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THE STATUS OF THE PIED OYSTERCATCHER *HAEMATOPUS LONGIROSTRIS* ON THE COASTAL FLATS OF KEPPEL SANDS AND JOSKELEIGH ON THE CAPRICORN COAST OF CENTRAL QUEENSLAND

GARY W. WILSON

ABSTRACT

This paper presents the results of three years of observations of the Pied Oystercatcher at Keppel Sands and Joskeleigh on the Capricorn Coast of Central Queensland. The data were collected during a study of six shorebird species at the location. Details are presented of the status, lack of breeding success, and disturbance of the species, and habitat modification. A call is made for additional studies of tropical coastland ecology and the effect on wader species of vehicles on beaches.

INTRODUCTION

The Pied Oystercatcher *Haematopus longirostris* ranges widely in coastal Australasia, (Hayman *et al.* 1986), though it is absent from littoral sites where cliffs replace beaches (Blakers *et al.* 1984). Typically the species forages for marine worms and molluscs on sandy intertidal flats, nesting just above the hightide mark and in coastal dunes (Lane 1987). Seasonal movements have been recorded (Thomas 1970; Minton 1988, 1991), but in southern Australia pairs breed at the same location in successive years (Lane 1987, Newman 1991). Breeding birds are prone to disturbance (Hewish 1990) and to loss of nests by predation and flooding (Lauro & Nol 1993). Concern has been expressed (Lane 1982, 1987; Newman & Patterson 1986; McFarland 1993) about the effects of disturbance on breeding success. In National Wader Counts, the Mackay and Morton Bay areas were recognised as important Queensland sites for the species (Lane 1987), while Driscoll (1990) found the Great Sandy Strait to be an important area. No data are available on the status of the species on the Capricorn Coast.

STUDY AREA AND METHODS

Keppel Sands (23°20'S, 150°48'E) and Joskeleigh (23°22'S, 150°47'E) are located at the southern end of the Capricorn Coast in Central Queensland. They are immediately north of the Tropic of Capricorn and the mouth of the Fitzroy River (Fig. 1). Extensive sand flats are exposed at low tide. Thirty-one surveys of the Pied Oystercatcher on these beaches during the January 1991 - December 1993 period are detailed here. Surveys were conducted once a month and at low tide. A pilot study had indicated that this and other wader species could not be accurately censused at the study site at high tide. Observations using a spotting scope and 10 x 40 binoculars were made from five points (see Fig. 1) designated, north to south, as Cawarral Creek, Front Beach 1 and 2, Pumpkin Creek and Joskeleigh Beach. The study areas included 6 km of tideline.

RESULTS

Pied Oystercatchers were observed during 30 of the 31 surveys (Fig. 2). Seasonal changes in number were not apparent, but the data indicate some local movement, with numbers varying widely between successive surveys, e.g. April, May and June 1993. A search of suitable nesting habitat failed to locate additional birds when numbers were lower than in the previous survey. Density of birds on the surveyed coastline ranged from 0.16 to 1.67 birds/km with a mean of 1.01 and a median of 1.67 birds/km. Nests of the species were located at the leading edge of the foredune at Joskeleigh Beach in September 1992 and October 1993; the former was lost to high seas and the latter destroyed by vehicular traffic. No hatchling or immature birds of the species were observed at any site during the study. No aggregations of non-breeding birds were observed, and most observations were of pairs of birds or two birds in a loose association and within 100m of each other.

Birds were most commonly found on the upstream flats of Cawarral Creek, about the bed of the Pumpkin Creek at low tide, and at Joskeleigh. Birds were regularly found on the Front Beach but were subject to disturbance by bathers, walkers and dogs. These birds retreated to more remote flats at times of maximum disturbance. Birds utilising the Cawarral Creek flats were subjected to increasing disturbance by crab and bait fishermen as the study progressed, and to habitat changes arising from upstream clearing which caused increased silting.

Birds on the Joskeleigh flats were frequently disturbed by four-wheel-drive, motorcycle and off-road recreation vehicles, by free-ranging cattle and dogs, and by horse riders. Habitat destruction and modification of sites within the study area increased in October 1993, when the top of several kilometres of foredune

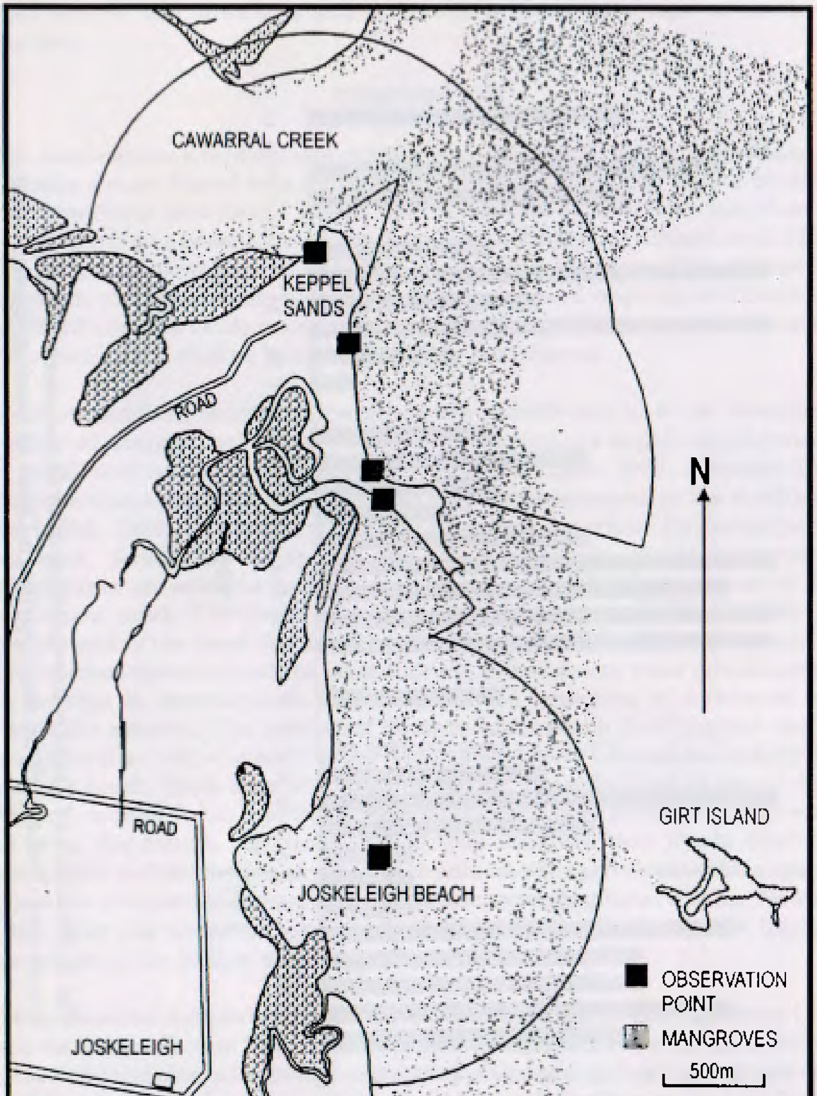

Fig. 1. Location of Keppel Sands and Joskeleigh study sites.

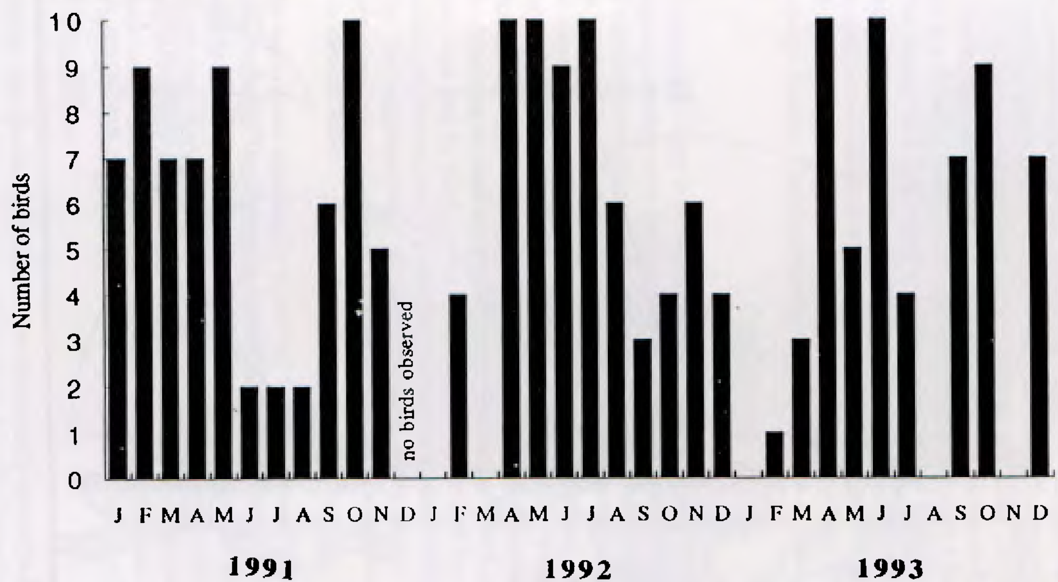

Fig. 2. Numbers of Pied Oystercatchers over three years at Keppel Sands and Joskeleigh on the Capricorn Coast of Central Queensland.

at Joskeleigh were bulldozed. The foredune was then breached by vehicles and tidal waters, and dune tops and surrounding areas were used as motocross locations.

DISCUSSION

The data indicate a bird density greater than the 0.19 birds/km recorded in the Cooloola-Fraser Island area by McFarland (1993), similar to the 1.6 birds/km found on North Stradbroke Island (McFarland 1993), and much less than the 7.7 birds/km on a beach in the Coorong of South Australia (Blakers *et al.* 1984). The lack of observations of breeding success and the disruption of breeding attempts, and the steadily increasing disturbance and ongoing modification of habitat during the study period, are cause for concern. They support a forecasted (Newman 1991) decline based on breeding disturbance.

The data and the length of the study are insufficient to allow meaningful statistical analysis, but the fact that Oystercatchers are long-lived (Hayman *et al.* 1986) and reluctant to change their nest-site (Lane 1987, Newman 1991) suggests that a lack of breeding success may not be apparent in the short term. Nol (1985, 1989), in studies of the site-tenacious American Oystercatcher *H. palliatus*, found that the species was able to maintain stable or increasing populations on suitable habitat despite poor reproductive success in four successive years. The study area documented here is prime habitat for the species and is the least disturbed on the Capricorn Coast, where substantial development has occurred and is continuing, and where off-road vehicle activity on beaches is commonplace. The scalping and breaching of foredunes is of particular concern. The number of other resident beach dwelling and nesting species at the study site, such as the Red-capped Plover *Charadrius ruficapillus* and the Beach Thick-knee *Burhinus neglectus*, have declined in recent years (Wilson, unpubl. data), and this suggests that Pied Oystercatcher numbers may do so in the future. McNicholl (1975) has observed that if site fidelity is genetically inflexible then any change in habitat will spell disaster for a species. There are documented cases of Pied Oystercatchers changing territories (Newman 1992), but the apparent inflexibility exhibited by the species is likely to contribute to its decline at this location.

Little base-line data exists on the status of shorebirds on the Capricorn Coast and the likely effects of disturbance and modification of habitat on them. In light of the rapid increase in the human population of Queensland and the concentration of that population on or near the coastline, studies to obtain information pertaining to tropical coastal ecology should be pursued as a matter of priority. The call by McFarland (1993) for additional research on the impact of off-road vehicles on beaches is timely and should be supported. The results of such research could be used to formulate appropriate management strategies.

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FLOWER USE AND AGGRESSION AMONG NECTARIVOROUS BIRDS IN A SUBURBAN GARDEN

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ABSTRACT

The foraging and aggressive behaviour of nectar-feeding birds were observed in a suburban garden containing flowering native and exotic plants. Large nectarivores (>60g) visited, almost exclusively, the *Grevillea* which had easily accessible nectar of high energy value. The remaining nectar-feeders (all <12g) used all plants to varying extents. Among the birds there was a size-related dominance hierarchy with the larger species attacking the smaller species. This, combined with beaks better suited to probing small flowers with deep corollas, could account for the use of less rich flowers by small nectarivores, although immature male or female Scarlet Honeyeaters often used stealth to feed at *Grevillea* inflorescences. A variety of nectar sources, with different flower shapes, densities and productivities, may be needed to enable a diversity of nectar-feeding birds to co-exist in suburban areas.

INTRODUCTION

Spatial and temporal partitioning of flower resources by nectar-feeding birds, by either interference (aggression) or exploitative (variable foraging efficiencies) means, is known for communities living in undisturbed habitats (e.g. Ford & Paton 1982, McFarland 1986, Rasch & Craig 1988). In this paper I examine the behaviour of birds using both native and exotic flowers in the less natural situation of a suburban garden. The general question being asked is how do nectarivorous birds use the flower resources in this environment; that is, what flowers do they visit (visitation rate, flower productivity and morphology) and what intraspecific and interspecific interactions occur when visiting the flowers?

STUDY AREA AND METHODS

The study was undertaken in a small garden of about 150m^2 in Kenmore, a western suburb of Brisbane (27^{o} 28' S, 153^{o} 01' E), Queensland. Apart from a few tall eucalypts in nearby streets, most of the original vegetation in the garden and adjacent areas has been replaced with exotic and non-local native shrubs and trees. Observations of birds and measurements of nectar availability were made over three days, 21-23 August 1990. At 0800, 1200 and 1530h each day, one hour was spent monitoring activity in the garden, namely which bird species visited which trees, the number of visits to each tree, and the behaviour of birds. Behaviour included bouts of calling, displays, displacements (one bird forcing another from a perch by overt aggression), and chases (one bird following another after forcing it from a perch).

Nectar production was estimated by placing cloth bags over two flowers, clumps of flowers or inflorescences on each of the plants used by the birds. One 'flower' was left covered for 24 hours while the other was left overnight (12 hours) and then sampled at 0600, 1000, 1400 and 1800h. The latter sampling allowed a comparison of day-time and night-time production. Nectar was collected using a syringe or a 50 microlitre capillary tube, and the sugar concentration measured using an Atago refractometer. Volume and concentration were used to calculate energy content (J/flower/h or 24h). On the first day the number of flowers or inflorescences on each plant was counted or estimated and used to determine total nectar productivity (kJ/shrub/24h).

RESULTS

Plants

The flowers of five plant species were visited by birds (Table 1). There was only one plant of each species and all were conspicuous and confined to a small area of the garden (<100m²). The *Grevillea* had large inflorescences, while the *Rondeletia, Metrosideros* and *Browallia* had clusters of small flowers and the *Bauhinia* had large individual flowers. Nectar was exposed in the *Grevillea* and *Metrosideros* but in the other three genera it lay at depths of 12-30mm within narrow corollas (Table 1).

The *Rondeletia* had the highest total productivity (spread among numerous flowers) while the *Grevillea* had the highest energy values per 'flower' (Table 1). All species secreted nectar throughout the 24hour period, but production peaked in the *Grevillea* between early afternoon and the following morning (1400-0600 h), and in the *Metrosideros, Rondeletia* and *Browallia* between 0600 and 1000 h. In the *Bauhinia* it was fairly constant and throughout the day (0600-1800 h).

The *Grevillea* was the plant most visited by birds, followed by the *Rondeletia, Metrosideros, Browallia* and *Bauhinia* (Table 2). Although not always recorded, most visits by birds included feeding at flowers unless they were attacked before they could feed. Apart from birds, insects also visited the flowers and a subjective assessment was made of insect use of the plants. Use, in terms of insect abundance and diversity, was low for the *Grevillea* (honey bee, wasp), *Browallia* (butterfly) and *Bauhinia* (butterfly), moderate for the *Rondeletia* (honey bee, butterfly, moth), and high for the *Metrosideros* (honey bee, native bee, wasp, butterfly and moth).

TABLE 1. Characteristics of plants visited by nectarivorous birds.

Plant species	Plant form	Status	Depth to nectar (mm)	Energy per 24hours J/flower*	kJ/shrub	No. of flowers*
Grevillea sp. 'Honey Gem'	Shrub	Native	0	3021	84.6	28
Metrosideros thomasii	Shrub	Exotic	0	103	74.2	720
Rondeletia amoena	Shrub	Exotic	12	8	124.0	15 500
Browallia jamesonii	Shrub	Exotic	25	46	55.2	1 200
Bauhinia variegata	Tree	Exotic	20-30	35	4.4	125

* includes inflorescence where applicable.

Birds

Nine species of nectar-feeding birds were seen in the garden during the study period. Of these, eight were recorded during defined observation times (Table 2) while the White-throated Honeyeater *Melithreptus albogularis* was once observed in the *Grevillea* immediately after the morning observation period. Other nectarivorous birds that have been seen visiting flowers in the garden at other times include the Scaly-breasted Lorikeet *Trichoglossus chlorolepidotus*, Musk Lorikeet *Glossopsitta concinna*, Pale-headed Rosella *Platycercus adscitus*, Lewin's Honeyeater *Meliphaga lewinii*, Eastern Spinebill *Acanthorhynchus tenuirostris* and Spangled Drongo *Dicrurus hottentottus*. All species visited *Grevillea* inflorescences while the spinebill also fed at the *Rondeletia*.

Rainbow Lorikeet *T. haematodus*. While not a common visitor to the garden (Table 2), this species was the largest nectarivore present. It was capable of displacing the most aggressive honeyeater (Noisy Friarbird - Table 3). The lorikeet fed only in the *Grevillea* (Table 2), used only displacements, and generally ignored most other species feeding in the same tree at the same time (Table 4).

Noisy Friarbird *Philemon corniculatus*. This friarbird, the most common user of the *Grevillea* (Table 2), often probed all inflorescences. The *Grevillea* was also the site of calling bouts (0.8 bouts/h), and of aggression against conspecifics and all smaller nectarivores encountered (Tables 3 & 4). The Noisy Friarbird had the highest use of chases, which were directed against frequent visitors to the *Grevillea* (Tables 2 & 3) whether large (Little Friarbird) or small (Scarlet Honeyeater) . Birds feeding or sitting in nearby trees other than the *Grevillea* were not attacked.

Noisy Friarbirds and Little Friarbirds engaged in a similar display when confronted with conspecifics feeding in the *Grevillea*. The display was seen on five of eight occasions when two or three conspecifics were together in the shrub (NF = 4/5, LF = 1/3). One bird would advance slowly toward another, at the same time giving a repeated call ('yodel chuck') with its head arched back and neck feathers fluffed out. The folded wings were lowered at the wrist and held stationary slightly away from the side of the body. On four occasions the bird faced with the displaying bird flew from the shrub, but on one occasion also began displaying. This resulted in the first displaying bird chasing the other.

Little Friarbird *P. citreogularis*. Although all flowering plants were visited, Little Friarbirds mostly used the *Grevillea* (Table 2) where they were often attacked by Noisy Friarbirds (Table 3). Displays were employed against conspecifics but aggression toward, and encounter with, smaller nectar-feeders

TABLE 2. Rates of visitation to plant species by nectarivorous birds. Bird species listed in order of descending body weight (Wt) - data from unpublished banding results and Keast *et al.* (1985). Bird abundance (No.) was the maximum number of individuals seen during the study in the garden and adjacent residences at any one time.

Bird Species	Wt (g)	No.	Number visits/hour *Grevillea*	*Metrosideros*	*Rondeletia*	*Browallia*	*Bauhinia*
Rainbow Lorikeet (RL)	130	4	0.3	--	--	--	--
Noisy Friarbird (NF)	120	5	3.8	0.1	--	--	--
Blue-faced Honeyeater (BfH)	107	2	0.1	--	--	--	--
Little Friarbird (LF)	80	4	1.1	0.1	0.1	0.2	0.1
Noisy Miner (NM)	68	14	0.8	--	--	--	--
Brown Honeyeater (BH)	11	5	0.2	0.4	1.3	1.1	1.1
Silvereye (S)	10	10	0.9	0.6	2.0	0.2	--
Scarlet Honeyeater (SH)	8	6	2.1	0.6	0.9	0.1	0.1
Total visitation rate			9.3	1.8	4.3	1.6	1.3
Total bird species visiting			8	5	4	4	3

was low for this species (Tables 3 & 4). Calling was rare.

Blue-faced Honeyeater *Entomyzon cyanotis*. Rarely seen in the garden (Table 2), this honeyeater mostly visited exotic palms to glean caterpillars off the fronds.

Noisy Miner *Manorina melanocephala*. A flock of miners that used nearby eucalypts occasionally passed through the garden. Visits to flowering plants, aggression and encounters with other nectarivores were infrequent (Tables 2, 3 & 4).

Brown Honeyeater *Lichmera indistincta*. While all plants were visited, the Brown Honeyeater was most often seen in the *Rondeletia, Browallia* and *Bauhinia* (Table 2). Birds called loudly when in the *Bauhinia* but were silent in the other plants. Earlier in the year, when fewer nectarivores were present, this honeyeater would call from, and feed in, the *Grevillea*. Brown Honeyeaters were mostly found alone (Table 4) but were aggressive toward conspecifics and smaller species when these were encountered (Table 3).

Scarlet Honeyeater *Myzomela sanguinolenta*. The *Grevillea* was the flowering plant most visited by Scarlet Honeyeaters (Table 2). Although frequently foraging alone (Table 4), the high visitation rate to the *Grevillea* meant that this honeyeater was often found and attacked by Noisy Friarbirds (Table 3). The behaviour of adult males (red birds) differed from that of females and immature males (brown birds). When feeding, adult males called loudly in all plants (*Grevillea* = 0.4, *Browallia* = 0.1, *Metrosideros* = 0.4, *Rondeletia* = 0.4 and *Bauhinia* = 0.3 calling bouts/h). Calling in the *Grevillea* resulted in almost immediate attack by a Noisy Friarbird if one was nearby. When the duration of *Grevillea* visits was measured, an adult male averaged only 0.7 minutes (n= 4) in the shrub before being evicted, while for brown birds, which made no loud calls when in any plants, a visit averaged 11.5 minutes (n = 10). On six occasions brown Scarlet Honeyeaters left of their own accord, and on other occasions the birds were expelled upon discovery by Noisy Friarbirds.

Silvereye *Zosterops lateralis*. Silvereyes visited the plants in small groups of 2-8 birds. Frequent visits were made to the *Rondeletia* (Table 2), where it was often difficult to tell whether insects, nectar or both were being taken when the flowers were probed. Although sometimes in the presence of other small nectarivores, Silvereyes were only intraspecifically aggressive. They were displaced by the smaller Scarlet Honeyeater and by larger species (Tables 3 & 4).

TABLE 3. Aggressive interactions among nectarivorous birds in flowering plants. Attacks are either chases or displacements(given in parentheses).

Species attacked	Species attacking: RL	NF	LF	NM	BH	S	SH
RL	2(0,2)						
NF	3(0,3)	6(1,5)					
LF	--	7(3,4)	2(0,2)				
NM	--	5(0,5)	--	2(0,2)			
BH	--	--	1(0,1)	--	2(0,2)		
S	--	2(0,2)	--	--	4(0,4)	4(0,4)	4(0,4)
SH	--	10(3,7)	--	--	1(1,0)	--	3(1,2)
Total	5(0,5)	30(7,23)	3(0,3)	2(0,2)	7(1,6)	4(0,4)	7(1,6)

TABLE 4. Percentage of observations of nectarivorous birds visiting plants alone or in the presence of other species (n = number of observations).

Bird species	n	% occurrence: Alone	RL	NF	BfH	LF	NM	BH	S	SH
RL	7	0	14	29	0	14	0	14	0	29
NF	40	45	5	13	0	8	2	0	2	25
BfH	1	0	0	0	0	0	0	0	0	100
LF	13	38	8	23	0	23	0	8	0	0
NM	2	0	0	50	0	0	50	0	0	0
BH	34	68	3	0	0	3	0	6	12	8
S	21	24	0	5	0	0	0	19	38	14
SH	41	51	5	24	3	0	0	7	5	5

DISCUSSION

The high use of the *Grevillea* by nectarivorous birds is not unexpected. Even though the plant is not the richest (kJ/shrub), it offers the greatest return per unit effort. The abundant nectar in each inflorescence is relatively easy to collect. This makes the *Grevillea* very attractive to the large nectarivores (high absolute energy needs) whose size and beak shape make feeding difficult at the smaller flowers with narrow corollas. Unlike the *Grevillea*, the *Rondeletia* has a very dispersed nectar resource which results in high foraging costs. Brown Honeyeater and Scarlet Honeyeater, being small (low absolute energy needs) with decurved beaks, are able to use those flowers with corollas efficiently. Immature and female Scarlet Honeyeaters also rely on being inconspicuous (small, quiet and brown) in order to feed at the rich nectar source.

Of interest is the low bird visitation to the *Metrosideros* despite the relatively rich (J/flower & kJ/shrub) and accessible nectar resource that it offers. The reason may be that, because of easy access, large numbers of a wide range of insects forage at the flowers throughout the day. The activity of the insects, particularly honey bees and native bees, probably removes most nectar, thus making unprofitable any visitation by the larger nectar-feeding birds.

The presence of a size-related dominance hierarchy among nectar-feeders in the garden is consistent with the findings for free-living nectarivores exploiting native plants(Ford & Paton 1982, McFarland 1986) and artificial feeders (Magarry 1983), and captive birds using feeders (Tullis & Wooller 1981). The level of interspecific and intraspecific aggression shown largely depends on the extent birds encounter each other. Although smaller, Scarlet Honeyeaters dominate Silvereyes. This departure from what would be predicted on size is not uncommon where the larger is generally considered less dependent on nectar as its main food (Tullis & Wooller 1981, McFarland 1986).

In the garden, Noisy Friarbirds are subordinate to Rainbow Lorikeets in one-on-one situations. In other localities, small parties of friarbirds, and similar-sized Red Wattlebirds *Anthochaera carunculata*, have successfully displaced the larger lorikeets (Hindwood 1939, Bruce 1973). The low aggressiveness and quiet foraging of the Little Friarbird in the garden appears to be typical of this species when in the presence of Noisy Friarbirds (Favaloro 1931). To reduce energy expenditure and the risk of injury in confrontation, both friarbird species use a similar intraspecific threat display rather than overt aggression to gain access to nectar. While the calls of the male Scarlet Honeyeater may act to deter conspecifics from visiting the plant being used, it is a disadvantage in the *Grevillea* resulting in the caller being detected and attacked by the Noisy Friarbird.

Use of garden plants by nectar-feeding birds is determined by a combination of the species' foraging efficiency (body size, beak-flower compatibility) and social behaviour (aggression and avoidance). Small species are able to survive in the presence of larger, more dominant nectarivores because of the availability of flowers whose low energy rewards and/or structure exclude larger birds. Even though dominant species may monopolise the richest source, the smaller species still attempt to use this plant, with varying success, despite the risk of being attacked. The results suggest that exotic plants in a garden situation can contribute to a gradient of nectar resources that enables a range of nectarivorous birds to co-exist in an area. While exotics may be useful, extreme care must be exercised to avoid selection of non-local plant species, both native and introduced, which have weed potential. If in doubt, it would be best to consult knowledgeable people in nurseries, the State conservation department, the herbarium or the Society for Growing Australian Plants.

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NOTES ON THE FOODS OF THE PLUMED FROGMOUTH *PODARGUS OCELLATUS PLUMIFERUS*

GEOFFREY C. SMITH, MURDOCH DE BAAR, JOHN KEHL, DAVID MILLEDGE and RICHARD SCHODDE

Few papers have discussed either the food or foraging behaviour of the Marbled Frogmouth *Podargus ocellatus*. Only the diet of the northern *P. o. marmoratus* has been documented, with beetles common in the crops of specimens collected by McGillivray (1918) and Atherton *et al.* (1980). Cockroaches, grasshoppers, moth larvae and spiders were also present. No details appear to have been published on the diet of the southern *P. o. plumiferus* (Plumed Frogmouth).

Information on the diet of the Plumed Frogmouth was obtained from three crops removed from specimens shot for study skins. These comprise two specimens collected by the CSIRO during 18-19 June 1985 in the Conondale Ranges and a specimen collected at Terania Creek near Lismore on 16 January 1981 by Milledge (1983) for The Australian Museum, Sydney.

Both of the crops collected in the Conondale Ranges contained cockroaches, crickets and earwigs (Table 1). The crop of the male also contained urticating hairy moth larvae, stoneflies and spiders, and the crop of the female had grasshoppers and a king cricket. In contrast to the crop contents of *P.o. marmoratus* (MacGillivray 1918, Atherton *et al.* 1980) no beetles (Coleoptera) were found (Schodde & Mason 1980). The male *P. o. plumiferus* collected at Terania Creek had eaten three species of Longhorn beetles, however, in addition to crickets and a cicada (D. Milledge unpublished data).

Foods consumed by the Plumed Frogmouth appear similar to those eaten by the northern *P. o. marmoratus* (cf. McGillivray 1918, Atherton *et al.* 1980). Although the Plumed Frogmouth may take larger prey species because of its larger body size (Schodde & Mason 1980), both subspecies consume cockroaches, crickets, grasshoppers, beetles, moth larvae and spiders. Most of these invertebrates are more likely to be found on the trunks, branches and foliage of trees, shrubs and lianes, rather than on the ground (M. De Baar pers. obs.; G. B. Monteith in Atherton *et al.* 1980; Table 1), indicating that Plumed Frogmouths forage mainly among vegetation. Plumed Frogmouths are nevertheless seen on or close to the ground and are occasionally caught close to the ground in mist-nets set within drainage lines (G.C. Smith and D. Milledge pers. obs.; Martin Schulz pers. comm.).

Marbled Frogmouths are known to take frogs (Schodde & Mason 1980), and they will probably consume other small vertebrates if given the opportunity. It is thought that some captures of Plumed Frogmouths in mist-nets have resulted

TABLE 1. Food items found in the crops of Plumed Frogmouths collected from the Conondale Ranges and Terania Creek.

Order	Family	Genus Species	Common Name	Contents	Notes
Male, Conondale Ranges:					
Plecoptera			Stonefly	2 wings	Found near watercourses or flying through forests toward other watercourses.
Blattodea	Blatellidae	*Blatella* sp.	Cockroach	4 complete, legs & heads	Found under bark and leaf litter, and on tree trunks
Dermaptera			Earwig	1 forceps	Around rotten logs, on tree trunks and possibly wandering on ground
Orthoptera	Gryllacrididae	*Hadrogryllacris* sp.		9 mandibles, 1 head	Predatory species occurring on trunk and branches
Lepidoptera	Anthelidae	*Anthela varia*	Moth larva	Numerous, part digested	Found on branches and leaves, probably of *Eucalyptus*
Arachnida	Araneae		Spider	2 chelicera	
Female, Conondale Ranges:					
Blattodea	Blattidae	*Blatella* sp.	Cockroaches	1 incomplete	As for male
Dermaptera			Earwigs	1 forceps	As for male
Orthoptera	Gryllacrididae	*Hadrogryllacris* sp.		1 head, 12 mandibles	Body with legs, as for male
Orthoptera	Tettigoniidae		Grasshopper	2 heads	Occurs on branches and around foliage
Orthoptera	Stenopalmatidae	*Australostomas* sp.	King cricket	2 mandibles	Occurs on ground, nocturnal predator
Terania Creek bird:					
Orthoptera	Gryllacrididae		Crickets	4 winged adults	As for male (Conondales)
Hemiptera	Cicadidae		Cicadas	1 complete	Found on trunk and branches
Coleoptera	Cerambycidae		Longhorn beetles	3 different species	Active diurnal or nocturnal fliers, feed on flowers, foliage or bark

from their attempts to take a Pale-yellow Robin *Tregellasia capito* (D. Milledge pers. obs.) and a micro-chiropteran (M. Schultz pers. comm.) caught in the same nets.

Plumed Frogmouths have been seen foraging in a spotlight beam and will perch close to a gas lantern if hung in the forest at night (G.C. Smith pers. obs.). Such lights attract insects and improve visibility. Birds appear to fly higher in the canopy on dark nights compared to moonlit ones. They are more easily caught when there is a full moon (G.C. Smith pers. obs.). Birds have also been observed sitting on palm fronds with wings outstretched (J.C. Kehl and C. Corben pers. obs.), but whether this is a foraging or merely perching behaviour is unknown.

ACKNOWLEDGEMENTS

Thanks to Chris Corben for allowing us to use unpublished observations.

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A NORTHERN SIGHTING OF THE CINNAMON QUAIL-THRUSH *CINCLOSOMA CINNAMOMEUM* IN QUEENSLAND

PETER ROWLAND

The nominate subspecies of the Cinnamon Quail-thrush *Cinclosoma cinnamomeum* is found among dry stony areas, especially around dried creek-lines. Within Queensland, the northern limit of its distribution is 56 km west of "Glenormiston", near Boulia (Ford 1983). There is no evidence of large-scale seasonal movements (Blakers *et al.* 1984), and clutches have been found in South Australia in all months (Ford 1983).

During the period 15 May to 25 May 1993, I was contracted to perform an avifaunal survey in an area of central-western Queensland. The funding for this survey was supplied by BHP Minerals. During the survey I was assisted by Stephen Malone, an employee of BHP. On 22 May, at 0900 h, we observed two female Cinnamon Quail-thrushes feeding around a series of dry creek beds on "El Rita" Station, about 130 km SSE of Cloncurry (21°55'52"S, 141°07'52"E). The vegetation within the area was predominantly Gidgee *Acacia cambagei*, Spinifex *Triodia molesta* and Barley Mitchell Grass *Astrebla pectinata*. On the same day, at 1300 h, I saw another female Cinnamon Quail-thrush, approximately 2.5 km north of the first site. On 24 May, at 0930 h, I saw a fourth bird, another female, in the vicinity of the previous sighting. This locality is some 275 km ENE of "Glenormiston".

A second avifaunal survey was conducted at the same site during the period 28 March to 6 April 1994. Several visits were made to "El Rita" Station, but no Cinnamon Quail-thrushes were sighted. However, during the late May 1993 to late March 1994 period, when Stephen Malone made numerous visits to the area, both male and female birds were seen regularly and there were no obvious periods of absence.

If further funds are available a third visit will be made to the area in August 1995. Ford (1983) lists July and August as egg-laying months in Queensland, while a female detailed in Hall (1974) was in full breeding condition in early June. It is possible that the August visit will provide an opportunity to confirm breeding at this site.

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BOOK REVIEW

CUCKOOS, NIGHTBIRDS & KINGFISHERS OF AUSTRALIA. Ronald Strahan (Editor). Angus & Robertson, Sydney, 1994, 270 pages, numerous colour photographs, $95.00.

This book, the penultimate of ten volumes, describes and illustrates Australian birds using photographs from the National Photographic Index of Australian Wildlife. The title is misleading. Bee-eaters, rollers, swifts, lyrebirds, pittas, cuckoo-shrikes, trillers, wagtails, pipits, larks, hirundines and scrub-birds are also included, and the text is 30% longer than the 1993 volume (also priced at $95). This miscellany involves the diverse styles of James Shields and fourteen other authors, ably edited by Ronald Strahan.

The standard format of this series is detailed in an earlier review (*Sunbird* 1993, 23:115). With the exception of two nightjar species, mensural data summarised in the technical synopses lack sample size; and very few species other than owls have male and female data distinguished. This thorough, readable text has few typographical errors, and the variation in styles is a bonus. I personally enjoyed the entries by Glen Ingram and Stephen Debus.

The bibliography includes some 1993-94 works, but the fact that Shane Parker "died just before completing his scrutiny" seems to indicate that much of the text was finalised some two years ago. Statements about extra-limital species such as Grey Wagtail and White Wagtail need to be recent to be meaningful, and other omissions include White-backed Swallow nomadic north to 20°S (*Sunbird* 1992, 22:73); Channel-billed Cuckoo overwintering south of the Gulf of Carpentaria (*Sunbird* 1992, 22:73); Pheasant Coucal nests are not always "on or within 1 metre of the ground", being as high as 1.6 m (*Emu* 1992, 92:142 and pers. obs.); and the introduced population of *castanops* Masked Owls which thrives at Lord Howe Island is not mentioned at all. Errors rather than omissions include Little Kingfisher and Buff-breasted Paradise-Kingfisher stated to range south to Townsville, whereas discussion for both mentions or focuses on Mackay; the widespread bee-eater in Europe is *apiaster* rather than *orientalis*; and the carefully documented Lynd-Burdekin divide (*Emu* 1986, 86:87) does not translate into "well-marked subspecies occur on either side of the river".

Despite the foregoing, this book is an attractively produced and eminently readable compilation which communicates a wealth of information.

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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.

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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.

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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.

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