THE SUNBIRD

Journal of the
QUEENSLAND ORNITHOLOGICAL SOCIETY

Volume 26 Number 1 March 1996

SUNBIRD 26(1) **March 1996**

CONTENTS

OFFICERS AND COUNCIL FOR 1996

President
LYNDA LITZ-TYNE

Vice President
IAN GYNTHER

Past President
ROY SONNENBURG

Country Vice Presidents
JON WREN, VALDA McLEAN

Treasurer
GARTH INNES

Secretary
JAN BELL

Outings Officers
GAYLE JOHNSON

Records Officer
IAN GYNTHER

Sunbird Editor
PETER BRITTON

Assistant Editors
REGINA MIGALA, JEREMY THOMPSON

Librarian
GRAHAM LEACH

Audiovisual Librarian
JOHN NOYCE

Projects Officer
IAN VENABLES

Conservation Officer
MICHAEL HARDING

Membership Secretary
GARTH INNES

Newsletter Editor
GREG ANDERSON

Property Officer
DENIS TAYLOR

Council Members
JULIAN BIELEWICZ, ROSLYN LAUNDON
DAWN MUIR , DON MUIR

The objectives of the Society are to promote the scientific study and conservation of birds by all means possible, with particuler reference to the birds of Queensland.

All members receive a monthly newsletter and a copy of the quarterly journal, *The Sunbird*. The price of *The Sunbird* to non-members is $6.00 per issue. The Society holds a general meeting and a field excursion each month.

General correspondence, including membership fees, should be addressed to the Secretary. *The Society's address is*

P.O. Box 97, St. Lucia, Queensland, 4067.

THE SUNBIRD

Volume 26 No. 1 March 1996

STRUCTURE OF BREEDING BIRD COMMUNITIES IN RAINFOREST AND REGROWTH FOREST IN TROPICAL QUEENSLAND

WILLIAM F. LAURANCE, CALEB E. GORDON and ETHAN PERRY

ABSTRACT

Breeding bird communities were compared, using acoustical/visual censuses, between upland rainforest and contiguous, 20-30 year-old regrowth forest on the Atherton Tableland in NE Queensland. A total of 61 species was recorded, with five favouring rainforest and eleven favouring regrowth. Most (4/5) rainforest-favouring birds were obligate insectivores and all were endemic to the Wet Tropics biogeographic region at the species or subspecies level. Regrowth-favouring birds were more variable in diet and frequently had larger geographic ranges.

The 61 species were divided into 12 feeding guilds based on diet and foraging ecology. Only one guild (trunk/bark searching insectivores) favoured rainforest, whereas two guilds (generalist carnivores and granivores) favoured regrowth. Although regrowth forest is avoided by some specialised insectivores, many Australian rainforest birds, especially those that utilise fruits or nectar, use regrowth forest when it adjoins rainforest.

INTRODUCTION

In the Wet Tropics biogeographic region of north Queensland (Stanton & Morgan 1977), intensive land uses during the past century have created complex mosaics of primary and disturbed habitats (Bell *et al.* 1987). Today, these mosaics include hundreds of tracts of regrowth forest, commonly ranging from a few to over one hundred hectares in area and often located on degraded or abandoned agricultural lands.

Many forest birds are sensitive to structural attributes of their habitat (MacArthur 1958, Recher 1969, Karr & Roth 1971, Pearson 1975, Kikkawa 1982, Frith 1984), and thus one might expect pronounced differences between avian assemblages

in primary and regrowth forest. Researchers have compared rainforest bird communities to those in secondary or fragmented habitats in Asia (McClure & Bin Othman 1965, Diamond 1972, Beehler 1978, Bell 1982, Wong 1986), Africa (Elgood & Sibley 1964, Brosset 1986, Newmark 1991), and the Neotropics (Terborgh & Weske 1969, Willis 1979, Evans 1986, Bierregaard & Lovejoy 1989, Bierregaard 1990, Canaday 1991). In tropical Australia, however, bird communities in secondary forests have received only limited attention. Kikkawa (1982) and Driscoll & Kikkawa (1989) discussed differences between bird assemblages in rainforest and regrowth in north Queensland, mainly at lowland sites; while Crome (1990) listed species detected within a 30 year-old tract of regrowth on the Atherton Tableland.

Data on the use of regenerating forest by birds are important for understanding the dynamics of regional bird populations (Loiselle & Blake 1992), for managing birds in fragmented landscapes (Lovejoy *et al.* 1986), and for understanding the role of avian frugivores in forest regeneration (Guevara & Laborde 1993). Consequently, we compared breeding bird assemblages in adjoining tracts of rainforest and regrowth forest on the Atherton Tableland, using standardised acoustical/visual censuses. We also contrasted the trophic organisation of these assemblages in an effort to identify differences in resource availability between the two habitats.

METHODS

Study area

The study area (17° 12' S, 145° 36' E) was located on the western flank of the Lamb Range above the Mulgrave River escarpment. The terrain is hilly and overlays mostly granitic soils at 750-800 m elevation. Rainfall averages 1400-2100 mm annually (Laurance *et al.* 1993).

The study site (Fig. 1) encompassed about 60 ha, of which 30-35 ha was a semi-rectangular tract of 20-30 year-old regrowth forest. The original rainforest was clear-felled and burned in 1960. The site supported cattle grazing until 1973, although some areas began to regenerate soon after clearing (S. Binnie pers. comm.). The regrowth was dominated by six tree species: two wattles (*Acacia aulacocarpa*, *A. circinnata*), Grey Bolleywood *Neolitsea dealbata*, Sasparilla *Alphitonia petrei*, Celerywood *Polyscias elegans* and Carabeen *Sloanea langii*. Lantana *Lantana camara* and Molasses Grass *Melinus minutiflora* were prevalent where tree cover was minimal.

The rainforest study area, roughly similar in size to the regrowth site, comprised a rectangular section of a large (>2000 ha) forest tract that adjoined the regrowth forest. This forest is predominantly complex notophyll vine-forest (Tracey 1982), although several rainforest types intergrade in the general area due to

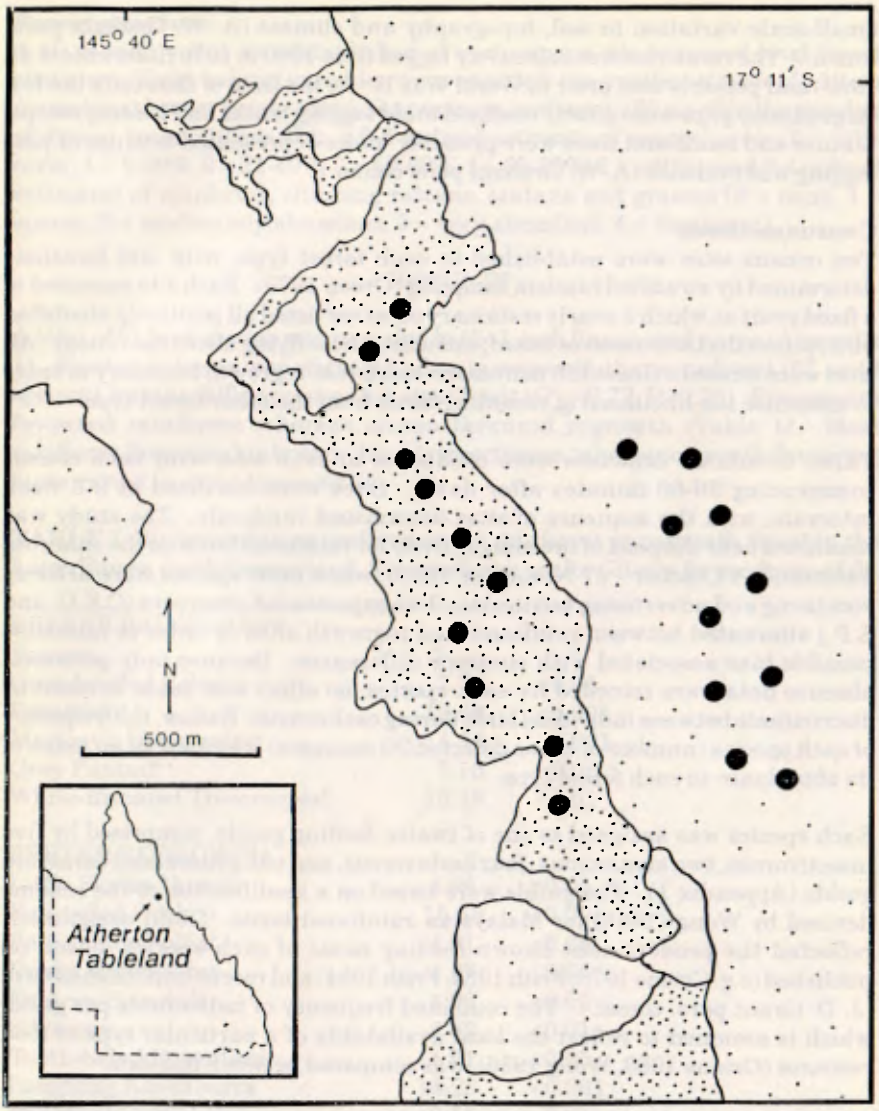

Fig. 1. Study area on the northeastern margin of the Atherton Tableland in north Queensland. Circles indicate approximate locations of census sites in rainforest and regrowth forest. Darkly stippled areas are regrowth, lightly stippled areas are rainforest, and unstippled areas are mostly cattle pastures.

small-scale variation in soil, topography and climate (A. W. Graham pers. comm.). The rainforest was selectively logged from 1960 to 1970 (Laurance *et al.* 1993) and possibly also prior to World War II. At the time of the study the few large canopy gaps were mostly confined to old logging tracks and loading ramps. Mature and moribund trees were probably under-represented because of past logging and cyclones (A. W. Graham pers. comm.).

Census methods

Ten census sites were established in each forest type, with site locations determined by stratified random sampling (Green 1979). Each site consisted of a fixed point at which a nearly stationary observer listed all positively identified bird species that were seen or heard, excluding those flying above the canopy. All sites were located at least 150 m from the rainforest-regrowth boundary in order to minimise the likelihood of recording birds from the other forest type.

Three 60-minute censuses were conducted at each site, with each census commencing 30-60 minutes after dawn. Sites were censused at 2-3 week intervals, with the sequence of sites determined randomly. The study was conducted near the peak of breeding activity for rainforest birds on the Atherton Tableland (4 October - 27 November 1989), when most species were actively vocalising and advertising territories. Two experienced observers (C.E.G. and E.P.) alternated between rainforest and regrowth sites in order to minimise possible bias associated with observer differences. Because only presence/absence data were recorded for each species, no effort was made to count or discriminate between individual birds during each census. Rather, the frequency of each species (number of times detected/30 censuses) was used as an index of its abundance in each forest type.

Each species was assigned to one of twelve feeding guilds, comprised by five insectivorous, two omnivorous, four herbivorous, and one generalised carnivore guilds (Appendix 1). The guilds were based on a modification of the scheme devised by Wong (1986) for Malaysian rainforest birds. Guild assignment reflected the predominant known feeding mode of each species, based on published (e.g. Crome 1978, Frith 1983, Frith 1984) and recent unpublished data (J. D. Grant pers. comm.). The combined frequency of individuals per guild, which is assumed to reflect the local availability of a particular type of food resource (Orians 1969, Wong 1986), was compared between habitats.

G-tests for goodness-of-fit, incorporating Williams' correction for sample size (Sokal & Rohlf 1981), were used to compare frequency and species richness data between habitats. For a few species, data were (X + 1) transformed to remove confounding zero values.

Forest structure

A 10 m-radius plot was established at each census site to record local forest structure. Eight habitat variables were recorded: the number of trees of >10 cm diameter at breast height (dbh); the percentage of trees >30 cm dbh; the number of *Acacia* trees >10 cm dbh; a 0-5 ordinal estimate of canopy cover (0 = <5% cover, 1 = 5-20%, 2 = 21-40%, 3 = 40-60%, 4 = 60-80%, 5 = >80%); and 0-4 ordinal estimates of epiphytes, climbing rattans, lantana and grasses (0 = none, 1 = sparse, 2 = moderately abundant, 3 = very abundant, 4 = dominant).

RESULTS

A total of 61 bird species was recorded in the Lamb Range study area (Appendix 1). Species richness was slightly higher in regrowth than rainforest (57 vs 48 species), but the difference was not significant (G_{adj}=0.77, P>0.20). Five species favoured rainforest whereas eleven favoured regrowth (Table 1). Most rainforest-favouring birds were obligate insectivores, whereas regrowth-favouring birds varied in diet (Appendix 1).

TABLE 1 Birds exhibiting preferences for rainforest or regrowth forest in the Lamb Range, north Queensland. Test statistics are for *G*-tests for goodness-of-fit.

PREFER RAINFOREST		
Species	G_{adj}	P
Grey-headed Robin[a]	7.72	<0.01
Fernwren[a]	12.68	<0.001
Macleay's Honeyeater[a]	11.38	<0.001
Grey Fantail[b]	7.10	<0.05
White-throated Treecreeper[b]	10.45	<0.01
PREFER REGROWTH		
Little Shrike-thrush	4.94	<0.05
Fan-tailed Cuckoo	15.53	<0.001
Pale-yellow Robin[b]	4.91	<0.05
Dusky Honeyeater	4.87	<0.05
Eastern Spinebill	4.06	<0.05
Silvereye	8.53	<0.01
Tooth-billed Bowerbird[a]	4.91	<0.05
Laughing Kookaburra	14.25	<0.001
Pheasant Coucal	8.18	<0.01
Mistletoebird	4.61	<0.01
Orange-footed Scrubfowl	4.61	<0.05

[a]Species confined to the Wet Tropics biogeographic region.
[b]This morphologically distinct race is confined to the Wet Tropics biogeographic region.

When the total numbers of birds in the twelve feeding guilds were compared between habitats (Appendix 1), the trophic organisation of the two communities was moderately different (G_{adj}=24.14, d.f.=11, P<0.025). Rainforest had significantly more trunk/bark-searching insectivores (G_{adj}=4.71, P<0.05), whereas regrowth had significantly more generalist carnivores/insectivores (G_{adj}=8.59, P<0.005) and granivores (G_{adj}=5.87, P<0.025).

Regrowth trees were typically smaller and sparser than those in rainforest (Table 2). Canopy cover in regrowth was variable, being sparse on ridgetops but nearly continuous in gullies, whereas rainforest plots usually had dense, continuous canopy cover. Climbing rattans and epiphytes were abundant in rainforest, whereas *Acacia* trees, Lantana and grasses were confined to regrowth (Table 2).

TABLE 2 Comparisons of selected physiognomic variables within 10 m-radius plots in rainforest (n = 10) and regrowth forest (n = 10) in north Queensland ($\bar{X} \pm$ SD). See text for descriptions of variables.

Variable	Rainforest	Regrowth
No. trees/plot (>10 cm dbh)	24.0 ± 3.5	11.0 ± 3.5
No. trees/plot (>30 cm dbh)	5.1 ± 0.7	0.9 ± 0.3
No. *Acacia* trees/plot (>10 cm dbh)	0	2.0 ± 1.1
Canopy Cover	4.3 ± 0.4	2.5 ± 1.6
Climbing Rattans	2.4 ± 0.7	0.5 ± 0.7
Epiphytes	1.2 ± 0.7	0.2 ± 0.4
Lantana	0	1.0 ± 1.1
Grasses	0	2.0 ± 2.3

DISCUSSION

Validity of census methods

There are a number of difficulties associated with obtaining unbiased censuses of birds in tropical rainforests (Karr 1981). Mist-nets are often used to sample birds in rainforest (Willis 1979, Bierregaard & Lovejoy 1989, Newmark 1991), but these are heavily biased toward small and medium-sized birds of the understorey (Terborgh *et al.* 1990, Canaday 1991). Acoustical/visual censuses (e.g. Bell 1982, Terborgh *et al.* 1990) provide a far more complete sample of species, but these can be biased toward vocal or conspicuous species (Emlen 1971, Reynolds *et al.* 1980). Despite its limitations, the standardised acoustical/visual censuses used in this study appeared to provide a reasonable estimate of frequency for most (>80%) species breeding in the study area, based on comparisons with opportunistic censuses (W. F. Laurance unpubl. data). Because

more than 60% of the detected birds were identified by sound, the censuses were not strongly influenced by differences in vegetation structure between rainforest and regrowth.

Species richness

An interesting result of this study is that species richness of breeding bird communities in primary rainforest samples (48 species) did not exceed that in adjacent, 20-30 year-old regrowth forest (57 species). There are three likely reasons for this finding.

Firstly, the rainforest avifauna of north Queensland is depauperate relative to those of other tropical continents (Driscoll & Kikkawa 1989). The low species richness and relative paucity of highly specialised and sedentary species (Crome 1990) probably arose because of pronounced shrinking of the Australian rainforest biome during cooling and drying episodes of the Pleistocene (Kikkawa *et al.* 1981, Webb & Tracey 1981, Hopkins *et al.* 1993).

Secondly, regrowth supports a number of habitat generalists and species from non-rainforest habitats or forest edge, which rarely enter rainforest (Bell 1982, Kikkawa 1982, Brosset 1986, Driscoll & Kikkawa 1989, Crome 1990). In this study, several species that favoured woodlands, forest ecotones and disturbed habitats (e.g. Red-browed Finch, Peaceful Dove, Silvereye and Pheasant Coucal) were confined to or far more prevalent in regrowth (see Appendix 1 for details including scientific names).

Thirdly, many nominally rainforest-dependent birds can utilise nearby regrowth forest to some degree (Elgood & Sibley 1964, McClure & Bin Othman 1965, Diamond 1972, Beehler 1978, Bell 1982, Brosset 1986, Evans 1986, Driscoll & Kikkawa 1989, Canaday 1991). Rainforest birds that are partially or wholly frugivorous or nectarivorous have been shown to readily colonise forest edges and other secondary habitats in Gabon (Brosset 1986), New Guinea (Bell 1982, Driscoll & Kikkawa 1989) and the Neotropics (Bierregaard & Lovejoy 1989, Canaday 1991). Of the 48 species recorded in rainforest, all but four were detected in regrowth, and only five exhibited a significant preference for rainforest (Table 1).

The observation that the majority of rainforest birds entered regrowth, whereas regrowth birds were rarely detected in rainforest, is consistent with the "shared preference model" of habitat selection devised by Rosenzweig (1991). This model proposes that different mechanisms are involved in habitat exclusion in rich and poor habitats. Occupants of putatively poor habitats (regrowth) are expected to be excluded from the richer habitat (rainforest) by direct interactions with aggressive denizens of the rich habitat. Rich-habitat dwellers, however, are excluded from the poor habitat by their inability to subsist on poorer resources (Rosenzweig 1991). Rainforest birds in regrowth may frequently be subordinate

or transient individuals which would not persist without the presence of nearby rainforest (Bell 1982).

Trophic structure

Significant differences in abundance were detected in only three of twelve avian feeding guilds. Species within the same guild often differed in their habitat associations (Appendix 1), suggesting that dietary preferences and feeding ecology were generally poor predictors of avian habitat preferences. However, some patterns were apparent, and these may reflect differences in the types and abundance of food resources in primary and regrowth forest; as well as structural differences between the two habitats, which influence avian habitat selection (Willis 1979, Bell 1982, Bierregaard & Lovejoy 1989, Canaday 1991, Newmark 1991).

Most (4/5) of the rainforest-favouring species were obligate insectivores (Table 2). Studies in Africa, Asia, South America and New Guinea have demonstrated that many specialised insectivorous birds, particularly those that forage in the understorey, are confined to primary forest (Willis 1979, Bell 1982, Brosset 1986, Bierregaard & Lovejoy 1989, Driscoll & Kikkawa 1989, Canaday 1991, Newmark 1991). The moist, stable microclimate of the rainforest is probably more favourable to invertebrates than are the drier, less buffered conditions in regrowth (e.g. Janzen & Schoener 1968, Janzen 1973, Frith & Frith 1990). In addition, species adapted for dark forest interiors may exhibit a psychological avoidance of more-open or patchy habitats such as regrowth (e.g. Lovejoy *et al.* 1986, Burnett 1992).

Like many of the obligate insectivores, Macleay's Honeyeater exhibited a significant preference for rainforest. Although partially frugivorous and nectarivorous, this species is a dead-leaf specialist (Crome 1978), probing for insects in clusters of dead leaves and bark crevices. Dead-leaf foraging is a specialised feeding adaptation among tropical rainforest birds (Rosenberg 1990). The Macleay's Honeyeater, like most of the obligate rainforest insectivores, is confined to the Wet Tropics biogeographic region (Frith 1983).

Unlike rainforest-favouring birds, regrowth-favouring species were variable in diet and included omnivorous, herbivorous, carnivorous and insectivorous species (Appendix 1). Granivores were confined to regrowth and included Red-browed Finch and Peaceful Dove, which specialise on small, non-rainforest seeds. Arboreal frugivore/granivore species such as Sulphur-crested Cockatoo, Australian King-Parrot and Crimson Rosella were common in regrowth. These species have generalised diets that include seeds of *Acacia* trees (Frith 1983) which were abundant in regrowth. The generalised carnivore/insectivore guild included opportunistic predators such as Laughing Kookaburra, Pheasant Coucal and Pied Currawong, which favour woodlands and open habitats.

Values of regrowth forest

Tracts of regrowth near rainforest provide foraging opportunities for a number of migratory or nomadic birds, especially elevational migrants which include many frugivores and nectarivores (Crome 1975, 1990, Loiselle & Blake 1992). In this study, several obligate or near-obligate frugivores (e.g. Wompoo Fruit-Dove, Purple-crowned Fruit-Dove, Tooth-billed Bowerbird and Spotted Catbird) were regularly detected in regrowth (Appendix 1). The phenologies of plants in regrowth forest often differ from those in rainforest, and at certain times of the year fruit abundance in regrowth may rival or exceed that in rainforest (Martin 1985). Indeed, regrowth may provide crucial resources for fruit- and nectar-feeding birds during periods of food scarcity (Terborgh 1986, Loiselle & Blake 1992). Frugivorous birds are important vectors of rainforest seeds into regenerating forest, and thus contribute to natural successional processes (Crome 1990, Guevara & Laborde 1993).

For some rainforest birds, however, regrowth provides only sub-optimal habitat (Terborgh & Weske 1969, Bell 1982, Driscoll & Kikkawa 1989) which supports few breeding individuals. In the Amazon Basin, Canaday (1991) found that White-plumed Antbirds *Pithys albifrons* captured in regrowth and forest-edge sites were never in breeding condition, whereas half of the individuals captured in rainforest interiors were in breeding condition. Under some circumstances, areas of regrowth forest could function as "dispersal sinks" (Pulliam 1988), draining individuals from a healthy breeding population in rainforest that might otherwise be colonizing more suitable habitats.

This study suggests that most species breeding in upland rainforest in north Queensland will utilise contiguous areas of regrowth forest, at least to some degree. It should be noted, however, that the forest tracts in which we conducted our censuses were unreplicated (cf. Hurlbert 1984), and it is possible that bird communities in other upland forests in the region will differ from those observed in this study. However, in a survey of birds of the Atherton Tableland near Boonjie, Crome (1990) also found no significant difference between bird species richness in rainforest (64 species) and 30 year-old regrowth forest (58 species), and similarly concluded that the majority of rainforest species would utilize adjoining regrowth. The concordance between these studies suggests that our findings are not atypical.

In north Queensland, few researchers have examined faunal communities in regenerating forests (Crome 1990). Future studies should compare faunal assemblages between a range of sites, and examine in detail the demography of species in secondary forests. Information on bird use of regenerating forest in fragmented landscapes (e.g. Green 1993, Isaacs 1994) is particularly relevant to current reafforestation efforts.

ACKNOWLEDGEMENTS

Dr R. Bierregaard, Dr J. Grant, F. Crome, C. Frith, Dr D. Frith, Dr K. Rosenberg, Dr A. Jansen, A. Graham, Dr P. Green and P. Britton commented on earlier drafts of the manuscript. Dr J. Grant also provided useful discussion on bird diets. WFL was supported by a senior research fellowship awarded by the Wet Tropics Management Authority.

REFERENCES

BEEHLER, B. 1978. Historical changes in the avifauna of Wau Valley, Papua New Guinea. *Emu* 78: 54-60.

BELL, H. L. 1982. A bird community of lowland rainforest in New Guinea. 4. birds of secondary vegetation. *Emu* 82: 217-224.

BELL, F. C., WINTER, J. W., PAHL, L. I. & ATHERTON, R. G. 1987. Distribution, area and tenure of rainforest in northeastern Australia. *Proc. Roy. Soc. Qld* 98: 27-39.

BIERREGAARD, R. O. 1990. Avian communities in the understory of Amazon forest fragments. Pp. 333-343 in *Biogeography and Ecology of Forest Bird Communities*. Eds. A. Keast and J. Kikkawa. The Hague: SPB Academic Publishing.

BIERREGAARD, R. O. & LOVEJOY, T. E. 1989. Effects of forest fragmentation on Amazonian understorey bird communities. *Acta Amazonica* 19: 215-241.

BROSSET, A. 1986. Response of birds to habitat modification in Gabon. *Ibis* 128: 171-172.

BURNETT, S. 1992. Effects of a rainforest road on movements of small mammals: mechanisms and implications. *Wildl. Res.* 19: 95-104.

CANADAY, C. 1991. *Effects of Encroachment by Industry and Agriculture on Amazonian Forest Birds in the Cuyaben Reserve, Ecuador*. M.Sc. Thesis, University of Florida, Gainesville.

CROME, F. H. J. 1975. The ecology of fruit pigeons in tropical northern Queensland. *Aust. Wildl. Res.* 2: 155-185.

CROME, F. H. J. 1978. Foraging ecology of an assemblage of birds in lowland rainforest in northern Queensland. *Aust. J. Ecol.* 3: 195-212.

CROME, F. H. J. 1990. Vertebrates and successions. Pp. 53-64 in *Tropical Rainforest: Science—Values—Meaning*. Eds. L. J. Webb & J. Kikkawa. Melbourne: CSIRO.

DIAMOND, J. M. 1972. *Avifauna of the Eastern Highlands of New Guinea*. Cambridge, Massachusetts: Nuttall Orn. Club.

DRISCOLL, P. V. & KIKKAWA, J. 1989. Bird species diversity of lowland tropical rainforests of New Guinea and Northern Australia. Pp. 123-152 in *Ecological Studies, Vol. 69: Vertebrates in Complex Tropical Systems*. Eds. M. L. Harmelin-Vivien & F. Bourliere. New York: Springer-Verlag.

ELGOOD, J. H. & SIBLEY, F. C. 1964. The tropical forest edge avifauna in Ibadan, Nigeria. *Ibis* 106: 231-247.

EMLEN, J. T. 1971. Population densities of birds derived from transect counts. *Auk* 88: 182-189.

EVANS, P. G. H. 1986. The effects of different forms of land use on tropical forest birds in Dominica, West Indies. *Ibis* 128: 168-175.

FRITH, D. W. 1984. Foraging ecology of birds in an upland tropical rainforest in north Queensland. *Aust. Wildl. Res.* 11: 325-347.

FRITH, D. W. & FRITH, C. B. 1990. Seasonality of litter invertebrate populations in an Australian upland tropical rain forest. *Biotropica* 22: 181-190.

FRITH, H. J. 1983. *Reader's Digest Complete Book of Australian Birds*. Sydney: Reader's Digest.

GREEN, R. H. 1979. *Sampling Design and Statistical Methods for Environmental Biologists*. New York: John Wiley.

GREEN, R. J. 1993. Avian seed dispersal in and near subtropical rainforests. *Wildl. Res.* 20: 535-557.

GUEVARA, S. & LABORDE, J. 1993. Monitoring seed dispersal at isolated standing trees in tropical pastures: consequences for local species availability. *Vegetatio* 107/108: 319-338.

HOPKINS, M. S., ASH, J., GRAHAM, A. W., HEAD, J. & HEWETT, R. K. 1993. Charcoal evidence of the spatial extent of the *Eucalyptus* woodland expansions and rainforest contractions in North Queensland during the late Pleistocene. *J. Biogeogr.* 20: 357-372.

HURLBERT, S. J. 1984. Pseudoreplication and the design of ecological field experiments. *Ecol. Monogr.* 54: 187-211.

ISAACS, J. L. 1994. *The Utilisation of Remnant Riparian Vegetation by Birds*. M.Sc. thesis, James Cook University, Townsville, Queensland.

JANZEN, D. H. 1973. Sweep samples of tropical foliage insects: effects of season, vegetation types, elevation, time of day, and insularity. *Ecology* 54: 686-708.

JANZEN, D. H. & SCHOENER, T. W. 1968. Differences in insect abundance and diversity between wetter and drier sites during a tropical dry season. *Ecology* 49: 96-110.

KARR, J. 1981. Surveying birds in the tropics. *Stud. Avian Biol.* 6: 548-553.

KARR, J. & ROTH, R. 1971. Vegetation structure and avian diversity in several New World areas. *Am. Nat.* 105: 423-433.

KIKKAWA, J. 1982. Ecological associations of birds and vegetation structure in wet tropical forests of Australia. *Aust. J. Ecol.* 7: 325-345.

KIKKAWA, J., MONTEITH, G. B. & INGRAM, G. 1981. Cape York Peninsula: major region of faunal interchange. Pp. 1695-1742 in *Ecological Biogeography of Australia*. Ed. A. Keast. The Hague: Junk.

LAURANCE, W. F., GARESCHE, J. & PAYNE, C. W. 1993. Avian nest predation in modified and natural habitats in tropical Queensland: an experimental study. *Wildl. Res.* 20: 711-723.

LOISELLE, B. A. & BLAKE, J. G. 1992. Population variation in a tropical bird community. *Bioscience* 42: 838-845.

LOVEJOY, T. E., BIERREGAARD, R. O., RYLANDS, A. B., *et al.* 1986. Edge and other effects of isolation on Amazon forest fragments. Pp. 257-285 in *Conservation Biology: The Science of Scarcity and Diversity*. Ed. M. Soule. Sunderland, Massachusetts, USA: Sinauer.

MACARTHUR, R. H. 1958. Population ecology of some warblers of northeastern coniferous forests. *Ecology* 39: 599-619.

MARTIN, T. E. 1985. Selection of second-growth woodlands by frugivorous migrating birds in Panama: an effect of fruit size and plant density? *J. Tropical Ecol.* 1: 157-170.

MCCLURE, H. E. & BIN OTHMAN, H. 1965. Avian bionomics of Malaya. 2. The effects of forest destruction upon a local population. *Bird Banding* 36: 242-269.

NEWMARK, W. D. 1991. Tropical forest fragmentation and local extinction of understorey birds in the eastern Usambara Mountains, Tanzania. *Conserv. Biol.* 5: 67-78.

ORIANS, G. H. 1969. The number of bird species in some tropical forests. *Ecology* 50: 783-801.

PEARSON, D. 1975. The relation of foliage complexity to ecological diversity of three Amazonian bird communities. *Condor* 77: 453-466.

PULLIAM, H. R. 1988. Sources, sinks and population regulation. *Am. Nat.* 132: 652-661.

RECHER, H. F. 1969. Bird species diversity and habitat diversity in Australia and North America. *Am. Nat.* 103: 75-79.

REYNOLDS, R. T., SCOTT, J. M. & NUSSBAUM, R. A. 1980. A variable circular-plot method for estimating bird numbers. *Condor* 82: 309-313.

ROSENBERG, K. V. 1990. Dead-leaf foraging specialization in tropical forest birds: measuring resource availability and use. *Stud. Avian Biol.* 13: 360-368.

ROSENZWEIG, M. L. 1991. Habitat selection and population interactions: the search for mechanisms. *Am. Nat.* 137: 5-28.

SOKAL, R. R. & ROHLF, F. J. 1981. *Biometry*, 2nd edn. San Francisco: Freeman.

STANTON, J. P. & MORGAN, G. 1977. *The Rapid Selection and Appraisal of Key and Endangered Sites: The Queensland Case Study*. Report No. PR4, School of Natural Resources, University of New England, Armidale, N.S.W.

TERBORGH, J. 1986. Keystone plant resources in the tropical forest. Pp. 330-344 in *Conservation Biology: The Science of Scarcity and Diversity*. Ed. M. E. Soule. Sunderland, Massachusetts: Sinauer.

TERBORGH, J., ROBINSON, S. K., PARKER, T. A., MUNN, C. A. & PEIRPONT, N. 1990. Structure and organization of an Amazonian forest bird community. *Ecol. Monogr.* 60: 213-238.

TERBORGH, J. & WESKE, J. S. 1969. Colonization of secondary habitats by Peruvian birds. *Ecology* 55: 765-782.

TRACEY, J. G. 1982. *The Vegetation of the Humid Tropical Region of North Queensland.* Indooroopilly: CSIRO.

WEBB, L. J. & TRACEY, J. G. 1981. Australian rainforest: patterns and change. Pp. 605-694 in *Ecological Biogeography of Australia*. Ed. A. Keast. The Hague: Junk.

WILLIS, E. O. 1979. The composition of avian communities in remnascent woodlots in southern Brazil. *Papeis Avulsos Zool.* 33: 1-25.

WONG, M. 1986. Trophic organization of understory birds in a Malaysian dipterocarp forest. *Auk* 103: 100-116.

WILLIAM F. LAURANCE, CSIRO Tropical Forest Research Centre, P.O. Box 780, Atherton, Q 4883. Present address: Biological Dynamics of Forest Fragments Project, National Institute for Research in the Amazon, C.P. 478, Manaus, AM 69011-970, Brazil.

CALEB E. GORDON & ETHAN PERRY, S.F.S. Centre for Rainforest Studies, Yungaburra, Q 4872.

APPENDIX 1. Frequency data (number of times detected/30 censuses) for bird species and avian feeding guilds in rainforest and regrowth forest.

Guild and Species	*Rain Forest*	*Regrowth Forest*
Leaf-litter Insectivores		
Chowchilla *Orthonyx spaldingii*[a]	22	23
Eastern Whipbird *Psophodes olivaceus*	23	30
White-browed Scrubwren *Sericornis frontalis*	0	2
Yellow-throated Scrubwren *S. citreogularis*[b]	5	0
Fernwren *Oreoscopus gutturalis*[a]	19	3
	69	**58**
Ground-pouncing Insectivores		
Grey-headed Robin *Heteromyias albispecularis*[a]	25	9
Pale-yellow Robin *Tregellasia capito*[b]	7	18
Fan-tailed Cuckoo *Cacomantis flabelliformes*	2	19
	34	**46**
Foliage-gleaning Insectivores		
Brown Greygone *Gerygone mouki*	30	30
Little Shrike-thrush *Colluricincla megarhyncha*	13	27
Bower's Shrike-thrush *C. boweri*[a]	15	15
Large-billed Scrubwren *Sericornis magnirostris*	22	19
Atherton Scrubwren *S. keri*[a]	0	1
Black-faced Monarch *Monarcha melanopsis*	24	28
Spectacled Monarch *M. trivirgatus*	27	26
Golden Whistler *Pachycephala pectoralis*	25	14

Grey Whistler *P. simplex*	0	1
Yellow-breasted Boatbill *Machaerirhynchus flaviventer*	15	13
Shining Bronze-Cuckoo *Chrysococcyx lucidus*	0	1
	171	**175**
Trunk/Bark-searching Insectivores		
Victoria's Riflebird *Ptiloris victoriae*[a,c]	27	23
White-throated Treecreeper *Cormobates leucophaeus*[b]	23	6
Pied Monarch *Arses kaupi*[a]	0	2
	50	**31**
Hawking Insectivores		
Grey Fantail *Rhipidura fuliginosa*[b]	9	1
Rufous Fantail *R. rufifrons*	0	1
White-eared Monarch *Monarcha leucotis*	13	20
Spangled Drongo *Dicrurus bracteatus*	18	20
Dollarbird *Eurystomus orientalis*	0	2
	40	**44**
Generalist Carnivores/Insectivores		
Laughing Kookaburra *Dacelo novaeguineae*	1	15
Forest Kingfisher *Todiramphus macleayii*	1	0
Black Butcherbird *Cracticus quoyi*	18	17
Pied Currawong *Strepera graculina*	1	4
Pheasant Coucal *Centropus phasianinus*	1	10
	22	**46**
Nectarivores/Insectivores		
Lewin's Honeyeater *Meliphaga lewinii*	30	30
Graceful Honeyeater *M. gracilis*	1	0
Macleay's Honeyeater *Xanthotis macleayana*[a]	24	6
Dusky Honeyeater *Myzomela obscura*	4	13
Yellow-faced Honeyeater *Lichenostomus chrysops*	0	2
Bridled Honeyeater *L. frenatus*[a]	0	2
Eastern Spinebill *Acanthorhynchus tenuirostris*	4	12
Silvereye *Zosterops lateralis*	5	19
Rainbow Lorikeet *Trichoglossus haematodus*	16	11
	84	**95**
Frugivores/Insectivores		
Cicadabird *Coracina tenuirostris*	6	8
White-bellied Cuckoo-shrike *C. papuensis*	0	1
Varied Triller *Lalage leucomela*	18	16
Mistletoebird *Dicaeum hirundinaceum*	6	16
	30	**41**
Arboreal Frugivores		
Wompoo Fruit-Dove *Ptilinopus magnificus*	25	15

Superb Fruit-Dove *P. superbus*	18	14
Rose-crowned Fruit-Dove *P. regina*	1	0
Spotted Catbird *Ailuroedus melanotus*	30	30
Tooth-billed Bowerbird *A. dentirostris*[a]	7	18
Figbird *Sphecotheres viridis*	4	6
Double-eyed Fig-Parrot *Cyclopsitta diophthalma*[b]	1	1
	86	**84**
Arboreal Frugivores/Granivores		
Sulphur-crested Cockatoo *Cacatua galerita*	12	11
Crimson Rosella *Platycercus elegans*	0	3
Australian King-Parrot *Alisterus scapularis*	7	11
	19	**25**
Terrestrial Frugivores/Granivores		
Orange-footed Scrubfowl *Megapodius reinwardt*	2	9
Australian Brush-turkey *Alectura lathami*	2	1
Emerald Dove *Chalcophaps indica*	8	6
	12	**16**
Granivores		
Red-browed Finch *Neochmia temporalis*	0	4
Peaceful Dove *Geopelia striata*	0	3
	0	**7**

[a]Species confined to the Wet Tropics biogeographic region.
[b]Morphologically distinct race confined to the Wet Tropics biogeographic region.
[c]Diets of Victoria's Riflebirds are sexually dimorphic, and because one sex appears to be largely insectivorous and thus limited by insect abundance (C. E. Gordon unpubl. data), this species has been classified as an insectivore.

THE STATUS OF THE GARGANEY IN QUEENSLAND

PETER L. BRITTON

Of the three Palaearctic ducks recorded as migrants to Australia, only the Garganey *Anas querquedula* is at all regular. Lansley & Chandler (1991) included several Queensland records in their discussion and concluded that it is an annual visitor in small numbers to the north and north-west of Australia and a vagrant south of the tropics. Though first recorded in Australia in 1881 (Campbell 1924), there were few records until the 1960s. A March 1988 Kimberley (Western Australia) record of seven groups totalling at least 24 individuals is exceptional (Jaensch & Vervest 1988).

Marchant & Higgins (1990) regard various published Queensland records in *Sunbird* and elsewhere as unconfirmed, unsupported or speculative, and thus unacceptable. Twenty-eight near Burketown on 2 April 1990 (Britton 1991) and a male at Townsville in February 1992 are too recent to be included in their discussion. The purpose of the present note is to document three recent records from tropical Queensland, all of which involved at least one male. Several observers (some not named here) saw the Townsville birds, while the Burketown flock was reported by two very experienced observers. A bird at Weipa in July 1976 (Kikkawa 1976) and a probable female at Cecil Plains, south-east Queensland on 26 September 1976 (Walter & Walter 1976) are not included.

The female Garganey, of a similar size to the Grey Teal *A. gracilis* but with a striped face, is difficult to distinguish from the female Eurasian Teal *A. crecca*, which ranges to south-east China and the Philippines (Vaurie 1965). The greyish (but not blue-grey) forewing, greenish-brown speculum and dark leading edge to the underwing are characteristic in flight at close range, however. In contrast, the male Garganey is unmistakable at all seasons of the year. In eclipse plumage, which lasts for about five months, the male retains the diagnostic blue-grey forewing (Northern Shoveler *A. clypeata* and Australasian Shoveler *A. rhynchotis* are larger, with a distinctive bill, while Blue-winged Teal *A. discors* has a bright blue forewing and lacks a white trailing edge to the speculum). In breeding plumage, assumed in January-March, males are strikingly patterned, with a broad white supercilium and sharp demarkation of brown breast from greyish flanks and white belly.

Two of the Townsville males were markedly patterned when seen by the author on 20 February 1988, while the 16 males near Burketown were in excellent breeding plumage on 2 April 1990 (S. Garnett *in litt.*). The male at Townsville in mid-February 1992 was in eclipse plumage. When flushed by the author and H.A. Britton on 15 February, the blue-grey forewing allowed it to be identified without hesitation. For 13 years both observers were residents of Kenya, where

this species is the most widespread Palaearctic duck, often in hundreds, sometimes thousands (Britton 1980). These diagnostic features of the males involved in all three records detailed below were noted with binoculars at ranges down to about 70 metres (pers. obs. and S. Garnett *in litt.*).

Blakey's Crossing, Townsville, 19°15'S, 146°48'E: 17 February-18 March 1988.
Five birds, four remaining until 18 March (P.L.B., H.A.B., J. McKean, G. Claridge *et al.*); plumage indicated that two males were completing moult into breeding plumage as early as 20 February.

Inverleigh Station, near Burketown, 18°01'S, 140°34'E: 2 April 1990.
Twenty-eight birds, including 16 males in breeding plumage (S. Garnett and A. Taplin). This ephemeral wetland, dry when visited by the author in July 1988, is documented by Claridge *et al.* (1988). Positioned 2.5 km south-west of Buffalo Lake and 23 km inland from the coast of the Gulf of Carpentaria, it has no known name.

S. Garnett *in litt.* provided the following details. At the time the Garganeys were present there were also 13 000 Grey Teal, 1000 Wandering Whistling-Duck *Dendrocygna arcuata*, 500 Plumed Whistling-Duck *D. eytoni*, 20 Pink-eared Duck *Malacorhynchus membranaceus* and 40 Hardhead *Aythya australis*. The season had been exceptionally dry throughout the region and this small waterhole held more waterfowl than all of the Gulf plains from the Mitchell to the McArthur Rivers. The birds flew obligingly from one end of the pool to the other, allowing the Garganeys to display their distinctive plumage to good advantage. Often they flew as a distinct small flock within the mass.

Typically, the records detailed by Marchant & Higgins (1990) involved 1-6 birds (exceptionally 8 and 24), mostly in northern parts of Western Australia and the Northern Territory. This is the largest number recorded in Australia, and it is likely that this species is an annual visitor to seasonal wetlands associated with beach ridges and low plateaux in the Carpentaria Land System (Buffalo Lake, Manrika Lake, Rocky Lake and other seasonal lakes which lack individual names).

Blakey's Crossing: 15-18 February 1992.
A single male in eclipse plumage (P.L.B., H.A.B., K. Shurcliffe, J. Wienecke). This site and other suitable wetlands along the eastern seaboard of tropical Queensland are visited on a regular basis by various competent observers. This distinctive species, which is unlikely to be overlooked, is best assessed as a vagrant or accidental visitor so far east.

ACKNOWLEDGEMENTS

I am grateful to Dr Stephen Garnett who commented on a draft of the paper and provided details of other species at Inverleigh Station.

REFERENCES

BRITTON, P.L. (Ed.) 1980. *Birds of East Africa, their habitat, status and distribution*. Nairobi: EANHS.

BRITTON, P.L. 1991. The Queensland Ornithological Society Bird Report, 1990. *Sunbird* 21: 65-89.

CAMPBELL, A.J. 1924. The Garganey Teal *Querquedula querquedula*. *Emu* 24: 146.

CLARIDGE, G., JOHNSON, R. & DALLISTON, C. 1988. An undescribed Gulf Plains Wetland in Queensland. *Stilt* 12: 53-54.

JAENSCH, R. & VERVEST R. 1988. Waterbirds in the Kimberley - Autumn 1988. *RAOU Newsletter* 77: 1-2.

KIKKAWA, J. 1976. The birds of Cape York Peninsula. Part 2. Distributional Patterns. *Sunbird* 7: 81-106.

LANSLEY, P.S. & CHANDLER, C. 1991. The First Sight Record of the Garganey *Anas querquedula* in Victoria. *Aust. Bird Watcher* 14: 10-12.

MARCHANT, S. & HIGGINS, P.J. (Eds) 1990. *The Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 1. Melbourne: Oxford University Press.

VAURIE, C. 1965. *The Birds of the Palearctic Fauna. Non Passeriformes*. London: Witherby.

WALTER, J. & WALTER, R. 1976. *Qld. Orn. Soc. Newsl.* 7 (10): 2.

PETER L. BRITTON, All Souls' & St Gabriel's School, Charters Towers, Q 4820.

FOOTNOTE

An eclipsed male was seen well by several observers at Awonga Sewage Works, Weipa (12° 38'S, 141° 52'E) on 25 December 1995. The diagnostic blue-grey forewing of the male Garganey in eclipsed plumage was noted (Glenn Holmes pers. comm.).

ADDITIONAL BIRDS FOR MOA ISLAND, TORRES STRAIT

D.C.NILAND

Incidental observations were made on the birds at Moa Island, in the south-west Torres Strait over a period of three weeks from 19 October 1994. Three separate days were spent at Kubin on the western side of the island, and the remainder at St Pauls on the eastern side. All observations at St Pauls were made within 2km of the village, in grasslands, small patches of remnant scrub, and along the beach and adjacent reef areas. There were some good areas of mangrove nearby, but time did not permit a visit. The most significant area at Kubin was a small remnant pool in a borrow pit near the airstrip.

The island was very dry at the time of my visit, and there was a continual strong south-east wind for the first two weeks. A comparison with the list in Draffan *et al.*(1983) showed that six of the species I found had not been recorded previously;

Grey Teal *Anas gracilis*. A small group at the Kubin pond.
Glossy Ibis *Plegadis falcinellus*. One at the Kubin pond.
Ruddy Turnstone *Arenaria interpres*. One on the beach at St Pauls
Black-winged Stilt *Himantopus himantopus*. A few at the Kubin pond.
Grey Plover *Pluvialis squatarola*. Two on the beach at St Pauls.
Sooty Tern *Sterna fuscata*. The distinctive call of this species was heard over the centre of Kubin village at night. I am familiar with this bird and its call on various Coral Sea islands, and have heard it previously at night in 1990 over the Lockhart River community.

The following sightings are noteworthy:

Australian Pelican *Pelecanus conspicillatus*. One in poor condition was seen perching on buildings and towers at St Pauls for long periods. It even landed on open ground near a house about 1km from the beach.
Noisy Pitta *Pitta versicolor*. A few calling in a small patch of scrub at St Pauls, somewhat contrary to comments by Draffan *et al.* (1983).
Leaden Flycatcher *Myiagra rubecula*. An early nesting record involved a pair at the nest (one usually sitting) at St Pauls.

REFERENCES

DRAFFAN, R.D.W, GARNETT, S.T. & MALONE G.J. 1983. Birds of the Torres Strait: An annotated list and biogeographical analysis. *Emu* 83: 207-234.

D.C. NILAND, 88 Clewley Street, Corinda, Q 4075.

RECORD OF WATER RAT *HYDROMYS CHRYSOGASTER* IN THE DIET OF A LESSER SOOTY OWL *TYTO MULTIPUNCTATA*

S.E. BURNETT, A.S. KUTT and B.E. TRIGGS

Studies examining the diet of the south-eastern Australian species of Sooty Owl *Tyto tenebricosa* have indicated that this species opportunistically takes the most available arboreal and terrestrial mammals in its preferred size range (Debus 1994). For example, in sclerophyll and rainforest sites with no or a limited history of disturbance, arboreal prey items (e.g. Common Ringtail Possum *Pseudocheirus peregrinus* [av. mass 900 g] and Sugar Glider *Petaurus breviceps* [av. mass 128 g]) contribute the greatest number of prey items and biomass, with scansorial species (e.g. small dasyurids and Fawn-footed Melomys *Melomys cervinipes* [av. mass 20-100 g]) the next most important source (Smith 1984, Loyn *et al.* 1986, Debus 1994, Holmes 1994). Terrestrial and scansorial prey items, such as rodents *Rattus* spp. (av. mass 100-300 g), the House Mouse *Mus musculus*, small dasyurids *Antechinus* and *Sminthopsis* spp. or the European Rabbit *Oryctolagus cuniculus* comprise a greater proportion of Sooty Owl diet in disturbed and burnt sites (Smith 1984, Loyn *et al.* 1986, Hollands 1991, Lundie-Jenkins 1993), even though in the latter case, arboreal prey items were still common in adjacent unburnt sites (Loyn *et al.* 1986).

The diet of the smaller northern species, the Lesser Sooty Owl *Tyto multipunctata*, has been less thoroughly studied. Preliminary surveys have indicated that their diet can include large proportions of invertebrate material (Schodde & Mason 1980); can be predominantly rodent-based (Grassland Melomys *Melomys burtoni*, Fawn-footed Melomys, Bush Rat *Rattus fuscipes*, Cape York Rat *R. leucopus*, Pale Field-rat *R. tunneyi*, Canefield Rat *R. sordidus*) on rainforest edges (Hollands 1991, Whittle 1994, Hinman in press); or can be predominantly arboreal/scansorial mammal-based (e.g. Fawn-footed Melomys, White-tailed Rat *Uromys caudimaculatus*, Long-tailed Pygmy-possum *Cercartetus caudatus*) in closed forest (Hollands 1991, Hinman in press). A thorough study of Lesser Sooty Owl diet from wet tropical rainforest using large pellet collections is currently being completed (author SEB unpubl.). Preliminary results from a large sample of pellets examined indicate a predominance of small (mass 100-300 g) arboreal/scansorial prey items (Fawn-footed Melomys, Prehensile-tailed Rat *Pogonomys mollipilosus*, *Antechinus* spp., Long-tailed Pygmy-possum, Sugar Glider) (author SEB unpubl.). To date, there has been no record of the Water Rat *Hydromys chrysogaster* in the diet of the Sooty or Lesser Sooty Owl from known published or unpublished sources.

During a fauna survey of low- to mid-altitude wet tropical rainforest on the eastern escarpment of the Lamb Range State Forest, conducted as part of the

Queensland Electricity Commission's Chalumbin-Woree 275 kV transmission line environmental impact statement (Kutt *et al.* 1995), three pellets of a Lesser Sooty Owl were collected from the banks of an unnamed small rocky stream (*Date*: 10 Nov 1994, *Grid*: 17°01' 15" S, 145° 40' 20" E, *Altitude*: 560 m, *Vegetation*: Tracey (1982) type 2a mesophyll vine forest). The large, solid nature of the pellet and the taphonomy of the remains indicate that the pellets were deposited by a *Tyto* owl. Lesser Sooty Owls were heard commonly at all survey sites throughout the study area, which included a range of eastern escarpment rainforest types from 300 to 700 m. It is the only tytonid known or expected to be present.

On examination of the pellets, the remains of a single Bush Rat (humerus, skull, left mandible) and at least two Water Rats (skull, two left and two right mandibles, one left and right femur, one left and right humerus) were recovered. The Water Rat skull measured 52mm at greatest length and 25mm at greatest width. These measurements place the animal within the known adult size range for the species (greatest skull length 50-60 mm, greatest skull width 25-30 mm, Watts & Aslin 1981), and therefore of an average mass range of 606-755 g (Strahan 1983). Though this is well outside the known prey range for Lesser Sooty Owls (300-400 g, SEB unpubl.), there is evidence that Water Rats in rainforest are much smaller in size than those recorded in other habitats. For example, five adult male and three adult female Water Rats trapped near rainforest waterbodies in Mt. Spec National Park weighed an average of 532 g and 425 g respectively (Vernes unpubl. data).

This record represents the first known record of Water Rat in the diet of the Lesser Sooty Owl. To the authors' knowledge, the only other record of Water Rat in the diet of an owl species in Australia is of seven individuals (six adults and one juvenile) identified from 1903 prey items examined in a review of the historic and pre-historic diet of the Masked Owl *Tyto novaehollandiae* in Tasmania (Mooney 1993), and one individual in the diet of a Barking Owl *Ninox connivens* in north-eastern South Australia (Muir & Corke 1993). Author BET has examined over 1200 pellets from seven owl species collected from throughout Australia and has not previously recorded the Water Rat in the diet of any owl species.

A number of hypotheses acting in concert or alone may explain the apparent absence of Water Rats as a prey item, despite the potentially opportunistic nature of the Sooty and Lesser Sooty Owl feeding patterns: most owls inhabiting dense forest probably initially rely on aural location of potential prey items, and as Water Rats utilise permanent trails on stream and river banks (Strahan 1983), the sound of water movement (particularly in rocky stream environments) may mask the sound of this species' activity; Water Rats forage aquatically and often feed at the edges of water bodies, and this may present a danger or deterrent to a striking owl; Water Rats are not entirely nocturnal, utilising more

crepuscular and dawn activity periods (Strahan 1983); and Water Rats occur in low numbers throughout wet tropical rainforest habitats (Laurence 1992).

A number of reasons are suggested as to why Water Rats were preyed upon in this instance. Firstly, in low to mid-altitude rainforest where arboreal prey items are of lower abundance, less typical terrestrial prey items may be taken more often. Secondly, the site where the pellets were collected comprised of a stream with a low water level, wide flat stream banks with open vegetation and a central rocky island. These environmental features have perhaps combined to allow easier detection and capture of the Water Rats. Thirdly, it is possible that this individual owl may be larger than usual or have a behavioural tendency to capture larger prey, including Water Rats.

ACKNOWLEDGEMENTS

Thanks to Karl Vernes, Zoology Department, James Cook University for the use of unpublished data and Stephen Debus, Zoology Department, University of New England for critically reviewing this note.

REFERENCES

DEBUS, S.J.S. 1994. The Sooty Owl *Tyto tenebricosa* in New South Wales. *Australian Birds* 28: 4-19.

HINMAN, V. in press. Vertebrate remains in collections of owl pellets from Queensland: new distribution records and rare species of mammals. *Mem. Qld Museum*.

HOLLANDS, D. 1991. *Birds of the Night*. Sydney: Reed.

HOLMES, G. 1994. Prey of the Sooty Owl in subtropical Australia. *Sunbird* 24: 25-27.

KUTT, A., SKULL, S., BURNETT, S. & KEMP, J. 1995. *Chalumbin to Woree 274 kV Transmission Line Environmental Impact Assessment: Flora and Fauna. Components 3 and 4*. Australian Centre for Tropical Freshwater Research report no. 95/04 to the Queensland Electricity Commission.

LAURENCE, W.F. 1992. Rainforest fragmentation and the structure of small mammal communities in tropical Queensland. *Cons. Biol.* 6: 23-32.

LOYN, R.H., TRAILL, B.J. & TRIGGS, B.E. 1986. Prey of Sooty Owls in East Gippsland before and after fire. *Vict. Nat.* 103: 147-149.

LUNDIE-JENKINS, G. 1993. The diet of the Sooty Owl *Tyto tenebricosa* in the Blue Mountains, N.S.W. *Emu* 93: 124-127.

MOONEY, N. 1993. Diet of the Masked Owl in Tasmania: past and present. In *Australian Raptor Studies*, Olsen, P. (Ed.) pp. 160-174. Melbourne: Australasian Raptor Association and RAOU.

MUIR, C. & CORKE, D. 1993. At the Barking Owl nest. *Australasian Raptor Assoc. News* 14: 8-9.

SCHODDE, R. & MASON, I.J. 1980. *Nocturnal birds of Australia*. Melbourne: Landsdowne Press.

SMITH, P. 1984. Prey items of the Sooty Owl and Barn Owl at Bega, New South Wales. *Corella* 8: 71-72.

STRAHAN, R. (Ed.) 1983. *The Australian Museum Complete Book of Australian Mammals*. Sydney: Angus & Robertson.

TRACEY, J.G. 1982. *The Vegetation of the Humid Tropical Region of North Queensland*. Atherton, Queensland: CSIRO.

WATTS, C.H.S. & ASLIN, H.J. 1981. *The Rodents of Australia*. Sydney: Angus & Robertson.

WHITTLE, J. 1994. Observations on the roosts, hunting behaviour and diet of a Lesser Sooty Owl *Tyto multipunctata* in fragmented rainforest. *Sunbird* 24: 40-43.

S.E. BURNETT & A.S. KUTT, Australian Centre for Tropical Freshwater Research, James Cook University, Townsville, Q 4811.

B.E. TRIGGS, c\- 'Dead Finish', Genoa, Vic. 3891.

BOOK REVIEW

FIELD GUIDE TO THE BIRDS OF AUSTRALIA. The most comprehensive one-volume book of identification. Ken Simpson and Nicolas Day. Penguin Books Australia Ltd, Melbourne, 1996. 400 pages, 131 colour plates, $35.00.

The first 279 pages of this lavishly illustrated work are in standard 'field guide' form, with text and map opposite lively and accurate plates. Inevitably, the subtitle on the flexible plastic cover invites comparisons with the single volume guide by Graham Pizzey, and also with the two-volume work by the Slaters. This review will focus on the book itself rather than better, good or best.

This fifth edition was deemed necessary to incorporate the significant changes in Christidis & Boles (1994, *The taxonomy and species of birds of Australia and its territories*), but there are various innovations and more images, particularly of younger birds. Recent additions to the Australian avifauna remain as a Rare Bird Bulletin, but an extra 20 plates have been added. The retention of Mistletoebird and Yellow-bellied Sunbird alongside various pardalotes (p. 175), without text or comment, when the same paintings are shown against their respective texts on p. 273, contrasts with Plains-wanderer, also shown on two plates but accompanied by a caption detailing evolutionary relationships.

Codes of relative abundance, and of the degree of sedentary, nomadic or migratory behaviour, have been added to every species, and distribution maps have been updated. The status of many species is clarified using two of the ten available codes of abundance, e.g. Budgerigar C-LA (common - locally abundant), whereas most have a sometimes misleading or inadequate single code. Thus, Barn Swallow is said to be 'moderately common', and Long-toed Stint, Wilson's Phalarope and Little Ringed Plover are said to be 'uncommon'.

There are errors on many maps: for example, Hooded Plover is not shown in coastal New South Wales; there are no Carpentarian Grasswren localities in Queensland; and a population of the Yellow-billed Kingfisher is shown well south of its established range. White-headed Petrel at 13°S (*Sunbird* 1993: 59) and numerous data available via *QOSI Annual Bird Reports* have not been added to distribution maps. Treatment for Supplementary List species, lacking confirmed records or established feral populations, is not at all consistent, e.g.. Eurasian Curlew, Western Sandpiper and Eurasian Golden Plover receive different coverage, including a blank map for Eurasian Curlew.

Apart from the detail on various maps there are very few errors. Frequent use of this outstanding Field Guide is thoroughly recommended.

PETER L. BRITTON, All Souls' & St Gabriel's School, Charters Towers, Q 4820.

INSTRUCTIONS TO AUTHORS

The Sunbird is published quarterly by the Queensland Ornithological Society to further the knowledge of birds in Queensland and adjacent northern regions of Australia.

Papers are invited from non-members as well as members on all aspects of ornithology, e.g. life history, taxonomy, distribution, behaviour and ecology. Articles may take the form of major articles on specific birds, birds in specific areas or habitats, or short notes on either birds themselves or the literature on birds, such as reviews of books or comments on published articles.

Submission of a paper implies that the results reported have not been published and are not being considered for publication elsewhere. The editor reserves the right to submit records of rare birds to the Records Appraisal Committee of the Royal Australasian Ornithologists Union.

Manuscripts can be supplied on floppy disk (IBM or MACINTOSH systems in Wordperfect 5.1 or Word 4.0 format) or in typed form on paper. When typed, the manuscript should be double-spaced and two copies sent. Papers longer than four typed A4 pages should have a summary. If needed, help may be given to authors to find relevant literature. Common names, scientific names and order of names should follow Christidis, L. & Boles, W.E. 1994. The taxonomy and species of birds of Australia and its territories. RAOU Monograph 2. Intending authors should consult recent issues of *The Sunbird* to see acceptable forms of contributions.

References should be listed in alphabetical order at the end of papers in the following styles; titles of journals will be abbreviated as in the *World List of Scientific Periodicals:*

FLEAY, D.H. 1937. Nesting habits of the brush turkey. *Emu* 36: 153-163.

FRITH, H.J. (Ed.) 1976. Mallee fowl. In *Complete Book of Australian Birds*, pp. 136-137. Sydney: Reader's Digest.

SERVENTY, D., SERVENTY, V.N. & WARHAM, J. 1971. *The Handbook of Australian Sea-birds*. Sydney: Reed.

SLATER, P. 1970. *A Field Guide to Australian Birds. Non-Passerines.* Adelaide: Rigby.

Tables and Figures should be numbered with Arabic numerals. Drawings and diagrams should be in Indian Ink on cartridge paper or tracing paper. If authors cannot arrange suitable drawings, the editor may arrange the drawing of figures and diagrams. Authors may submit photographs (preferably black and white) with their manuscripts.

Reprints may be obtained at cost price by special request.

Manuscripts should be sent to:

Peter Britton (Editor Sunbird), C/- All Souls' and St Gabriel's School, Charters Towers, Queensland, 4820.