# MONITORING HUTTON'S SHEARWATER 1986-1989

By GREG SHERLEY

ABSTRACT

The distribution of Hutton's Shearwater (*Puffinus huttoni*) in the Kaikoura ranges is restricted to the upper Kowhai River and Shearwater Stream catchments. Survey quadrats were established and colony boundaries mapped as baseline data for monitoring. The breeding population was estimated to be at most 134 400 pairs, less an unknown number of non-breeding pairs and unmated birds. Productivity in used burrows in the Kowhai River and Shearwater Stream catchments was estimated at 31% and 16% respectively. Numbers have declined since the 1880s. The species fits the IUCN category of 'vulnerable'.

## INTRODUCTION

Hutton's Shearwater (*Puffinus huttoni*) is known to breed only in the upper Kowhai River and Shearwater Stream catchments in the Seaward Kaikoura Range near the north-eastern coast of the South Island, New Zealand (Figure 1). Previous work includes studies on its (1) breeding and distribution (Harrow 1965, 1976; Sherley, unpub. Department of Conservation file reports), (2) effect on erosion in the Seaward Kaikoura Range (Evans 1973), (3) similarity to the Fluttering Shearwater (*P. gavia*) and Sooty Shearwater (*P. griseus*) (Wragg 1987), (4) migration (Warham 1981), and (5) food and measurements (Tarburton 1981, West 1985). What little is known of Hutton's Shearwater is summarised in Marchant & Higgins (1990).

My objectives were to record and map the distribution of burrows and estimate the size and productivity of the population. These are the first results from what should be a 6-8 year monitoring study.

## METHODS

Field trips were made on 14-16 September 1986, 9-24 March 1987, 18-25 March 1988 and 7-15 February 1989. The first trip was made to attempt a banding study of adults in a colony (grid ref. NZMS1 S49, 898 086), but this attempt was abandoned because of heavy snow. The last three surveys were at the period when chicks were beginning to leave the burrows.

During the field work I checked the entire upper catchments of the Kowhai River and Shearwater Stream for burrows.

### Mapping colonies

The term "colony" is used for a discrete area of burrows, usually bounded by bare rocks, scree or bluffs. I determined the colony boundaries on foot and plotted them on aerial photographs (scale 1:6,441 Kowhai River and 1:5,000 Shearwater Stream). Colonies were categorised by the number of burrows as low, medium and high density so that quadrats could be placed as evenly as possible throughout the range of sites used for burrows. No significant differences were found in average figures between these rough categories, and so their data were pooled for calculations. The colony boundaries, quadrats and photopoints are shown in Figures 2 and 3.

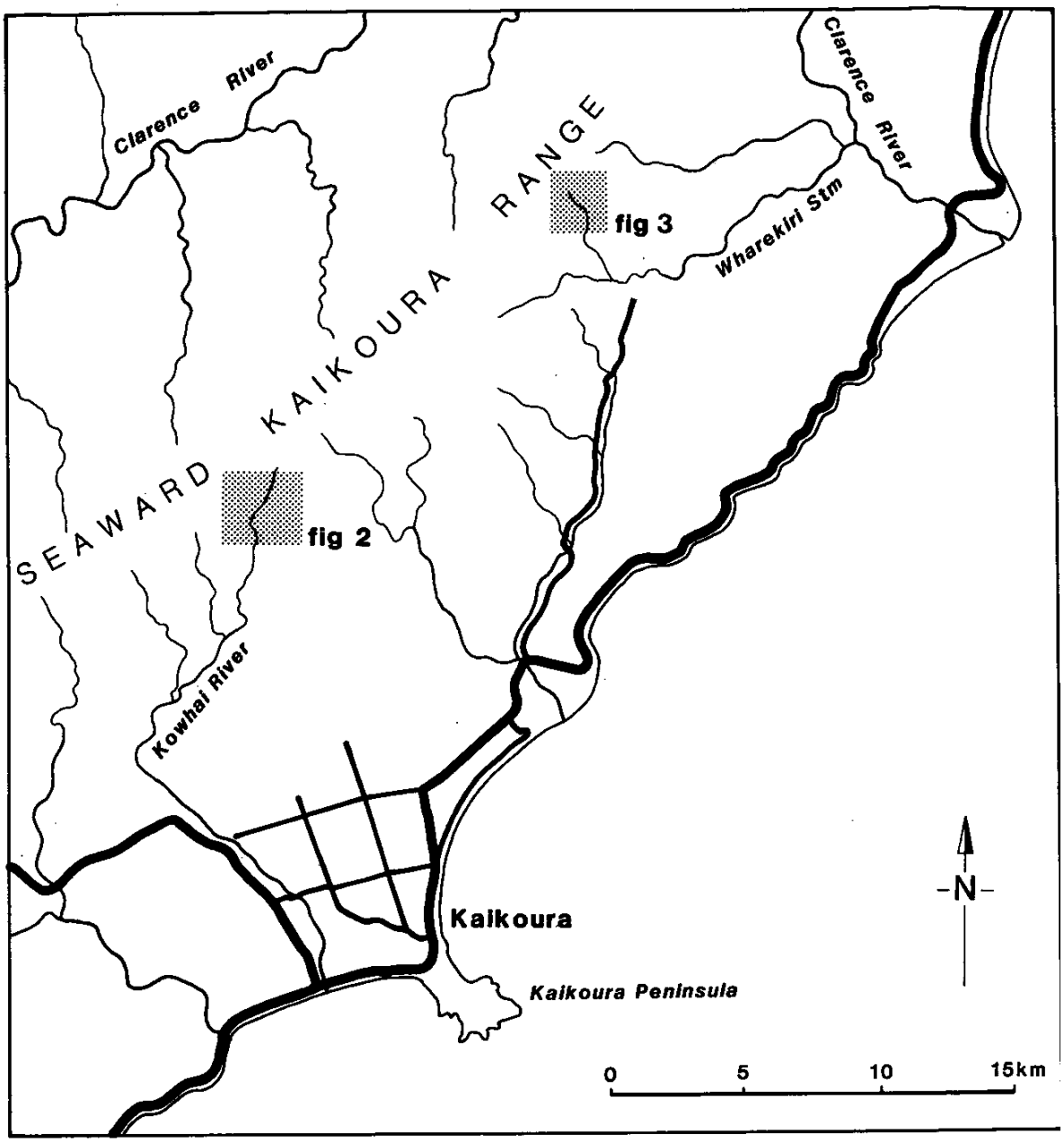


FIGURE 1 — Seaward Kaikoura Range and the location of Hutton's Shearwater colonies in Kowhai River and Shearwater Stream

## Surveying burrows

The 10 x 10 m quadrats were set up in 17 of 36 definable colonies. All but one of the substantial colonies had at least one quadrat (see Figures 2 and 3). Quadrats were established in burrow areas which were considered representative of the surrounding surveyed colonies. The vegetation and soil was qualitatively described in 15 quadrats.

Each quadrat was marked with galvanised poles with numbered aluminium tags attached. Quadrats were subdivided into four subquadrats. These subquadrats were searched systematically from the downhill end and the following variables scored.

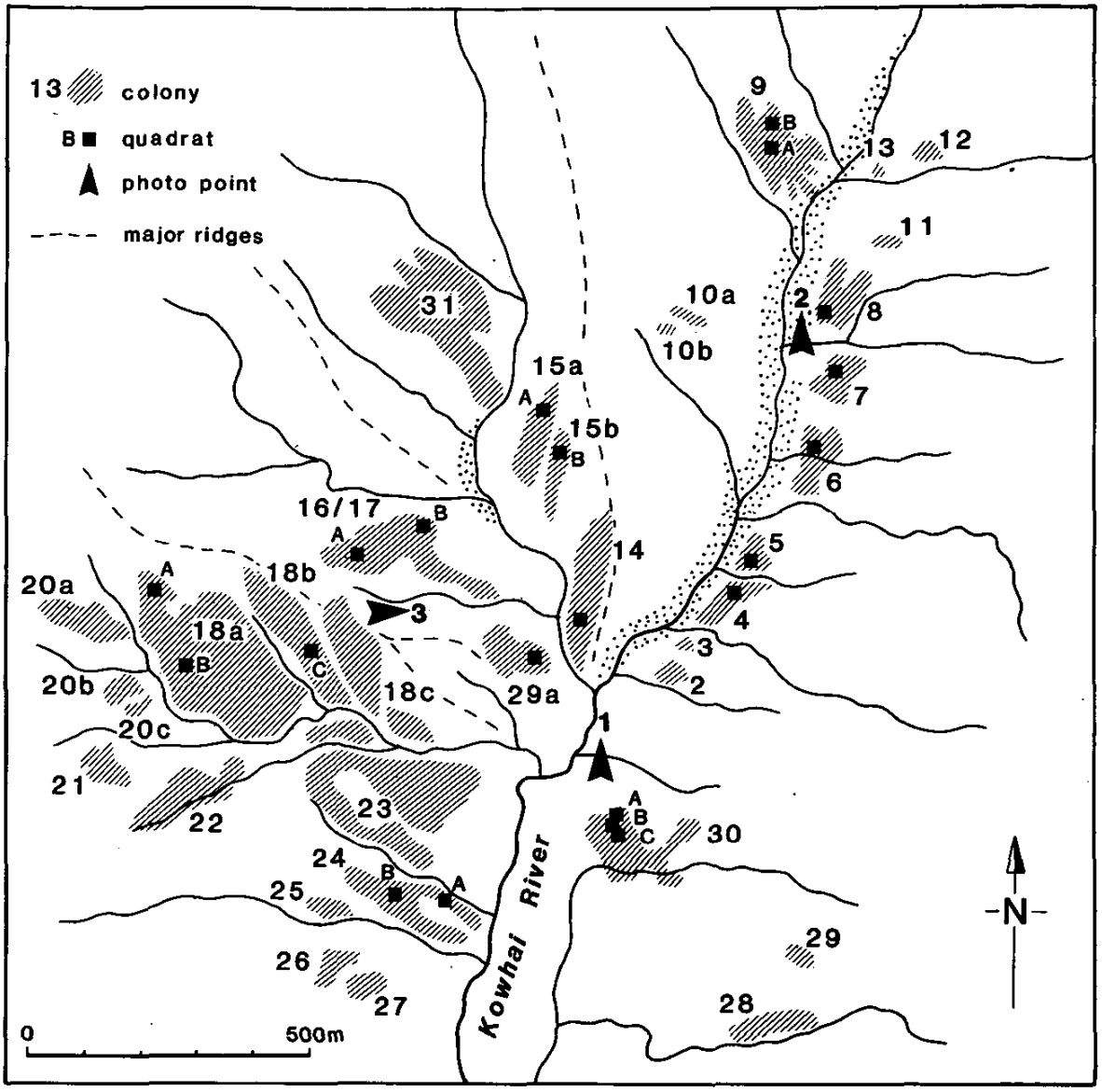


FIGURE 2 — Kowhai River colonies of Hutton's Shearwater, showing sites of survey quadrats and photopoints. Colony numbers correspond to those listed in Appendix 1 and with numbered tags used in the field. Note — No colony "19" was ever recorded.

1. *Burrow entrances*: All holes obviously dug by shearwaters were noted including multiple entrances. Corrections for multiple entrances were made later (see Table 2).
2. *Used/unused burrows*: Shearwaters typically clean out their burrows annually. The entrances of used burrows looked "swept clean", with debris removed or fresh earth apparent from recent digging. Burrows containing down and/or a chick were also noted as "used". If an entrance led to two or more nest chambers, these chambers were scored separately.
3. *Burrows with down*: We traced burrows to the nest chambers usually by pushing an arm as far as possible up the burrow. Most burrows were so long that we had to hold as an extension a 1-2 m branch of *Hoheria populnea* with the thin end frayed so that, when it was twisted around in the burrow, it would pick up loose down from the chick (if present) or the burrow wall.

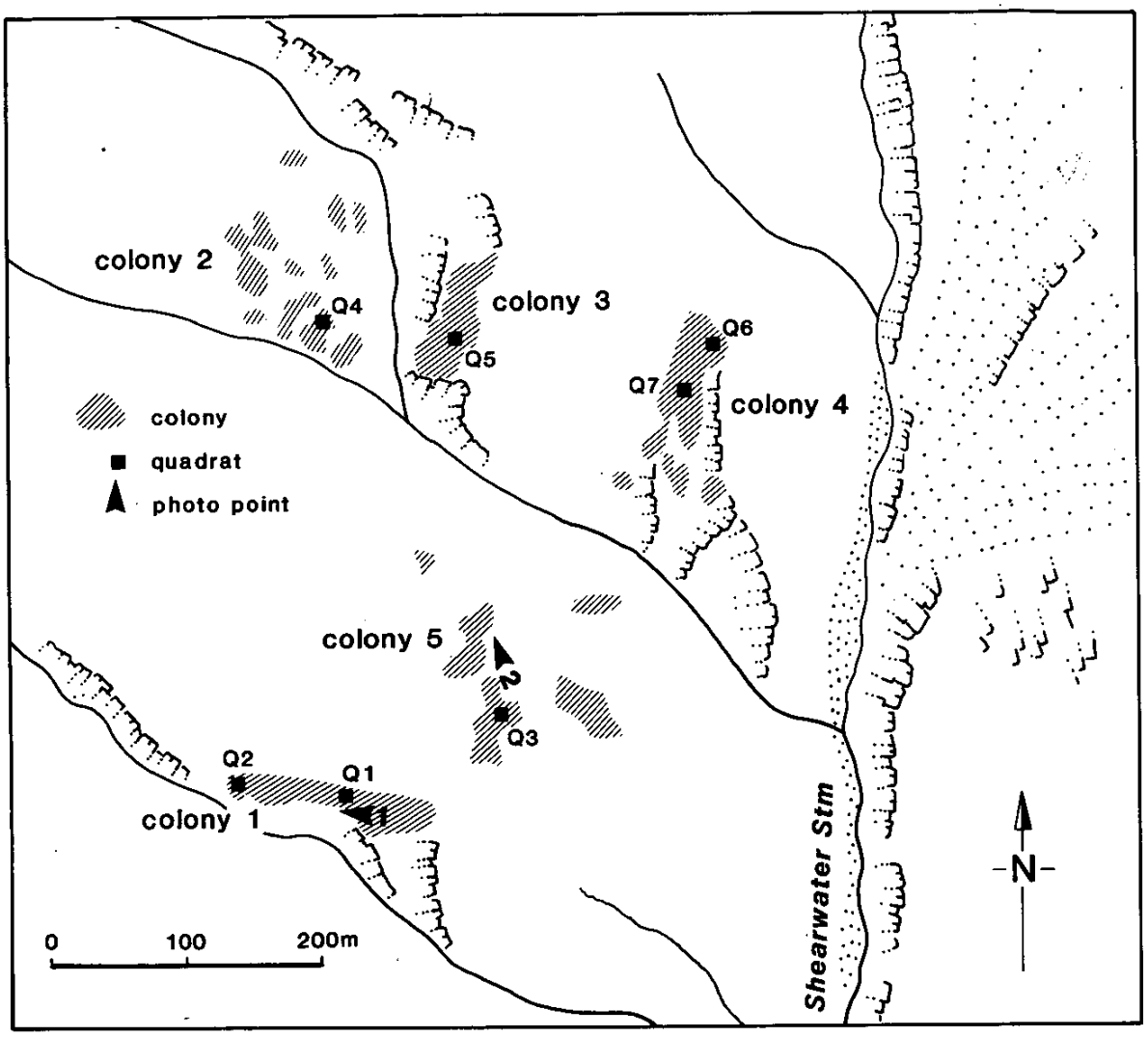


FIGURE 3 — Shearwater Stream colonies of Hutton's Shearwater, showing sites of survey quadrats and photopoints. Colony numbers correspond to those listed in Appendix 1.

4. *Burrows with chicks*: Chicks were detected by their movement, their calling, or copious amounts of down attached to the stick. Most burrows with chicks had so many fleas and mites that they were crawling over the arm drawn out of the burrow. We banded chicks only if they were easy to reach; none were dug out.

Colony areas were calculated with a Planix digital planimeter. The boundaries of the colonies were traced nine times and the average taken as the area of the colony. The total of these areas was taken as the total area of ground with burrows in the two catchments. Each colony's size was calculated by assuming that the density of burrow entrances, used burrows, etc. in the colony was the same as the density measured in quadrats within that colony. When a colony had several quadrats, the colony's size was calculated using the average density of those quadrats. When a colony had no quadrat, the figures from all 22 quadrats were used to estimate average densities of burrow entrances etc.

"Productivity" refers to the number of burrows with young or down feathers. We did not record whether the young were successfully raised. Young had already left some of the burrows by the time we inspected them. Productivity was calculated by adding the number of burrows with chicks and down observed and dividing the result by the total number of used burrows. The number of "used burrows" that were not laid in is unknown.

**Photopoints**

All photos were taken through a 50 mm lens on a SLR 35 mm camera.

***Kowhai River : Photopoint 1*** (grid ref. S49 902095) is on a short spur at the point where the tussock runs out onto rocks (see Fig. 2).

***Photopoint 2*** (grid ref. S49 897097) is beside a large boulder (c. 10 m high) which overhangs towards the centre of the valley and forms a shelter at its base (see Fig. 2).

***Photopoint 3*** (grid ref. S49 890093) is on a spur near the top of colony 18c (see Fig.2).

***Shearwater Stream : Photopoint 1*** (grid ref. S42 + 43 015198) is at the "edge" of colony 1, where Mr Harrow used to camp and study burrows. The site is on the sharp spur at the top of the scree on the true left of the colony (see Fig.3). The field of view includes the left-hand side of the colony (looking downhill) that adjoins the active scree which leads into Shearwater Valley.

***Photopoint 2*** (grid ref. S42 + 43 014200) is on the north-facing side of the next spur (upstream on same side of Shearwater Valley from the spur mentioned for photopoint 1). The photopoint is very near the top of the ridge on the only practical route from colony 1 to the upper Shearwater Stream catchment (see Fig. 3).

Large-scale aerial photographs with locations and directions to photopoints have been placed on file at the Department of Conservation's Kaikoura Field Centre.

## RESULTS

The boundaries of the various colonies are shown in Figures 2 and 3. These, boundaries were frequently where topsoil gave way to rocky areas or had been lost to erosion and was too shallow for burrowing. The average depth of soil in 11 quadrats was 35 cm (SD = 10).

In the Kowhai River catchment, 22 quadrats were surveyed in 19 colonies (Appendix 1A, Figure 2), which gave a representation of all but one of the large (> 400 $m^2$) colonies. Therefore, of the 36 "definable" colonies 53% were surveyed by quadrats. The burrow densities were highly variable (Table 1). In the Shearwater Stream catchment (Figure 3) all five colonies were sampled by at least one quadrat (Appendix 1B).

Data from quadrats were extrapolated to total estimated areas of colonies to gauge productivity of the birds in each catchment (Table 2). Productivity of shearwaters was 31% in the Kowhai River catchment (330/1078) and 16% in the Shearwater Stream catchment (37/227). In the 15 quadrats where vegetation cover was assessed, the tussock *Chionochloa pallens* was the dominant species (Table 3).

TABLE 1 — Number of burrow entrances and use of burrows by Hutton's Shearwaters in quadrats surveyed in Kowhai River catchment

| | | | | Burrows Containing | |
|---|---|---|---|---|---|
| | Burrow Entrances | Unused Burrows | Used Burrows | Chicks | Down Only |
| Mean no./quadrat | 66.0 | 6.0 | 49.0 | 4.0 | 11.0 |
| SD | 31.0 | 6.6 | 24.0 | 4.0 | 12.0 |
| n | 22 | 22 | 22 | 22 | 22 |

Note: The number of burrow entrances does not equal the sum of unused and used burrows because some burrows had multiple entrances.

TABLE 2 — Estimated numbers of burrow entrances and use of burrows by Hutton's Shearwaters in Kowhai River and Shearwater Stream catchments (except for area, all figures rounded to nearest 100)

| | | | | | Burrows Containing | |
|---|---|---|---|---|---|---|
| | Estimated Area (ha) | Burrow Entrances | Unused Burrows | Used Burrows | Chicks | Down Only |
| Kowhai River | 24.22 | 163 000 | 13 000 | 124 600 | 9 400 | 31 500 |
| Shearwater Stream | 2.65 | 13 100 | 600 | 9 800 | 450 | 900 |
| Total | 26.87 | 176 100 | 13 600 | 134 400 | 9 850 | 32 400 |

Note: The number of burrow entrances does not equal the sum of unused and used burrows because some burrows had multiple entrances.

## DISCUSSION

### The breeding population

I estimated that there were 133 400 used burrows in the Kowhai and Shearwater Stream catchments in 1988. However, these survey data cannot give a precise population total. Rather, they can best be used as a base for continued monitoring to reveal trends. Monitoring would involve counting the quadrats every 3-5 years, mapping the boundaries of the colonies again and using the photopoints again.

TABLE 3 — Number of quadrats out of 15 in the Kowhai River catchment with various percentages of vegetation cover

| | Percent coverage | | | | |
|---|---|---|---|---|---|
| | 90-100 | 70-89 | 60-69* | 20-29* | 0-9* |
| *Chionochloa pallens* | 8 | 1 | | 1 | 3 |
| *C. flavescens* | 2 | 1 | 1 | | |
| *Hoheria populnea* | 1 | | 1 | | |
| Introduced grasses | | 1 | | | 3 |
| *Ranunculus* spp. | | | | | 1 |
| *Aciphylla* spp. | | | | | 1 |
| Weed species | | | | | 1 |

* Intervening scores did not occur

I calculated that 42 250 burrows contained chicks, but this may have been an underestimate. As chicks get older they lose most of their down and often what down remains on the walls of the burrow quickly becomes matted and not obvious. However, Alison Davis (pers. comm.) reported down lasting a whole year in some burrows. The burrows in the Shearwater Stream colonies seemed longer than those in the Kowhai River catchment and it was often difficult to know whether one had reached the nest chamber.

The total number of Hutton's Shearwaters will be larger than the 134 400 used burrows (= pairs) reported in Table 2. As with most procellariiform birds (Warham 1991), an unknown number of non-breeding Hutton's Shearwaters is presumably at sea during any given breeding season, and other paired and unpaired birds are visiting the colonies.

If most of the used burrows did represent the number of pairs that *attempted* to breed (presumably one pair per nest chamber), the number of breeding Hutton's Shearwaters would be in the order of 134 400 pairs. However, non-breeding pairs and single birds prospecting for mates are likely to visit burrows during the season to clean them out. A more accurate way of assessing the number of breeding pairs would be to determine the proportion of burrows which contained an egg shortly after the laying period.

The total number of "burrow entrances" (176 000) is much larger than the number of used and unused burrows (148 000 nest chambers) because many chambers had two or more entrances. Thus, if the numbers of burrow entrances alone were used to represent the number of nest chambers, the number of nest chambers would be overestimated by about 16%. In addition, 10% of all nest chambers were unused.

**Historical evidence**

In 1967 Brian Bell (pers. comm.), of the NZ Wildlife Service, surveyed George Spur (grid ref. NZMS1 S42 + 43 014 226) and found no burrows. In the same year there was a positive report of "mutton birds" in alpine areas on Middle Hill Farm (probably between grid ref. S42 + 43 903223 and 070205).

Between 1966 and 1978, when Geoff Harrow was studying Hutton's Shearwater, he sought information from acquaintances who had worked in the Seaward and Inland Kaikoura Ranges as government deer or goat cullers and musterers. He also searched for burrows at various localities and provided me with the following historical notes.

Harrow checked Happy Valley Streams (centred on grid refs S42 + 43 005168 and 010177) and the alpine areas of Mt Stace (S49 952095) but found no sign of old or recent burrows. In 1980, he checked the headwaters of the Dee Stream catchment, including Shoestring Spur to Tapu Peak, and found burrows estimated to be 50 years old on a spur centred on grid reference S35 997435. He also reported old shearwater burrows on Little Hau (S49 893028) about 60 m above the bushline in 1965/66, in the Kowhai River-Hapuku River Saddle (S49 911064), and below Snowflake (S49 845055). In 1989, Department of Conservation staff searched the alpine areas of the following catchments: Dubious, Limestone, Gore, Palmer and Fidgett. No sign of burrows was found.

Euan Wilson, an ex-government goat culler, told Harrow that he saw shearwaters in the headwaters of the Dee Stream between 1932 and 1935, that is, in the Coverham Block of what is now Bluff Station. Wilson also checked the headwaters of the Branch Stream but discovered nothing. Other historical accounts include musterers taking shearwaters from the Jam Stream and "mutton-birds" from a ridge leading to the summit of Tapuaenuku (Marlborough Express newspaper, 27 January 1883).

Noel Boyd, a helicopter pilot based at Kaikoura, has had many years of flying experience over the Inland and Seaward Kaikoura Ranges. He can confidently recognise shearwater burrows (as I have seen him do), but reported (pers. comm.) that he had seen no "active" shearwater burrows in his flying experience over the Seaward and Inland Kaikoura Ranges, except at those active sites reported in this paper.

I believe that these accounts of Hutton's Shearwater (or a species like it) in the Seaward and Inland Kaikoura Ranges provide evidence that the size and distribution of the colonies has declined. If the historical references to burrows and shearwaters do all refer to Hutton's Shearwater, particularly when they are only casual observations and so almost certainly understate the bird's presence, one can conclude that the species has been declining since at least the 1880s. Harrow (pers. comm.) thought that the density of burrows at his two study areas (see Harrow 1965, 1976) was much lower in 1989 than in 1975, when he was last at his study site. Unfortunately, we could not find his original study quadrats to make an exact comparison.

**Likely causes of decline**

The numbers of Hutton's Shearwater may be reduced by erosion, predation, and possibly lack of food. Since the start of this study I found two entire

colonies that had slipped away. Erosion from uphill often covers burrows with alluvium. Water tends to run between the often very shallow soil and the basement rock, and flood burrows.

During the study, two stoats (*Mustela erminea*) were seen systematically searching burrows late in the breeding season. Carcasses, apparently eaten by stoats, have also been found. Harrow saw white-coated stoats searching the colonies for food in July, and so stoats may remain at high altitudes all year round and therefore be able to prey on Hutton's Shearwaters at all stages of their breeding cycle. Other possible predators are Harriers (*Circus approximans*), NZ Falcon (*Falco novaeseelandiae*) and Kea (*Nestor notabilis*). Few, if any, rats are on the colonies (Sherley 1989), although in the past rats may well have been more common in parts of the shearwater's former range.

Hutton's Shearwater could be affected by a fall-off in overall food supply or by irregular availability of seasonal prey species such as krill (euphausiid species) and small fish (e.g. cupeid species). Hutton's Shearwater is known to eat both these groups in the breeding season (West 1985). The abundance of krill at the surface may be influenced by irregular incursions of warm water, which prevent the upward migration of krill off the Kaikoura coast. These incursions during the summer have been more frequent than usual during the summers 1986-92 (Jim Mills, pers. comm.).

Chamois and deer seem no threat to Hutton's Shearwater colonies, although chamois sign was in more than 90% of the quadrats and in 100% of the colonies surveyed. Since live deer capture began, the vegetation cover has dramatically increased (Geoff Harrow, Brian Bell, pers. comm.). In this context, Evans's (1973) claim that Hutton's Shearwater burrowing initiates erosion appears unsubstantiated. There is extensive erosion in the Seaward Kaikouras in areas without shearwaters and so colonies with a combined total area of less than 30 ha cannot be a significant erosion risk.

Most researchers measuring the productivity of petrels observe nest chambers directly and monitor the fate of a number of burrows over one or more breeding seasons. Because I did not do this, it is probably pointless to infer much about Hutton's Shearwater's breeding. Alison Davis (Department of Conservation) has begun a study of the breeding success of Hutton's Shearwaters in 50 burrows of the Kowhai River catchment. In the 1989/90 and 1990/91 summers, fledging success was 30% and 28% (proportion of burrows with eggs that produced flying young) and stoat (*Mustela erminea*) predation was implicated in the failure of some burrows (Alison Davis, pers. comm.).

The International Union for Conservation of Nature and Natural Resources (IUCN) has a category system for describing the conservation status of species. The 'vulnerable' category includes species whose numbers are decreasing or seriously depleted, whose ultimate security is not yet assured, and which are "abundant but are under threat from serious adverse factors throughout their range" (Williams & Given 1981). Evidence from this study, that the Hutton's Shearwater seems to be declining, justifies classing the species as vulnerable. Although Bell (1986) came to the same conclusion, I believe the reason he gave for the decline (habitat destruction by browsing animals causing erosion) is incorrect.

Hutton's Shearwaters breed at high altitudes and the snow cover in the Seaward Kaikoura Range varies greatly from year to year (pers. obs. for 7 years). Thus, breeders in higher altitudes and on south- and east-facing slopes may not be able to dig through deep snow to reach their burrows until very late in the breeding season. If breeding success depends on certain foods being abundant at certain times, the short breeding season of pairs using burrows at high altitude could severely limit their success. Questions on the relative and combined importance of predation, climatic factors and food supply for breeding success need urgent answers if we are to ensure the survival of the species.

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APPENDIX 1 Quadrat (10 x 10 m) data for colonies surveyed between 18 to 24 March 1988 in the Kowhai River and Shearwater Stream catchments

A. Kowhai River

| Quad No.[1] | Colony[2] | Grid[3] | Area($m^2$) | Burrow Entrances | Used Burrows | Unused Burrows | Burrows Containing | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Chicks | Down |
| FS02301 | 8 | S49 903098 | 5670 | 65 | 46 | 11 | 14 | 0 |
| FS02302 | | | | | | | | |
| FS02303 | 12 | S42 907101 | 1244 | 42 | 28 | 4 | 4 | 0 |
| FS02304 | | | | | | | | |
| FS02305 | 6 | S49 903095 | 5116 | 45 | 25 | 4 | 8 | 7 |
| FS02306 | | | | | | | | |
| FS02307 | 7 | S49 903096 | 4195 | 45 | 36 | 8 | 1 | 14 |
| FS02308 | | | | | | | | |
| FS02309 | 15A | S49 898097 | 3688 | 100 | 77 | 4 | 7 | 28 |
| FS02310 | | | | | | | | |
| FS02311 | 15B | S49 898096 | 5867 | 109 | 61 | 26 | 2 | 12 |
| FS02312 | | | | | | | | |
| FS02313 | 14 | S49 897092 | 8389 | 120 | 84 | 23 | 3 | 47 |
| FS02314 | | | | | | | | |
| FS02315 | 5 | S49 903093 | 2212 | 38 | 22 | 3 | 0 | 2 |
| FS02316 | | | | | | | | |
| FS02317 | 4 | S49 902092 | 4333 | 56 | 40 | 5 | 3 | 6 |
| FS02318 | | | | | | | | |
| FS02319 | 18a | S49 888093 | 41486 | 36 | 26 | 0 | 4 | 4 |
| FS02320 | | | | | | | | |
| FS02321 | 18a | S49 889091 | 41486 | 40 | 31 | 1 | 5 | 6 |
| FS02322 | | | | | | | | |
| FS02323 | 18b | S49 892091 | 3267 | 96 | 86 | 2 | 0 | 28 |
| FS02324 | | | | | | | | |
| FS02325 | 29a | S49 896091 | 4926 | 63 | 54 | 5 | 4 | 16 |
| FS02326 | | | | | | | | |
| FS02327 | 9 | S42 903101 | 11524 | 89 | 62 | 7 | 2 | 15 |
| FS02328 | | (Quad "A" on Fig.2) | | | | | | |
| FS02329 | 9 | S42 902103 | 11524 | 64 | 39 | 6 | 1 | 3 |
| FS02330 | | (Quad "B" on Fig.2) | | | | | | |
| FS02331 | 24 | S49 894086 | 9179 | 32 | 22 | 0 | 0 | 1 |

| Quad No.[1] | Colony[2] | Grid[3] | Area($m^2$) | Burrow Entrances | Used Burrows | Unused Burrows | Burrows Containing | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Chicks | Down |
| FS02333 | 24 | S49 892086 | 9179 | 102 | 77 | 4 | 1 | 22 |
| FS02334 | | (Quad "B" on Fig 2) | | | | | | |
| FS02335 | 1[4] | S49 897086 | 1152 | 8 | 8 | 0 | 1 | 0 |
| FS02336 | | (Quad "A" on Fig 2) | | | | | | |
| FS02337 | 1[4] | S49 898086 | 1152 | 42 | 35 | 2 | 1 | 6 |
| FS02338 | | (Quad "B" on Fig 2) | | | | | | |
| FS02339 | 1[4] | S49 900086 | 1152 | 69 | 56 | 2 | 2 | 6 |
| FS02340 | | (Quad "C" on Fig 2) | | | | | | |
| FS[5] | 16/17 | S49 894093 | 9858 | 112 | 92 | 4 | 8 | 19 |
| FS | | (Quad "A" on Fig 2) | | | | | | |
| FS[5] | 16/17 | S49 895094 | 9858 | 93 | 71 | 3 | 8 | 10 |
| FS | | (Quad "B" on Fig 2) | | | | | | |
| **B.** | **Shearwater Stream** | | | | | | | |
| 1 | 1 | S42 014199 | 4656 | 16 | 14 | 3 | 0 | 0 |
| 2 | 1 | S42 014199 | 4656 | 41 | 34 | 3 | 3 | 7 |
| 4 | 2 | S42 009205 | 6250 | 52 | 38 | 2 | 3 | 2 |
| 5 | 3 | S42 012205 | 4000 | 57 | 37 | 3 | 2 | 3 |
| 6 | 4 | S42 013204 | 5429 | 10 | 3 | 2 | 0 | 0 |
| 7 | 4 | S42 014203 | 5429 | 57 | 43 | 2 | 4 | 9 |
| 3 | 5 | S42 012205 | 6125 | 74 | 58 | 1 | 0 | 4 |

**C. Other colony areas drawn on Figure 2 (Kowhai River) but not surveyed with 10 x 10 m quadrats**

| Colony No. | Area ($m^2$) | Colony No. | Area ($m^2$) |
|---|---|---|---|
| 3 | 415 | 21 | 3042 |
| 9a | 1244 | 22 | 8297 |
| 10a | 922 | 23 | 24714 |
| 10b | 414 | 25 | 1613 |
| 13 | 400 | 26 | 2581 |
| 18c | 23417 | 27 | 1752 |
| 20a | 6223 | 29b | 922 |
| 20b | 1971 | 30 | 8117 |
| 20c | 415 | 31 | 22541 |

Notes to Appendix 1

1 = Two numbers apply to each quadrat. They refer to the aluminium tags wired to poles at the two downhill corners of a quadrat, the smaller number being situated on the left facing uphill.

2 = Numbers correspond to colony numbers on Figures 2 and 3.

3 = Grid references apply to New Zealand Mapping Service Series 1 maps S42 + S43 and S49.

4 = The three quadrats in colony 1 occur in the colony studied by Geoff Harrow (Harrow 1965, 1976).

5 = No quadrat numbers because no tags were placed on corner quadrat poles.

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# SHORT NOTE

## Food plants of the Bellbird, Tui, and New Zealand Pigeon

From July 1990 to June 1992, I kept monthly lists of the New Zealand native plant foods which I saw three native bush and garden birds eating in coastal Otago (mainly in Dunedin). They are summarised in the table below. The Bellbird (B), Tui (T), and New Zealand Pigeon (P) all include fruit (F) in their diet. The two honeyeaters also take nectar (N), while the pigeon eats leaves, buds and flowers (L). There are fewer records for the Tui because it is less common here than the other two species. Please note that this is a collection of random observations, not a methodical study.