

# THE BREEDING AND FLOCKING BEHAVIOUR OF YELLOWHEADS AT ARTHUR'S PASS NATIONAL PARK

By A. F. READ

## ABSTRACT

Yellowheads (*Mohoua ochrocephala*) were observed between November 1983 and May 1984 in the Hawdon River Valley, Arthur's Pass National Park. Of 11 breeding pairs, at least three had a third adult associated with them. Three pairs were watched in detail, and two nests were found, both in holes in live beech trees. The maximum breeding range was 7 ha. Young fledged in late December, and so laying had occurred in early November and hatching in late November-early December. There was no indication of double broods or renesting. Family groups of adults and juveniles remained in their breeding ranges for up to 2.5 days after fledging and then ranged throughout the forest. Parental care continued for about 55 days. From mid-January family groups began to come together for several hours and flocks of up to 25 Yellowheads were seen. In April and May flocks of 6-12 Yellowheads were seen, the birds apparently remaining together all day. Yellowheads were often in mixed species flocks.

## INTRODUCTION

The Yellowhead (*Mohoua ochrocephala* Gmelin 1789) is an insectivorous South Island forest passerine which, together with the Whitehead (*M. albicilla*), forms a well-differentiated endemic genus of obscure affinity (Fleming 1962, Keast 1977, Falla *et al.* 1979). The Yellowhead's distribution, unlike that of the Whitehead in the North Island, appears to have been contracting since the 1880s, and in recent years its patchy distribution has become still further reduced (Child 1981, Gaze 1985). While studying the abundance and habitat use of Yellowheads in Arthur's Pass National Park during 1983-84 (Read 1984), I took the opportunity to observe breeding and flocking behaviour.

Only two studies have dealt in any detail with the behaviour of the Yellowhead: those of Guthrie-Smith (1936) in the Pukikirunga Range of Abel Tasman National Park and of Soper (1960, 1963) in the Eglington Valley, Fiordland National Park. Both these studies concentrated on breeding behaviour, particularly nest building, mating and incubation, and made little mention of post-breeding behaviour. All other information on Yellowhead behaviour has come from anecdotal records by early naturalists (for example, Potts 1869, Reischek 1885, Smith 1888). Current knowledge of the Yellowhead has been summarised by Robertson (1985).

My aims in this paper are firstly to describe the breeding cycle of Yellowheads at Arthur's Pass, which is now the northernmost locality where Yellowheads are present in sustainable numbers (Gaze 1985), and secondly to provide information on their post-fledging behaviour.

## METHODS

### Study area

The Hawdon River Valley (42°58'S, 171°45'E) lies to the east of the main divide in Arthur's Pass National Park. Although steep and gorged in its upper reaches, the Hawdon River is braided below its junction with the East Hawdon Stream and meanders across a wide flood plain down to 600 m a.s.l. The stable areas of river flats are grassed, and the lower terraces and main slopes are covered by mixed forest of red beech (*Nothofagus fusca*) and mountain beech (*N. solandri* var. *cliffortioides*), rising to a sharp timberline at 1200-1300 m a.s.l. The history, landforms, vegetation and fauna of the area are described in detail by Read (1984). About 500 ha of forest were searched for Yellowheads during the study (Read & O'Donnell, in press), in particular the forests on the west of the braided section of the river.

### Observations

I kept notes of breeding and flocking behaviour seen during the study, which lasted from November 1983 to May 1984, and located breeding pairs during a distribution survey from 21 November to 4 December 1983. If a breeding pair was seen consistently with a third bird I considered the trio to be 'co-operatively breeding' (Emlen 1984). To estimate the maximum area of each breeding range, I assumed that the ranges were circular and took as the radius the longest distance I saw adults away from their nest.

Three pairs were watched in detail, and the nests of two of these were watched for 5 hours in mid-December to see how often the parents fed the nestlings. I inferred their breeding cycles from observed fledging dates and from the incubation and fledging periods (18 and 21 days respectively) determined by Soper (1963).

Groups of Yellowheads were followed for long periods after nesting, and general notes of flock size, parental care and other species associated with the flocks were kept.

The Yellowheads were not banded and so I could not recognise them individually. Until late December I could tell the sex of nesting adults because one bird of each breeding pair or trio always had a brighter yellow head and less dark colouring on the back of its head. This bird I assumed to be male, after Guthrie-Smith (1936) and Soper (1960). However, I could not use this difference after December, possibly because of the post-nuptial moult (Read 1984). Cunningham & Holdaway (1986), after a study of museum specimens, discussed the difficulty of sexing Yellowheads.

### Terminology

*Home range:* The area around the nest in which adult Yellowheads foraged during incubation and brooding. Because the density of breeding pairs was low in the Hawdon Valley (1 pair/45.5 ha, Read & O'Donnell, in press) and I did not see breeding Yellowheads interacting with other Yellowheads, I could not tell whether home ranges were actively defended and so qualified as territories.

*Itinerant non-breeders:* Birds seen at a locality only once and therefore assumed to be mobile and not breeding.

## RESULTS

Eleven breeding pairs were found during the distribution survey (Read & O'Donnell, in press). Three broods fledged between 17 and 23 December, and so laying had occurred between 8 and 15 November and hatching between 29 November and 6 December. Another pair was feeding nestlings on 24 December and presumably had laid after 15 November. Figure 1 shows the inferred breeding cycles of the first three pairs and summarises the behaviour of Yellowheads in the study area after young had fledged.

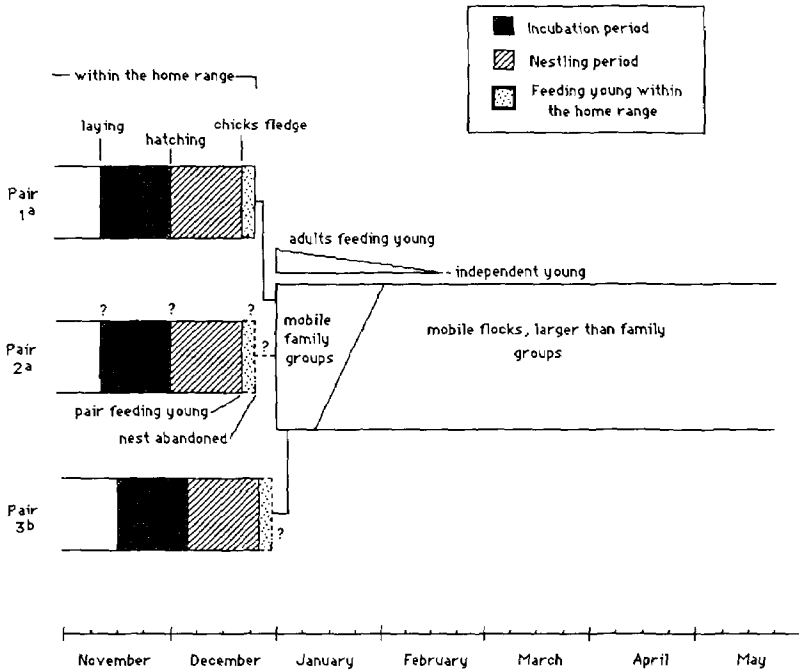


FIGURE 1 — The breeding cycle of the three pairs watched most intensively, and a summary of how Yellowheads behaved after abandoning their home ranges. Dates of laying and hatching were calculated back from known dates of fledging, using the incubation and fledging periods given by Guthrie-Smith (1936) and Soper (1963). a = nests found; b = no nest found but very weak fledglings being fed on the ground; ? = date cannot be inferred.

### Behaviour during nesting

Both nests found were in holes in live trees, one 12 m up a red beech, the other 15 m up a mountain beech. Both trees were partly hollow, and the entrance holes of both nests were worn smooth. The only nest visible was a neat, cup-shaped arrangement of moss and grasses.

Of the eleven home ranges found, at least three contained a third bird (Table 1). Two of these birds were females, but the sex of the third was not known. Only one of the three pairs watched closely had an associate (a female), but because the birds were not banded I could not tell whether both females were incubating.

I could not determine clutch and brood sizes, but family groups with two and four juveniles were seen after fledging (Table 1).

TABLE 1 — Size of Yellowhead groups seen. Only groups which could be properly counted are included

	Group Size	Number
Nesting (late Nov - mid-Dec)	Single pairs	8
	1 pair + 1 helper	3
	Itinerant non-breeders	6
After fledging but still within home range	1 pair + 2 fledglings	3
	1 pair + 1 adult + 2 fledglings	1
December, outside home range	1 pair	1
	1 pair + 2 fledglings	3
	Itinerant non-breeders	2
Early January	2 adults	1
	2 adults + 2 juveniles	7
	3 adults + 2 juveniles	2
	2 adults + 4 juveniles	1
Mid-January to mid-February	3 adults	1
	2 adults + 2 juveniles	4
	3 adults + 3 juveniles	2
	2 adults + 4 juveniles	1
	Flocks: 5-10 birds	2
	11-15 birds	1
	16-20 birds	1
>20 birds	2	
March to May	Flocks: 5-10 birds	4
	11-15 birds	1

At the two nests watched in mid-December, both adults were feeding nestlings c.16 days old. The adults foraged up to 150 m from the nest, although usually much less. Thus, the maximum area of the breeding home ranges was 7 ha. During 5 hours of observation males fed the nestlings every 11.5 min on average (range 8-18 min), and females fed them every 14 min (range 8-22 min). Both parents usually flew to the hole within 2 minutes of each other. On several occasions the adults fed the nestlings from the edge of the hole without going in.

#### Post-fledging behaviour within home range

At first, the fledglings in two home ranges could fly only a few metres and so the adults had to forage in the same areas as they had when nesting. These fledglings were very conspicuous, begging for food and making feeble attempts to forage and fly. Both parents fed the young, and one group of fledglings was also fed by a helper. Individual fledglings in both groups were

fed on average every 23 min (range 2-64 min; 9.5 hours of observation). This was slightly less often than the young were fed in the nest, possibly because the fledged young were also partly foraging for themselves.

For their first few hours after leaving the nest the fledglings were within 1 metre of the ground, perched in the undergrowth or among windfall, and often directly on the ground. As the juveniles gained strength they were gradually able to fly higher, and slowly progressed higher in the forest. One family group remained in the same area for 2.5 days. I could not revisit the other family for 10 days, by which time they had left their breeding range.

Although the young fledglings were usually hidden in the undergrowth, they seemed easy for predators to catch. While approaching one fledgling I scared a feral cat (*Felis catus*) only a metre from the young bird, and later saw the cat twice more.

#### **Behaviour after dispersing from home range**

The Yellowhead families abandoned their home ranges in late December, and during the rest of the study I saw no Yellowheads in any of the breeding home ranges. There was no indication of renesting or double brooding; all the Yellowheads were travelling widely and none were seen regularly at any locality.

Family groups of two or three adults and two to four juveniles ranged through the forest (Table 1). I followed several groups for six hours or more, and after mid-January these often travelled 1.0-1.5 km.

In late December and early January the juveniles perched in the canopy, often out of sight from the ground. They would remain in the same tree for 10-20 minutes and occasionally for as long as an hour while the adults foraged nearby. Both adults fed the young, returning with food every 2-6 minutes (20 hours of observation). Eventually the adults would move to another tree and call, the juveniles would fly into the new tree, and the pattern would be repeated. By mid-January the young began to follow the adults, begging noisily, and so they spent less time in individual trees. Only once were adults seen to move well away from their juveniles, when eight Yellowheads mobbed a roosting Morepork (*Ninox novaeseelandiae*) about 100 m from the juveniles.

The juveniles' foraging attempts became more frequent as they grew older. In late December and January they spent less than 20% of the time foraging, but this had increased to about 65% by February. The rest of the time was spent calling, preening and roosting (Read 1984). As the juveniles began to forage more intensively they ranged vertically through the forest, often coming down to the lower understorey or the ground to feed. They were still being fed by adults, although only once every half hour. After mid-February no adults were seen feeding young. Thus, parental care continued for about 55 days, although this was difficult to determine exactly because no juveniles were colour banded.

Juveniles gave adult-type calls in February, but I could still distinguish them from adults by their more laboured flight, begging calls and mottled colouring, and by the greater time spent preening and roosting. They were also more inquisitive, often perching within 1 m of observers.

## Flocking

From mid-January family groups began coming together for short periods, and I saw flocks of up to 25 Yellowheads (Table 1). These flocks were very noisy, calling and singing. Within these flocks I saw Yellowheads chase each other only twice, and in general they made only vocal contact. The amount of calling by each bird was related to the number of Yellowheads in the flock: individuals called more often in large flocks than in family groups. Whenever two or more family groups were together, their greater noise apparently attracted other Yellowheads and larger flocks would form. After several hours the flocks would break into family-sized groups again. In April and May I saw flocks of 6 to 12 Yellowheads that stayed together all day.

The flock noise was much less in autumn, and by May I could often locate flocks only by the noise of debris hitting the forest floor after being dislodged by foraging birds.

Many other species associated with the Yellowhead flocks, and especially with the larger flocks: parakeets (*Cyanoramphus* spp.), Fantails (*Rhipidura fuliginosa*), Yellow-breasted Tits (*Petroica macrocephala*), Riflemen (*Acanthisitta chloris*), Brown Creepers (*Finschia novaeseelandiae*), Grey Warblers (*Gerygone igata*), Silvereyes (*Zosterops lateralis*), and Bellbirds (*Anthornis melanura*) (Read & McClelland 1984). The Yellowheads led these mixed species flocks and determined where they went. Parakeets were often seen following Yellowheads, even during the nesting period. They often fed at the exact site a foraging Yellowhead had just left which suggests some sort of feeding association, although the frequency of this behaviour was not quantified. When recordings of Yellowhead calls were played they often attracted parakeets.

The Yellowheads were, in general, not aggressive towards other species. Throughout the study only nine interspecific behavioural interactions were noted: a stoat (*Mustela erminea*), a roosting Morepork and a Long-tailed Cuckoo (*Eudynamys taitensis*) were mobbed, and two Yellow-breasted Tits, a Chaffinch (*Fringilla coelebs*), a Rifleman and a Fantail were chased when they came within 0.5 m of a foraging Yellowhead or a roosting juvenile.

## DISCUSSION

Both Guthrie-Smith (1936) in Abel Tasman National Park and Soper (1963) in Fiordland National Park found that breeding occurred during November and December, as I did in the Hawdon Valley. However, in Nelson Lakes National Park, Moncrieff (1925) observed Yellowheads feeding fledglings on 22 November, which means the eggs would have been laid in mid-October. G. Elliott (pers. comm.) found Yellowheads incubating in mid-October in the Eglinton Valley, Fiordland National Park. These differences suggest that the timing of breeding can vary. Moncrieff (1957) stated that Yellowhead breeding begins in October, but she gave no further details.

Breeding in the Hawdon River Valley during my study apparently finished earlier (late December) than it does elsewhere or than it has done

in other years. Moncrieff (1957) said that breeding continued until February, and in the Eglington Valley in 1985 breeding did not finish until mid-February (G. Elliott, pers. comm.). There are two records of Yellowheads feeding chicks in the Arthur's Pass region after December: one in the Waimakiriri catchment in early March (OSNZ Nest Record Scheme) and one in early February 1986 in the Hawdon River Valley itself (P. Reese, pers. comm.). The lack of renesting by Yellowheads in the Hawdon River Valley in 1983-84 probably accounts for the shorter breeding season. Yet Yellowheads are apparently fully capable of raising two broods in Fiordland National Park (G. Elliott, 1986).

Why, then, did the Yellowheads in the Hawdon River Valley have a shorter, later breeding season and why did they not attempt a second brood? Perrins (1970) suggested that the date of laying is determined by the time at which the female is able to find enough food to form eggs, and there is now experimental evidence for this from at least ten studies (Davies & Lundberg 1985 and references therein). Food availability has also been demonstrated to affect the number of clutches laid (Davies & Lundberg 1985). Thus the single broods and shorter breeding season, as well as the low density of Yellowheads, could be due to a shortage of food in the Hawdon Valley during my study.

Associate adults were at two of the five nests Soper (1963) studied, but with such small samples in both this and Soper's study it is not yet possible to draw any conclusions as to the frequency of co-operative breeding in Yellowheads. Furthermore, it is still unclear whether the third bird is purely a nest helper (Emlen 1984), or whether Yellowheads are polygamous (Soper 1963 p.34, Robertson 1985 p.277) with several birds contributing physically and genetically to the young in one nest. Certainly, though, a third Yellowhead may contribute to the raising of young even when the density of breeding pairs is very low and there is no obvious shortage of suitable breeding habitat or non-breeding adults (Read & O'Donnell, in press).

In view of the vulnerable conservation status of Yellowheads, the feeding of young on or close to the ground during the first few hours out of the nest must be cause for concern. Further study is needed to see whether my results are typical. Being hole nesters, Yellowheads are unlikely to abandon their nest prematurely. If fledglings do spend their first few hours after leaving the nest near the ground, they may be at risk from mammalian predators, particularly when predator densities are high, for example after a beech seeding year (King 1983).

**Further study:** As Yellowheads have vanished to the north and west of Arthur's Pass National Park and their present range is continuing to contract (Gaze 1985), the fate of the Hawdon Valley birds is important for the future of the species. If behaviour during the 1983-84 summer was typical, my study raises several problems. How often do fledglings spend their first few hours close to the ground? How often do Yellowheads have a shortened breeding season and not attempt second broods?

The Yellowhead may also be a good species to use for answering theoretical questions on mixed-species flocks and co-operative breeding: for

example, what role do Yellowheads play in these flocks and why are adult trios present at nests when there is no apparent shortage of breeding habitat or of unmated birds?

#### ACKNOWLEDGEMENTS

For their help in the field I thank Michael Beentjes, Clive Copeman, Peter Dilks, Graeme Elliott, Peter McClelland, Colin O'Donnell, Paul Pearson and Dave Rhodes. I am also grateful to Ralph Powlesland for suggesting Yellowheads as a study topic, Colin O'Donnell for help and advice throughout, the University of Canterbury for the use of the Cass Field Station, and Chris Parsons and Chris LeCren of Christchurch Boys' High School for the use of Kidson Lodge. This work was financed by the New Zealand Wildlife Service while I was an employee and later by a travel grant, for which I am most grateful. Malcolm Crawley, Murray Efford, Graeme Elliott, Barrie Heather, Phil Moors, Colin O'Donnell, Ralph Powlesland and Ron Read criticised earlier drafts.

#### LITERATURE CITED

- CHILD, P. 1981. Birdlife of Mount Aspiring National Park. National Parks Scientific Series No.4. Wellington: Department of Lands and Survey.
- CUNNINGHAM, J. B.; HOLDAWAY, R. N. 1986. Morphology and head colour in the Yellowhead. *Notornis* 33: 33-36.
- DAVIES, N. B.; LUNDBERG, A. 1985. The influence of food on time budgets and the timing of breeding in the Dunnock, *Prunella modularis*. *Ibis* 127: 100-110.
- ELLIOTT, G. 1986. *Mohoua*, a declining species. *Forest & Bird* 17 (3): 26-28.
- EMLÉN, S. T. 1984. Co-operative breeding in birds and mammals. Pages 305-339 in J. R. Krebs, N. B. Davies (eds). *Behavioural Ecology. An Evolutionary Approach*. 2nd ed. Oxford: Blackwell.
- FALLA, R. A.; SIBSON, R. B.; TURBOTT, E. G. 1979. *The New Guide to the Birds of New Zealand and Outlying Islands*. Auckland: Collins.
- FLEMING, C. A. 1962. History of the New Zealand land bird fauna. *Notornis* 9: 270-274.
- GAZE, P. D. 1985. Distribution of Yellowheads (*Mohoua ochrocephala*) in New Zealand. *Notornis* 32: 261-269.
- GUTHRIE-SMITH, H. 1936. Sorrows and Joys of a New Zealand Naturalist. Dunedin: A. H. and A. W. Reed.
- KEAST, A. 1977. The relationships of *Finschia* and *Mohoua* (Family Muscicapidae). *Notornis* 24: 50-52.
- KING, C. M. 1983. The relationships between beech (*Nothofagus* sp.) seedfall and populations of mice (*Mus musculus*), and the demographic and dietary response of stoats (*Mustela erminea*) in three New Zealand forests. *J. Anim. Ecol.* 52: 141-166.
- MONCRIEFF, P. 1925. Yellowheads and other birds at Lake Rotorua [sic]. *Emu* 25: 21-27.
- MONCRIEFF, P. 1957. *New Zealand Birds and How to Identify Them*. 5th ed. Christchurch: Whitcombe & Tombs.
- PERRINS, C. M. 1970. The timing of birds' breeding seasons. *Ibis* 112: 242-255.
- POTTS, T. H. 1869. On the birds of New Zealand. *Trans. Proc. NZ Inst.* 2: 40-78.
- READ, A. F. 1984. The abundance and habitat use of Yellowheads (*Mohoua ochrocephala* Gmelin 1789) in the Hawdon River Valley, Arthur's Pass National Park. BSc (Hons) thesis, University of Otago.
- READ, A. F.; MCCLELLAND, P. 1984. Orange-fronted Parakeets in the Hawdon Valley, Arthur's Pass National Park. *Notornis* 31: 266-267.
- READ, A. F.; O'DONNELL, C. F. J. in press. Abundance of Yellowheads in the Hawdon River Valley, Arthur's Pass National Park in 1983 and 1984. *Notornis*.
- REISCHEK, A. 1885. Observations on the habits of some New Zealand birds, their usefulness or destructiveness to the country. *Trans. Proc. NZ Inst.* 18: 96-104.
- ROBERTSON, H. A. 1985. Yellowhead. Page 277 in *Complete Book of New Zealand Birds*. Sydney: Reader's Digest.
- SMITH, W. W. 1888. On the birds of the Lake Brunner District. *Trans. Proc. NZ Inst.* 21: 205-224.
- SOPER, M. F. 1960. Observations on the nesting of the Yellowhead. *Notornis* 8: 259.
- SOPER, M. F. 1963. *New Zealand Bird Portraits*. Christchurch: Whitcombe & Tombs.
- ANDREW READ, *New Zealand Wildlife Service, Department of Internal Affairs, P.O. Box 19546, Christchurch and Department of Zoology, Otago University, P.O. Box 56, Dunedin*  
 Present Address: *Department of Zoology, Oxford University, South Parks Road, Oxford OX1 3PS, England*