INVESTIGATION NO: S5030/117
CORPORATE OBJECTIVE: 1.3

INVESTIGATION TITLE: Population dynamics and breeding biology of the known-aged population of red-billed gulls, Kaikoura Peninsula.

INVESTIGATION LEADER: J A Mills

STUDY VENUE: Nelson/Marlborough Region

INVESTIGATION STATUS: Current

CLIENT: DOC

EXPECTED FINISH DATE: June 1990

INVESTIGATION SUMMARY:
Aspect of the breeding biology and population dynamics of the red-billed gull have been studied annually at the Kaikoura Peninsula since 1964. The overall aim of the study has been to examine how a population regulates its numbers. Presently five generations of colour-marked gulls are being followed, and the population is one of the best marked and intensively studied in the world. Over the 25 years 100,000 recovery records from 30,000 individuals have been collected and entered on computer.

OBJECTIVES:
The aim of the, initiated in 1964, has been to examine factors which regulate population size and structure. The population at Kaikoura has been banded annually since 1958 and because many individuals are of know age and known parentage, a unique opportunity has been available to study factors which control populations. Factors under investigation include:

1. The role inheritance plays in aspects of the breeding biology.

2. The lifetime reproductive rates of individual birds. Lifetime reproductive rates provide the best measure of fitness. "Biological fitness" is of great theoretical importance for species management.

3. The age of first breeding, the effect of age on breeding success and the proportion of the population which breeds.

4. Factors affecting survivorship of adults.

METHODS:
Banding of nestling red-billed gulls at Kaikoura has been undertaken annually for 30 years (1958-1987) and more than 90,000 have been marked. Study birds have been colour-marked for identification and up until 1986, 3304 adults were given individual colour combinations; an additional 859 marked with a single colour, and 245 received a large darvic band engraved with alphabetic and numerical characters. As well, since 1979, 1078 chicks have been marked with a single colour band. Each season the fate of nests of colour-marked gulls is determined.

RESULTS AND ACTIVITIES (1988):

1. The main emphasis of the field work in 1988 centred on studying the influence of inheritance on morphology and aspects of the breeding biology.

2. During the summer a BSc honours student from Victoria University joined the red-billed gull research programme and was supervised in a study of the use gulls made of artificial feeding sites such as dumps and outfalls from fish processing works. The results of this study indicate that predominantly large males feed at these sites.

INTERIM RESULTS TO DATE:

1. Preliminary analysis has shown that breeding success is not inherited. Laying date and frequency of breeding, which are important factors determining how successful a bird will be as a breeder, are also traits not strongly inherited.

2. An analysis of the lifetime reproductive rates of individuals indicates that there is considerable variation between individuals in the total number of young they fledge.

3. Of those birds which attempted to breed, 36% of the males and 39% of the females fledged no young in their lives. Overall, 20% of the males produced 58% of the fledged young and 15% of the females produced 52%. Thus relatively few individuals maintained the population from one generation to the next. Only 17% of the males and 24% of the females produced young which subsequently bred.

4. Young from parents which fledged just one bird during their lifetime had a similar chance of being recruited into the breeding population as those from parents which fledged as many as nine. However, parents which produced a large number of fledged young tended by weight of numbers, to have more progeny recruited into the next breeding generation.

5. Those individuals that lived longest tended to recruit more young into the breeding population. Similarly, the more seasons a bird bred, the greater the number of young fledged. However, some birds which lived 12 to 15 years never fledged any young.

6. Heavier females hatched more eggs than lighter individuals. Although heavier females did not live longer than lighter individuals they tended to breed more frequently and to have more partners. There was a trend for heavier females to fledge more young than lighter females.

7. Heavier males fledged a greater number of young than lighter males (Fig.1)

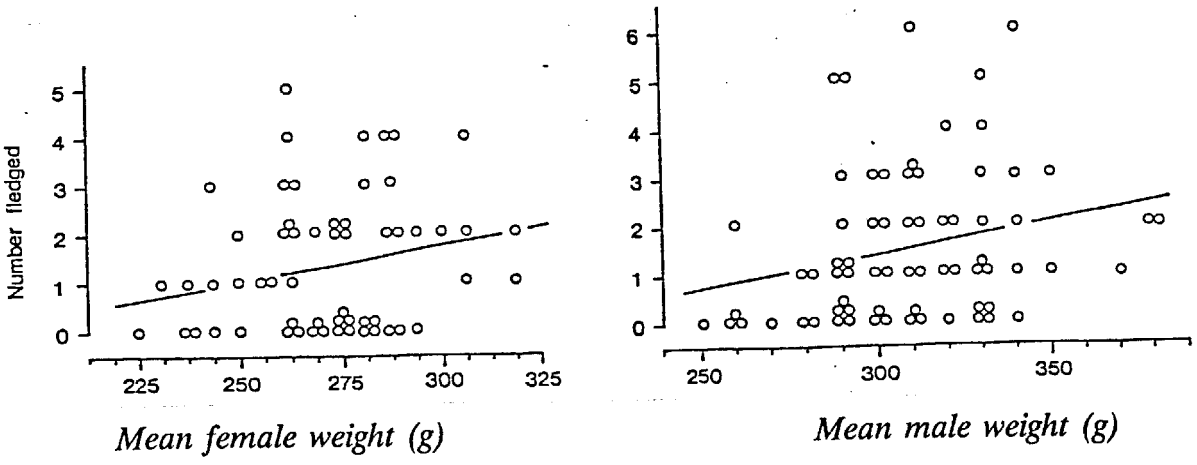

Figure 1: Lifetime productivity to fledging of female and male red-billed gulls in relation to body weight.

8. The red-billed gull has an extremely long egg-laying period, from late September to the end of December. Those birds that consistently bred early in the season produced the most surviving young (Fig.2).

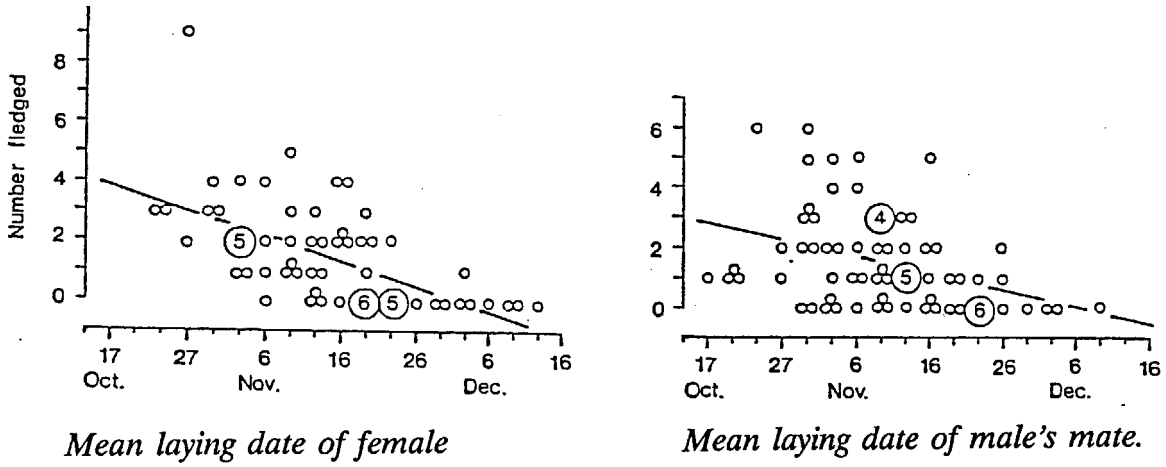

Figure 2: Lifetime fledging success of females and males in relation to laying dates.

CONCLUSIONS TO DATE:

Management implications

The widely held belief that most individuals of viable populations produce enough young to replace themselves is not true. Only a few individuals produce the majority of young which survive to breed in the next generation. Therefore not all individuals in the population are worthy of the same conservation effort. **This is very much at variance with current management practices.** The same conclusions have been reached from a long-term study of blue ducks.

The findings from this project have implications for current takahe management. It is essential when gathering clutches from the field for artificial rearing, that the most productive individuals are left with at least one egg. The removal of complete clutches may well prove counter- productive because replacement nests are likely to be less successful.

2. This project has emphasised the importance of long-term studies in gaining fundamental information on how populations are maintained and regulated.

COMMENTS:

Significance of study

The red-billed gull population at Kaikoura is currently one of the best marked and intensively studied populations in the world. Annual banding since 1958 has resulted in a marked population ranging up to 28 years of age. In 1967 colour- marking of breeding pairs was commenced and the nesting success of these individuals and some of their progeny have been followed. Presently there are five generations being studied. In no other research project has the opportunity arisen to study the role of inheritance to the extent is now possible in the red-billed gull population at Kaikoura.

A collaborative research programme on geneflow between populations, and on the role of inheritance in the determination of body size is being undertaken with Dr Allan Baker of Royal Ontario Museum, Toronto, Canada.

Findings from the gull study have important implications for management of animal populations. The study is at an important stage because information on the role of inheritance is now able to be collected. Such information is fundamental to evolutionary theory and to an understanding of how populations can be efficiently managed.

INVESTIGATION NO: S5020/118
CORPORATE OBJECTIVE: 3.3

INVESTIGATION TITLE: The breeding biology, population dynamics, diet, habitat requirements and movement of takahe in the Murchison Mountains, Fiordland National Park.

INVESTIGATION LEADER: J A Mills

STUDY VENUE: Takitimu/Southern

INVESTIGATION STATUS: Current

CLIENT: DOC

EXPECTED FINISH DATE: July 1991

INVESTIGATION SUMMARY:
The study was initiated in 1972 to establish the causes of the decline in takahe *(Notomis mantelli)* numbers which occurred between 1967 and 1972, and to develop management techniques which would ensure the long-term survival of the species. The investigation was undertaken in three areas within the Murchison Mountains, Takahe Valley, Miller Peak and Eyles-Wisely.

OBJECTIVES:
1. To establish the reasons for the decline of takahe.

2. To obtain information on takahe about recruitment, from reproduction and immigration, and losses from mortality and emigration, in different parts of the bird's range.

3. To describe the diet and habitat requirements of takahe and to establish whether deer compete with takahe for the available resources.

METHODS:
The breeding biology of individual takahe was followed intensively from 1972 to 1976 and since then on a less intensive basis. The movement, territory size and dispersal of takahe were investigated over a 2 year period using radiotelemetry. The diet was investigated using field observations of food eaten and by recording feeding sign. The competitive interaction between takahe and red deer was studied from rumen samples collected from red deer, and forage availability was measured from random plot samples. Biomass studies of mid-ribbed tussock *(Chionochloa pallens)* were also undertaken to assess the impact of simulated takahe and deer grazing on the plant.

RESULTS:
1. Study of the breeding biology and population dynamics carried out between 1972 and 1976 showed that approximately 80% of birds breed annually and hatching success was about 70%. Generally, chick survival was extremely low with about 74% of the chicks hatching dying within 3 months. The population continued to decline until 1980 when only 114 birds were left. Since then the population has recovered and by 1986 there were 180 present.

2. The cause of the decline was found to be competition with introduced deer for food. Experimental manipulation of tussocks to simulate deer grazing showed that tussocks cannot tolerate being grazed in the manner used by deer. Eight years after tussocks were cut to simulate deer grazing, the plants biomass was 64% less than that of uncut tussocks. It is estimated that tussocks would take 20 years to recover from deer grazing. Between 1973 and 1976 intensified deer control, including the introduction of shooting from helicopters (Fig.1a), produced a 60% decline in deer numbers as indicated by pellet density (Fig.1c). Since 1976 there has been little evidence of deer feeding in the alpine grasslands above the treeline and from 1983, the takahe population has shown a dramatic improvement, the numbers of adult and yearling birds increasing from 114 to 181 (Fig.1d). The long lag period between the removal of intense deer pressure in the grasslands in the mid-1970's and the beginning of the recovery of the takahe population in 1983 is consistent with the slow rate of recovery of tussocks cut to simulate deer grazing.

3. The deer diet studies show that tussocks and grasses make up approximately 23% of the food ingested. Other important items include *Griselinia littoralis* (5%), *Hoheria glabrata* (5%), *Aciphylla takahea* (7%), *Anisotome haasth* (3%), *Celmisia verbascifolia* (3%) and *Ranuncuhcs lyalli* (2%).

4. Takahe were found to be extremely selective feeders choosing individual plants and parts of the plant that contain the highest nutrient content.

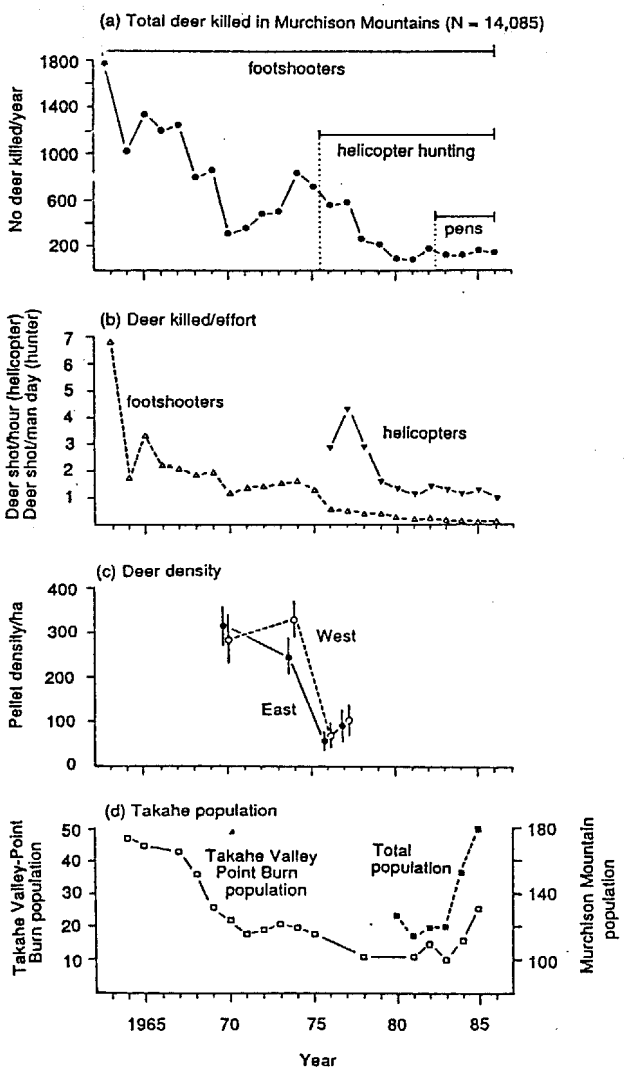

Figure 1

(a) The number of red deer killed in the Murchison Mountains (650 km^2 area). Three techniques have been used, foot hunting, shooting from helicopters, and deer capture pens. Between 1962 and 1985 14,085 deer have been killed or removed.

(b) The number of red deer killed per man day --- ---, the number of red deer shot from helicopters per hour

(c) Deer density as expressed by number of deer pellets/hectare * 95% confidence interval (data redrawn from Parkes et al. 1978). Western section of Murchison Mountains ---- Eastern section of Murchison Mountains

(d) The takahe population in the Takahe Valley-Point Burn study area - -, total takahe population in the Murchison Mountains

5. Radiotelemetry studies revealed that takahe preferred to remain in the alpine grasslands for as long as possible. When snow conditions prevented feeding in the grasslands, the birds moved into the adjacent beech forest. Takahe in some areas were able to remain in the alpine grasslands even in the presence of heavy snow conditions. Those which were able to remain in alpine grasslands were judged to be in better habitat and subsequently had higher breeding success during summer.

CONCLUSIONS:

For takahe to survive in Fiordland, intensive deer control has to be maintained. Any reduction in deer control will result in increased pressure on sensitive plant species critical for takahe survival.

RECOMMENDATIONS:

The results of the research programme have been translated into management proposals. These proposals recommended three procedures -

1. That management efforts be directed to maintaining the viability of the wild population. his involved (a) maintaining deer control, (b) manipulating clutches to ensure that as many takahe as possible are incubating fertile eggs, (c) removing one egg per clutch from up to 15 pairs for artificial rearing at a captive rearing facility near Te Anau (Burwood Bush), and (d) extending the range of takahe into other parts of Fiordland where extensive takahe habitat exists (Glaisnock-Edith area of Stuart Mountains).

2. Establish a captive rearing facility at Burwood Bush to rear stock for release back into the wild and for the establishment of alternative populations on predator-free islands (Maud Island).

3. Establish population on pasture grass on a predator-free island (Maud Island).

PUBLICATIONS:

Lee, W.G.; Mills, J.A.; Lavers, R. B. 1988: Effect of artificial defoliation of mid-ribbed snow tussock, *Chionochloa pallens,* in the Murchison Mountains, Fiordland, New Zealand. *New Zealand Journal of Botany 26*:511-523

Mills, J.A.; Mark, A.F. 1977: Food preferences of takahe in Fiordland National Park, New Zealand, and the effect of competition from introduced red deer. *Journal of Animal Ecology 46*:939-958

Mills, J.A.; Lavers, R.B.; Lee,W. G. 1984: The takahe - a relict of the Pleistocene grassland avifauna of New Zealand. *New Zealand Journal of Ecology 7*.57-70

Mills, J.A.; Lee, W.G.; Lavers, R.B. (in press): Experimental investigations of the effects of takahe and deer grazing on *Chionochloa pallens* grassland, Fiordland, New Zealand. *Journal of Applied Ecology*.

Mills, J.A.; Lee, W.G.; Mark, A.F; Lavers, R.B. 1980: Winter use of takahe *(Notornis mantelli)* of the summer-green fern *(Hypolepis millefolium)* in relation to its annual cycle of carbohydrates and minerals. *New Zealand Journal of Ecology 3:* 131-137.

INVESTIGATION NO: S5020/116
CORPORATE OBJECTIVE NO: 3.3

TITLE: The population dynamics, breeding biology, diet, habitat requirements and movement of kakapo.

INVESTIGATION LEADER: R.G. Powlesland

ASSOCIATED RESEARCHERS: B.D. Lloyd, S. Triggs (S&R) & C. Daugherty (Victoria University) - genetics of kakapo. D. Body (Biotechnology Division, DSIR) - lipid analyses of a clutch of infertile kakapo eggs. R.J. Moorhouse (Auckland University) - M.Sc. study of Little Barrier Island kakapo population

STUDY VENUE: Southern, Northern Regions

CLIENT: DOC

INVESTIGATION STATUS: Current

EXPECTED FINISH DATE: March 1992

INVESTIGATION SUMMARY:
The mortality, breeding behaviour, diet, habitat preferences, movements and genetics of kakapo on Stewart Island were investigated. In addition, the accuracy of remote radio-tracking equipment was determined and a quantitative assessment made of the vegetation types in the study area. Field work was completed in early 1988. The booming behaviour of male kakapo transferred to Little Barrier Island in 1982, and to Codfish Island in 1987-89, was monitored. On Codfish Island the phenology of some kakapo food plants was assessed.

OBJECTIVES:
1. To collect information on the mortality, breeding behaviour, diet, habitat preferences and movements of kakapo on Stewart Island, with emphasis on information that might be helpful in making decisions for the conservation of the species.

2. To determine if the kakapo breed successfully on Little Barrier and Codfish Islands.

METHODS:
1. Stewart Island - no fieldwork undertaken by Science & Research staff during the past 12 months.

2. Little Barrier Island - The use of track-and-bowl systems by kakapo in January-February 1989 was determined from sign at the systems and by listening for kakapo calls.

3. Codfish Island - In January 1989 the phenology of 132 tagged plants was noted and at night kakapo calls were listened for from prominent landforms.

RESULTS AND ACTIVITIES (1988)

Stewart Island

Management staff and wage workers, using trained dogs, visited all known track-and-bowl systems and much of the surrounding areas in January 1989 in search of kakapo. Nine

males were found, of which only one was known previously, and all were transferred to Codfish Island. No females were captured, but sign of at least three additional kakapo was seen.

Little Barrier Island

Of the 45 known track-and-bowl systems, 22 had been visited by kakapo up to the end of February. Only 10 systems were used frequently, and none showed signs of having been visited nightly for longer than a week. Only two nights were spent listening for kakapo calls in January because of inclement weather, but listening conditions in February were often very good. Some booming and much skrarking was heard. By mid-February about seven males were active at track-and-bowl systems on any one night. At the start of the February trip (15th) several down and a few contour feathers were found at least five systems. The numbers of feathers at any one system ranged up to 16. Whether they were dislodged as the result of matings, fights or moult is unknown.

Codfish Island

Kakapo calls were monitored from 11 January until 8 March. In mid-February one bird was heard skrarking persistently. Then on 4 March a bird was heard booming and at least another three gave skrarks. This represents the first occasion that booming has been heard on Codfish Island.

Several shrub species bore good amounts of flowers or fruit, particularly those in coastal sites sheltered from southerly winds. Of the emergent and canopy species, rata flowered profusely, miro bore good quantities of fruit. Consequently, in some habitats food should have been readily available to kakapo.

During January the transfer of nine males from southern Stewart Island brought the total number of kakapo on Codfish Island to 25 (20 males and five females).

RESULTS TO DATE:

Stewart Island

Since 1981, 46 kakapo (14 females and 32 males) have been transferred from Stewart Island to Little Barrier and Codfish Islands. Evidence from the January 1989 searches suggest that only a few birds remain on Stewart Island.

The species' cryptic plumage and habit of remaining motionless when approached to avoid detection are not effective against mammalian predators hunting by scent. Cat predation of radio-tagged adult kakapo in 1982 reached 56% per annum. This predation, the infrequent breeding and the low productivity of kakapo has resulted in the Stewart Island population declining.

The food of the Stewart Island population includes several parts of plants from, a wide variety of species. However, a few species form the bulk of the diet: rhizomes of *Lycopodium ramulosum* and *Blechnum* spp., leaves of *Dracophyllum longifolium, Gahnia procera, Leptospermum scoparium* and *Olearia colensio,* and fruit of *Cyathodes juniperina.* Nutrient analyses of these foods shows them to have very low concentrations of nitrogen, which is a reflection of the nitrogen-deficient peaty soils of southern Stewart Island. Nitrogen content provides a crude index of protein content and protein is an important component of a bird's diet during egg formation and nestling growth. When kakapo bred in 1981 and 1985, fruit was readily available on rimu or pink pine - species that had produced

little or no fruit in intervening years. These fruit were found to contain about twice as much nitrogen as the common foods in the kakapo's diet. Thus, kakapo may breed only when relatively protein-rich foods are readily available.

Males call at traditional sites called track-and-bowl systems to attract females to mate with. The call most frequently given by males at their systems is the "boom", but "skrarks" and "chings" are also produced. In a breeding year, males boom intensively for 12 or more weeks, while in non-breeding years males may not boom at all, or spend only a few weeks booming.

Mating apparently occurs in January-February, after which the female returns to her home range to nest. The nest is typically a ready-made hole, either in the ground or at the base of a tree. Three clutches found in 1985 were of two, three and four eggs. Hatching occurs about 25 days after egg-laying. The young leave the nest when about 10 weeks old, but remain near to it for a further fortnight.

Little Barrier Island

Twenty-two (13 males and 9 females) were transferred to this island in 1982. One male was found dead in 1983. In the winter of 1986 a census was carried out which established that at least 16 kakapo (8 males, 6 females and 2 of unknown sex) survived.

The males on Little Barrier have boomed at the same time of year as those on Stewart Island: December-April. Although booming was first heard on Little Barrier in 1984, concerted booming has occurred only in 1986 and 1988. Initially, the track-and-bowl systems were widespread on the ridge tops above 400 m a.s.l. However, in the last three seasons the outlying systems have been abandoned. The frequently used systems are concentrated mainly along the central ring-ridge of the island. In the 1985, 1986, 1988 and 1989 summers an estimated eight males have simultaneously occupied track-and-bowl systems. Thus far there is no evidence that any female has nested, though it is unlikely that unsuccessful nesting would have been detected. No young were found during the 1986 census.

Codfish Island

The first kakapo were moved to Codfish Island in July 1987. To date, 20 males and five females have been transferred. It is difficult to assess the success of the transfers because none of the kakapo were radio-tagged. Fresh feeding sign has been found in several parts of the island indicating that some of the kakapo have survived.

Kakapo first called on Codfish Island in summer 1989. However, because the birds started calling late in the season (4 March) a few gave calls, it is very unlikely that breeding has occurred.

CONCLUSIONS TO DATE:

Stewart Island

Kakapo eggs, chicks and adults are vulnerable to predation by introduced mammalian predators. This is particularly so of the eggs and defenceless chicks because they are left unprotected in ground-level nests for a few hours each night. Between 1978 and 1988, Stewart Island kakapo bred only in 1981 and 1985. Breeding years were characterised by unusually plentiful supplies of fruit. It is therefore likely that kakapo are prevented from breeding in most years by inadequate nutrition.

Little Barrier Island
This island provides kakapo with sufficient food and shelter for their individual maintenance. However, after nearly seven years there is no evidence of successful breeding and so the island may not be entirely suitable for the species.

Codfish Island
Since birds were last released on to the island in January 1989, it is too soon to determine the success of the transfers.

COMMENTS:

1. **The location and transfer of any remaining Stewart Island kakapo to Codfish Island**

   Apparently, only a few kakapo remain on Stewart Island. Extensive searches need to be made as soon as possible to find these birds so that they can be moved from the threat of predation by cats. Searches should be carried out in winter and/or spring because kakapo feeding sign is more readily found at these times.

2. **The monitoring of kakapo populations on Little Barrier and Codfish Islands**

   Since none of the kakapo on these islands are radio-tagged, monitoring of male booming is required each summer to provide an indication of whether or not breeding is occurring. Information on the duration and intensity of a booming season will provide a guide as to whether or not mating has occurred Ultimately, however, it is essential to know if young birds have been recruited into the population. Since all kakapo released on Little Barrier and Codfish Islands were banded. As well as enabling us to assess kakapo breeding success, the results of such censuses will provide an indication of adult survival and condition.

3. **Supplementary feeding of kakapo on Little Barrier Island.**

   There are only 40 known kakapo, of which just 11 are females. It is thus urgent that the species be encouraged to breed frequently and successfully. If no young are found on the island during this year's proposed census, supplementary feeding of the population should be commenced. Such a procedure should determine if an improved diet, both in quality and quantity, will promote and sustain breeding.

PUBLICATIONS AND PAPERS IN PREPARATION RELATING TO KAKAPO RESEARCH

1. Triggs, S.J.; Powlesland, R.G. & Daugherty, C.H. in press. Genetic variation and conservation of kakapo *(Strigops habroptilus:* Psittaciformes). Conservation Biology.

2. Powlesland, R.G.; Lloyd, B.D.; Best, H.A. & Merton, D.V. Breeding biology of the kakapo *Strigops habroptilus* on Stewart Island, New Zealand. Second draft almost complete.

3. Body, D.R. & Powlesland, R.G. Lipid composition of a clutch of kakapo *(Strigops habroptilus)* (Aves: Cacatuidae) egg.
   The manuscript is being internally reviewed.

4. Powlesland, R.G. Recovery plan for kakapo, 1989-1993. Department of Conservation.

5. Lloyd, B.D. & Powlesland, R.G. The conservation of kakapo *(Strigops habroptilus)* in New Zealand. (In prep).

6. Moorhouse, R.J. & Powlesland, R.G. Aspects of the ecology of kakapo *(Strigops habroptilus)* liberated on Little Barrier Island (Hauturu): a biological refugee in a new environment. Final revision in process prior to submission for publication.

INVESTIGATION NO: S5030/132
CORPORATE OBJECTIVE NO: 3.3

INVESTIGATION TITLE: Translocation of Black Petrels from Great Barrier to Little Barrier Island.

INVESTIGATION VENUE: Northern Region, Great Barrier and Hauraki Districts

INVESTIGATION LEADER: M J Imber

ASSOCIATED RESEARCHERS: I McFadden, P Scofield (Auckland University, MSc)

INVESTIGATION STATUS: Current

CLIENT: DOC

EXPECTED FINISH DATE: 1990 (translocations); 1996 (assessment)

SUMMARY:
Petrel populations have often declined or become extinct through predation and loss of breeding habitat. This study is a trial to boost a population of Black Petrels severely diminished by predation in the past (Little Barrier Island) by transferring fledglings from a flourishing colony (Great Barrier Island). By translocating fledglings about 5 to 20 days from departure they may become imprinted on the recipient island and eventually breed there. Translocations began in 1986 and are intended to be done over 5 years. Assessment, by comparing proportions of native and transferred birds returning to breed on Little Barrier Island, begins in 1991.

OBJECTIVES:
1. To transfer fledglings from one island to another and thereby establish and improve techniques for such an operation, including:
   - selection of birds for transfer
   - handling
   - method of transfer
   - receptor burrows (artificial vs. natural)
   - supplementary feeding.

2. To assess the effectiveness of the operation by subsequently finding out what proportion of the transferred birds returns to breed in the receptor colony, compared to the proportion of native birds returning.

METHODS:
Fledglings from Great Barrier Island are selected by 4-6 staff over about 3 days before transfer. They are fully-fledged (down free), or nearly so, and weigh at least 800g, but preferably over 1 kg, on the day of transfer. They are, as far as can be determined visually, free of disease or abnormality. All are banded, including those rejected. Only fledglings that can be caught through burrow mouths are available; donor burrows are not disturbed by digging.

Simultaneously, 2 staff on Little Barrier Island select receptor burrows. These are burrows that are vacant due to failed breeding or non-breeding of the owning pair, due to the fledgling having already gone, or to the burrow being in disuse as a result of past predation.

Some are niches and recesses, not obviously used by Black Petrels but similar to some nest sites on Great Barrier Island. These, and disused burrows, are cleaned out and dry leaves are put in to make a nest.

On Little Barrier Island all fledglings found are banded if they are caught. It is the relative rate of return to Little Barrier of these compared to that of the transferred birds that will determine the trial's level of success.

The day before transfer all fledglings to be transferred are put individually in pet carrying boxes and assembled at Kaiarara Hut. Transfer is by helicopter (the Bell Jet Ranger can take about 60 pet boxes inside in one load). From Little Barrier Island base a crate on a long "strop", packed with the pet boxes, is carried by the helicopter to the summit ridge (where there is no landing pad). While 2 staff unload the boxes, the helicopter returns with 3 more staff who jump off to help with releasing the birds. The helicopter departs with the empty crate.

All birds are placed in receptor burrows within 5 hours of transfer. Those requiring to be fed are put in easily accessible nests. They are fed within two days and then at 3-day intervals, with a maximum of four feeds each. Food comprises whole squid, kept deep frozen at base till needed; cut into 1 cm wide strips. Birds are given as much as they will take.

RESULTS (1988):
The number of birds available for transfer was less than in previous years because M J Imber had a prior commitment at the optimum time. Forty birds were successfully transferred on 15 May. Six birds were supplementarily fed three times each, but a seventh bird due for feeding moved from its burrow and was not rediscovered.

The mean weight on transfer was 9988, range 800-12908. There were no known losses or deaths during transfer or subsequently on Little Barrier Island.

RESULTS TO DATE:
This is the third transfer (Table 1). One hundred and forty six (146) birds have now been translocated. There have been no known losses or deaths, other than the 4 birds lost out of the crate in 1987. Most translocated birds accept the burrow to which they are moved. There is concern only where such a bird needs subsequent feeding, and thorough searches usually retrieve it. About 1 bird each year has not been recovered for feeding and may have departed underweight.

TABLE 1: The third transfer.

YEAR	DATE	NO. TRANSFERRED	MEAN WEIGHT(g)
1986	10 May	46	942
1987	4 May	60	918
1988	15 May	40	998

CONCLUSIONS TO DATE:
The inter-island transfer should always be done inside the helicopter. Otherwise the methods used in this operation seem perfectly satisfactory.

COMMENT:
I recommend that two more transfers be done (1989 and 1990) to complete the 5 originally planned. Assessment should begin in early 1991 as intended.