

Short Communications

Foraging and Aggressive Behaviour of the Regent Honeyeater *Xanthomyza phrygia* in Northern New South Wales

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The Regent Honeyeater *Xanthomyza phrygia* is an endangered species that has declined recently for reasons that are not entirely clear (Garnett 1992; Webster & Menkhorst 1992). It inhabits eucalypt woodland and forest, mostly west or north of the Great Dividing Range between extreme southern Queensland and central Victoria (Blakers *et al.* 1984; Franklin *et al.* 1989). Perhaps only about 200 birds remain in Victoria and it is apparently only a vagrant to South Australia or Queensland (Franklin *et al.* 1987; Franklin & Menkhorst 1988). The western slopes of New South Wales may be its current stronghold (Ley 1990; Ley & Williams 1992; Webster & Menkhorst 1992).

Franklin *et al.* (1989) reviewed habitat, feeding behaviour, social behaviour and interactions with other birds from the literature, their own observations and surveys. They proposed a hypothesis that Regent Honeyeaters, as they move over large areas in search of eucalypt nectar, have been particularly susceptible to loss and fragmentation of their habitat. In addition, habitat changes may have allowed large aggressive honeyeaters, such as miners *Manorina* and friarbirds *Philemon*, to increase so that they now interfere with the ability of Regent Honeyeaters to gain access to rich nectar sources and to breed.

In this paper we present data on time spent foraging on nectar and insects, the rate at which adults feed young and interactions with other birds. Although collected opportunistically, these data lend some support to the above hypothesis, which we develop further in the discussion.

Methods and study sites

Regent Honeyeaters were studied at several sites 60-80 km west of Armidale in spring 1989 and 1990. About 30 birds were present in 1989, on the properties 'Ross Hill' and 'Matoni', 25 km SSE of Bundarra. Many pairs bred, some successfully, though most of our data were

collected on only two breeding pairs (Ley & Williams 1992). Fewer birds were studied in 1990. These were on a travelling stock route 20 km SE of Bundarra. At least two pairs attempted to breed, both unsuccessfully (Davis & Recher 1993).

The habitat was wide corridors or remnants of eucalypt woodland. Dominant trees were Red Ironbark *Eucalyptus sideroxylon* and White Box *E. albens*, both of which flowered in both years, though more extensively in 1989. Other tree species included Blakely's Red Gum *E. blakelyi*, Yellow Box *E. melliodora* and New England Stringybark *E. caliginosa*. Understorey was patchy, but in places dense, with *Cassinia* the main genus.

Time budgets were prepared in 1989 by noting, from a digital wristwatch, when an individual changed its activity. Time spent flying was accumulated on a stopwatch. Activities included perched (inactive, preening or on nest), foraging (the method, food type and site were recorded), interactions (noting species involved and which was the aggressor) and flight (including that involved as part of other activities). Time spent in each activity was summed and apportioned between categories. In addition, nests or recent fledglings were watched and the number of visits by parents was recorded over a timed period. Where possible we noted the food brought to the young.

In 1990, individuals were watched for as long as possible while apparently establishing territories and building nests, and the number of aggressive encounters were recorded.

Results

Feeding behaviour

Regent Honeyeaters spent 38% of their time feeding, slightly more time than they spent perching (Table 1). Most of the feeding was on nectar of *E. sideroxylon*.

Table 1 Number of seconds and percentage of time spent in each activity by Regent Honeyeaters in November and December 1989 (the number of seconds and percentage time spent flying is included in other activities, so the total excludes these).

Feed Flowers	Insects	Perch	Preen	Nest	Aggres- sion	Fly	Total
4713	1548	5938	1385	833	1814	2054	16231
29%	9.5%	36.6%	8.5%	5.1%	11.2%	12.7%	

Insects were taken by hawking, or snatching, gleaning and hovering from foliage and bark.

The young were fed 124 times in 195 minutes of observation, or 39 times per hour. Adults were frequently seen taking nectar directly from flowers to nestlings and fledglings, but insects were also seen to be fed to the young on about 10% of visits.

Aggressive behaviour

The Regent Honeyeaters spent about 11% of their time chasing or being chased by other birds in 1989, with 13% of the time flying, much of this being included in aggression (Table 1). A total of 143 chases was observed in 1989, in just under 4.5 hours, a rate of 32 chases per hour (Table 2). In 1990, when observations were restricted to birds while they were nest building, there were 1081 interactions in 16 hours of observation, giving 67 chases per hour. The results indicated that the level of aggression declined during the breeding season from territory establishment and nest building, through incubation to feeding fledglings. However, the higher aggression rate in 1990 might have been for other reasons, such as more competitors or less food or because observers concentrated on this behaviour.

A small number of interactions involved other Regent Honeyeaters, but two-thirds of aggressive encounters were with Noisy Friarbirds *Philemon corniculatus*. Most of the rest also involved large honeyeaters: Noisy Miners *Manorina melanocephala* or Red Wattlebirds *Anthochaera carunculata*. Other species included Fuscous Honeyeaters *Lichenostomus fuscus* and Musk Lorikeets *Glossopsitta concinna*. In nearly every case the Regent Honeyeaters were the aggressors, despite the fact that they were often chasing much larger birds.

Discussion

Our observations during 1989 and 1990 indicated that Red Ironbark was a major nectar source for Regent Honeyeaters during the breeding season, as found by Franklin *et al.* (1989) and Webster & Menkhurst (1992). In addition, nectar from ironbark was an important source of energy for nestlings and fledglings. In this respect Regent Honeyeaters may differ from Red Wattlebirds and Noisy Friarbirds, which feed their young almost entirely on insects or manna (Ford *et al.* 1991; H. Ford unpubl. data). The rate of feeding nestlings and fledglings also seemed much higher for Regent Honeyeaters (39 times per hour), than for Red Wattlebirds (seven times per hour) and Noisy Friarbirds (nine times per hour). Our data are limited for Regent Honeyeaters, but average rates of feeding young are still much higher than the highest recorded for Red Wattlebirds and Noisy Friarbirds (26 times per hour), after 111 and 128 hours of observation for those species. Most of our observations for all three species were collected during the morning (0700-1100), and for the last two species included nestlings and fledglings the same ages as the

Table 2 Number of aggressive interactions between Regent Honeyeaters and other birds in 1989 and 1990.

Date	Minutes of observation	Number of attacks involving Regent Honeyeaters and:					Total
		Regent Honeyeater	Noisy Friarbird	Red Wattlebird	Noisy Miner	Others	
5-14 November 1989 (incubating)	187	1	103	0	1	11	116
12-26 November 1989 (feeding fledglings)	81	0	7	0	0	20	27
25-29 October 1990 (nest-building)	965	31	708	52	277	13	1081
Total	1180	32	818	52	278	44	1224

Regent Honeyeaters observed. The difference between the species may be because nectar, used more by Regent Honeyeaters, is a poorer food source than insects and manna, meaning that less energy can be gained per visit.

The average time spent feeding (39%) was not atypical for honeyeaters, though this time can vary greatly, depending on season and food abundance (Paton 1982; McFarland 1986; Ford 1989; Armstrong 1991a). Webster & Menkhorst (1992) found that Regent Honeyeaters spent an average of 20.4% of their time foraging.

In contrast, the proportion of time spent in aggression (11%) was higher than recorded for any other species of honeyeater (see McFarland 1986; Armstrong 1991b). Red Wattlebirds and Noisy Friarbirds near Armidale only spent about 1% of their time chasing or being chased by other birds (Ford *et al.* 1991; H. Ford unpubl. data). While attending their nests these species were involved in about one chase per hour in 1990, but 4-6 chases per hour in 1991. Even at a heavily flowering and popular *Grevillea robusta* tree in late 1991, Noisy Friarbirds were involved in only 18 chases per individual per hour and Red Wattlebirds six chases per hour. All these values were below the rates of 30-70 chases per hour that we observed for Regent Honeyeaters. However, the levels of aggression recorded by Webster & Menkhorst (1992), 1.5% of time and seven chases per hour, were closer to our Red Wattlebird and Noisy Friarbird data.

Our results support previous observations that large honeyeaters are the main target of attacks by Regent Honeyeaters in the breeding season (Franklin *et al.* 1989). Our impression was that many of these chases were ineffective at removing the intruders. This is perhaps not surprising as Red Wattlebirds and Noisy Friarbirds weigh about three times as much as Regent Honeyeaters and are renowned for their aggressiveness. Even when successful, Regent Honeyeaters still had to attack a succession of intruders, which would have incurred a significant energetic cost to them.

We suspect that honeyeaters have declined in New England, with the exception of the Noisy Miner, which benefits from habitat degradation (Ford & Bell 1982; Loyn 1987). Declines in honeyeaters and the nectar-feeding lorikeets have also occurred in the wheatbelt of Western Australia (Saunders 1989). These declines are associated with changes in food abundance and availability caused by loss, fragmentation and degradation of native vegetation. Clearing for agriculture has been most

extensive on the most productive soils, which could have provided the most reliable and rich sources of nectar and other foods (e.g. manna and lerp). Thus, although superficially it appears that much habitat remains, this could be inferior in its ability to sustain honeyeater populations. In addition, where nectar-feeders visit a succession of sources, perhaps over many years, the loss of any of these could have a disproportionate effect on populations.

There is evidence that arboreal marsupials select habitats along a gradient in soil nutrients and moisture (Braithwaite *et al.* 1983; Lunney & Leary 1988). Clearing for agriculture and forestry has therefore tended to have a disproportionate impact on species, such as the Koala *Phasarcos cinereus*, which were most abundant in forests growing on the most productive soils. It is also evident that the most abundant and diverse invertebrate communities are found in eucalypt forests on the richest soils (Majer *et al.* 1993; Recher *et al.* 1991).

It appears that honeyeaters also respond to the gradient in richness of both nectar (Ford 1979) and invertebrates (Wykes 1985). Consequently, a variety of species may be segregated between habitats according to the richness of nectar or other food resources (Ford & Paton 1982; Wykes 1985). Superimposed on this gradient is the temporal variability in food, both seasonally and from year to year. Honeyeaters respond to these patterns by either being resident and switching their food supply over time (e.g. New Holland Honeyeater *Phylidonyris novaehollandiae*, Paton 1982) or by moving, often in a complex fashion, among productive patches. We suggest that the Regent Honeyeater is a rich patch fugitive, dependent on the richest patches, which it must find sequentially. The loss and fragmentation of habitats may have blurred the distinctness of the honeyeaters' niches, forcing several species to congregate on the remaining fragments, more than they would have done so originally. In this situation the species that are most dependent on the richest food source, such as the Regent Honeyeater, would be most affected and show the greatest decline in abundance and distribution.

We agree with Franklin *et al.* (1989) that habitat destruction has led to the decline of the Regent Honeyeater, but also suggest that the extreme aggressiveness shown by Regent Honeyeaters to other species is a further contributing factor. Keast (1968) described the Regent Honeyeater as a nomadic species, which nested in loose aggregations at rich flows of nectar. We hy-

pothesise that their tendency to nest together allowed Regent Honeyeaters to exclude aggressively larger honeyeaters from a nectar source without demanding excessive energy or time to be wasted by any individual pair. Group defence is shown by other honeyeaters such as Noisy and Bell Miners *M. melanophrys* (Dow 1977; Loyn *et al.* 1983). Such an interpretation explains both our observations of the Regent Honeyeater being highly aggressive and also feeding relatively large amounts of nectar to its young.

With habitat loss and fragmentation, Regent Honeyeaters can no longer reach sufficient numbers in nesting aggregations to share the effort of excluding other birds. This is especially so as other honeyeaters, such as Noisy Friarbirds and lorikeets, are concentrated into these remaining nectar sources. Noisy Miners present a rather different problem for Regent Honeyeaters, as they become more common in fragmented and degraded habitat, perhaps because insects and carbohydrate-rich foods, such as lerps, initially increase. Regent Honeyeaters are therefore forced to spend disproportionately more time and energy in aggression in both better and poorer quality remnant habitat. The higher aggressive rates that we found compared with Webster & Menkhorst (1992) may be because our sites were in remnants and corridors in farmland, whereas much of their work was in more extensive habitat at Warrumbungles National Park, Chiltern Park and Killawarra State Forest.

If our interpretation of Regent Honeyeater behaviour and ecology is correct, it indicates that both aggression among honeyeaters and the availability of food need to be addressed in developing a management strategy for the species. Simply protecting all remaining habitat where the species has been recorded may be inadequate, as much of this could be marginal and unable to sustain Regent Honeyeater populations, even as a network. In particular, a recovery plan for the Regent Honeyeater may require the control of numbers of other honeyeaters with which it competes for food and space.

Rich-patch fugitives are not unusual in the Australian avifauna. Other examples may be the Letter-winged Kite *Elanus scriptus*, Partridge Pigeon *Petrophassa smithii*, Swift Parrot *Lathamus discolor* and Scarlet-chested Parrot *Neophema splendida*. Many of these have declined with habitat loss and degradation. Their conservation provides a challenge to ornithologists far greater than that presented by sedentary habitat specialists such as the Noisy Scrub-bird *Atrichornis clamosus*.

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References

- Armstrong, D.P. 1991a. Nectar depletion and its implications for honeyeaters in heathland near Sydney. *Australian Journal of Ecology* 16, 99-109.
- Armstrong, D.P. 1991b. Aggressiveness of breeding territorial honeyeaters corresponds to seasonal changes in nectar availability. *Behavioral Ecology and Sociobiology* 29, 103-111.
- Blakers, M., Davies, S.J.J.F. & Reilly, P.N. 1984. *The Atlas of Australian Birds*. RAOU and Melbourne University Press, Melbourne.
- Braithwaite, L.W., Dudzinski, M.L. & Turner, J. 1983. Studies on the arboreal marsupial fauna of eucalypt forests being harvested for woodpulp at Eden, N.S.W. II. Relationship between the fauna density, richness and diversity, and measured variables of the habitat. *Australian Wildlife Research* 10, 231-247.
- Davis, W.E. & Recher, H.F. 1993. Notes on the breeding biology of the Regent Honeyeater. *Corella* 17, 1-4.
- Dow, D.D. 1977. Indiscriminate interspecific aggression leading to almost sole occupancy of space by a single species of bird. *Emu* 77, 115-121.
- Ford, H.A. 1979. Interspecific competition in Australian honeyeaters — depletion of common resources. *Australian Journal of Ecology* 4, 145-164.
- Ford, H.A. 1989. *Ecology of Birds: an Australian Perspective*. Surrey Beatty, Sydney.
- Ford, H.A. & Bell, H.L. 1982. Density of birds in eucalypt woodland affected to varying degrees by eucalypt dieback. *Emu* 81, 202-208.
- Ford, H.A. & Paton, D.C. 1982. Partitioning of nectar sources in an Australian honeyeater community. *Australian Journal of Ecology* 7, 149-159.
- Ford, H.A., Debus, S., Wyborn, S., Tremont, S., Nano, T., Strickson, J. & Cunningham, M. 1991. Breeding behaviour of the Red Wattlebird and Noisy Friarbird. *Australasian Society for the Study of Animal Behaviour Newsletter* 6-7.
- Franklin, D.C. & Menkhorst, P.W. 1988. A history of the Regent Honeyeater in South Australia. *South Australian Ornithologist* 30, 141-145.
- Franklin, D., Menkhorst, P. & Robinson, J. 1987. Field surveys of the Regent Honeyeater *Xanthomyza phrygia* in Victoria. *Australian Bird Watcher* 12, 91-95.
- Franklin, D., Menkhorst, P. & Robinson, J. 1989. Ecology of

- the Regent Honeyeater *Xanthomyza phrygia*. Emu 89, 140-154.
- Garnett, S. 1992. Threatened and extinct birds of Australia. RAOU Report 82.
- Keast, J.A. 1968. Seasonal movements in the Australian honeyeaters (Meliphagidae) and their ecological significance. Emu 67, 159-210.
- Ley, A. 1990. Notes on the Regent Honeyeater *Xanthomyza phrygia*. Australian Bird Watcher 13, 171-173.
- Ley, A.J. & Williams, M.B. 1992. The conservation status of the Regent Honeyeater near Armidale, NSW. Australian Bird Watcher 14, 277-281.
- Loyn, R.H. 1987. Effects of patch area and habitat on bird abundances, species numbers and tree health in fragmented Victorian forests. Pp. 65-77 in Nature Conservation: the Role of Remnants of Native Vegetation. Eds D.A. Saunders, G.W. Arnold, A.A. Burbidge & A.J.M. Hopkins. Surrey Beatty, Sydney.
- Loyn, R.H., Runnalls, R.G., Forward, G.Y. & Tyers, J. 1983. Territorial Bell Miners and other birds affecting populations of insect prey. Science 221, 1411-1413.
- Lunney, D. & Leary, T. 1988. The impact on native mammals of land-use changes and exotic species in the Bega district, New South Wales, since settlement. Australian Journal of Ecology 13, 67-92.
- Majer, J.D., Recher, H.F. & Ganeshanandam, S. 1993. Variation in foliar nutrients and its relation to arthropod communities on *Eucalyptus* trees in eastern and Western Australia. Australian Journal of Ecology 17, 383-393.
- McFarland, D.C. 1986. The organization of a honeyeater community in an unpredictable environment. Australian Journal of Ecology 11, 107-120.
- Paton, D.C. 1982. The diet of the New Holland Honeyeater, *Phylidonyris novaehollandiae*. Australian Journal of Ecology 7, 279-298.
- Recher, H.F., Majer, J.D. & Ford, H.A. 1991. Temporal and spatial variation in the abundance of eucalypt canopy invertebrates: response of forest birds. Pp. 1568-1575 in Acta XX Congressus Internationalis Ornithologici, Christchurch 1990, 3. Ed. B.D. Bell *et al.* New Zealand Ornithological Trust Board, Wellington.
- Saunders, D.A. 1989. Changes in the avifauna of a region, district and remnant as a result of fragmentation of native vegetation: the wheatbelt of Western Australia. A case study. Biological Conservation 50, 99-135.
- Webster, R. & Menkhurst, P. 1992. The Regent Honeyeater (*Xanthomyza phrygia*): population status and ecology in Victoria and New South Wales. Arthur Rylah Institute for Environmental Research Technical Report Series No. 126.
- Wykes, B. 1985. The Helmeted Honeyeater and related honeyeaters of Victorian woodlands. Pp. 205-217 in Birds of Eucalypt Forests and Woodlands: Ecology, Conservation, Management. Eds J.A. Keast, H.F. Recher, H.A. Ford & D. Saunders. Surrey Beatty, Sydney.

On Cyclones, *Pisonia grandis* and the Mortality of Black Noddy *Anous minutus* on Heron Island

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The population of noddies on Heron Island (23°26'S, 151°51'E) has been increasing exponentially since early this century (Barnes & Hill 1989). The rate of increase has averaged c. 7% per annum, although it has not been even; considerable variation in numbers occurs from year to year (Hulsman 1984; Ogden unpubl. data). Periodic declines may follow cyclones, such as that in 1967 which killed many noddies and destroyed nesting trees (Kikkawa 1970). Cyclone 'David' in 1976 also did much damage on Heron Island (Flood & Jell 1977) and resulted in the deaths of noddy chicks from starvation

because the adults were unable to collect food (Hulsman 1977).

On Heron Island, as elsewhere on the Great Barrier Reef, noddies nest mainly in *Pisonia grandis* trees (Dale *et al.* 1984; Hulsman *et al.* 1984; Barnes & Hill 1989) and utilise the shed leaves for nest building material. Both adults and chicks can become ensnared by the sticky fruits of *Pisonia* and they usually die when this happens. Chicks blown out of nests are usually ignored by adults (Congdon 1991) and become trapped in the fruit clusters on the forest floor. Cribb (1969) remarks