AGGRESSION AMONG HOODED ROBINS *Melanodryas cucullata* AND OTHER BIRDS

LULU L. FITRI[1,2] and HUGH A. FORD[1]

[1]Division of Zoology, University of New England, Armidale, New South Wales 2351
[2]Present address : Laboratoire de Psychophysiologie et d'Ethologie, Université de Paris **X**, 200, Avenue de la République, 92001 Nanterre Cedex, FRANCE

Male Hooded Robins *Melanodryas cucullata* displayed more aggression towards conspecifics than did females, and may be involved in more aggression with other species. Intraspecific aggression was infrequent, with 2.5 acts per hour, probably because the species occurs at low density and most groups have few neighbours.

Most interspecific aggression was directed at ecologically similar ground or aerial foraging insectivores, such as other robins, Jacky Winters *Microeca fascinans* and Willie Wagtails *Rhipidura leucophrys*. This could have been due to misdirected intraspecific aggression, as these species resemble either male or female Hooded Robins, or due to potential competition for food. Smaller ground-feeding insectivores, such as thornbills, were also the recipients of Hooded Robin aggression.

Several interactions involved the notoriously aggressive honeyeaters, though Robins were often the aggressor rather than recipient of aggression. Robins sometimes attacked potential nest predators, such as Laughing Kookaburras *Dacelo novaeguineae*. Female Robins showed injury-feigning behaviour to an intruding Kookaburra and often to people near to her nest.

INTRODUCTION

The Hooded Robin *Melanodryas cucullata* is a widespread species in Australia (Blakers *et al.* 1984), yet it appears to be common nowhere. Furthermore, there is evidence that it has declined markedly in eucalypt woodland in southern Australia (reviewed by Fitri and Ford 1997). It is one of a large number of ground-foraging birds that occur in agricultural areas and whose decline is giving rise to concern for their long-term conservation (Recher and Lim 1990; Barrett *et al.* 1994).

Although many hypotheses have been proposed for the loss of birds in fragmented and degraded woodland in Australia, few data are available to test these (Ford *et al.* in prep.). One hypothesis, which is supported by data and experiments, is that aggressive honeyeaters, such as Noisy Miners *Manorina melanocephala*, exclude many insectivorous birds from degraded woodlands (Dow 1977, Grey *et al.* in press). A second hypothesis, which has some support, is that nest predators have increased, leading to inadequate breeding success and recruitment. Thirdly, simplification of ecosystems is believed to lead to a reduction in species diversity, due to competition amongst ecologically similar species. This idea is best developed for birds on islands (e.g. Diamond 1975), but has not been applied to birds in remnant woodland in Australia.

In this paper we describe aggressive behaviour by Hooded Robins. We quantify the frequency of intra- and interspecific aggression, and the extent to which this aggression involves honeyeaters, nest predators and ecologically similar species.

STUDY SITES AND METHODS

The study was carried out in eucalypt woodland at three sites within 50 kilometres of Armidale (Gara, Strathaven, Torryburn, described in Fitri and Ford 1997). From April 1991 to April 1992, L. L. Fitri collected time budgets of Hooded Robins by following individual birds and recording all activities and their duration. When aggressive acts occurred, she recorded their frequency and the identity of the aggressor and the aggressed birds. The aggressors were individuals that either chased or threatened other species, whereas the aggressed birds were individuals that were chased or threatened. An aggressor was considered to be threatening another individual when it approached within 0.5 metres of it, leading the threatened bird to respond. Sometimes either threatening or threatened birds performed agonistic displays, which included exposing contrasting wing feathers and/or pointing the open beak at their opponent.

During the breeding season (September to December 1991), aggressors were considered to be threatening the Hooded Robin's nest if they went close enough to the nest to cause the parents to scold, fly away or display injury-feigning behaviour.

Four groups of species were identified: honeyeaters, nest predators, ground-feeding insectivores and others (Table 1). The third group included species that glean or pounce on prey on the ground, and to some degree capture aerial prey. Hooded Robins mostly glean or pounce on the ground throughout the year, but may spend up to 16% of their time in summer in aerial pursuit of prey (Fitri 1993). Thornbills were sometimes not identified, but as most were Yellow-rumped and Buff-rumped, they are included in the ground-foraging insectivore group. The final group, though heterogeneous, included a number of aerial feeding or foliage-feeding insectivores.

G tests and χ^2 tests were used to compare frequencies of intraspecific aggression involving each sex and the four seasons respectively. A three-way ANOVA was used to test variation in number of interactions per hour (interaction rate) among sexes of Hooded Robins, sites and seasons, for the whole study period. Data were log-transformed if the variances were unequal. Five per cent levels of significance were used for all tests.

TABLE 1

Species that interacted aggressively with Hooded Robins. G = ground-foraging insectivore, H = honeyeater, P = predator, O = other. Number of cases of aggression towards Hooded Robin (>HR) and aggression from Hooded Robin (HR>). Yellow-rumped and Buff-rumped Thornbills were combined as they were not always identified to species.

Species		>HR	HR>
Sacred Kingfisher (G)	*Todiramphus sancta*	0	1
Brown Treecreeper (G)	*Climacteris leucophaea*	3	7
Buff-rumped Thornbill (G)	*Acanthiza reguloides* ⎫	4	33
Yellow-rumped Thornbill (G)	*Acanthiza chrysorrhoa* ⎭		
Jacky Winter (G)	*Microeca fascinans*	14	35
Scarlet Robin (G)	*Petroica multicolor*	1	15
Yellow Robin (G)	*Eopsaltria australis*	0	2
Grey Shrike-thrush (G)	*Colluricincla harmonica*	4	1
Restless Flycatcher (G)	*Myiagra inquieta*	1	2
Willie Wagtail (G)	*Rhipidura leucophrys*	26	22
White-eared Honeyeater (H)	*Lichenostomus leucotis*	2	2
Fuscous Honeyeater (H)	*L. fuscus*	6	6
White-plumed Honeyeater (H)	*L. penicillatus*	8	11
White-naped Honeyeater (H)	*Melithreptus lunatus*	1	0
Eastern Spinebill (H)	*Acanthorhynchus tenuirostris*	0	1
Laughing Kookaburra (P)	*Dacelo novaeguineae*	2	4
Pied Butcherbird (P)	*Cracticus nigrogularis*	1	0
Australian Magpie (P)	*Gymnorhina tibicen*	6	0
Pied Currawong (P)	*Strepera graculina*	2	0
Australian Raven (P)	*Corvus coronoides*	7	0
Scaly-breasted Lorikeet (O)	*Trichoglossus chlorolepidotus*	1	0
Eastern Rosella (O)	*Platycercus eximius*	1	0
Rainbow Bee-eater (O)	*Merops ornatus*	0	2
Crested Shrike-tit (O)	*Falcunculus frontatus*	1	0
Golden Whistler (O)	*Pachycephala pectoralis*	1	1
Rufous Whistler (O)	*P. rufiventris*	3	1
Grey Fantail (O)	*Rhipidura fuliginosa*	1	2
White-winged Triller (O)	*Lalage sueurii*	1	1
Dusky Woodswallow (O)	*Artamus cyanopterus*	16	2
Diamond Firetail (O)	*Emblema guttata*	0	3
Total		113	154

RESULTS

Description of Aggressive Behaviour

In general, the aggressive displays of Hooded Robins were not spectacular. The following intraspecific interactions were noted:

a) Threat display: dominant birds landed on a perch and either held their body low with wings close to the body or fluffed their feathers, flicked their wings, and pointed their bill at their opponent. Sometimes the threatened bird gave a 'squee' sound, followed by either displacement to another perch or flying away. Displacement comprised the dislodging of a threatened bird from its perch with the approaching bird then occupying the same perch. Dominant females more frequently threatened submissive females rather than supplanting, chasing, or pecking them.

b) Supplanting: where the dominant bird landed near another bird, causing the latter to leave its perch. Supplanting was rarely followed by any threat display. Females were usually supplanted by males.

c) Chasing: where the birds chased one another, with agitated piping sounds. They chased irregularly, sometimes high through the trees and so rapidly

that the roles of individuals were hard to follow. After stopping for a few seconds at a perch, they sometimes continued chasing until lost from sight. Chasing was frequent between males and females, and among males. Some of this chasing could have been courtship. When males chased each other, sometimes females took part, by following their partners in chasing the other male. This behaviour was similar to the aggression shown in border disputes, but occurred between members of a group.

d) Pecking: where one bird pecked another. On two occasions, a male pecked a female at Torrybum in order to take prey from his partner's bill. Once, at Gara, an adult male was seen to peck an immature male which was still in grey plumage.

Intraspecific Interactions

Hooded Robins may live as pairs or in groups, including one or more non-breeding helpers (Fitri and Ford 1997). Interactions between groups were seen less frequently than those within groups. Interactions between neighbouring groups were usually seen during border disputes. Most disputes were between males rather than between males and females or between females. Border disputes commonly involved two males from neighbouring territories, which had come

within 10 metres of each other. Trespassing birds were usually chased from perch to perch by the territory owner. This was accompanied by agitated piping and scolding. Birds never made physical contact in the air (i.e. one had already left a perch before the other arrived at the same or different perch). Disputes lasted up to 4 minutes and traversed up to about 40 metres, with chasing occurring among the canopy of trees rather than near the ground.

Members of a group maintained close proximity for most of the time. This was especially so during the breeding season when either males or helpers gave food to females on a perch or at the nest. Both parents were also seen guarding their fledglings. Outside the breeding season, males and/or females usually perched no closer than 0.5 metres from each other, otherwise one would tend to threaten the other.

The rate of aggressive interactions per hour among Hooded Robins for each sex and season is shown in Table 2. Males were more often the aggressor than were females (147 versus 22 cases, $\chi^2 = 92.5$, $p < 0.001$, df = 1, assuming equal frequency of aggression by each sex). However, there was no difference in the frequency of being the recipient of aggression (78 versus 91, $\chi^2 = 1$, $p > 0.05$). Cases of males threatening or chasing females were more frequent than the reverse ($\chi^2 = 53.5$, $p < 0.001$, df = 1). Pooling data from all sites showed that there were significant differences in intraspecific interaction between seasons ($G_3 = 11.84$, $p < 0.001$), it being least frequent in summer.

Interspecific Interactions

Hooded Robins showed a similar range of aggressive behaviours towards other species, though 72 per cent of incidents involved chases. A total of 267 aggressive interactions was recorded for Hooded Robins with 30 species of birds in the three study sites (Tables 1 and 3, full details in Fitri 1993). There were only 2.95 interactions per hour of observation (mean of 2.83–3.18 at each site).

Males were more frequently involved in interspecific aggression than females, though this was not quite significant (Table 4). The frequency of aggressive interactions differed significantly between seasons, being most frequent in autumn and least frequent in spring (Table 4). There was no significant difference in interaction rate between sites and none of the statistical interactions among sex, site or season was significant (Table 4).

From 9–21 per cent of aggressive encounters involved honeyeaters at each site (Tables 1 and 3). Hooded Robins were as likely to be aggressive towards honeyeaters (20 observations) as they were to be the target of aggression (17 observations).

Only 5–10 per cent of interactions at each site involved potential nest predators (Tables 1 and 3). In all cases, the predators were threatening or chasing the Robins, except when males twice chased and twice threatened a Laughing Kookaburra. A female Robin showed injury-feigning behaviour when a Kookaburra stopped close to her nest with nestlings. The male scolded and then chased the Kookaburra. A few days later the Robin's nest was abandoned. Feigning injury often occurred when intruding people approached the young; adults crouched, ran and tumbled on the ground so that their legs were hidden, before stopping, flapping their wings and jumping onto the sides of a tree trunk.

Robins interacted frequently with several ecologically similar species at all three sites (Table 5). Over 60 per cent of aggression at each site involved Hooded Robins with other ground-foraging insectivores (Table 3). Interactions with Willie Wagtails and Jacky Winters were frequent, more so in summer ($\chi^2 = 62.95$, $p < 0.001$, df = 3, comparing 4 seasons). Scarlet Robins *Petroica multicolor* featured frequently in interspecific interactions with Hooded Robins at Gara and Strathaven (Table 5). During late autumn and early winter 1992, Hooded Robins foraged together with Flame Robins *P. phoenicea* in open habitat at Gara and twice chased them (these data not included in main results as methodical collection of data had ceased). Hooded Robins also chased thornbills at all sites (Table 5), especially in autumn and winter.

During laying and incubation, females seemed less aggressive than males, when other species came close

TABLE 2

Intraspecific interaction rate (observations/hour) between and within groups of Hooded Robins in all three study sites over all seasons (1991-1992), m/m = males aggressed males, m/f = males aggressed females, f/f = females aggressed females, f/m = females aggressed males (number of chases are given in parentheses).

Season	Gara				Strathaven				Torryburn			
	m/m	m/f	f/f	f/m	m/m	m/f	f/f	f/m	m/m	m/f	f/f	f/m
Autumn	1.07	1.22	0.69	0.15	0.78	0.92	0	0	0.71	1.95	0	0.35
	(14)	(16)	(9)	(2)	(6)	(7)	(0)	(0)	(4)	(11)	(0)	(2)
Winter	0.2	0.81	0.4	0	0	1.51	0	0	3.18	1.29	0	0
	(1)	(4)	(2)	(0)	(0)	(7)	(0)	(0)	(37)	(15)	(0)	(2)
Spring	1.27	1.91	0.64	0	0.76	1.15	0	0.38	0.78	0.39	0	0
	(2)	(3)	(1)	(0)	(2)	(3)	(0)	(1)	(2)	(1)	(0)	(0)
Summer	0	0.99	0	0.17	0	0.66	0	0.66	0	1.38	0	0.28
	(0)	(6)	(0)	(1)	(0)	(1)	(0)	(1)	(0)	(5)	(0)	(1)

TABLE 3

Number of aggressive interactions between Hooded Robins and other ground-foraging insectivores, honeyeaters, potential predators and other species at each study site in each season (number of interactions per hour and percentage in brackets).

Interactions with : Total Hours	Gara 30.3	Strathaven 27.1	Torryburn 33.3	Total 90.7
Honeyeaters				
Autumn	1	1	7	9
Winter	4	4	8	16
Spring	3	0	6	9
Summer	0	2	1	3
Total	8	7	22	37
	(0.26; 9.5%)	(0.26; 9.1%)	(0.66; 20.7%)	(0.41;13.9%)
Predators				
Autumn	0	5	1	6
Winter	0	1	0	1
Spring	0	0	2	2
Summer	4	1	8	13
Total	4	7	11	22
	(0.13; 4.8%)	(0.26; 9.1%)	(0.33; 10.4%)	(0.24;8.2%)
Ground-foragers				
Autumn	25	20	41	86
Winter	16	20	11	47
Spring	3	3	2	8
Summer	12	6	12	30
Total	56	49	66	171
	(1.85; 66.7%)	(1.81; 63.6%)	(1.98; 62.3%)	(1.88;64%)
Others				
Autumn	11	8	2	21
Winter	1	1	1	3
Spring	2	1	3	6
Summer	2	4	1	7
Total	16	14	7	37
	(0.53; 19%)	(0.52; 18.2%)	(0.21; 6.6%)	(0.41;13.9%)
TOTAL	84	77	106	267

TABLE 4

Three-way ANOVA examining variations in interspecific interaction rate per hour of Hooded Robins with other species of bird by sex, site and season.

Source of variation	df	MS	*F*	*P*
Sex	1	1.07	3.78	0.057
Site	2	0.01	0.03	0.97
Season	3	0.92	3.27	0.03
Sex × Site	2	0.38	1.36	0.37
Sex × Season	3	0.19	0.67	0.57
Site × Season	6	0.26	0.92	0.49
Sex × Site × Season	6	0.45	1.6	0.17
Error	48	0.28		

TABLE 5

Number of interactions between Hooded Robins and several ecologically similar species, at each study site. First figure is aggression by Hooded Robin, second figure is aggression directed at Hooded Robin, (percentage of all interactions at that site in brackets).

Species	Gara	Strathaven	Torryburn
Jacky Winter	6, 0 (7.1)	6, 4 (13.0)	23, 10 (31.1)
Willie Wagtail	10, 12 (26.2)	4, 7 (14.3)	8, 7 (14.1)
Scarlet Robin	5, 0 (5.8)	10, 1 (14.3)	0, 0 (0)
Thornbills	15, 3 (9.3)	12, 1 (16.9)	6, 0 (5.7)

to the nest. Two occasions were seen at Strathaven when a Weebill *Smicrornis brevirostris* hovered close to the Robin's nest and a Willie Wagtail came to within 1 metre of the nest. The Weebill was displaced by the female, but the Willie Wagtail was chased by the male. In fact, the Hooded Robin's nest was only 3 metres away from the Willie Wagtail's nest. On one occasion at Hillgrove State Forest (10 kilometres east of Armidale), a female Robin paid no attention at all when an unidentified thornbill come close to her while

she was incubating her eggs. At Torryburn a female Robin once threatened a Rainbow Bee-eater *Merops ornatus*, when it stopped on a perch 5 metres from the Robin's nest and later the male Robin chased it. The Bee-eater had a nest-hole 10 metres from the Robins' nest.

All but five of the interactions with other species were with insectivores. Most of these were with aerial foragers (Dusky Woodswallows *Artamus cyanopterus*

— 18 times, Grey Fantail *Rhipidura fuliginosa* — 3, Rainbow Bee-eater — 2) or leaf gleaners/snatchers (whistlers *Pachycephala* spp. — 6, White-winged Triller *Lalage sueurii* — 2).

DISCUSSION

Male Hooded Robins play the major part in territorial defence and aggressive interactions with conspecifics, as in Eastern Yellow — *Eopsaltria australis*, Scarlet and Flame Robins (Huddy 1979; Fleming 1980; Marchant 1985, 1987; Robinson 1989a, 1989b). Males of most species defend their territories more than the females do (Perrins and Birkhead 1983).

Overall, Hooded Robins participate in an average of 2.5 aggressive acts per hour with conspecifics. Much of this aggression is within groups. The slightly larger males tend to dominate females and twice took food from them. Aggression between groups is probably infrequent because the species occurs at low density, and groups have few neighbours. In addition, Hooded Robins participate in about 3 acts of aggression per hour with other species. A total of 5.5 acts of aggression per hour is comparable with that shown by many honeyeaters (0.5 to 7.7 per hour), which are renowned for their aggressiveness (reviewed in Ford and Debus 1994).

Male Hooded Robins were more aggressive than females in chasing and threatening other species and were the recipients of more attacks, though this difference was not quite significant. Male and female Hooded Robins adopt different roles during the breeding season. Females build the nest, lay and incubate the eggs, and are less active in foraging, while males guard their mates and defend the territory and nests from intruders (Fitri 1993). However, this only partly explains the sexual difference in aggressiveness, as most aggression was shown outside the breeding season.

The low rate of interaction with honeyeaters (0.42 interactions per hour) and the fact that Robins were aggressors in over half of the interactions suggest that Hooded Robins, at our sites, are not suffering from excessive interference from honeyeaters. This does not mean that honeyeaters, especially Noisy Miners, are not a potential problem at other sites.

Interactions with nest predators were infrequent, and most involved Robins being chased or threatened. Aggression and injury-feigning behaviour in defence of the nest and young was only observed towards Kookaburras and people. Nest success is low in Hooded Robins (Fitri 1993), with most failures being due to predation. Observations at the nest obviously give a poor indication of the importance of nest predators.

Over 60 per cent of aggressive acts involving Hooded Robins were with other ground-foraging insectivores. Willie Wagtails glean and snatch prey from the ground and hawk insects from the air, while Jacky Winters pounce on the ground and hawk and other robins feed mostly on the ground, especially in autumn and winter (Ford *et al.* 1986; Robinson 1992, 1993). Birds were not censused at our study sites, but in similar eucalypt woodland at nearby Eastwood State Forest, ground-feeding insectivores make up about 20% of individuals (Ford 1985). There is a number of possible explanations why Hooded Robins should chase mostly ground-feeding insectivores. First, they are most often close to other ground-foragers. Second, other ground-foraging insectivores are potential competitors with Hooded Robins. Third, if the other species resemble Hooded Robins in appearance, interspecific aggression may result from misdirected intraspecific aggression (Savard and Smith 1987).

Although insects in south-eastern Australia tend to peak in spring or summer, and decrease in autumn and winter (Woinarski and Cullen 1984, Pyke 1985, Bell and Ford 1986), insects on the ground sometimes peak in autumn (Huddy 1979). Also some species, such as Scarlet Robins (Huddy 1979) and Buff-rumped Thornbills *Acanthiza reguloides* (Bell and Ford 1990) tend to forage more on the ground in autumn and winter. This indicates that the higher rates of aggression by Hooded Robins in autumn compared with spring may be due to increased encounters with other ground-feeding insectivores. Interactions in winter could be due to either high encounter rates or to food shortage. The hypothesis that competitive interactions among ground-foraging insectivores may have contributed to declines of some of these species is worthy of further investigation.

Robinson (1993) found that both Scarlet and Flame Robins sometimes attacked Jacky Winters, and noted that Jacky Winters somewhat resemble female Scarlet and Flame Robins in behaviour and appearance. Jacky Winters were frequent recipients of aggression from Hooded Robin and their greyish-brown plumage is like the greyish plumage of female and sub-adult male Hooded Robins. Sullivan (1993) noted that Hooded Robins were aggressive to Scarlet Robins and Willie Wagtails, two other frequent recipients of aggression in our study. Willie Wagtails and Scarlet Robins resemble male Hooded Robins, at least from behind. However, the Wagtail's foraging behaviour of twisting from side to side on a perch and erratically pursuing aerial prey and the red breast of the Scarlet Robin should reduce the risk of mistaken identity by male Hooded Robins. Experiments with stuffed birds or models are required to test the hypothesis that aggression between robins and similar species are due to misdirected intraspecific aggression. However, we consider it a less satisfactory hypothesis than interspecific interaction.

ACKNOWLEDGMENTS

REFERENCES

Barrett, G. W., Ford, H. A. and Recher, H. F. (1994). Conservation of woodland birds in a fragmented rural landscape. *Pac. Cons. Biol.* **1**: 245–256.

Bell, H. L. and Ford, H. A. (1986). A comparison of the social organization of three syntopic species of Australian thornbill, *Acanthiza*. *Behav. Ecol. Sociobiol.* **19**: 381–392.

Bell, H. L. and Ford, H. A. (1990). The influence of food shortage on interspecific niche overlap and foraging behavior of three species of Australian warblers (Acanthizidae). *Stud. Avian Biol.* **13**: 381–388.

Blakers, M., Davies, S. J. J. F., and Reilly, P. N. (1984). 'The Atlas of Australian Birds'. (RAOU and Melb. Univ. Press: Carlton.)

Diamond, J. M. (1975). Assembly of species communities. In 'Ecology and Evolution of Communities.' (Eds M. L. Cody and J. M. Diamond). Pp. 342–444. (Belknap Press: Harvard.)

Dow, D. D. (1977). Indiscriminate interspecific aggression leading to almost sole occupancy by a single species of bird. *Emu* **77**: 115–121.

Fitri, L. L. (1993). 'Ecology and behaviour of Hooded Robins (*Melanodryas cucullata*) in the Northern Tablelands of New South Wales'. (M.Sc. Thesis, University of New England, Armidale).

Fitri, L. L. and Ford, H. A. (1997). Status, habitat preferences and social organisation of the Hooded Robin *Melanodryas cucullata* in the Northern Tablelands of New South Wales. *Aust. Bird Watcher.* **17**: 142–155.

Fleming, P. (1980). 'A comparative ecology of four sympatric Robins'. (B.Sc. Hons. Thesis, University of New England, Armidale.)

Ford, H. A. (1985). The bird community in eucalypt woodland and eucalypt dieback in the Northern Tablelands of New South Wales. In: 'Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management.' (Eds A. Keast, H. F. Recher, H. Ford and D. Saunders.) Pp. 333–340. (Surrey Beatty & Sons: Chipping Norton.)

Ford, H. A. and Debus, S. (1994). Aggressive behaviour of Red Wattlebirds *Anthochaera carunculata* and Noisy Friarbirds *Philemon corniculatus*. *Corella* **15**: 141–147.

Ford, H. A., Noske, S. and Bridges, L. (1986). Foraging of birds in eucalypt woodland in north-eastern New South Wales. *Emu* **86**: 168–179.

Grey, M. J., Clarke, M. F. and Loyn, R. H. (1997). Initial changes in the avian communities of remnant eucalypt woodlands following a reduction in the abundance of Noisy Miners *Manorina melanocephala*. *Wildlife Research* **24**: 63–64.

Huddy, L. (1979). 'Social behaviour and feeding ecology of Scarlet Robins (*Petroica multicolor*)'. (B.Sc. Hons. Thesis, University of New England, Armidale, NSW.)

Marchant, S. (1985). Breeding of the Eastern Yellow Robin *Eopsaltria australis*. In 'Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management.' (Eds A. Keast, H. F. Recher, H. Ford and D. Saunders.) Pp. 231–240. (Surrey Beatty & Sons: Chipping Norton).

Marchant, S. (1987). Territorialism and co-operative breeding of the Eastern Yellow Robin *Eopsaltria australis*. *Corella* **11**: 1–64.

Perrins, C. M. and Birkhead, T. R. (1983). 'Avian Ecology'. (Blackie: Glasgow.)

Pyke, G. H. (1985). Seasonal patterns of abundance of insectivorous birds and flying insects. *Emu* **85**: 34–39.

Recher, H. F. and Lim, L. (1990). A review of current ideas of the extinction, conservation and management of Australia's terrestrial vertebrate fauna. *Proc. Ecol. Soc. Aus.* **16**: 287–301.

Robinson, D. (1989a). Interspecific aggression and territorial behaviour between Scarlet Robin *Petroica multicolor* and Flame Robin *P. phoenicea*. *Emu* **89**: 93–101.

Robinson, D. (1989b). Ecology and Behaviour of the Scarlet Robin *Petroica multicolor* and Flame Robin *P. phoenicea* in southeastern Australia. (Ph.D. Thesis, Monash University, Clayton.)

Robinson, D. (1992). Habitat use and foraging behaviour of the Scarlet Robin and the Flame Robin at a site of breeding-season sympatry. *Wildlife Research* **19**: 377–395.

Robinson, D. (1993). Interspecific aggressive behaviour between robins and other birds in eucalypt forest. *Corella* **17**(4): 107–110.

Savard, J. P. L. and Smith, J. N. M. (1987). Interspecific aggression by Barrow's Goldeneye: a descriptive and functional analysis. *Behaviour* **102**: 168–184.

Sullivan, D. (1993). The breeding and non-breeding behaviour of the Hooded Robin *Melanodryas cucullata* in Canberra, 1990–1991. *Aust. Bird. Watcher* **15**: 99–107.

Woinarski, J. C. Z. and Cullen, J. M. (1984). Distribution of invertebrates on foliage in forests of south-eastern Australia. *Aust. J. Ecol.* **9**: 207–232.

WEAR RATES OF ALUMINIUM AND STAINLESS STEEL LEG BANDS ON SILVER GULLS

R. D. WOOLLER and S. J. WOOLLER

Biological Sciences, Murdoch University, Western Australia 6150

More Silver Gulls *Larus novaehollandiae* have been banded in Australia than any other non-passerine species (Baker *et al.* 1995). The 6 per cent recovery rate has resulted in over 9 000 recoveries and a longevity record of more than 28 years for one individual. However, the interpretation of these recoveries requires some understanding of the durability and readability of bands, especially for seabirds and other long-lived species. One major study of Silver Gulls used aluminium, numbered bands that were readable on free-living birds, combining them with visible colour bands (Ottaway *et al.* 1984). This resulted in recovery rates much greater than in most large-scale gull-banding programmes worldwide, many of which no longer use aluminium bands on gulls because of concerns about their rapid wear (Coulson 1976). More recently, stainless steel bands have also been used on Silver Gulls in Australia. This note compares the wear rates of some conventional butt-ended aluminium and stainless steel bands used on Silver Gulls.

The returned bands, kindly provided by the Australian Bird Banding Scheme, were weighed to