

VARIATION WITHIN THE REDPOLLS OF CANTERBURY

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ABSTRACT

The measurements of the Redpoll (*Carduelis flammea*) in Canterbury, New Zealand, were investigated. Variation in plumage colour are compared with study skins and published data for British Redpolls. New Zealand and British Redpolls are shown to differ and it is suggested that differences may be due to 'founder effect' rather than 'hybridisation' between two or more introduced races, as had previously been postulated. The occurrence of light-coloured plumage was more common in males. Females showed a much wider range of poll colour.

INTRODUCTION

The Redpoll species complex has been the subject of debate for many years, and the validity of some species is still in doubt, let alone the races of supposed species (Troy 1985).

The Redpoll in New Zealand was determined by Westerskov (1953) and Niethammer (1971) as *Carduelis flammea cabaret*. However, Stenhouse (1962) showed that the variation within birds at Lincoln deviated from the published characteristics of *C.f. cabaret* and proposed that New Zealand birds were derived partly from another race, probably *C.f. flammea*.

Such a hypothesis may be true, but the true ranges of variation for the various races have not been clearly described.

The fact that the plumage of Redpolls in New Zealand is variable is well known, but little has been done to record this variation. The main purpose of this study was to investigate the measurements and plumages of Redpolls in Canterbury, New Zealand.

METHODS

From February to June 1983, 590 Redpolls were banded at Courtenay, Canterbury (43° 26'S, 172° 09'E). The birds were caught in mist nets while post-breeding flocks were feeding on various seed crops, particularly favoured being rape (*Brassica napus*) and evening primrose (*Oenothera* spp.). Flocks of up to 2000 birds were noted on the latter crop in March and early April.

An additional 237 birds were caught and banded at Spencerville (43° 24'S, 173° 5'E), north of Christchurch, from June to August 1983. These birds were attracted to small seeds and chaff put out as supplementary stock feed. From this mixture the Redpoll preferred small seed of various grasses, clovers, brassicas and weeds.

The birds were aged and sexed by the criteria of Boddy (1981). They were aged by the shape of fresh tail feathers, first-year birds having more NOTORNIS 32: 245-253 (1985)

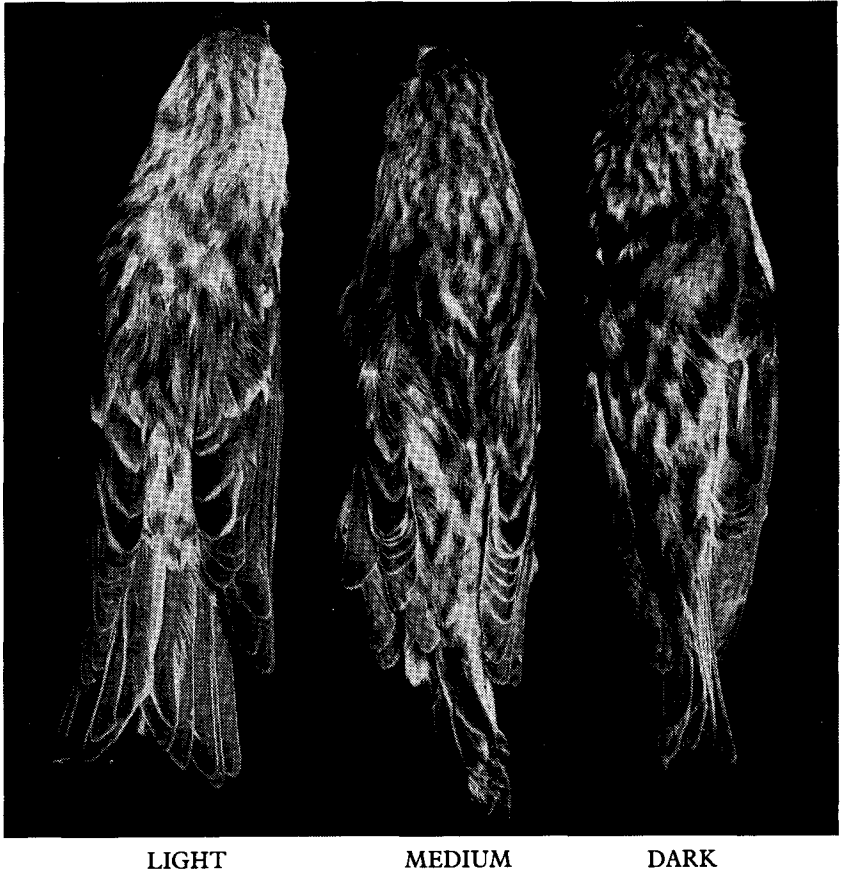


FIGURE 1 — Museum skins of Redpoll from New Zealand showing plumage variation

pointed feather tips than adults. The age of some birds with intermediate tail feathers or with wet or damaged feathers was not determined. Juveniles have a distinctive plumage and lack colour on the crown (poll).

Some Redpolls are hard to sex. During and after the moult, adult birds were sexed according to the amount of red or pink on the breast, cheeks and rump. Birds without pink or red or with only a few pink or red feathers were classed as females. Birds with a general wash of pink or red over the breast were classed as males.

Some birds could not be sexed, and a few may have been incorrectly sexed, but such errors were probably too few to affect the results greatly.

The measurements made were of wing length, tail length, bill length, bill depth, tarsus length, and weight.

Because of the intricate colouring of individual feathers, a colour standards chart was impractical to use in the field. Therefore a simplified plumage description was used. Overall plumage colour of each bird was assessed as being light, medium or dark.

Light birds were generally buff-brown streaked with dark brown and white and often were particularly buff around the neck. Dark birds were grey-brown with very dark brown centres to the back feathers. Plumage colour varied continuously from light through to dark, and we used the three classes mainly to separate the extreme types. Figure 1 shows skins from the National Museum, Wellington, that are examples of these three classes.

For each bird we recorded the amount of white on the rump, the presence of white wingbar, the colour of the poll and the colour of the breast. Rump colour was designated as white, brown or intermediate, disregarding the occurrence of pink or red on males.

Polls of adult and post-juvenile birds were recorded as having no colour or as being bronze, yellow, orange-red, light red, bright red, dark red or purple. Table 1 gives specimens in the National Museum, chosen as standards of these colours for comparison in future studies. Poll size, from front to rear, was measured on a few birds.

TABLE 1 — Redpoll specimens in the National Museum, Wellington, used as colour standards

Poll Colour	Specimen Number	Collected From
No colour	DM9401	Alexandra, Otago
Bronze	DM14708	Gorge Rd, Southland
Yellow	DM13193	Campbell Island
Orange-red	DM13184	Campbell Island
Light red	DM12205	Gorge Rd, Southland
Bright red	DM12196	Gorge Rd, Southland
Dark red	DM14699	Gorge Rd, Southland
Purple	(no specimen available)	

The breast colour of males was recorded as being slightly pink, pink, red or very red. We realise that such subjective assessments do not help anyone attempting comparative work, but the wide variation in shades of pink and red made the colours hard to match precisely to colour standards. The four classes of breast colour we used are not necessarily equal progressions of change from slightly pink to very red but were chosen as being easily determined colour intensities.

After this field study, JFMF examined the study skins of Redpolls of British and European origin in the British Museum (Natural History) at Tring.

RESULTS AND DISCUSSION

Age and sex ratios

Overall, the ratio of males to females was nearly equal (45% male: 55% female). However, the ratio varied widely between catches. In February 41% of the birds caught were female ($n=49$), in March 63% were female ($n=108$) and in May 66% were female ($n=39$). At Spencerville in June one day's catch contained 71% adult males ($n=48$), but in July the sex ratio was equal ($n=86$).

The proportion of young birds also varied considerably. From February to June at Courtenay the monthly percentages of juveniles or first-year birds were 55%, 25%, 6%, 41% and 50%. Such variation in ratios between samples may be due to the flocking of birds of similar age or sex, which is common in finches (Newton 1972).

Most of the birds caught were unbanded, even when catches were made on consecutive days. A low retrap rate between February and March (4.6% of adults and 8.9% of juveniles) indicated that the birds were mostly different ones. The flocks may perhaps have been local birds from exotic plantations on the Canterbury Plains and birds moving down the Waimakariri Valley from the inland high country.

Measurements

Measurements and weights are given in Tables 2 and 3.

The various races of Redpoll vary in size, especially in wing length, and Stenhouse attempted to determine the subspecific status of Redpolls in New Zealand by measurements. He thought that the wing lengths of some New Zealand Redpolls exceeded the range of the British race *C.f. cabaret*, perhaps because some birds of the longer-winged race *C.f. flammea* had also been introduced.

He quoted Witherby (1938) for the wing length range of *C.f. cabaret* as males 67-73 mm and females 63-69 mm. More recent studies, however, show a greater variation in wing length. Evans (1966) recorded that 95% of birds caught in Northumberland had wing lengths ranging male 65-72 mm and female 63-71 mm. Da Prato & Da Prato (1978) reported that males have a range of 69-75 mm and females 64-72 mm in Midlothian. Birds in Nottinghamshire had wing lengths of males 67-74 mm and females 64-73 mm (Boddy 1981). We do not know whether these workers attempted critically to assign their birds as being resident *C.f. cabaret* or immigrant *C.f. flammea*.

With the greatly increased number of Redpolls banded in Britain since 1938, it is more reasonable to accept the ranges quoted by Boddy as being typical of the Redpoll in Britain. Figure 2 shows the wing length distribution of Redpolls in Canterbury. The range is comparable with that of the British birds. Any slight deviation from the British birds, either in range or particularly in frequency distribution, could either be the result of introgression of *C.f. flammea* genes, as proposed by Stenhouse, or the result of a 'founder effect' based upon the genetic contribution of the few birds originally introduced.

TABLE 2 — Measurements (mm) of Redpolls in Canterbury, New Zealand

Measurement		N	Range	Mean	SD
Wing length	Male	198	65.0-74.0	70.0	1.7
	Female	229	63.0-72.0	68.2	1.7
Tail length	Male	46	47.0-55.0	52.1	2.2
	Female	52	47.0-56.0	52.5	2.2
Bill length	Male	66	8.0-10.0	9.1	0.5
	Female	63	8.0-10.4	9.1	0.5
	Juvenile	14	7.5-10.0	8.9	0.6
Bill depth	Male	66	5.5-7.0	6.2	0.3
	Female	63	5.1-7.0	6.0	0.3
Tarsus length	Male	49	13.5-16.5	14.8	0.8
	Female	53	13.1-17.0	15.0	0.8

TABLE 3 — Weights (g) of Redpolls in Canterbury, New Zealand

Age/Sex	Month	N	Range	Mean	SD
Adult male	Feb/Mar	85	10.0-15.0	12.0	0.8
	Jun/Jul	74	11.5-15.5	13.0	0.8
	Aug	47	11.0-15.5	13.3	1.1
Adult female	Feb/Mar	129	10.0-14.0	11.5	0.8
	Jun/Jul	57	10.5-14.5	12.5	0.9
	Aug	51	11.0-13.5	12.4	0.7
Juvenile	Feb/Mar	120	9.5-13.5	11.3	0.9

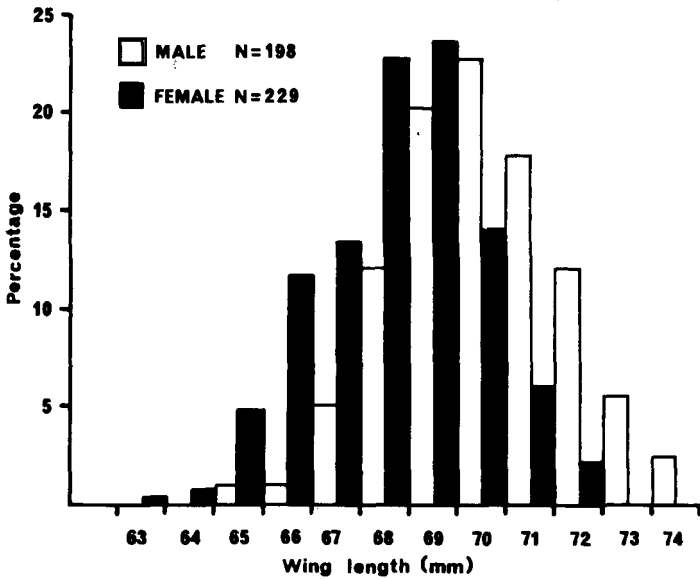


FIGURE 2 — Frequency distribution of wing lengths of Redpolls in Canterbury, New Zealand

TABLE 4 — Plumage variation of 140 male and 186 female Redpolls

Character	Percentage of birds showing character	
	Male	Female
A. Overall plumage colour		
Light	25	13
Medium	41	45
Dark	34	42
B. White wingbar		
Without white wingbar	24	34
	76	66
C. Rump colour		
Mostly white	15	13
Intermediate	54	57
Mostly brown	31	30

Plumage characteristics

Table 4 gives the results from a sample of 326 birds.

More males had light plumage than females. However, light plumage was less frequent overall than dark or medium plumage. Of light males, 71% had white rumps.

Light plumage and the occurrence of a white wingbar were considered to be *C.f. flammea* characteristics (Stenhouse 1962). The present study showed introgression of the various plumage characteristics. White wingbars occurred at a similar frequency in each plumage colour class, but there was a trend for lighter birds to have white rumps and for dark birds to have browner rumps. Some very dark birds, however, had white rumps and wingbars.

The mean wing length of light and dark birds was the same (Table 5). Wing length ranges were also the same for birds with or without white wingbars.

Stenhouse (1962) used data on wing length, plumage colour and occurrence of white wingbar to propose that both *C.f. cabaret* and *C.f. flammea* had been introduced into New Zealand. The present study, with larger samples, confirms and quantifies the frequency of these characteristics.

Examination of the Redpolls in the British Museum revealed that *C.f. cabaret* had a similar range of plumage colouring to New Zealand birds. The collection of British birds contained a higher proportion of dark-plumaged birds, usually without wingbars. However, a few light-coloured birds were similar to those we found in our New Zealand sample.

A museum collection of skins may not be representative of a wild population, and so a comparison of frequencies of plumage types was not attempted.

Poll colour and size

Table 6 gives the range and frequency of poll colour.

The poll size of males ranged from 9.0 to 13.0 mm with a mean of 10.5 mm (n=26). Females generally had smaller polls with a range of 6.5-12.0 mm and a mean of 9.0 mm (n=55). All males had some colour in the poll, but none were recorded with a bronze or yellow poll. Orange-red polls were more frequent in females. Only one bird, a female, had a purple poll. Females therefore had a greater range of poll colour than males.

Poll colour may be due to pigment content or concentration and to feather structure (Troy & Brush 1983). We do not know if pigment content is affected by environmental factors or diet in Redpoll, as has been reported in other finch species (Washington & Harrison 1969).

Breast colour of male Redpolls

The red or pink on the breast of males may depend upon pigment concentration or how far unpigmented feather tips are overlapping and obscuring the colour beneath (Troy & Brush 1983). Feather-tip abrasion can therefore increase the apparent colour intensity. Table 7 shows the change of colouring from March to August.

In March, only 16% of males had red breasts, and this proportion increased through successive months. By August, 78% of birds had red or

TABLE 5 — Relationship between extreme plumage types and wing length (mm) in Redpolls in Canterbury

Sex	Plumage	N	Range	Mean	SD
Male	Light	34	67-74	70.1	1.6
	Dark	41	65-74	70.3	1.9
Female	Light	24	64-71	68.2	1.7
	Dark	79	63-73	68.4	1.8

TABLE 6 — Variation in poll colour of 244 male and 299 female Redpolls in Canterbury

Poll Colour	Percentage of Birds	
	Male	Female
No colour	0.0	0.3
Yellow	0.0	0.7
Bronze	0.0	4.7
Orange-red	4.1	18.1
Light red	4.9	5.7
Bright red	66.8	40.5
Dark red	24.2	29.8
Purple	0.0	0.3

TABLE 7 — Development of breast colour in male Redpolls in Canterbury

Month	Age group	N	Percentage of birds as			
			Slight pink	Pink	Red	Very red
March	Adult	62	55	29	16	0
April	Adult	65	49	17	34	0
May	Adult	9	22	22	56	0
June	Adult	42	7	8	62	23
July	Adult	26	8	11	27	54
August	Adult	31	0	23	23	55
May	First year	4	100	0	0	0
June	First year	11	75	25	0	0
July	First year	13	85	15	0	0
August	First year	11	91	9	0	0

very red breasts. The number of birds with slightly pink breasts decreased from 55% to 0% over the same period.

First-year birds did not develop red breasts but some coloured up to pink from June onwards.

CONCLUSIONS

This study has quantified some of the variation among Redpolls in one district of New Zealand. Some differences do occur between the Redpolls of other New Zealand regions but little is known (Fennell & Sagar 1985). The environment may influence population characteristics but, equally, differences between New Zealand and British Redpolls may be due to the founder effect of a limited genetic input into the New Zealand population. A study of biochemical differences between the two populations might provide further information.

We do not know enough to determine the racial origin of New Zealand Redpolls. In many characteristics, the New Zealand birds deviate little from the British race *C.f. cabaret*, but the frequent occurrence of white wingbars is a major difference. Because few of the birds originally introduced into New Zealand are likely to have survived and bred, a strong genetic founder effect may have occurred in a species with such variable plumage characteristics.

We recommend that Redpolls in New Zealand should not be defined trinomially in terms of the European races.

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