas around the latter lake, particularly West Bay, weed is absent, and only alongside stream mouths at its southern end does Canadian pond-weed extend close inshore to depths of 0.7 to 1.5 m. Before the arrival of this weed, species of *Myriophyllum, Chara,* and *Potemogeton* would probably have occupied the same zones. The relative lack of weed in shallower water (i.e. 0.8 to 2.4 m depth) at Lake Rotoiti is thought to be related to its greater wave action and possibly to its lower temperatures. Extensive weed-beds did exist in the shallows of West Bay until dredging in the late 1940s lowered the lake

level and increased the scouring effect of the Buller River's outlet (D.D. Cummings, pers. comm.). Similarly, the bay by Coldwater Stream at the southern end of Lake Rotoiti used to be covered in weed that was removed by a major change of course of the Travers River at about the same time (D.D. Cummings, pers. comm.).

The vegetation along the shores of both lakes shows a sharp transition from water to forest with no fringe of other vegetation. Lake Rotoroa has a long margin of flax and shrubs round its southern end in which is tangled a mass of fallen stems and trapped logs, and extensive reed-beds with bulrushes at the northern township end. However both southern and northern ends of Lake Rotoiti have been greatly modified. The Travers River flats were cleared for grazing around the middle of last century and cattle were removed from there in 1976. A Tyree photograph of c.1900 (Nelson Provincial Museum, Tyree Collection, photo 5437) shows the there just as it is today, the edge broken by trampling and covered with a sward of grasses, a few clumps of emergent rushes but no reed-beds. The raised shingle beaches at the northern end at West and Kerr Bays were present last century (Nelson Provincial Museum, Brown Collection, 1868-91, photo 32) but there were then extensive swamps behind them with dense vegetation.

Lake Rotoroa has the only island, 'Tom's Rock' (c.100 m^2), which since it was burnt (pre-1950) supports a fairly open vegetation.

3.4.4 Requirements of Waterfowl

The black swan prefers to feed on vegetation in shallow water up to a maximum depth of one metre though it will also graze on land. Its favoured foods are water-weeds of the genera *Elodea, Egeria, Myriophyllum* and *Potamogeton* (M. Williams, pers. comm.), all of which except the second are found in the two lakes. It builds its nest as a large heap of reeds, grasses and water-weeds usually in the cover of reeds or on islands.

The New Zealand scaup probably has a varied diet including insects and plant material (M. Williams, pers. comm.) and it feeds primarily by diving to depths up to 3 or 4 m (Oliver 1955). It nests at the edge of water, building a nest mound of grass buried among flax roots and blades (Oliver 1955).

Both the southern crested grebe and the New Zealadn dabchick feed mostly on small fish. They have similar kinds of floating nests that must be hidden and anchored in dense vegetation, allowing the birds to reach them direct from the water without being seen.

Of the ducks visiting the lakes, the grey duck and mallard feed on aquatic vegetation and invertebrates, and the mallard also joins the paradise shelduck in grazing grass.

3.4.5 Discussion

The present preference shown by swans and scaup for Lake Rotoroa can be explained by the greater availability of both aquatic vegetation and nest-sites there. In the past the differences between both the aquatic and lake-fringe vegetation of the two lakes was less and black swans used to nest at the head of Lake Rotoiti.

The crested grebe and are now gone from both lakes. In the past the grebe too favoured Lake Rotoroa, probably explained by the presence of suitable vegetation for nest-sites there.

The clearest decline in numbers at the lakes has been that of the grebe but verbal accounts suggest that scaup were also much more abundant in the past. Both species have declined nationally (Robertson 1985) and many of the likely reasons are apparent at Nelson Lakes. First there was destruction of the fringe vegetation and subsequent stocking of the flats by cattle, then likely predation by introduced mammals. Accelerated erosion caused by overgrazing by deer, which were particularly abundant in the Park in the 1920s and 1930s, would have contributed to increased water run-off. More frequent and greater floods would have led to losses of nests and nest sites.

Changes to the lakes' biotic system are likely to have accompanied the increased sedimentation caused by erosion and also to the introduction of brown trout to Lake Rotoiti in 1873 and Lake Rotoroa c.1900, and of rainbow trout to both lakes in 1913 and 1923 respectively (Sowman 1981). The stability of this system was clearly affected, as demonstrated by changes in the numbers of rainbow trout at Lake Rotoroa, which were abundant by the 1930s yet almost disappeared over the Second World War period fishing pressure was reduced (Sowman 1981). The indirect effect of introducing trout was to increase disturbance of the area by fishermen and by the powerboats they use. Finally the introduction of Canadian pond-weed will have also affected the system, reducing the diversity of the weed-beds through competitive exclusion of most native species and probably in turn reducing the invertebrate fauna they supported.

Many of these pressures on waterfowl had their strongest effect at Lake Rotoiti, particularly human disturbance which peaks at the times when powerboat, water-ski and yachting races are held. The removal of cattle from the flats may lead to an eventual return of lake-edge vegetation there but, while human disturbance is maintained at current levels, this lake will continue to hold few waterfowl. Pollution from an expanding St Arnaud township and from oil from increased use of powerboats has been recognised as possible threats to Lake Rotoiti in the future.

While disturbance at Lake Rotoroa is being kept to a minimum it should be possible to retain breeding swans and scaup and maintain a suitable site for grebes should they return. However instabilities exist in the lake's biota as shown by the vast proliferation of Canadian pond-weed in 1971 and 1973 and its reduction in following years (Brown 1982). These instabilities may adversely affect waterfowl.

3.5 Birds of Lowland Forest in the Park

3.5.1 Introduction

Nelson Lakes National Park contains a relatively small area of lowland forest (Table 2) (defined as that lying below 700 masl (Saunders 1980)). A group of its bird species are more or less restricted to this area: New Zealand pigeon, tui, robin and yellow-crowned parakeet; and others are concentrated there: grey warbler, fantail, shining cuckoo and bellbird. Distributions of these species can be related to plants of the lowland forests.

Table 2. Lowland forest areas at Nelson Lakes National Park

Location	Area below 700 m (hectares)	Notes
Lake Rotoiti shoreline	389	
Travers Valley	302	Excludes extensive grass flats, forested last century
Lake Rotoroa shoreline	1997	Excludes southern end of lake
Sabine Valley	1144	
D'Urville Valley	2076	
Matakitaki Valley	2615	
Glenroy Valley	1152	
TOTAL AREA	9675	9.5% total Park
Total Park Area	101 755	At 31/3/86

3.5.2 Botanical Characteristics

The Park lies on the limit of the range of several lowland tree and shrub species in the region. In particular podocarps (with the exception of *Podocarpus hallii*) occur at few sites mainly around Lake Rotoroa. Rimu is found on all sides of the lake, to 595 masl on the eastern (Porika Track) and probably slightly higher on the western, and it also occurs at one site on the shore of Lake Rotoiti. Matai, miro and kahikatea are also found around Lake Rotoroa, the first two extending a short way up the D'Urville and Sabine Valleys with seedlings as far up as Bull Creek (488 masl) in the former. Lake Rotoroa is also the only area of the Park where certain broadleaved understory plants are found, for example *Melicytus ramiflorus, M. lanceolata, Cordyline banksii, COprosma rotundifolia* and *C. robusta* (W.D. Burke, pers. comm.).

Overall the dominant canopy tree in the lowland areas is red beech. It also extends up through altitudinal zones where it is co-dominant with silver beech and then largely replaced by silver, reaching its altitudinal limit at 1080 masl (range 897-1164 masl, n=6, W.D. Burke, unpublished data). An important food resource associated with red beech is honeydew, a product of the beech scale insect which also colonises hard beech in the Park. The altitudinal limit of honeydew appears to be at 840-930 masl (n=-4 localities). Both the amount of honeydew on a tree and the number of these trees decline with increasing altitude so that the honeydew resource is concentrated in the lowland forest. This is further compounded by the distribution of hard beech which is largely restricted to the surrounds of Lake Rotoroa. Another important food tree that is restricted to lowland areas of the Park is the kowhai which only occurs on the shores of Lake Rotoroa.

3.5.3 Birdlife

The New Zealand pigeon (p. 25) demonstrates the greatest dependence on lowland forest areas at Nelson Lakes. All but three records were from areas below 700 masl, two of the three were at unspecified points on tracks which ranged from 450-760 masl and only one (Glenroy Valley 21/1/85) was at high altitudes over 1060 m. DSIR Ecology Division's research at Mt Misery has suggested that the area at the head of Lake Rotoroa is vital winter habitat for pigeons from a wide area due partly to the presence of kowhai. Some birds occupied this area at all times of year but others moved to higher altitude forest in the breeding season (Clout *et al.* 1986).

Parakeets showed a similar pattern, most birds being found below 600 masl (77.2% of all sightings). Seasonal changes were not so clear. Their present distribution appears to relate to the area of lowland forest available in each valley. During this survey no parakeets were detected around Lake Rotoiti or up the Travers Valley despite playing taped calls. They were more widespread in the D'Urville Valley than in the Sabine, and most abundant in the Matakitaki.

Tui and robins were largely confined to lower sites, the former favouring an altitudinal range of 450-700 masl and the latter 450-600 masl. Both also occurred near timberline, tui feeding on and shrubs above the forest in summer and autumn, and robins apparently resident in its upper zone all year at a few sites in the Park. The altitudinal distribution of tui is very similar to the distribution of honeydew though whether there is a causal relationship between the two is uncertain.

A clear picture of the other species concentrated at low levels but occurring throughout the Park could not be obtained by the mapping scheme with its limited quantitative information. However the 5-minute counts done by DSIR Ecology Division on Mt Misery showed that grey warbler, fantail and shining cuckoo were in greatest numbers at low to mid-altitude.

3.6 Seasonal Changes in Bird Distributions in the Park

The relative few records from winter (Section 3.1, Fig. 2) makes it difficult to assess seasonal changes. Movements out of the Park in autumn and back in spring were shown by the overseas migrants, shining cuckoo and long-tailed cuckoo, by kingfishers, gulls, terns and some waders which are concentrated near the coast in winter. Within the Park obvious seasonal movements were shown by the finches, as for example the chaffinch (Fig. 23). This species was typically present throughout the forest in spring and summer, then forming flocks after breeding and moving to lower levels within the park or out of it altogether into the surrounding farmland. Fig. 23 shows a tendency for birds to be concentrated at the northern (lower) end of the Park in May, June and July (excluding the Glenroy and Matakitaki Valleys where insufficient records are available). The pattern of widespread sightings in April and August at either end of this winter period are typical of the rest of the year.

Of the native resident species, large scale movements of both kaka and pigeons seem to occur within the Park and to and from surrounding State Forests (DSIR Ecology Division, unpublished results). Movements to lower levels in winter may be typical of several species but good evidence is only available for the tui (Fig. 24). Birds appear to leave the upper parts of the valleys in winter concentrating in the lowland forest around Lake Rotoroa, the lower D'Urville Valley, and Lake Rotoiti. DSIR Ecology Division (unpublished results) similarly recorded an influx of tui on their Mt Misery transect in winter.

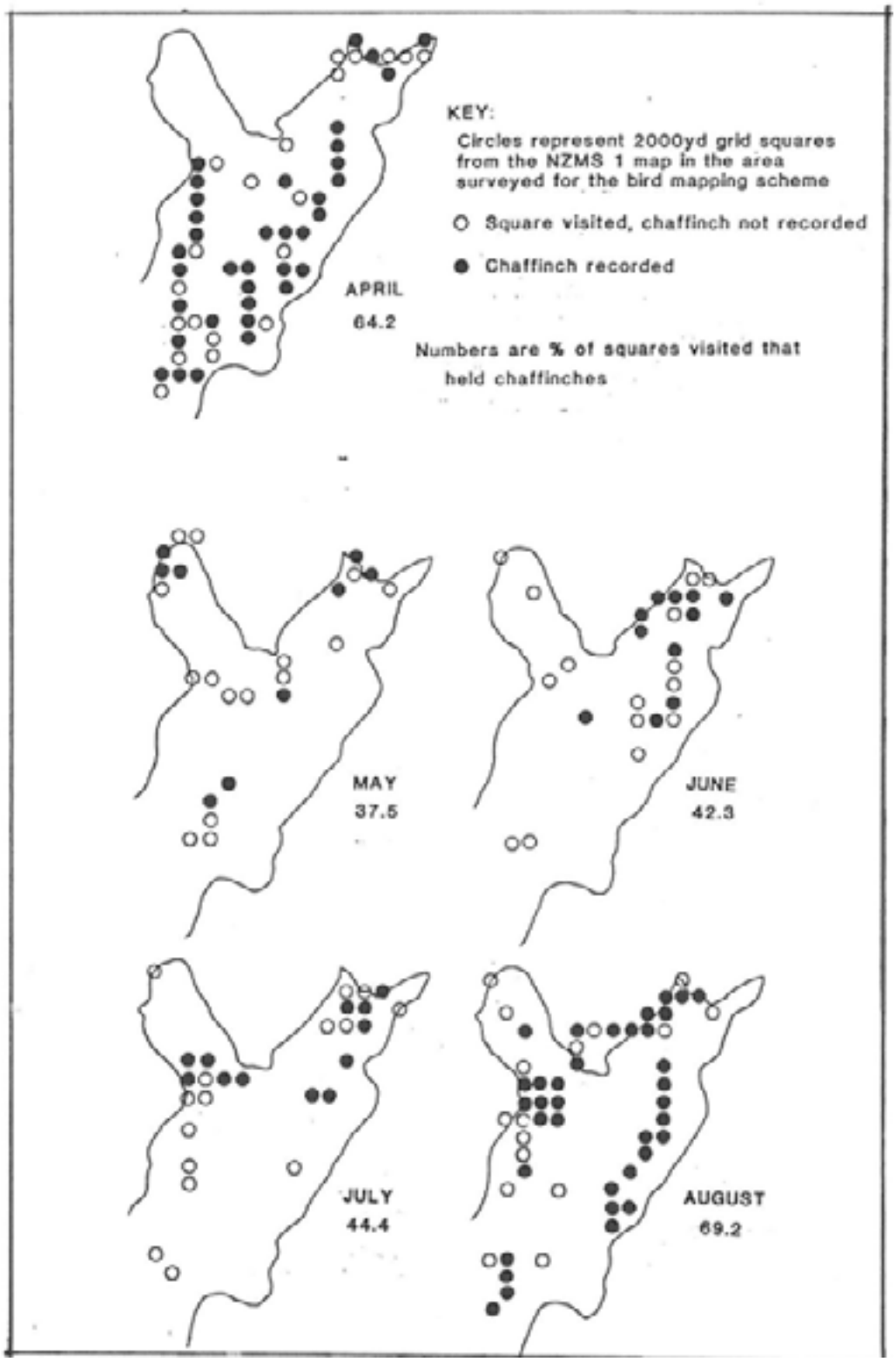


Fig. 23 Chaffinch records, eastern side of Nelson Lakes National Park, April to August

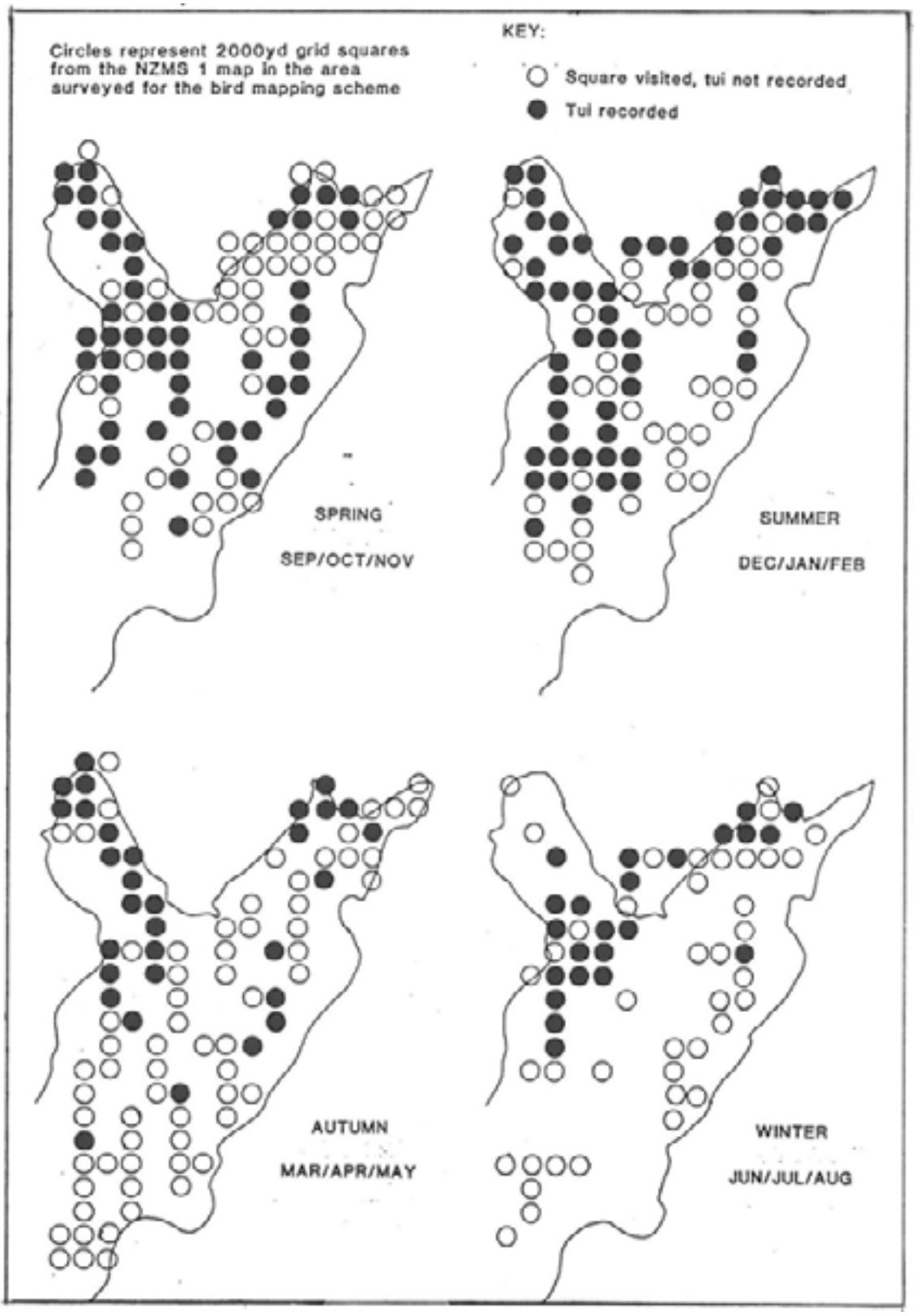


Fig. 24. Tui records, eastern side of Nelson Lakes National Park, by season.

4. DISCUSSION

4.1 Factors Determining Bird Distributions in the Park

4.1.1 Introduction

In reviewing present bird distributions the importance of lowland forest (<700 masl) (Section 3.5) and particularly that containing podocarps around Lake Rotoroa is clear. Pigeons, parakeets, tuis and robins are in general confined to this habitat. Kikkawa (1966) found higher bird densities in the podocarp-dominant forest at the lake than in beech-dominant areas nearby, only the rifleman favouring the latter.

Lowland forest occupies only 10% of the Park but makes up a much larger proportion of the surrounding State Forests of Tutaki, Howard and Big Bush. Movements of some of Nelson Lakes birds to lower levels in winter have been demonstrated (Section 3.6) and it is likely that some move out of the Park into these surrounding forests. Recent work in Big Bush has recorded an apparent influx of tui in winter over a wide area (I. Millar and D. Butler, pers.comm.).

Within the Park the five major valleys show differences in their birdlife, relating in part to the area of lowland forest each contains. Parakeets for example seem almost absent from the Travers and most numerous in the D'Urville and Matakitaki Valleys. More detailed surveys of other species would be expected to support this ordering of valleys according to their importance to birds, and in which the Sabine and Glenroy Valleys would have medium importance. The level of human disturbance may be a factor in determining the birdlife of each valley. The blue duck, for example, is most abundant in the Matakitaki which is visited less often than the valleys to the east.

The survey technique does not allow an assessment of the changes in numbers of the more widespread species. Factors currently influencing bird populations can however be identified and predictions about future trends made. The factors will all interact but can be divided into food supply, competition and predation.

4.1.2 Food Supply

For many birds the condition of the forest's vegetation has a major influence on food supply. In general the more diverse the vegetation the greater the availability of food to a range of species. Past browsing by herbivores, particularly deer, clearly did reduce diversity but present lower numbers are leading to a recovery. Any lessening in hunting pressure could fairly rapidly result in significant deterioration of the forest again.

4.1.3 Competition

Several bird species are currently affected by direct competition with the two wasp species now prevalent in the Park. Wasps were first noted in New Zealand in the 1920s and by the 1960s were described as a menace within the Park, rangers destroying over sixty nests a season in the areas most frequented by the public. The dominant species then was probably *Vespula germanica,* but in recent years the common wasp *V. vulgaris* has become perhaps equally prominent. DSIR Ecology Division are researching the impacts of wasps and it appears that in summer they are responsible for a dramatic depletion of the honeydew resource, a major food of bellbirds, tui, silvereyes and kaka. H. Moller (pers. comm.) has shown that bellbirds and tui consequently were excluded from small patches of beech forest in late summer. Wasps also take large numbers of insects and are likely to reduce the summer insect supply for birds.

4.1.4 Predation

Indications are that mammalian predators are not as numerous as in the past. Feral cats may be a problem near settlements, and rats and stoats may become locally abundant in seasons following heavy seeding of beeches. Trapping at Mt Misery by DSIR Ecology Division (1974-84) showed that numbers of rats and stoats are generally low, though during these years there was never an opportunity to measure populations in a year when all beech species seeded heavily. Rat and mouse numbers do increase in spring and summer with the increased availability of beech seed as food, and in the past have reached vast numbers in these good beech seed years. The kiore 'plagues' last century (Handly 1895) were probably such examples. Stoat numbers increase with the availability of rodents (King 1983). It has been shown that each stoat takes roughly the same proportions of birds and rodents in its diet irrespective of rodent numbers, so that the larger numbers of stoats in a 'seedfall' year would result in more birds being killed (King 1983). In the past it has been suggested that robins were subject to significant population declines when stoat numbers were high and this is the subject of current DSIR Ecology Division research on Mt Misery.

Counts near Reefton (Dawson *et al.* 1978) and in Big Bush (I. Millar and D. Butler, have shown marked fluctuations in forest bird populations from year to year, so assessments of trends are difficult to make without results over a long period. Possible monitoring of populations in the Park is discussed in the following section (4.2).

4.2 Management Implications of the survey

This section discusses the management of the Park for the benefit of its based on factors identified in the previous discussion affecting distributions.

4.2.1 Predator Control

The control of mammalian predators is a time-consuming task. Stoats are widespread in the Park and their reproductive capabilities make it particularly difficult to reduce their numbers by trapping (King 1984). It may be possible to predict when stoat numbers will be at their highest and their impacts on birds greatest, in relation to beech seeding, and concentrate control then. Cat control should be a continuing aim, reinforced by education about the dangers of releasing unwanted pets into the forest. However it may be that the bird species remaining in the Park are those that can co-exist with the predators now present and control should focus on specific cases. There is no information on whether long-lived species like parakeets and kaka are maintaining their numbers, though indications are that the latter may not be. The development of predator-proof nest-boxes rather than predator control may be more effective in insuring the survival of these species (Flux *et al*. 1984).

4.2.2 Herbivore Control

The present level of control pressures on deer should be maintained to ensure continued improvement in forest condition. Chamois are apparently increasing in number and may have most effect on the forest near timberline where regeneration is naturally slow (Hayward 1977). Here they may offer competition to keas. The chamois in the Park are said to provide good trophies and recreational hunting of this species should be actively encouraged to reduce this competition.

Possum density in the Park's beech forests is relatively low (Appendix 4) yet this has been shown to be sufficient to severely reduce mistletoe productivity (Wilson 1984), and other palatable and fruit-producing plants important to birds may be equally affected. A poisoning operation on Mt

Misery temporarily reduced mistletoe damage but it increased again within a year as possums re-occupied the area despite a follow-up of kill-trapping (Clout and Gaze 1984). Control over a wider area using baits like '1080' from the air is now considered a risk to some bird species (Spurr 1979) and this method probably cannot be justified in the Park.

4.2.3 Habitat Management

The National Parks policy aims to manage Parks with minimal interference to natural processes, but aiding the 'repair' of habitats damaged by man or his livestock may be justified. The Travers Valley river flats will probably eventually return to forest now that burning and grazing have ceased, and planting could encourage this. Restoration of a lake-edge vegetation and shrubs, reeds or rushes could be of immediate benefit to waterfowl (Section 3.4). Cattle damage to forest margins still occurs in the Glenroy and Matakitaki Valleys and fencing of grazing leases there is desirable.

Maintaining water quality of the Park's lakes and rivers is important for the aquatic food chains on which several birds depend and uncontrolled developments at St Arnaud or Rotoroa might be major threats. The importance of Lake Rotoroa to the Park's waterfowl has been stressed and disturbance here should be minimised. Activities such as powerboat races, float-plane operations and water-skiing must be restricted to Lake Rotoiti and their impacts on that ecosystem should be considered in planning future park management.

The braided river valleys of the Glenroy and Matakitaki provide a habitat for water birds not found elsewhere in the Park and they should be protected from major disturbance, e.g. mining. The aquatic habitats of the Park are poorly understood and no further introductions of other fish species should be contemplated.

4.2.4 Management of Areas Outside the Park

The Park's boundaries are artificial and do not necessarily represent a distinct ecological unit, birds in particular being dependent on other areas at certain times of year. The sympathetic management of adjacent lowland areas of State Forest is highly desirable. Large, contiguous tracts of forest are more important than isolated pockets for species with poor dispersal. Robins are such a species and they will apparently not move across farmland or young pine plantations. Large blocks mean fewer 'edges' where rodents and predators can occur in larger numbers, e.g. areas of fern, farmland and young plantations. Developments such as roading that create further 'edges' should be discouraged.

Wetlands were not represented in the Park at the time of the survey. A swamp near St Arnaud has since been acquired as a reserve, but unmodified examples remain in the lower Matakitaki Valley that could be added to the Park.

4.2.5 Future Bird Surveys

An aim of the present survey was to establish baseline information on bird distributions against which to measure future changes. The most effective way of detecting any such changes should be considered. One option would be to repeat the survey in 5 or 10 years time, another might be to concentrate on certain species or on particular areas.

For the more common, widespread forest bird species it would require a very major population change before this showed up as a change in distribution, particularly one detectable by the

present scheme. For rarer species, blue duck for example, it is only worthwhile surveying certain squares, those along rivers in this case. A survey of the entire Park might not include enough visits to these squares to obtain the complete distribution of such a species. The main reason for repeating the survey would be to provide up-to-date maps for interpretation and to encourage the public to take a more direct interest in by filling in record cards.

Future bird census work in the Park should be directed to answering certain questions. To detect changes in numbers of the common forest birds regular counts are required at fixed sites and the DSIR Ecology Division transect remaining on Mt Misery provides an opportunity for future censuses. Specific surveys are required for the rarer forest species that are not sufficiently represented in counts, e.g. kaka and parakeet, or species in other habitats, e.g. blue duck.

4.2.6 Management of Human Activity

Activities on the major lakes may have clear consequences for but it is more difficult to assess the impacts of tramping, camping, fishing and climbing carried out in the Park's interior. The provision of a track system ensures that only a small fraction of the Park's forest is subject to regular disturbance. However most tracks do follow rivers and increased use may have implications for the survival of blue duck, so any new routes should perhaps be placed slightly back from them.

5. REFERENCES

Adams, J.S. 1965. D'Urville valley report -March 1965. Unpublished report of Wildlife Service, Wellington. 6pp.

Allan, H.H. 1961. *Flora of New Zealand.* Volume 1. Government Printer, Wellington. 1085pp.

Batcheler, C.L., Cowan, P.E. 1988. Review of the status of the possum (*Trichosurus vulpecula*) in New Zealand. Unpublished report, Forest Research Institute, Christchurch, and DSIR Ecology Division, Lower Hutt.

Broad, L. 1892. *Jubilee History of Nelson.* Bond Finney & Co., Nelson. 205pp. (Reprinted by Capper Press, Christchurch, 1976)

Brough, J. 1883-4. Diaries (unpublished). Held at Nelson Provincial Museum.

Brough, J. 1895-9. Diary extracts, Karamea/Wangapeka (unpublished). Held at Nelson Provincial Museum.

Brown, J.M.A. (ed.) 1979. The Nelson Lakes and their aquatic weeds. DSIR Information Series 142, Wellington. 32pp.

Brunner, T. 1848. *The Great Journey, an expedition to explore the interior* of *the Middle Island, New Zealand, 1846-48.* Pegasus Press, Christchurch, 1952.

Bull, P.C. 1977. Birdlife. In *Nelson Lakes Park Handbook,* 3rd edition, pp. 64-73. Department of Lands and Survey, Nelson. Stiles, Nelson.

Bull, P.C., Gaze, P.D., Robertson, C.J.R. 1985.*The Atlas of bird distribution in New Zealand.* Ornithological Society of New Zealand, Wellington. 296pp.

Buller, W.L. 1870. On *Zosterops lateralis* in New Zealand, with an account of its migrations. *Transactions NZ Institute (Zoology)* III: 15-23.

Buller, W.L. 1888. *History of the birds of New Zealand.* 2 Volumes. Privately published, London.

Buller, W.L. 1905. *Supplement to the birds of New Zealand.* 2 Volumes. Privately published, London.

Burke, W.D. 1985. Higher plants (lycopods, ferns, gymnosperms, flowering plants) of the southern extension to Nelson Lakes National Park. Unpublished report, Lands and Survey Department, Nelson.

Child, P. 1981. Birdlife of Mount Aspiring National Park. *National Parks Scientific Series* 4, Department of Lands and Survey, Wellington. 64pp.

Clarke, C.M.H. 1970. Observations on population, movements and food of the kea (*Nestor notabilis*). *Notornis* 17: 105-114.

Clout, M.N., Hay, J.R. 1981. South Island kokako (*Callaeas cinerea cinerea*) in Nothofagus forest. *Notornis* 28: 256-59.

Clout, M.N., Gaze, P.D. 1984. Brushtail possums (*Trichosurus vulpecula* Kerr) in a New Zealand beech*(Nothofagus)* forest. *NZ Journal of Ecology* 7:

Clout, M.N., Gaze, P.D., Hay J.R., Karl, B.J. 1986. Habitat use and spring movements of New Zealand pigeons at Lake Rotoroa, Nelson Lakes National Park. 33 (1): 37-45.

Cotterel, J.S. 1843. Letter from Nelson (unpublished). Held at Nelson Provincial Museum.

Cracraft, J. 1976. The species of moas (Aves: Dinornithidae). *Smithsonian Contributions to Paleobiology* 27: 189-205.

Craig, J.L. 1972. Investigation of the mechanism maintaining polymorphism in the New Zealand fantail, *Rhipidura fuliginosa* (Sparrman). *Notornis* 19(1): 42-55.

Cumberland, K.B. 1981. *Landmarks.* Readers Digest, Sydney.

Dawson, D.G., Dilks, P.J., Gaze, P.D., McBurney, .G.R., Wilson, P.R. 1978. Seasonal differences in bird counts in forests near Reefton, South Island, New Zealand. *Notornis* 25(4): 257-278.

Dingwall, P.R., Atkinson, I.A.E., Hay, C. 1978. The ecology and control of rodents in New Zealand nature reserves. *Department of Lands and Survey Information Series* 4, Wellington. 237pp.

Falla, R.A., Sibson, R.B., Turbott, E.G. 1982. *The new guide to the birds of New Zealand.* Collins, Auckland. 247pp.

Fleming, C.A. 1962. History of the New Zealand land bird fauna. *Notornis* 9: 270-74.

Flux, J.E.C. 1966. Breeding of song thrushes and blackbirds at St Arnaud, Nelson. *Notornis* 13(3): 142-49.

Flux, J.E.C. 1967. Hare numbers and diet in an alpine basin in New Zealand. *New Zealand Ecological Society Proceedings* 14: 27-33.

Flux, J.E.C., Bowen, A., Gibbs, N., Ruarus, S., Beggs, J. 1984. Nest boxes for parakeets and kaka. Unpublished poster paper, New Zealand Ecological Society Conference, Nelson.

Fox, N.C. 1978. Territorial spacing of the New Zealand falcon *(Falco novaeseelandiae). Notornis* 25: 203-212.

Gaze, P.D. 1985. Distribution of yellowheads (*Mohoua ochrocephala*) in New Zealand. *Notornis* 32(4): 261-269.

Gaze, P.D., Clout, M.N. 1983. Honeydew and its importance to birds in beech forests of the South Island, New Zealand. *New Zealand Journal of Ecology* 6: 33-37.

Haast, J. von 1861. *Report of a topographical and geologica exploration of the western districts of the Nelson Province, New Zealand.* C & J. Elliot, Nelson.

Handly, J.W. 1895. Notes on some species of New Zealand birds. *Transactions New Zealand institute* XXVIII: 360-367.

Harrison, M. 1970. The orange-fronted parakeet (*Cyanoramphus malherbi*). *Notornis* 17(2): 115-125.

Hayward, J. 1977. Wild animal survey, Nelson Lakes National Park. Unpublished report, NZ Forest Service, Nelson.

Heaphy, C. 1842. *Narraitve of a residence in various parts of New Zealand.* Smith & Elder, London. Hocken Library, Dunedin, 1968, facsimile no. 7.

Heaphy, C. 1846. Account of an exploring expedition to the southwest of Nelson. Nelson Examiner, 7 & 14 March 1846.

Heather, B.D. 1982. The cattle egret in New Zealand, 1978-80. *Notornis* 29: 241-268.

Irwin, J. 1976. Lake Rotoroa (South Island) Bathymetry1:15,840. NZ Oceanographic Institute Chart. Lake Series.

Irwin, J., Del Main, W. 1976. Lake Rotoiti (South Island) Bathymetry 1:11,880. NZ Oceanographic Institute Chart, Lake Series.

Kikkawa, J. 1966. Population distribution of land birds in temperate rainforest of southern New Zealand. *Transactions of the Royal Society, Zoology* 7(7): 215-277.

King, C.M. 1983. The relationships between beech (*Nothofagus* sp.) seedfall and the populations of mice (*Mus musculus*), and the demographic and dietary response of stoats (*Mustela erminea*), in three New Zealand forests. *Journal of Animal Ecology* 52: 141-166.

King, C.M. 1984. *Immigrant Killers- introduced predators and the conservation of birds in New Zealand.* Oxford University Press, Auckland. 224pp.

King, C.M., Moody, J.E. 1982. The biology of the stoat (*Mustela erminea*) in the National Parks of New Zealand; Food Habits. *NZ Journal of Zoology* 9: 57-80.

Kinsky, F.C. (ed.) 1970. *Annotated checklist of the birds of New Zealand.* A.H. & A.W. Reed for Ornithological Society of New Zealand, Wellington. 96pp.

Kinsky, F.C. 1980. Amendments and additions to the 1970 Annotated Checklist of the birds of New Zealand. *Notornis* 27 (Supplement). 23pp.

Kirk, T.W. 1881. Abnormal colouring in the kokako. *Transactions New Zealand Institute* XIV: 544.

Lands & Survey Department 1979. Proceedings of a seminar on bird surveys in National Parks and Reserves. *National Parks Scientific Series* 16. 20p. Department of Lands & Survey, Wellington.

Marriner, G.R. 1908. *The kea. A New Zealand problem.* 151 pp.

Marchant, 1938. Unpublished report in Helm, A.S. 1963. *Nelson Lakes National Park. A short history, bibliography and gazetteer.* Unpublished file note, Department of Lands and Survey, Nelson.

Millar, D.G.L. 1967. Recent archaeological excavations in the northern part of the South Island. *Nelson Historical Society Journal* 11(2): 5-12.

Millar, D.G.L. 1971. Excavations of an archaic site at Tahunanui, 520/2, Nelson. *New Zealand Archaeological Association Newsletter* 14(4): 161-172.

Millener, P.R. 1982. And then there were twelve: the taxonomic status of *Anomalopteryx oweni* (Aves: Dinornithidae). *Notornis* 29(3): 165-170.

Millener, P.R. 1984. Honeycomb Hill cave -a survey of scientific and scenic resources. Internal report, National Museum of New Zealand.

Moncrieff, P. 1925. Yellowheads and other birds at Lake Rotoroa. *The Emu* XXXV: 21-27.

Moncrieff, P. 1935. Two trips into the hinterland of the Nelson Province, New Zealand. *The Emu* XXXV: 137-144.

Moncrieff, P. 1938. Birds of Nelson Province, New Zealand. *The Emu* XXXVII: 206-239.

Moore, L.B., Edgar, E. 1970. *Flora of New Zealand.* Volume II. Government Printer, Wellington.

Morse, P.M. 1981. Wildlife values and wildlife conservation of Buller and North Westland. *NZ Wildlife Service Fauna Survey Unit Report* 29. 185p.

Nelson Lakes National Park Board 1977. *Nelson Lakes National Park –A handbook for visitors,* 3rd edition. Stiles, Nelson.

Newport, J.N.W. 1962. *Footprints. The story of the settlement and development of the Nelson back country districts.* Whitcombe & Tombs Ltd. 428pp.

Oliver, W.R.B. 1949. The moas of New Zealand and Australia. *Dominion Museum Bulletin* 15. 206pp.

Oliver, W.R.B. 1955. *New Zealand Birds.* 2nd edition. A.H. & A.W. Reed, Wellington.

Reid, B. 1978. The history of the takahe (*Notornis mantelli*). In *Proceedings of the seminar on the takahe and its habitat,* pp. 14-50. Fiordland National Park Board, Invercargill.

Robertson, C.J.R. (ed.) 1985. *Complete book of New Zealand.* Readers Digest, Sydney. 319pp.

Saunders, A. 1980. Wildlife and lowland forests. *NZ Wildlfe Service Fauna Survey Unit Report* 27.17pp.

Scarlett, R.J. 1968. An owlet-nightjar in New Zealand. *Notornis* 15(4): 254-266.

Scarlett, R.J. 1974. Moa and man in New Zealand. *Notornis* 21(1): 1-12.

Simpson, M.J.A. 1977. Vegetation. In *Nelson Lakes National Park Handbook,* 3rd edition, pp. 50-63. Stiles, Nelson.

Sowman, W.C.R. 1981. *Meadow, mountain, forest and stream.* The provincial history of nelson acclimatisation Society 1863-68. Stiles, Nelson.

Spurr, E.B. 1979. A theoretical assessment of the ability of bird species to recover from an imposed reduction in numbers, with particular reference to 1080 poisonings. *New Zealand Journal of Ecology* 2: 46-63.

Stidolph, R.H.D. 1946. *New Zealand Bird Notes* 1(11): 132, 135.

Taylor, M.E.U. (ed.) 1971. Nelson Lakes survey. Unpublished report, Cawthron Institute, Nelson. to Nelson Lakes National Parks Board.

Taylor, R.H., Flux, J.E.C. 1965. *Mammals.* Reprinted from *Nelson Lakes National Park Handbook,* Department of Lands and Survey, Nelson.

Taylor, R.H. 1966. Seasonal and altitudinal distribution of kingfishers in the Nelson district. *Notornis* 13(4): 200-203.

Taylor, R.H., Thomas, B.W. 1973. A survey of near Lake Rotoroa and in the D'Urville Valley, Nelson Lakes National Park. Unpublished report, DSIR Ecology Division, Lower Hutt.

Taylor, R.H., Heatherbell E.G., Heatherbell, E.M. 1986. The orange-fronted parakeet *Cyanoramphus malherbi* is a colour morph of the yellow-crowned parakeet *C. auriceps. Notornis* 33(1): 17-22.

Thomas, B.W. 1977. Report on a survey of the birdlife in the Upper Sabine Valley, Nelson Lakes National Park, October / November 1977. Unpublished report, DSIR Ecology Division, Nelson.

Thomas, B.W., Clare, M. 1976. Report on bush wren survey, Sabine Valley, Nelson Lakes National Park, December 1976. Unpublished report, DSIR Ecology Division, Nelson.

Thomson, G.M. 1922. *Thenaturalisation of animals and plants in New Zealand.* Cambridge University Press, London.

Tilley, J.A.V. 1984. Meteorological records, Mt Misery. May 1978 -August 1983. Unpublished report, DSIR Ecology Division, Nelson.

Townsend, I. 1960-61. Biological Records. Records of the Nelson Speleological Group, 1960-61, Nelson. 26pp.

Wellman, H.W. 1962. Maori occupation layers at D'Urville Island, New Zealand. *New Zealand Journal of Geology and Geophysics* 5: 55-73.

Westerskov, KE. 1972. History of distribution of the crested grebe *(Podiceps cristatus*) North Island and Nelson/ Marlborough. 19: 74-82.

Wilkes, O.R., Scarlett, R.J. 1967. Excavation of a moa hunter site at the mouth of the Heaphy River. *Records of the Cantebury museum* VIII (3): 177-208.

Williams, G.R., Harrison, M. 1972. The laughing owl, *Sceloglaux albifacies*) (Gray 1844). A general survey of a near-extinct species. 19: 4-19.

Williams, M. 1979. Detecting the presence of blue duck from its faecal sign. *Notornis* 26: 306-307.

Williams, M. 1980. Some demographic characteristics of New Zealand's black swan. *Wildlife -a review.* New Zealand Wildlife Service 1980: 14-32.

Williams, M. 1981. *The duckshooter's bag.* The Wetland Press, 123pp.

Williams, P.W. (ed.) 1980. Metro Cave - a survey of scientific and scenic resources. Unpublished report to Department of Lands and Survey, Geography Department, University of Auckland. 46pp.

Wilson, P.R. 1984. The effects of possums on mistletoe on Mt Misery, Nelson Lakes National Park. In Proceedings of Section A4e, 15th Pacific Science Congress, Dunedin, February 1983. *Lands and Survey Information Series* 12, Wellington.

Wilson, P.R. 1985. Kaka Research, Nelson Lakes National Park. Unpublished progress report, DSIR Ecology Division, Nelson.

Wisheart, C.J. 1980. Wild Animals. In Simpson, P. (ed.), *Wairau Mountain Lands,* Marlborough Catchment Board and Regional Water Board, Blenheim. 177pp.

Zumbach, D.V. 1965. Honorary Ranger's report. Unpublished report, Department of Lands and Survey, Nelson.

6. ACKNOWLEDGEMENTS

I thank Mal Clarborough and Peter Croft of Nelson Lakes National Park for my involvement in this bird survey and I am grateful for their enthusiastic support over several years. The staff of the Nelson office of the Department of Lands and Survey provided logistic and administrative assistance. I thank Andy Garrick, Greg Sherley and Philip Simpson (both Department of Conservation) for guiding the project through to this publication. Warren Burke was an excellent companion on field trips. Thanks are also due to Alan Price, Nelson/Marlborough Regional Conservancy, Department of Conservation, Nelson, who drew the maps, Jane Napper, Department of Conservation, who arranged production of the final report, and Jan Heine for her thorough editing.

I am grateful to the staff of DSIR Ecology Division (now DSIR Land Resources), Nelson for making their research material available and for commenting on drafts of this report. Peter Bull, John Preece also made valuable comments on the text. Tony Robinson, Ministry of Works, Nelson, assisted with the computerisation of results and the preparation of interim distribution maps. Local residents, particularly Alex McConochie and Don Cummings, provided information on historical trends and Ron Scarlett of Canterbury Museum supplied sub-fossil records. The mapping scheme would not have been a success without the contributions of the many observers too numerous to name.

APPENDIX 1: NATIONAL PARKS AND RESERVES BIRD MAPPING SCHEME

After a seminar on bird surveys in National Parks and Reserves, reported in Lands and Survey Department (1979), the National Parks and Reserves Bird Mapping Scheme was set up in 1981.

The following two pages of instructions were distributed with the recording cards (example on pp. 76-77) to staff and amateur bird watchers, to use while they moved about a National Park.

NATIONAL PARKS AND RESERVES BIRD MAPPING SCHEME

The scheme uses distribution records collected by amateur bird watchers to build up maps of the distribution of the birds in our national parks and reserves. The smallest contribution helps with management: e.g. the distribution of the less common birds, or an understanding of the biological wealth of the park and its surrounds. The information also contributes to displays, leaflets, and other educational material.

WHAT YOU NEED

Recording forms are available from any national park or reserve ranger station and from offices of the Department of Lands and Survey. You will also need an NZMS 1 topographic map (1 :63 360 or 1 inch to 1 mile) of the area you intend to visit. The *New guide to the birds of New Zealand* by Falla, Sibson and Turbott (1979, Collins, London) is the best guide to the birds you may see.

RECORDING

Number

Species are recorded by indicating the number of each species seen or heard beside their name in the checklist. Sometimes you can make a precise count; e.g. when a few of an uncommon species are encountered, or a flock in open country could all be seen. More often you will be able to make only a rough estimate; e.g. a flock of shags flying off quickly out of sight, or a few birds singing in the bush. For the more common birds, in situations where a total count cannot be made, records on the coarse scale of 0-10 (+),11-100 (++),over 100 (+++) are still useful. Sometimes when you will not feel confident to make any guess about the numbers detected, simply put a cross (x) in the number column. Species not covered in the checklist may be added in the 'others' section at its end. For parakeets you may cross out the 'red' or 'yellow' if you have seen the bird well enough to identify the species, but unidentified parakeet records are allowable.

Locality

For all parks except Fiordland the birds will be mapped on a square grid of 2000 yard side. The NZMS 1 maps show 1000 yard lines and our squares are bounded by the *even-numbered* lines. The square number is given by the number of the line to its left followed by the number of the line below (see Figure 2). For Fiordland we use the 10 000 yard squares, found on the NZMS 18 (1:250 000) maps, and both even-and odd-numbered lines are needed. You should sketch the shape and location of the area searched in the square (top left of the recording card), using the 1000 yard lines which quarter the area, as a guide. For Fiordland these quarters are not on the map. The map number is necessary for putting your records into a wider context and the locality description is to complement your sketch and square number. The smaller the area of search, the more useful the records will be for correlation with habitat. You should certainly begin a new card for a new square, and you are encouraged to complete two or more cards for a square if it contains quite different habitats.

Date

If you spend more than one day in an area you may indicate a range of dates thus: 10-13/11/79, but use a new card for a new month.

Effort
The number of individuals and of species detected increases the longer you spend looking. To inform us

roughly of the amount of watching you did, a coarse estimate of the number of hours is asked for. You don't have to be so precise that you must time yourself .

Habitat

You can use the 'notes' section to enlarge on the simple checklist. Where possible, it is best to confine a card to a single habitat and begin a new card as you leave it.

Notes

Please remember to put those asterisks beside the names of species for which you have made notes; it makes it much easier to retrieve your information. Notes are particularly needed on feeding, breeding, and any doubts about identification. There is also an individual record card available on which there is more room for notes; you can use this for those records where you have seen something of special interest.

Your records are valuable and should not be wasted, so please use a sharp pencil and write neatly.

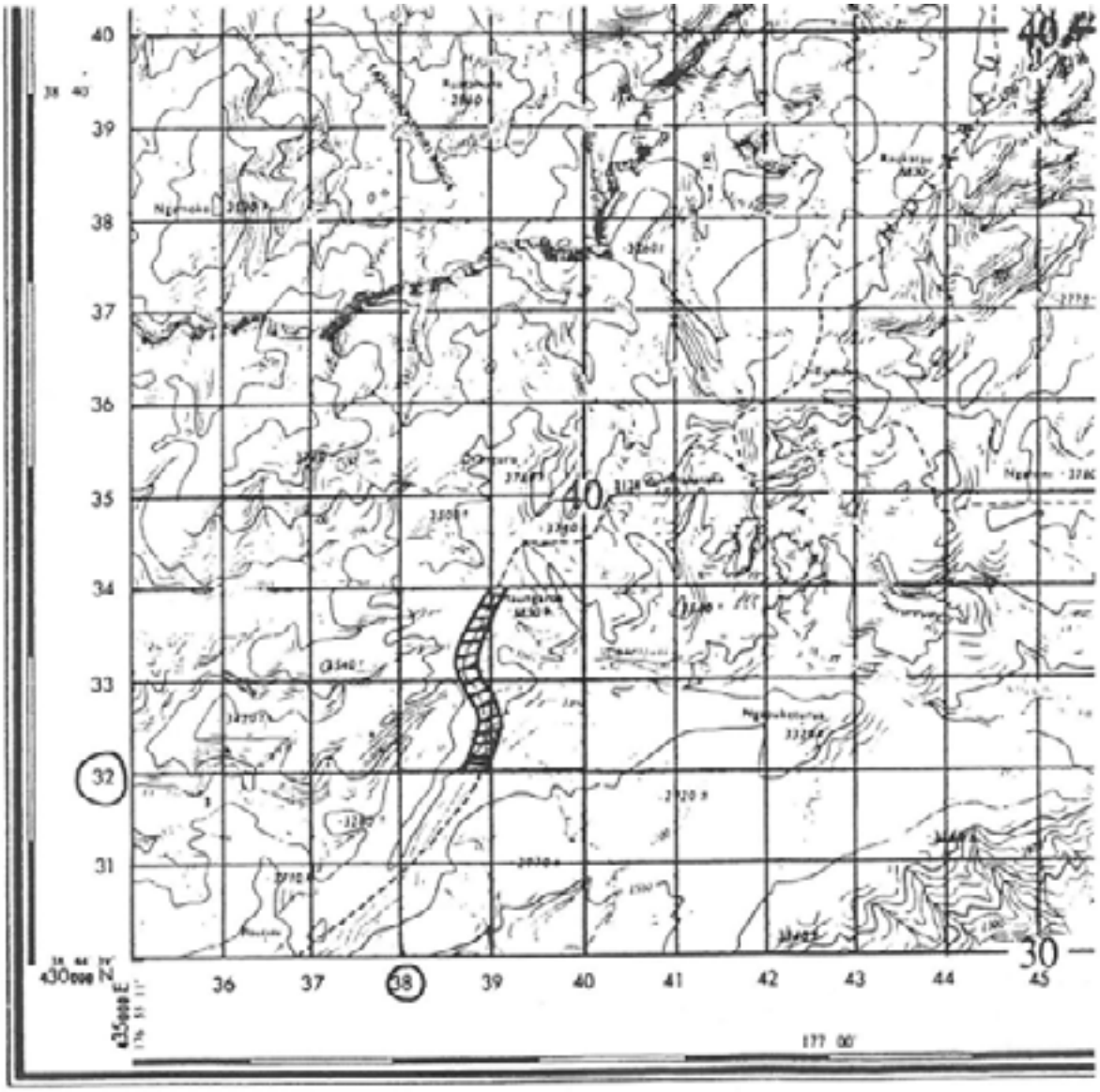
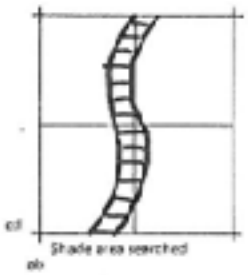


Figure 2. A corner of NZMS 1 Sheet N96 (Maungapohatu) showing how to read the square number (3832).



NATIONAL PARKS & RESERVES BIRD MAPPING SCHEME

Map No:	N		9	6	Square No:	3	8	3	2

Locality: Huiarau Ra. track, Sth of Maungaroa

Observer: D.G. Dawson

Date:	29 d	11 m.	79	Effort in hours			½

NOTES: (e.g. Activity or breeding, put an * by the checklist name of any species mentioned in the notes.)

HABITAT (Tick one or more)
✓ Beech Forest
Other Native Forest
Exotic Forest
Scrub, Fern & Second Growth
Developed Farmland
Tussockland
Alpine & Subalpine
Rock & Scree
Swamp & Marsh
Lake, Pond, Tarn
River, Stream, Riverbed
Estuary & Mudflat
Sandy Coast & Dunes
Rocky Coast
At Sea
Residential & Urban

The parakeet was identified by call alone. Bellbirds and grey warblers were feeding fledglings. A pigeon was seen to take a five-finger berry.

SPECIES		NO
Banded Dotterel		
Bellbird	*	++
Bittern		
Black Backed Gull		
Black Billed Gull		
Blackbird		+
Black Fronted Tern		
Black Shag		
Black Swan		
Blue Duck		1
Brown Creeper		
Brown Kiwi		
Brown Teal		
Californian Quail		
Canada Goose		
Caspian Tern		
Chaffinch		+++
Crested Grebe		
Dabchick		
Falcon		2
Fantail		+
Fernbird		
Goldfinch		
Great Spotted Kiwi		
Greenfinch		
Grey Duck		
Grey Teal		
Grey Warbler	*	++
Harrier		1
Hedge Sparrow		
House Sparrow		
Kaka		3
Kea		
Kingfisher		
Little Black Shag		
Little Shag		
Long Tail Cuckoo		2
Magpie		
Mallard		
Morepork		
Myna		
N.Z. Pigeon	*	+
Paradise Duck		
Parakeet (Red/Yellow)	*	2
Pied Shag		
Pied Stilt		
Pipit		

SPECIES	NO
Pukeko	
Red Billed Gull	
Redpoll	
Reef Heron	
Riflerman	++
Robin	2
Rock Wren	
Scaup	
Shining Cuckoo	+
Shoveler	
Silvereye	+
S.I. Pied Oystercatcher	
Skylark	
Song Thrush	
Spotless Crake	
Spur Winged Plover	
Starling	
Tit	
Tui	1
Variable Oystercatcher	
Weka	
Welcome Swallow	
White Faced Heron	
White Fronted Tern	
Whitehead	+
White Heron	
Yellow Hammer	
Yellowhead	
OTHERS	
Number of Species:	18
In the number column you may:	
- Just indicate presence	x
- Estimate number e.g.	c.90
- Indicate exact count e.g.	18
- Use + for 1-10	
++ for 11-100	
+++ for 101+	

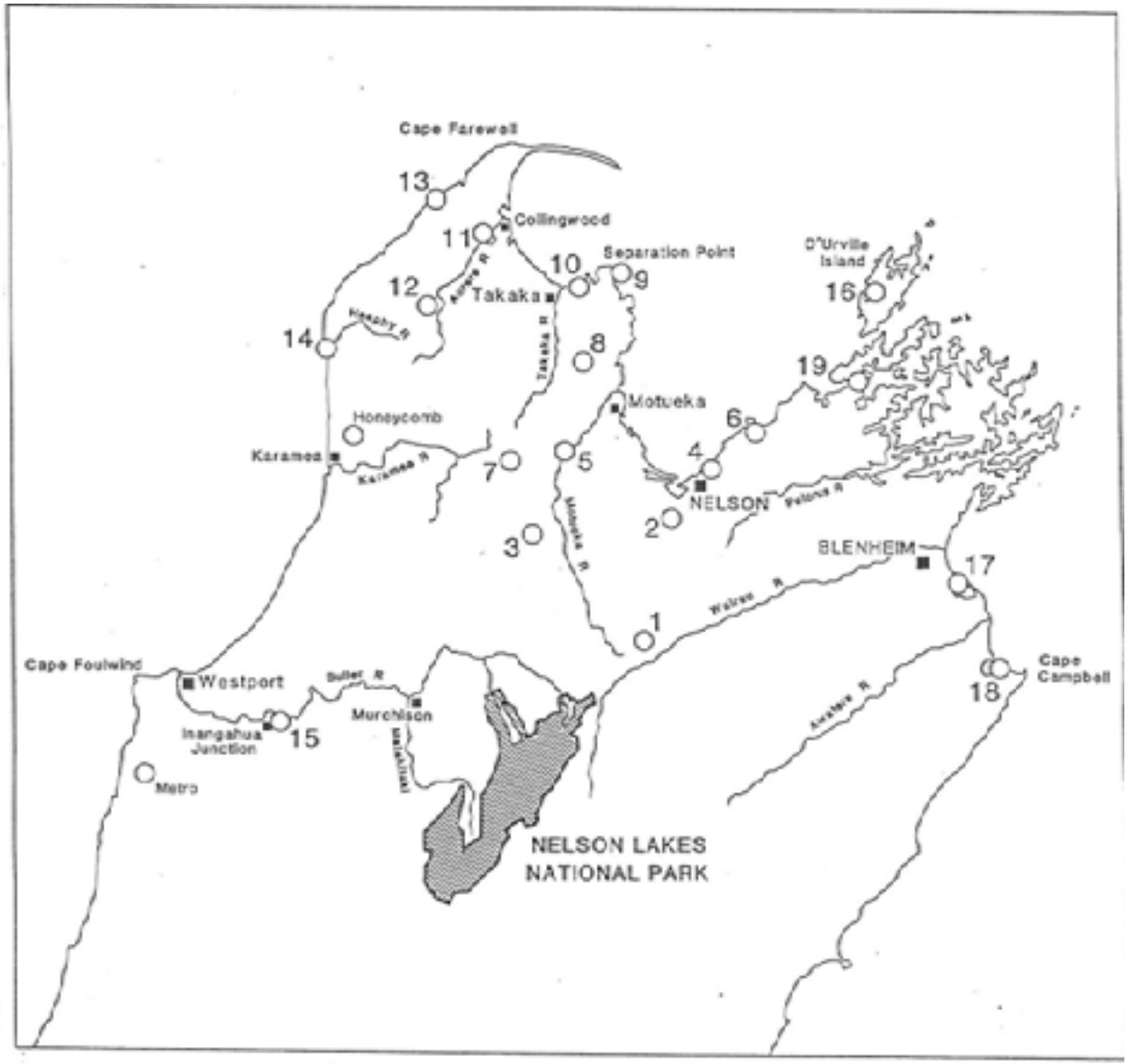


Fig. 25 Sites of sub-fossil bird remains recorded in Appendix 2, Tables 1 and 2

APPENDIX 2: SUB-FOSSIL BIRDS OF THE REGION

Table 1 presents records of sub-fossil bird remains obtained from the localities shown in Figure 25.

Table 2 assembles more detailed information available about moas to assess the likelihood which species may have existed in Nelson Lake National Park. The assumption made is that any moa species, found at a large number of different sites, including those occurring well inland, over a wide area, was probably present in the Park.

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Order: Palaeognathiformes						
Anomalopteryx didiformis	Lesser Moa	1,4,6	7,8,9,11, 12,13	17,18,19	*	*
Megalapteryx didinus	"	5,6	7,15	16,17	*	*
M. benhami	"	6	7	19	*	*
Pachyornis elephantopus	"	*	8,10,12	17	*	*
Emeus crassus	"		14	17,18		*
Euryapteryx geranoides	"	3,4	7,8	?16,17,18	*	*

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Dinornis novaezealandiae	Greater Moa	*	8,11,?13,14	16	*	*
D. giganteus	"	*	*		*	*
D. torosus	"	6	7,8,12		*	*
Order: Apterygiformes						
Apteryx oweni	Little Spotted Kiwi		8,12		*	*
A. haastii	Great Spotted Kiwi		8,12,14		*	*
A. australis	Brown Kiwi					
Order: Procellariformes						
Pterodroma inexpectata	Mottled Petrel				*	
P. cookii	Cook's Petrel				*	
P. nigripennis	Black-winged Petrel				?*	*
Pachyptila turtur	Fairy Prion				*	*

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Procellaria westlandica	Westland Black Petrel				*	*
P. parkinsoni	Black Petrel		13			
Puffinus tenuirostris	Short-tailed Shearwater					*
P. griseus	Sooty Shearwater	4				
P. gavia	Fluttering Shearwater	4				
P. assimilis	Little Shearwater		8			*
Pelagodroma marina	White-faced Storm Petrel					*
Pelecanoides urinatrix	Diving Petrel	*	14		*	
Order: Pelecaniformes						
Phalacrocorax carbo	Black Shag				*	
P. melanoleucos	Little Shag	*				

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Order: Anseriformes						
Cygnus sumnerensis	Extinct Swan	6		17,18		
Cnemiornis calcitrans	South Island Extinct Goose				*	*
Euryanas finschi	Finsch's Duck	*	*	18	*	
Anas superciliosa	Grey duck	*	*		*	*
A. aucklandica	Brown teal	?*	?*			
Hymenolaimus malacorhynchos	Blue Duck	*	*		*	
Order: Falconiformes						
Circus eylesi	Extinct Harrier			18	*	
Harpagornis moorei	Extinct Eagle			17,18	*	
Falco novaeseelandiae	NZ Falcon	*	*			

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Order: Galliformes						
Coturnix novaezelandiae	NZ Quail				*	
Order: Gruiformes						
Aptornis otidiformis	Extinct Giant Rail		8	17,18	*	
Porzana tabuensis	Spotless Crake					*
Gallirallus australis	Weka	4	7,8,14		*	*
G. minor	Little Extinct Woodhen	6	8,13,14	18		*
Gallinula hodgeni	Hodgen's Rail			18	*	
Fulica chathamensis	Extinct Coot			18	*	
Porphyrio mantelli	Takahe	2	8,14	17,18	*	*

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Order: Charadriiformes						
Coenocorypha aucklandica	Subantarctic Snipe		14 (?species)		*	
Order: Columbiformes						
Hemiphaga novaeseelandiae	NZ Pigeon	4	7,8,14		*	
Order: Psittaciformes						
Strigops habroptilus	Kakapo	*	7,8,14		*	*
Nestor meridonalis	Kaka		14			
Nestor sp.n.	Small Extinct Kaka	4	*			*
N. notabilis	Kea				*	
Cyanoramphus sp.	Parakeet sp.	4	14		*	

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Order: Caprimulgiformes						
Megaegotheles novaezelandiae	Owlet-nightjar	1	8,12,13,14		*	
Order: Strigiformes						
Sceloglaux albifacies	Laughing Owl	*	8	18	*	
Ninox novaeseelandiae	Morepork	*	14			
Order: Passeriformes						
Acanthisitta chloris	Rifleman				*	
Xenicus longipes	Bush Wren				*	
X. gilviventris	Rock Wren				*	
Traversia lyalli	Stephens Island Wren				*	
n. sp. 3	Extinct Wren (? 3 spp.)				*	

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Anthus novaeseelandiae	NZ Pipit		14		*	
Bowdleria punctata	Fernbird		14			*
Finschia novaeseelandiae	Brown Creeper		14		*	
Mohoua ochrocephala	Yellowhead		8		*	
Gerygone igata	Grey Warbler				*	*
Rhipidura fuliginosa	Fantail		14		*	*
Petroica macrocephala	Yellow-breasted Tit				*	
P. australis	NZ robin	*	8,14		*	*
Zosterops lateralis	Silvereye		14			*
Anthornis melanura	Bellbird	*	14		*	*
Prosthemadera novaeseelandiae	Tui	4	7,14		*	*
Philesturnus carunculatus	Saddleback	*	14		*	

Species	Common Name	Location of Sub-fossil Remains				
		Nelson/ Motueka	Golden Bay/ NW Nelson/ Buller	North Marlborough	Honeycomb Hill	Metro Cave
Callaeas cinera	Kokako	*	14		*	*
Turnagra capensis	NZ Thrush		14		*	
Palaeocorax morionum	Extinct Crow			17,18	*	

Key:

* Asterisk in nelson or Golden Bay columns indicates an unspecific record obtained from the lists of R. Scarlett, Canterbury Museum.
* Asterick in Honeycomb Hill or Metro Cave columns denotes presence in the concerned.

Sites, numbered 1-19 on Fig. 25 (source in parentheses):

1. Red Hills (R. Frost, pers.comm., T.H. Worthy, pers comm..).
2. Aniseed Valley (Reid 1978).
3. Matariki (Oliver 1949).
4. Tahunanui (Millar1971).
5. Pokororo (Oliver 1955).
6. Rotokura, Cable Bay (Millar 1967).
7. Mt Arthur (Oliver 1955, T.H. Worthy, pers. comm.).
8. Takaka Hill (Oliver 1955, Townsend 1960-1).
9. Anapai, Abel Tasman N.P. (Millar 1967).
10. Tarakohe (Oliver 1955).
11. Aorere River (Oliver 1949).
12. Gouland Downs (R. Scarlett, pers. comm.).
13. Paturau (R. Scarlett, pers. comm.).
14. Heaphy River Mouth (Wilkes and Scarlett 1967).
15. Inangahua (Oliver 1955).
16. D'Urville island (Oliver 1955, Wellman 1962).
17. Wairau Bar (Scarlett 1974, Oliver 1955).
18. Marfell beach/Lake Grassmere (Scarlett 1974).
19. Wairangi (Oliver 1955).

Other sources:

Honeycomb Hill Cave	–	Millener (1984) T.H. Worthy (pers. comm.)
Metro Cave	–	Williams, P.W. (1980).

TABLE 2: Comparison of Locations of Moa Remains

Species	Dates (AD) of remains found (Fleming 1962) (Key below)	Distribution (Figure 25)			
		Widespread South Island (Oliver 1949, 1955)	No. sites where present	Includes inland sites	Includes east & west coasts
Anomalopteryx *didiformes*	1150 (1)	Yes	14	Yes	Yes
Megalapteryx didinus	1700 (2)	Yes	7	Yes	Yes
M. benhami	None	No	4	No	No
Pachyornis elephantopus	1150, 1230 (1)	Yes	7	Yes	Yes
Emeus crassus	1100, 1520 (2)	Yes	4	No	Yes
Euryapteryx geranoides	1150, 1550 (1) 1450, 1670 (3)	Yes	9	Yes	Yes
Dinornis novaezealandiae	1300 (1)	Yes	8	Yes	Yes
D. giganteus	1350 (2) 1280, 1490 (3)	No	4	Yes	No
D. torosus	1670 (3)	Yes	6	Yes	No*

* Found on West Coast and to Cable Bay in the east but not in Marlborough.

Key to dates:
(1) Date of site. Moa remains not closely associated with the dated material, and their ages cannot be precisely established.
(2) Remains dated by close association with C14-dated beddings.
(3) Bones or stomach contents directly C14-dated.

APPENDIX 3: BIRD RESEARCH IN THE PARK - PAST, PRESENT AND FUTURE

This appendix summarises past and present research on birds carried out within the Park and suggests possible future topics.

A3.1 Past Research

A3.1.1 Population Distribution of Land Birds (Kikkawa 1966)
A survey of bird populations in several South Island districts as they existed between 1958-61 included a week spent at Rotoroa in Jan/Feb 1961 counting areas at the Sabine River mouth and the lower Valley. It was concluded that bird densities were higher in podocarp-dominant forest (188 pairs/100 acres) than in *Nothofagus* - dominant forest (109 pairs/100 acres). Species favouring the former were NZ pigeon, tui, silvereye, song thrush and blackbird; the rifleman was the only species favouring the latter.

A3.1.2 Seasonal and Altitudinal Distribution of Kingfishers (Taylor 1966)
Seasonal counts of kingfishers were made on a transect extending from Nelson via Lake Rotoiti and the Travers Valley to Cupola Basin between 1963 and 1966. Each spring there was an influx of birds into the higher country, first appearing at St Arnaud in late August/September and in the Travers Valley 1 to 2 weeks later. They moved back into the lower country in March peaking in numbers there in July and August. In summer they were found at altitudes up to 790 masl but in midwinter were only below 150 masl and then they were concentrated at the coast.

A3.1.3 Breeding of Song Thrushes and Blackbirds (Flux 1966)
The breeding of these species was studied in the lower Travers Valley and at St Arnaud from October 1962 to December 1965. Nest sites and materials used in their construction were described, clutch size was measured, and breeding density and nesting success were shown to be lower than populations at Auckland and in Britain. Stoats were considered the main predators.

A3.1.4 Population, Movements and Food of Kea (Clarke 1970)
A study of kea at Cupola Basin and Mt Robert between 1964 and 1966 involved the capture and banding of 35 birds. A resident density of one adult bird/sq. mile was found and seasonal movements were described (see p. 26). Juveniles dispersed in spring moving out of their family ranges. Observations on feeding showed many plants and grasshoppers to be taken and the kea was considered an important disperser for subalpine plants.

A3.1.5 Seasonal and Altitudinal Distribution of Birds (DSIR Ecology Division, Nelson)
A major ecological study was carried out along a transect from the shore of Lake Rotoroa to the summit of Mt Misery from 1974 to 1984 by scientific staff of DSIR Ecology Division. Five-minute bird counts were made along the transect four times a year and the results (currently being prepared for publication) are summarised in Section 3.2 (species summaries) and Section 3.6. Small mammal trapping was also carried out (Appendix 4), beech tree seeding was measured, weather data collected (Tilley 1984), possums studied (Clout and Gaze 1984) and the effect of possums on mistletoes was recorded (Wilson 1984).

A3.1.6 Habitat Use and Movements of Pigeons (Clout *et al.* 1986)
This study was based in the forest around Lake Rotoroa where the pigeons were counted on a transect and plant phenology recorded. Birds were most often seen there from June to September

when feeding was concentrated on kowhai. Two birds were caught and fitted with radio-transmitters and both left the study area in Sept/Oct moving to higher altitude forest where at least one established a nest. Whether breeding at altitude is common for pigeons is the subject of research in other areas in the region.

A3.1.7 Ecology of Kaka (Wilson 1985)
A study of kaka on Mt Misery in 1984/85 examined the seasonal movements, habitat requirements, home ranges and activity budgets of these birds using radio-telemetry. Recently the study has shifted to Big Bush where the importance of honeydew as a seasonal food source is being examined and large-scale movements of birds to the Park and other areas have been recorded.

A3.2 Present Research

A3.2.1 Population Dynamics of Robins – J.R. Hay, Department of Conservation
The breeding and mortality of robins is being studied on Mt Misery through the monitoring of a sample of banded birds. The work focuses on the impacts of predators on robins in relation to the beech-seeding cycle.

A3.3 Future Research

A3.3.1 Importance of Lowland Forest
The studies of pigeons and kaka (A3.1.6, A3.1.7) show that forests at different altitudes are important to these species at different times of year. Five-minute counts carried out in Big Bush forest (Millar and Butler, in prep.) have shown that tui also undergo seasonal movements and they could represent the next priority for a radio-telemetry study in the area to examine this in detail.

A3.3.2 Species of Limited Distribution
Blue duck and yellow-crowned parakeet are examples of species with limited distributions within the Park and with possibly declining populations. The former needs to be accurately censused to allow monitoring of numbers, and its breeding success and dispersal could be studied if sufficient pairs are available. Parakeet breeding biology could be studied in lowland areas where they are still relatively plentiful, e.g. Lake Rotoroa, Matakitaki Valley. These two species are probably long-lived birds and it is important to know whether they are reproducing successfully and sustaining their populations.

APPENDIX 4: MAMMAL POPULATIONS IN THE PARK

The arrival of the introduced mammal species in the Park was mentioned in the introduction and this appendix outlines their present status.

A4.1 Herbivores

A4.1.1 Red Deer (*Cervus elaphus*)
Red deer numbers in the Park now seem relatively stable after peak populations in the 1930s were high enough to cause overbrowsing of food plants and lead to a population decline. About 200 are taken annually by hunters. Hayward (1977) found a very low density of 273 hectares/deer in a survey of the Travers, Upper East and West Sabine and Hamilton and Begley Valleys. Most animals were concentrated in lower altitude red beech forest adjacent to flats and in the timberline forest adjacent to subalpine grassland.

A4.1.2 Chamois (*Rupricapra rupicapra*)
A small population is present throughout the mountain areas of the Park, apparently higher in central areas (Hopeless Creek, Sabine) than in the north-east (Speargrass to St Arnaud) (Hayward 1977). Recent helicopter capture statistics indicate the highest numbers to be in the west, Matakitaki and Glenroy, where hunting is less. About 60 were shot annually in the 1960s and this rose to nearer 150 in the early 1970s. Chamois favour bluff and scree areas where vegetation is critical to prevent erosion (Wisheart 1980) and they show an increased use of timberline areas (Hayward 1977).

A4.1.3 Cattle (*Bos bos*)
Cattle are grazed on the river flats of the Glenroy and Matkitaki Valleys but were removed from the Travers in 1976.

A4.1.4 Wild Pig (*Sus scrofa*)
A small number of pigs are lulled in the Park annually, e.g. 12 in 4 years of Ranger reports in the 1970s. Any impact they make on forests is largely confined to areas alongside river flats and stream beds. During this bird survey, pigs were seen in the Matakitaki Valley and Nardoo Creek and they also occurred occasionally around the St Arnaud/Mt Robert/Speargrass area, on the sides of Lake Rotoroa, and in the lower Sabine and D'Urville Valleys (Taylor and Flux 1965).

A4.1.5 Goat (*Capra capra*)
Goats are rare in the Park as they generally favour grassland and scrub, but they have been reported from the Glenroy and Matakitaki Valleys.

A4.1.6 Brush-tailed Possum (*Trichosurus vulpecula*)
Possums are now spread throughout the Park at all altitudes in the forest but numbers are relatively low (Hayward 1977). Densities of about one per two hectares of beech forest at Mt Misery are low compared to other sites: cf. densities (measured by similar technique) of 7.0 – 10.7/ha in broadleaf/podocarp forest, 1.0 – 3.0/ha in pine forest, and 0.5 – 1.2/ha in farmland (Batchelor and Cowan 1988).

Damage to broad-leaved species has been severe, with defoliation of lancewood, broadleaf and fuchsia frequently recorded, and a major impact on mistletoes has been documented on Mt Misery (Wilson 1984).

A4.1.7 Hare (*Lepus europaeus*)
Hares occur in the Park in two discrete populations, one on the river flats and one in alpine grassland above timberline (Hayward 1977). Flux (1967) found a densitiy of 8 hares in 125 hectares of north-facing slopes in Cupola Basin. Hares will eat beech seedlings at bush edges and may do as much damage as deer in such areas (Sowman 1981).

A4.1.8 Rabbit (*Oryctolagus cuniculus*)
Rabbits are now found only on the edges of the Park. The population once living on the Travers flats have died out since grazing of the area by cattle ceased.

A4.2 Rodents and Carnivores

A4.2.1 Rat (*Rattus* spp.)
The ship rat (*Rattus rattus*) is apparently the only rat species now found in the Park. Trapping on Mt Misery between May 1974 and February 1984 caught an average of 0.66/100 trap nights (t.n.) with the highest number, 2.99/100 t.n., trapped in November 1982 (DSIR Ecology Division, Nelson, pers. comm.).

A4.2.2 House Mouse (*Mus musculus*)
Mice are present in the forests and grasslands of the Park. On Mt Misery an average of 3.2 mice were caught per 100 trap nights (t.n.) during the trapping study there, the highest summer peak being 15.02/100 t.n. in February 1975 (DSIR Ecology Division, pers. comm.).

A4.2.3 Cat (*Felis felis*)
Cats were seen on the edge of the Park during the survey but they are generally scarce within the forests.

A4.2.4 Ferret (*Mustela putorius furo*)
Ferrets never reached any numbers in the Park and are only common at the northern end of Lake Rotoiti (Taylor and Flux 1965).

A4.2.5 Weasel (*Mustela nivalis*)
Weasels have not been recorded in the park recently though they were common in the Nelson province in earlier years (Taylor and Flux 1965).

A4.2.6 Stoat (*Mustela erminea*)
Stoats occur throughout the park, their populations fluctuating in response to the numbers of rats and mice which are, in turn, influenced by the availability of beech seed (King 1983). Studies carried out at 3-monthly intervals at Mt Misery from 1974 to 1984 have shown that the number of stoats caught per 100 trap-nights varied from 0 to 5.3, with an average of 1.5. Highest numbers occurred in November and February (DSIR Ecology Division, Nelson, unpublished data). The diet of stoats at Nelson Lakes was described by King and Moody (1982) from animals trapped by park staff. Birds made up 23.8% of the diet (by weight), about the average for all National Parks in New Zealand and they were most frequent in summer samples and least in autumn ones.

INDEX OF COMMON NAMES OF BIRDS RECORDED IN NELSON LAKES NATIONAL PARK