

# THE SUNBIRD



*Journal of the*  
**QUEENSLAND ORNITHOLOGICAL SOCIETY**

Volume 27

Number 4

December 1997

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# THE SUNBIRD

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Volume 27 No. 4

December 1997

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## AVIAN FRUGIVORY IN A SUBTROPICAL RAINFOREST: ELEVEN YEARS OF OBSERVATIONS IN LAMINGTON NATIONAL PARK

R. J. CHURCH

### ABSTRACT

Observations of fruit-eating by 21 bird species were made in a subtropical rainforest over an eleven year period from 1985 to 1995. The fruits of 125 plant species were utilised. Fruit feeding reached a peak from February to April and was lowest during the period from July to October, reflecting fruit availability. The greatest variety of fruits was eaten by Regent Bowerbirds and Lewin's Honeyeaters. The fruits visited by the greatest numbers of bird species were *Alphitonia excelsa*, *Ficus platypoda*, *Piper novae-hollandiae*, *Diploglottis australis*, *Polyscias elegans*, and *Elaeocarpus obovatus*. Predictability of fruiting and the use of fruits by various bird groups are discussed.

### INTRODUCTION

Over two-thirds of Australian subtropical rainforest plants are fleshy fruited and, for this reason, are presumed to be bird-dispersed (Williams *et al.* 1984). In many cases, however, we do not know which fruits are actually eaten by birds, or which plant species are visited by which bird species. When such observations are recorded (e.g. Floyd 1989), it is usually not mentioned whether the birds make frequent or occasional use of the fruits.

Living at the edge of the continent's largest remaining tract of subtropical rainforest for more than a decade has given me an opportunity to record many observations and thus contribute to our store of knowledge on this subject. This paper presents a summary of these observations.

### METHODS AND STUDY AREA

The study area comprises rainforest and edge habitat near Green Mountains, Lamington National Park (28°S, 153°E), close to and including the author's home

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property at 740m asl. The fruiting seasons of trees, shrubs, vines and forbs and the birds visiting the fruiting plants were recorded over a period of eleven years (1985-1995). Feeding observations were recorded almost daily throughout this period, with notes being made of the species and locations of fruiting plants and the species of birds. Foraging methods and dates of observations were also noted. All yearly records of fruiting, and most monthly ones were made along a 5 km section of Lamington National Park Road, which traverses dry and subtropical rainforest and its peripheral areas.

Observations were mainly opportunistic, but trees seen in flower were noted and inspected periodically for commencement of fruiting. In addition, Regent Bowerbirds, Satin Bowerbirds and Green Catbirds were fed daily at our residence, and seeds in their faeces and in the drinking pool frequently gave an indication as to what plants to look for.

## RESULTS

### Birds eating fruits

One hundred and twenty-five species of fruits were seen to be consumed by the thirteen most commonly observed species of frugivorous birds (Table 1). Visits by three other frugivorous and five primarily insectivorous birds are recorded in Table 2. Fruits eaten by the greatest numbers of bird species were: *Alphitonia excelsa*, *Ficus platypoda* var. *platypoda*, *Piper novae-hollandiae*, *Diploglottis australis*, *Polyscias elegans* and *Elaeocarpus obovatus* (10 to 20 species), followed by *Ficus macrophylla*, *Olea paniculata*, *Elattostachys xylocarpa*, *Diospyros pentamera*, *Ficus superba* var. *henniana* and *Guioa semiglauca* (8 or 9 species).

Fruit-doves were collectively seen to eat the fruits of 33% of the observed plant species, and other common frugivores which are potential dispersers ate fruits from 56% of the plant species. Fruits of 52% of the plant species were eaten by birds known or assumed to be seed predators (Table 1), and 4% were eaten by birds that are primarily insectivorous (Table 2). Bird species eating the greatest variety of fruits were Regent Bowerbird (70 species), Lewin's Honeyeater (60 species) and Satin Bowerbird (55 species).

### Yearly and seasonal fruiting records of some important food plants

*Dendrocnide excelsa*, a common tree in the area, produces male and female flowers on separate trees. Crops of the pink fruit are produced in the late autumn and winter and fruiting appeared to be correlated with autumn weather conditions. No fruit was observed on trees during 1986, 1991 or 1994 when very dry conditions prevailed during autumn and early winter. Trees also failed to fruit in 1989 after high rainfall in April (752 mm). The five fruit-doves and Australian King-Parrot were never observed eating the fruit, but Wonga Pigeons ate fruit off fallen bunches on the ground.

TABLE 1. Fruits eaten by the most common frugivores. Numbers refer to months (1=January, 2=February, etc.). Each 'occ' indicates that only one or two observations were made for any particular plant. Life form: T=tree, TS=tall shrub, S=shrub, LS=low shrub, V=vine, P=parasite, F=forb, G=graminoid. \*=naturalised species. LH=Lewin's Honeyeater, S=Silvereye, PR=Paradise Riflebird, GC=Green Catbird, RB=Regent Bowerbird, SB=Satin Bowerbird, RCFD=Rose-crowned Fruit-Dove, W=Wompoo Fruit-Dove, TP=Topknot Pigeon, BCD=Brown Cuckoo-Dove, WHP= White-headed Pigeon, CR=Crimson Rosella, KP=King-Parrot.

| Species  | Life Form | LH  | S   | PR  | GC  | RB    | SB  | RCFD | W   | TP | BCD | WHP | CR | KP  |
|--|-----------|-----|-----|-----|-----|-------|-----|------|-----|----|-----|-----|----|-----|
| <b>DICOTYLEDONS</b>                                    |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <b>Akaniaceae</b>                                      |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <i>Akania bidwillii</i>                                | T         | 4   |     |     |     | 4     | 4   |      |     |    |     |     |    |     |
| <b>Alangiaceae</b>                                     |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <i>Alangium villosum</i><br>subsp. <i>polyosmoides</i> | T         |     |     |     | 1,2 | 1     |     | 2,3  | 1,2 | 2  |     |     |    |     |
| <b>Anarcardiaceae</b>                                  |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <i>Euroschinus falcata</i>                             | T         | 1,2 | 1   |     |     | 1,2   | 1,2 |      |     |    | 1   |     |    | 1,2 |
| <b>Apocynaceae</b>                                     |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <i>Carissa ovata</i>                                   | LS        |     |     |     |     | 1,2   | 8   |      |     |    |     |     |    |     |
| <b>Araliaceae</b>                                      |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <i>Cephalalaria cephalobotrys</i>                      | V         |     |     |     |     | 6 occ |     |      |     |    |     |     |    |     |
| <i>Polyscias elegans</i>                               | T         | 4-7 | 4-7 | 5-7 | 4-8 | 4-8   | 5-7 |      |     | 6  | 4-7 |     |    | 5   |
| <i>Polyscias murrayi</i>                               | T         |     |     |     |     |       |     |      |     |    | 3,4 |     |    |     |
| <b>Celastraceae</b>                                    |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <i>Celastrus subspicata</i>                            | V         | 5,6 | 5   |     |     |       |     |      |     |    |     |     |    |     |
| <b>Cucurbitaceae</b>                                   |           |     |     |     |     |       |     |      |     |    |     |     |    |     |
| <i>Diplocyclos palmatus</i>                            | V         |     |     |     |     | 6     |     |      |     |    | 7   |     |    | 6   |
| <i>Sicyos australis</i>                                | V         |     |     |     |     |       |     |      |     |    |     |     |    | 2-7 |
| <i>Zehneria cunninghamii</i>                           | V         | 5   |     |     |     |       |     |      |     |    | 2,4 |     |    |     |

| Species                          | Life Form | LH  | S   | PR | GC              | RB              | SB           | RCFD   | W      | TP   | BCD | WHP | CR | KP    |
|----------------------------------|-----------|-----|-----|----|-----------------|-----------------|--------------|--------|--------|------|-----|-----|----|-------|
| <b>DICOTYLEDONS (cont.)</b>      |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <b>Dilleniaceae</b>              |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Hibbertia scandens</i>        | V         |     |     | 1  | occ             |                 |              |        |        |      |     |     |    |       |
| <b>Ebenaceae</b>                 |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Diospyros australis</i>       | T         | 6   | occ |    |                 | 6               | occ          |        |        |      |     |     |    |       |
| <i>Diospyros pentamera</i>       | T         | 1   |     |    | 1-3,9,<br>11,12 | 1-3,8,<br>11,12 | 1,2,3,<br>12 | 1,2,12 | 2,3,12 | 1,12 |     | 11  |    |       |
| <b>Ehretiaceae</b>               |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Ehretia acuminata</i>         | T         | 2-4 |     |    | 2               | 2-4             | 2            | 2      |        | 2    |     |     |    |       |
| <b>Elaeocarpaceae</b>            |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Elaeocarpus kirtonii</i>      | T         |     |     |    | 11              |                 |              |        |        |      |     |     |    |       |
| <i>Elaeocarpus obovatus</i>      | T         | 2-6 |     | 3  | 2-4             | 2-5             | 2-5          | 3      |        | 2-4  |     |     | 3  | 3     |
| <b>Euphorbiaceae</b>             |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Baloghia inophylla</i>        | T         |     |     |    |                 |                 |              |        |        |      |     |     |    | 1,2   |
| <i>Breynia oblongifolia</i>      | T         |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Claoxylon australe</i>        | T         | 2,3 |     |    |                 |                 |              |        |        |      | 1,2 |     |    |       |
| <i>Cleistanthus cunninghamii</i> | T         |     |     |    |                 |                 |              |        |        |      |     |     | 9  | 12    |
| <i>Drypetes deplanchei</i>       | T         | 5   |     |    |                 | 5               | 5            |        | 4      |      |     |     |    |       |
| <i>Omalanthus nutans</i>         | S         | 1,2 | 1   |    |                 |                 |              |        |        |      | 2,3 |     |    |       |
| <b>Flacourtiaceae</b>            |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Casearia multinervosa</i>     | T         | 4   | occ |    |                 | 4               | occ          |        |        |      |     |     |    |       |
| <i>Scolopia braunii</i>          | T         | 2,3 |     |    | 2,3             | 2               | 2,3          |        |        | 2    |     |     |    | 1-3   |
| <b>Icacinaceae</b>               |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Pennantia cunninghamii</i>    | T         |     |     |    |                 |                 |              | 11,12  | 11,12  | 12   |     |     |    |       |
| <b>Lauraceae</b>                 |           |     |     |    |                 |                 |              |        |        |      |     |     |    |       |
| <i>Cinnamomum virens</i>         | T         |     |     |    | 12              | 12              | 12           | 12     |        | 12   |     | 12  |    |       |
| <i>Cryptocarya bidwillii</i>     | T         |     |     |    |                 | 2,12            | 1,12         |        | 1      | 12   |     |     |    | 11,12 |
| <i>Cryptocarya erythroxylon</i>  | T         |     |     |    |                 |                 |              |        |        | 9,10 |     |     |    |       |
| <i>Cryptocarya obovata</i>       | T         |     |     |    |                 |                 |              |        |        | 4    |     |     |    |       |

| Species   | Life Form | LH       | S    | PR   | GC              | RB       | SB              | RCFD | W        | TP     | BCD   | WHP | CR     | KP     |
|---|-----------|----------|------|------|-----------------|----------|-----------------|------|----------|--------|-------|-----|--------|--------|
| <b>DICOTYLEDONS (cont.)</b>                     |           |          |      |      |                 |          |                 |      |          |        |       |     |        |        |
| <i>Cryptocarya triplinervis</i>                 | T         | 3        |      |      |                 |          |                 |      | 3        | 3      |       |     | 2      | 3      |
| <i>Litsea reticulata</i>                        | T         |          |      |      |                 | 2        | 2               |      |          | 2      |       | 2   |        | 12     |
| <i>Neolitsea australiensis</i>                  | T         |          |      |      | 5,6             |          |                 |      | 7        |        |       | 1,2 |        |        |
| <b>Loganiaceae</b>                              |           |          |      |      |                 |          |                 |      |          |        |       |     |        |        |
| <i>Strychnos axillaris</i>                      | T         | 6        | occ  |      |                 |          |                 |      |          |        |       |     |        |        |
| <b>Loranthaceae</b>                             |           |          |      |      |                 |          |                 |      |          |        |       |     |        |        |
| <i>Amylotheca dictyophleba</i>                  | P         |          |      |      |                 | 3        | occ             |      |          |        |       |     |        |        |
| <b>Meliaceae</b>                                |           |          |      |      |                 |          |                 |      |          |        |       |     |        |        |
| <i>Anthocarpa nitidula</i>                      | N         | 2        |      | 3    | 2,3             | 3-5      | 2-4             | 2,3  | 4        |        |       |     |        |        |
| <i>Dysoxylum fraserianum</i>                    | T         | 3,4      |      | 3,4  |                 | 3        | 3               |      |          |        |       |     |        |        |
| <i>Dysoxylum rufum</i>                          | T         | 2        |      | 12   |                 | 2,12     |                 |      |          |        |       |     |        |        |
| <i>Melia azedarach</i> var. <i>australasica</i> | T         | 5,6      |      |      | 5,6             | 6        |                 |      | 4-6      |        |       |     | 4      | 4      |
| <i>Owenia cepiodora</i>                         | T         |          |      |      |                 |          |                 | 4    |          |        |       |     |        |        |
| <i>Synoum glandulosum</i>                       | T         |          |      | 1,2  |                 |          |                 |      |          |        |       |     |        |        |
| <b>Menispermaceae</b>                           |           |          |      |      |                 |          |                 |      |          |        |       |     |        |        |
| <i>Legnephora moorei</i>                        | V         |          |      |      | 3               |          |                 | 2,3  |          |        |       |     |        |        |
| <b>Mimosaceae</b>                               |           |          |      |      |                 |          |                 |      |          |        |       |     |        |        |
| <i>Acacia maidenii</i>                          | T         | 1,12     | 1,12 | 1,12 |                 | 12       |                 |      |          |        | 12    |     | 1,6,12 | 6,9-12 |
| <b>Moraceae</b>                                 |           |          |      |      |                 |          |                 |      |          |        |       |     |        |        |
| <i>Ficus coronata</i>                           | T         |          |      |      |                 |          | 3               |      |          |        |       |     |        |        |
| <i>Ficus macrophylla</i>                        | T         | 10,11    |      |      | 2,11            | 2,3,9-11 | 3,9-12          |      | 2,3,9-12 | 2,3,10 |       |     | 11     |        |
| <i>Ficus platypoda</i> var. <i>platypoda</i>    | T         | 1,10-12  | 1    |      | 11,12           | 1,10-12  | 1,9-12          | 1,12 | 10-12    | 11,12  |       |     | 6,12   |        |
| <i>Ficus superba</i> var. <i>henneana</i>       | T         | 3,6,9-12 |      |      | 3,6,9           | 3,7      | 1,3             |      |          | 1,3    | 3,5,8 |     |        |        |
|   |           |          |      |      | 10              | 9-12     | 7-12            |      | 8-12     | 10-12  |       |     |        |        |
| <i>Ficus watkinsiana</i>                        | T         |          |      |      | 1,2,5,<br>10,11 | 3,4      | 1-3,5,<br>10-12 |      | 4,5      | 2      |       |     | 1,6,12 |        |
| <i>Maclura cochinchinensis</i>                  | V         | 2,3      |      |      |                 | 2,11     | 2-4             |      |          |        |       |     |        |        |
| <i>Malaisia scandens</i>                        | V         |          |      |      |                 | 2        | 1               |      |          |        |       |     |        |        |

| Species                        | Life Form | LH   | S      | PR | GC   | RB       | SB   | RCFD | W  | TP     | BCD     | WHP       | CR   | KP   |
|--------------------------------|-----------|------|--------|----|------|----------|------|------|----|--------|---------|-----------|------|------|
| <b>DICOTYLEDONS (cont.)</b>    |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| <i>Streblus brunonianus</i>    | T         | 2-4  |        |    |      |          |      |      |    |        | 1,2,4   |           | 2,6  | 1,4  |
| <b>Myrsinaceae</b>             |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| <i>Rapanea howittiana</i>      | T         | 1    | 1      |    |      |          | 12   | 1    |    |        |         |           |      |      |
| <b>Myrtaceae</b>               |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| <i>Acmena ingens</i>           | T         |      |        |    | 9    |          |      |      | 10 | 10     |         |           |      |      |
| <i>Acmena smithii</i>          | T         |      |        |    |      |          |      |      |    |        |         |           | 6    | 5    |
| <i>Austromyrtus hillii</i>     | T         | 3,4  |        |    |      |          |      |      |    |        |         |           | 4,5  |      |
| <i>Decaspermum humile</i>      | T         | 8,11 |        |    |      | 3,8,9,11 | 8    | 11   |    |        |         |           | 6,12 |      |
| <i>Rhodamnia argentea</i>      | T         | 4-7  |        |    | 4,5  | 3-5,7    | 3-5  |      |    | 5,6    |         |           |      |      |
| <i>Rhodamnia rubescens</i>     | T         |      |        |    |      | 2        | 2    |      |    |        |         |           |      |      |
| <i>Rhodomyrtus psidioides</i>  | T         | 6    |        |    |      | 5        | 4,5  |      |    |        |         |           | 4    | 5,6  |
| <i>Syzygium australe</i>       | T         | 4    |        |    |      | 4        | 3    |      |    |        |         |           |      |      |
| <i>Syzygium crebrinerve</i>    | T         |      |        |    |      |          |      | 4    |    |        |         |           |      |      |
| <i>Syzygium francisii</i>      | T         |      |        |    |      |          |      |      | 4  |        |         |           |      |      |
| * <i>Syzygium paniculatum</i>  | T         | 5-7  |        |    |      | 6        | 7    |      |    |        |         |           |      | 5    |
| <i>Tristaniopsis collina</i>   | T         |      |        |    |      |          |      |      |    |        |         |           | 6occ |      |
| <b>Oleaceae</b>                |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| <i>Jasminum dallachii</i>      | V         |      |        |    |      | 10       |      |      |    |        | 9       |           |      |      |
| <i>Jasminum simplicifolium</i> | V         |      |        |    |      |          | 5occ |      |    |        |         |           |      |      |
| subsp. <i>australiense</i>     |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| <i>Olea paniculata</i>         | T         |      |        |    | 9-11 | 8-11     | 8-11 |      | 10 | 10     | 11      | 9,10      |      | 9,10 |
| <b>Phytolacaceae</b>           |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| * <i>Phytolacca americana</i>  | LS        |      |        |    |      |          |      |      |    |        | 3occ    |           |      |      |
| * <i>Phytolacca octandra</i>   | LS        |      | 2-4,6  |    |      | 4        | 6    |      |    |        | 1-3,4,6 |           |      | 6,8  |
| <b>Piperaceae</b>              |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| <i>Piper novae-hollandiae</i>  | V         | 1,2  | 1,2,12 | 2  | 1,2  | 1,2      | 1,2  | 1,2  | 12 | 1,2,12 | 11      | 1,2,11,12 |      |      |
| <b>Pittosporaceae</b>          |           |      |        |    |      |          |      |      |    |        |         |           |      |      |
| <i>Pittosporum undulatum</i>   | T         | 5    | 4-6    |    |      | 3,5      | 4    |      |    |        |         |           |      |      |
| <b>Polygonaceae</b>            |           |      |        |    |      |          |      |      |    |        |         |           |      |      |

| Species  | Life Form | LH     | S      | PR   | GC    | RB     | SB        | RCFD | W     | TP   | BCD  | WHP | CR       | KP           |
|--|-----------|--------|--------|------|-------|--------|-----------|------|-------|------|------|-----|----------|--------------|
| <b>DICOTYLEDONS (cont.)</b>                      |           |        |        |      |       |        |           |      |       |      |      |     |          |              |
| <i>Muehlenbeckia gracillima</i>                  | V         | 4occ   |        |      |       |        |           |      |       |      |      |     |          |              |
| <b>Rhamnaceae</b>                                |           |        |        |      |       |        |           |      |       |      |      |     |          |              |
| <i>Alphitonia excelsa</i>                        | T         | 1-4,12 | 1-4,12 | 3,12 | 11,12 | 1-3,12 | 2-4       |      | 12occ |      | 2,12 | 10  | 1-4,7,12 | 2-4,6,7,9,12 |
| <i>Emmenosperma alphitonioides</i>               | T         |        |        |      |       |        |           |      |       |      |      |     | 3        | 9            |
| <b>Rosaceae</b>                                  |           |        |        |      |       |        |           |      |       |      |      |     |          |              |
| * <i>Duchesnea indica</i>                        | F         | 1,3    |        |      |       | 1,2,12 | 1-3,11,12 |      |       |      |      |     |          | 6            |
| <i>Rubus moluccanus</i>                          | LS        | 1,5,6  |        |      |       | 1,6    |           |      |       |      |      |     |          |              |
| <i>Rubus moorei</i>                              | V         |        |        |      |       | 11occ  |           |      |       |      |      |     |          |              |
| <i>Rubus rosifolius</i>                          | LS        | 10,11  |        |      |       | 10,11  | 8-11      |      |       |      |      |     |          |              |
| <b>Rubiaceae</b>                                 |           |        |        |      |       |        |           |      |       |      |      |     |          |              |
| <i>Morinda jasminoides</i>                       | V         | 2      |        |      |       | 2,3    |           |      |       |      |      |     |          |              |
| <b>Rutaceae</b>                                  |           |        |        |      |       |        |           |      |       |      |      |     |          |              |
| <i>Acronychia baeuerlenii</i>                    | T         |        |        |      |       |        |           |      |       |      |      |     |          | 3            |
| <i>Acronychia oblongifolia</i>                   | T         |        |        |      | 10    | 10     | 7         |      | 10    | 9-12 |      | 9   |          |              |
| <i>Acronychia suberosa</i>                       | T         |        |        |      |       |        |           |      |       |      |      |     |          | 11           |
| * <i>Citrus limon</i>                            | T         |        |        |      |       | 8occ   |           |      |       |      |      |     |          |              |
| <i>Geijera salicifolia</i> var. <i>latifolia</i> | T         |        |        |      |       |        |           |      |       |      | 12   |     |          |              |
| <i>Halfordia kendack</i>                         | T         |        |        |      |       | 1      |           |      |       | 1    |      |     |          |              |
| <i>Melicope micrococca</i>                       | T         | 3,4    | 3,4    |      |       |        |           |      |       |      |      |     | 3-4      | 2,4          |
| <i>Pentaceras australe</i>                       | T         |        |        |      |       |        |           |      |       |      |      |     | 1-4,12   |              |
| <i>Sarcomelicope simplicifolia</i>               | T         |        |        |      |       |        |           |      |       |      |      | 9   |          |              |
| <i>Zanthoxylon brachyacanthum</i>                | T         | 4occ   |        |      |       |        |           |      |       |      |      |     |          |              |
| <b>Sapindaceae</b>                               |           |        |        |      |       |        |           |      |       |      |      |     |          |              |
| <i>Cupaniopsis flagelliformis</i>                | T         |        |        | 3,5  |       |        |           |      |       |      |      |     |          |              |
| var. <i>australis</i>                            |           |        |        |      |       |        |           |      |       |      |      |     |          |              |
| <i>Cupaniopsis foveolata</i>                     | T         |        |        | 2    |       |        |           |      |       |      |      |     |          |              |
| <i>Sarcopteryx stipata</i>                       | T         | 1,12   | 1,12   | 12   | 12    | 1,12   | 1,12      |      |       |      |      |     |          | 1,12         |



| Species                          | Life Form | LH        | S      | PR       | GC   | RB       | SB      | RCFD | W    | TP   | BCD      | WHP | CR    | KP                 |
|----------------------------------|-----------|-----------|--------|----------|------|----------|---------|------|------|------|----------|-----|-------|--------------------|
| <b>DICOTYLEDONS (cont.)</b>      |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Diploglottis australis</i>    | T         | 12        |        | 12       | 1,12 | 12       | 12      | 1,12 | 1,12 | 1,12 | 12       |     | 12    | 1,12               |
| <i>Elattostachys xylocarpa</i>   | T         | 4-6,10    | 4-6    | 4,5,7,10 |      | 5,7,10   | 4,5,10  |      |      |      |          |     | 4     | 2,6,10             |
| <i>Guioa semiglauca</i>          | T         | 2         | 2      | 2        | 2    | 2        | 2       |      |      |      |          |     | 2     | 2                  |
| <i>Jagera pseudorhus</i>         | T         | 9-12      |        | 10-12    |      | 9-11     | 9-11    |      |      |      |          |     |       |                    |
| <i>Mischocarpus anodontus</i>    | T         | 4,5       |        | 4,5      |      | 4,5      |         |      |      |      |          |     |       |                    |
| <b>Sapotaceae</b>                |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Planchonella myrsinoides</i>  | T         |           |        |          |      |          |         |      |      |      |          |     |       | 5,9                |
| <b>Simaroubaceae</b>             |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Guilfoylia monostylis</i>     | T         |           |        |          | 4occ |          | 4occ    |      |      |      |          |     |       |                    |
| <b>Solanaceae</b>                |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Duboisia myoporoides</i>      | T         |           |        |          | 11   |          |         |      |      |      |          |     |       |                    |
| * <i>Physalis peruviana</i>      | LS        | 4         |        |          |      |          | 4,5     |      |      |      | 11       |     | 4,5,8 |                    |
| <i>Solanum aviculare</i>         | S         | 1-3,5,6,8 |        |          | 1-3  | 1-3,8    | 2-6,8,9 |      |      |      |          |     |       |                    |
| * <i>Solanum mauritianum</i>     | S         |           |        |          |      |          | 8,9     |      |      |      |          |     |       |                    |
| * <i>Solanum americanum</i>      | F         | 3,5,7,12  | 2,4,12 |          |      | 1,4,8,12 |         |      |      |      | 5,7,9,12 |     |       | 3,6,7,9,10,3,11,12 |
| * <i>Solanum pseudocapsicum</i>  | F         |           |        |          |      |          |         |      |      |      | 11,12    |     |       | 10                 |
| <b>Sterculiaceae</b>             |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Brachychiton acerifolius</i>  | T         |           |        |          | 7    | 8        | 8       |      |      |      |          |     |       |                    |
| <i>Brachychiton discolor</i>     | T         |           |        | 9        |      | 7-9      | 6-8     |      |      |      |          |     |       |                    |
| <b>Symplocaceae</b>              |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Symplocos thwaitesii</i>      | T         |           |        |          | 2,3  | 2,3      | 2,3     | 2,3  | 2    | 2    |          |     |       |                    |
| <b>Thymelaeaceae</b>             |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Phaleria chermisideana</i>    | T         |           |        |          | 2occ |          |         |      |      |      |          |     |       |                    |
| <i>Pimelea neoanglica</i>        | T         | 11        |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Wikstroemia indica</i>        | T         |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <b>Ulmaceae</b>                  |           |           |        |          |      |          |         |      |      |      |          |     |       |                    |
| <i>Aphananthe philippinensis</i> | T         |           |        |          | 5    |          | 5       |      |      |      | 4        |     |       |                    |

| Species                      | Life Form | LH      | S            | PR  | GC  | RB      | SB   | RCFD | W   | TP  | BCD | WHP | CR   | KP     |
|------------------------------|-----------|---------|--------------|-----|-----|---------|------|------|-----|-----|-----|-----|------|--------|
| <b>DICOTYLEDONS (cont.)</b>  |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <b>Urticaceae</b>            |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <i>Dendrocnide excelsa</i>   | T         | 6,7     | 6            | 5-7 | 5-7 | 5-7     | 5-7  |      |     |     |     |     | 5-7  |        |
| <b>Verbenaceae</b>           |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| * <i>Lantana camara</i>      | S         | 1,4     | 1,4-7,<br>12 |     |     | 1       | 12   |      |     |     |     |     | 12   |        |
| <i>Premna lignum-vitae</i>   | T         |         |              |     | 10  | 11      |      |      | 11  |     |     |     | 6,11 |        |
| <b>Vitaceae</b>              |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <i>Cayratia clematidea</i>   | V         | 2-6     |              |     |     | 4,5     |      |      |     |     |     |     |      |        |
| <i>Cayratia euryneura</i>    | V         | 3       |              |     | 4   | 3       |      |      | 4   | 4   |     |     |      |        |
| <i>Cissus antarctica</i>     | V         |         |              |     | 5-8 | 2,7,8   | 6-8  | 4    | 4   | 6   |     |     | 6    |        |
| <i>Cissus hypoglauca</i>     | V         |         |              |     |     |         |      |      | 4   |     |     |     |      |        |
| <i>Tetrastigma nitens</i>    | V         | 4       |              |     | 5,6 | 4-6     | 4-7  |      | 3-7 | 5-7 |     |     |      | 4      |
| <b>MONOCOTYLEDONS</b>        |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <b>Agavaceae</b>             |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <i>Cordyline petiolaris</i>  | S         | 4,5     |              |     |     | 4       |      |      |     |     |     |     |      |        |
| <i>Cordyline rubra</i>       | LS        |         |              |     |     | 3       |      |      |     |     |     |     |      |        |
| <b>Araceae</b>               |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <i>Pothos longipes</i>       | V         |         |              |     |     |         |      |      |     |     |     |     |      | 1,4,12 |
| <b>Liliaceae</b>             |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <i>Dianella caerulea</i>     | G         | 1,11,12 |              |     |     | 1,11,12 | 1,12 |      |     |     |     |     | 1    | 11,12  |
| <b>Philesiaceae</b>          |           |         |              |     |     |         |      |      |     |     |     |     |      |        |
| <i>Eustrephus latifolius</i> | V         |         |              |     |     |         |      |      |     |     |     |     |      | 12occ  |

**TABLE 2. Fruits eaten by birds that were seldom recorded consuming fruit in the study area.**

| Bird                | Plant   | Family         | Month |
|---------------------|---|----------------|-------|
| Mistletoebird       | <i>Cayratia clematidea</i>                      | Vitaceae       | 4     |
|                     | <i>Rhodomyrtus psidioides</i>                   | Myrtaceae      | 6     |
|                     | <i>Dendrocnide excelsa</i>                      | Urticaceae     | 6     |
|                     | <i>Amylotheca dictyophleba</i>                  | Loranthaceae   | 3     |
|                     | * <i>Cotoneaster glaucophylla</i>               | Rosaceae       | 3     |
| Common Koel         | <i>Rubus rosifolius</i>                         | Rosaceae       | 11    |
|                     | <i>Jagera pseudorhus</i>                        | Sapindaceae    | 11    |
|                     | <i>Ficus superba</i> var. <i>henneana</i>       | Moraceae       | 11    |
|                     | <i>Ficus platypoda</i> var. <i>platypoda</i>    | Moraceae       | 12    |
|                     | <i>Ficus macrophylla</i>                        | Moraceae       | 2     |
| Figbird             | <i>Elaeocarpus obovatus</i>                     | Elaeocarpaceae | 3     |
|                     | <i>Ficus superba</i> var. <i>henneana</i>       | Moraceae       | 12    |
|                     | <i>Ficus platypoda</i> var. <i>platypoda</i>    | Moraceae       | 10    |
|                     | <i>Ficus macrophylla</i>                        | Moraceae       | 2,4   |
|                     | <i>Ficus watkinsiana</i>                        | Moraceae       | 4     |
|                     | <i>Olea paniculata</i>                          | Oleaceae       | 9,10  |
| Varied Triller      | <i>Melia azedarach</i> var. <i>australasica</i> | Meliaceae      | 6     |
|                     | <i>Alphitonia excelsa</i>                       | Rhamnaceae     | 12    |
|                     | <i>Ficus platypoda</i> var. <i>platypoda</i>    | Moraceae       | 10    |
| Golden Whistler*    | <i>Polyscias elegans</i>                        | Araliaceae     | 9     |
|                     | <i>Elattostachys xylocarpa</i>                  | Sapindaceae    | 5,6,7 |
| Crested Shrike-tit* | <i>Jagera pseudorhus</i>                        | Sapindaceae    | 11    |
|                     | <i>Elattostachys xylocarpa</i>                  | Sapindaceae    | 5,6,7 |
|                     | <i>Sarcopteryx stipata</i>                      | Sapindaceae    | 12    |
| Eastern Whipbird    | * <i>Physalis peruviana</i>                     | Solanaceae     | 5     |
| Grey Shrike-thrush  | <i>Dianella caerulea</i>                        | Liliaceae      | 4     |
|                     | * <i>Duchesnea indica</i>                       | Rosaceae       | 1     |

\* Golden Whistler and Crested Shrike-tit consumed arils only after removing them from the seed.

The vine *Tetrastigma nitens* produced prolific crops during the autumn and winter months of 1986, 1987, 1991, 1992 and 1995. Flocks of Topknot Pigeons and small parties of Wompoo Fruit-Doves fed on the fruit for periods of up to two months. *Polyscias elegans* provided reliable autumn and winter crops, and most of the trees bore fruit annually from 1985 to 1995, even during dry periods. *Olea paniculata* was another important food source, but fruited irregularly during late winter and the spring of 1985, 1986, 1990, and 1992-1995. White-headed Pigeons and Regent Bowerbirds ate the green unripe fruit and King-Parrots stripped some trees of green fruit. *Elaeocarpus obovatus* carried ripe fruit for long periods in summer and autumn during 1987, 1990, 1992, 1993 and 1995. Ripe fruit occasionally remained on individual trees for weeks before any

feeding observations were made, although at other times the trees were very well visited by birds. Both large and small trees produced very large crops. Trees were situated at the forest edge or in open paddocks.

Four species of *Ficus* were utilised throughout each year, and fruit was available in any month of the year on at least one of the four species. However, more frequent crops were produced in spring and summer. *Ficus watkinsiana* is the most abundant fig in the area, while *F. macrophylla*, *F. platypoda* var. *platypoda* and *F. superba* var. *henneana* occur as occasional trees. *F. obliqua* was not located and only a few small trees of *F. coronata* and *F. fraseri* were noted.

The common vine *Piper novae-hollandiae* fruited in the spring and summer months of 1985, 1986, 1988-1991, 1993 and 1994, and its fruit was eaten in an unripe condition by White-headed Pigeons and Topknot Pigeons. *Diospyros pentamera* carried crops of ripe fruit in the spring and summer months of 1987-1988, 1988-1989, and 1993-1994. One tree under regular observation bore yellow fruit from May to September 1993, and ripe reddish fruit from October through to the following early February. Some fruit was seen to be eaten when yellow during August and September by Regent Bowerbirds and Green Catbirds. *Diploglottis australis* was popular when ripe crops were produced in the December - January period, although no fruit was produced in the summer seasons of 1986-1987, 1988-1989, 1990-1991 or 1993-1994. *Cryptocarya erythroxylon* is common in places above West Canungra Creek, and attracts large flocks of Topknot Pigeons whenever crops are produced in spring. *Pennantia cunninghamii* is found mainly along creek banks and in other moist situations; consequently only one small tree was found in the area under observation. Topknot Pigeons, Rose-crowned Fruit-Doves and Wompoo Fruit-Doves are attracted to fruiting *Pennantia* trees in spring and summer.

#### **Plants observed to have irregular or extended fruiting seasons**

*Olea paniculata* fruited irregularly, but when crops were produced they provided a food source that was eaten in a green or ripe condition for periods of up to four months. Individual trees of *Ficus watkinsiana* and *F. superba* var. *henneana* fruited continuously for long periods and ripe fruit was usually available on some trees throughout the year. *Guilfoylia monostylis* produced large crops that remained in a ripe condition on some trees for six months or longer, although there was only a single occasion when fruit was observed being eaten (by a Green Catbird and a Satin Bowerbird). *Diospyros pentamera* bore crops on only three occasions during the study period, but some trees carried edible fruit that was utilised for periods of up to seven months. *Alphitonia excelsa* carried prolific crops in most years for periods of up to eight months. The fruit was consumed in a green condition by Green Catbirds, Crimson Rosellas and King-Parrots. *Rhodamnia argentea* had high visitation rates when trees fruited, but this occurred only in 1989 and 1993. Similarly, *Scolopia braunii* was popular during the fruiting events that occurred only in 1987, 1992 and 1993.

## DISCUSSION

### Fruit and bird groups

It is commonly suggested (e.g. Snow 1976) that the more highly frugivorous birds preferentially eat oil-rich fruits, whereas birds with a more varied diet eat the watery, carbohydrate-rich fruits. This is partially supported by the fact that all species of the oil-rich Lauraceae in the study were seen to be eaten by fruit-doves and more than half of them by bowerbirds. The oil-rich *Olea* was also eaten by fruit-doves and bowerbirds, and the two other Oleaceae fruits were eaten by bowerbirds. In contrast, only one Lauraceae and no Oleaceae were eaten by the more generalist Lewin's Honeyeater.

There was, however, much overlap and most plant families were utilised by a variety of birds. Over half of the fruit species were eaten by at least one seed predator, and eighteen species were seen to be eaten only by seed predators. The effect of these seed-digesting birds on the overall dispersal and survival of seeds of these species is as yet unknown. The encapsulated fruits of only one of the Sapindaceae species were eaten by fruit-doves, whereas fruits of all eight species were eaten by bowerbirds or Paradise Riflebirds, which probably have a greater manipulative ability (Beehler 1989).

### Seasonality

The greatest diversity of fruit was available from late spring to early winter (June), especially from February to April. The bleakest season was from July to October. Some birds such as the Rose-crowned Fruit-Dove disappear from about May and reappear in spring, while White-headed Pigeons become locally nomadic. Topknot Pigeons become nomadic and Wompoo Fruit-Doves probably move to lower altitudes. However, at least some individuals of all common frugivores apart from the Rose-crowned Fruit-Dove and White-headed Pigeon were recorded in all or most months, in some years at least.

Fruits which are available from July to October are thus likely to be of considerable importance to frugivorous birds, especially to the obligate frugivores. Fruits that were seen to be eaten by seed-dispersing fruit-doves (and also by some bowerbirds) between July and October included *Tetrastigma nitens*, *Acronychia oblongifolia*, *Ficus macrophylla*, *F. platypoda*, *F. superba*, *F. watkinsiana*, *Acmena ingens*, *Jasminum dallachii*, *Olea paniculata* and *Neolitsea australiensis*. The eating of green fruits at times may indicate a certain degree of desperation by the birds because of a general lack of available fruit.

Fruits eaten by bowerbirds during this lean season, but not seen to be eaten by seed-dispersing fruit-doves, included *Polyscias elegans*, *Diospyros pentamera*, *Decaspermum humile*, *Rhodamnia argentea*, *Jasminum simplicifolium*, *Rubus rosifolius*, *Elatostachys xylocarpa*, *Jagera pseudorhus*, *Mischocarpus anodontus*,

*Solanum aviculare*, *Brachychiton acerifolius*, *B. discolor*, *Dendrocnide excelsa* and the introduced (from New South Wales) *Syzygium paniculatum*. The nectar of *Grevillea robusta* becomes an important food for Regent Bowerbirds (and to a lesser extent for Satin Bowerbirds) from July to December.

Given the variability in fruiting seasons and bird preferences, management plans for small reserves or forest restoration areas should consider the planting of a variety of local fleshy-fruited species, including some of the species with high visitation rates and some of those which fruit more or less reliably during the lean season.

#### ACKNOWLEDGEMENTS

My thanks to Ronda Green for her help and suggestions with the first draft of this paper. I am indebted to Bill McDonald for plant identifications over the years, to Peter O'Reilly for some feeding records, and to two anonymous referees for their helpful comments on the manuscript.

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## THE BIRDS OF LOW WOODED ISLAND, NORTH QUEENSLAND

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## ABSTRACT

An annotated checklist of thirty-nine bird species from Low Wooded Island has been compiled from observations made between 1983 and 1996. Breeding was confirmed for seven species. Data are compared with those from several other islands.

## STUDY AREA AND METHODS

Low Wooded Island is a low vegetated coral cay situated at 15°06'S, 145°23'E, 45 km NNE of Cooktown, North Queensland. The salient mainland feature, Cape Bedford, lies 18 km to the south-west, while the closest island is Three Isles, 4 km to the south-east. For climatic details see McLean (1993). The island is approximately 1200 m in length by 500 m in width. Significant portions of the island's periphery are bordered by calcareous beach rock, particularly marked at the southern and eastern sectors, while extensive coral rubble bank deposits extend around most of the upper shoreline. Comparatively small areas of drying reef flat are to be found at the island, the most prominent portion being off the southern shoreline. A small sandspit occupies the most north-westerly end of the island.

Floristically the island's interior is dominated throughout by mangrove forest consisting of two primary species, *Ceriops tagal* var. *australis* and *Bruguiera exaristata*. Closer to the shoreline, *Manikara kauki* trees and *Pemphis acidula* shrubs predominate, along with other intermingled vegetation, while *Casuarina equisetifolia* var. *incana* trees prevail in the most westerly parts of the island. A small grassed area interspersed with herbs, shrubs and low trees is situated just west of the most south-easterly end of the island. *Avicennia*, *Rhizophora* and other mangroves are scattered about the island's inter-tidal zone.

The six visits to the island documented here refer to the periods 20 August 1983, 22-23 September 1985, 14 November 1992, 9 February 1993, 30 December 1994-1 January 1995 and 19 December 1996. Typically, the duration of these visits by the author was less prolonged than those conducted at Three Isles and the Hope Islands (McLean 1993, 1996). Each visit comprised of at least one circumnavigation of the island's shoreline on foot, and the interior was wholly or partly traversed. Late afternoon counts of Pied Imperial-Pigeon were obtained from either the western most shoreline or an anchored vessel off the western shore. The island affords a poor anchorage other than in light winds and there are no basic facilities or fresh water for recreational use.

## BRIEF ORNITHOLOGICAL HISTORY

There is a lack of published information on the avifauna of Low Wooded Island, although population estimates of Pied Imperial-Pigeon are included by King (1990). Scientific names for all species are given in Appendix 1.

## RESULTS AND DISCUSSION

Appendix 1 details the thirty-nine bird species recorded at Low Wooded Island, seven of them breeding. These numbers fall well short of totals from three comparable coral cays in the Cooktown area; i.e. Eagle Island (Smith 1987), Three Isles (McLean 1993) and the Hope Islands (McLean 1996), which support 52 (11 breeding), 57 (9 breeding) and 57 (11 breeding) species, respectively. A noticeable feature that contributes to this discrepancy at Low Wooded Island is the reduced area of reef flat exposed at low tide. Only 20 species of Charadriiformes were recorded, whereas there were 27 species at Eagle Island and 26 species at both Three Isles and the Hope Islands. The small number of the Eastern Reef Egret is likewise significant, the maximum count involving only seven birds, whereas numbers from the other three cays ranged from 31 to 287. The virtual absence of winter visits probably accounts for the comparative lack of passerines (only three species), whereas the other three islands each provided six or seven passerine species.

The status of the four breeding terns at Low Wooded Island is, however, similar to the situation at Eagle Island, Three Isles and Rocky Islets (Smith & Ogilvie 1989). The most prolific species is the Black-naped Tern, with six separate and widely distributed nesting colonies. Three colonies were located during each of the December 1994 and 1996 visits, with totals of 47 and 61 nests, respectively. Nests, spaced about 1 m apart, each contained either 1 or 2 eggs, and a few chicks were also observed. In December 1996 two separate colonies of nesting Lesser Crested Terns were found on the southern side of the island, consisting of 45 and 35 single egg nests. Spacing between each nest was about 30-40 cm.

Two separate colonies of nesting Roseate Terns observed on the December 1996 visit comprised of twelve nests (communal with nesting Black-naped Terns) at the eastern side of the island and five nests at the southern side. Eight nests lined with needles from nearby *Casuarina* trees were found on the northern side of the island in December 1994 and a few chicks were also present at this site. All three colonies were located on coral shingle ridges and most nests contained two eggs. The seventeen Roseate Tern nests recorded here in December 1996 compare favourably with Eagle Island's twenty nests during the 1984-85 season (Smith & Buckley 1986), and also with twenty-three nests at Three Isles in December 1996 (pers. obs.). These are the only other known breeding sites in the immediate area. No nesting was noted on three earlier summer visits to Three



Isles, when counts of only eleven birds in January 1991, two in February 1993 and none in November 1992 were noted by McLean (1993). These local fluctuations are noteworthy and support the nomadic breeding regime of this threatened species (Milton *et al.* 1996). Only 4-6 scattered Bridled Tern nests with eggs were recorded during each of the December visits, from the western and north-western parts of the island. Nests were placed under low grasses, herbage and creepers on a shingle or coarse sand surface. In contrast, the nesting sites for the other three tern species were primarily on coral shingle ridges, usually 0.5-1.5 m above high water mark, although sometimes only 50 cm from the water's edge. A few Black-naped Tern nests were deposited on top of a large horizontal beachwashed log.

There appears to be no published account of Brown Quail or Pheasant Coucal on vegetated cays in the Great Barrier Reef (Kikkawa 1976), although this absence is not surprising, given the comparative lack of data from the more isolated islands. Up to five Brown Quail were flushed on five of the six visits to Low Wooded Island, from a small area supporting sparse to moderate grass, herb and shrub species near the south-eastern end of the island. A solitary adult Pheasant Coucal in non-breeding plumage was recorded on four of the six visits, mainly from mangroves. Both species are common on the adjacent mainland (*pers. obs.*) and both have been recorded from continental Lizard Island, 43 km to the north (*pers. obs.*, MacGillivray 1852).

Low Wooded Island, Three Isles and the Hope Islands are all prominent breeding islands for the migratory Pied Imperial-Pigeon (King 1990); the Hope Islands support at least 10000 pairs, Three Isles at least 6000 pairs, and Low Wooded Island at least 2000 pairs. King (1990) estimated the population size of this pigeon at Low Wooded Island on 8 November 1982. Brief counts were conducted by the author at each of these island sites during November, December and other summer months over the past few years. At Low Wooded Island, on 30 December 1994 at 1745 EST, a maximum of 210 birds per minute (bpm) was counted returning to the island from mainland feeding sites; and at 1800 h the following evening, 250 bpm were recorded. However, counts at similar times on 19 December 1996 resulted in a maximum count of only 140 bpm. Sunset was at 1850 h on this last date. It is instructive to compare these counts with data collected on similar dates and at similar times of day at Three Isles and the Hope Islands, respectively 190 bpm and 98 bpm. Admittedly, the counts at both Three Isles and the Hope Islands involved only the largest and most populated islet in each group, whereas counts from Low Wooded Island were holistic. All counts were made without the aid of binoculars, so a proportion of distant flocks and individuals will have been missed at all sites.

Low Wooded Island is one of an intrinsic group of isolated mangrove-clad islands in the Cooktown region that are all important as breeding sites for the Pied

Imperial-Pigeon. The evidence presented here on breeding populations of various tern species and the Pied Imperial-Pigeon indicates that Low Wooded Island is more important for these potentially vulnerable species than first thought.

### ACKNOWLEDGEMENTS

I thank Peter Britton who kindly provided material for this project.

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### APPENDIX 1

#### ANNOTATED SPECIES LIST FOR LOW WOODED ISLAND

\* indicates breeding record(s)

Brown Quail *Coturnix ypsilophora*. 1-5 birds flushed frequently from grassland about 20 cm in height, on all visits except February 1993 and always from the same south-eastern area.

Brown Booby *Sula leucogaster*. One adult flying offshore on 22 September 1985.

Australian Pelican *Pelecanus conspicillatus*. 2-5 regularly seen feeding in shallows about the island and resting at the north-western sandspit.

Eastern Reef Egret *Egretta sacra*. Although regularly seen on each visit, counts involved only 2-7 birds.

Great Egret *Ardea alba*. Single birds noted in November 1992 and December 1996 from the southern reef flat.

Striated Heron *Butorides striatus*. A solitary adult seen on most summer visits near or at the water's edge, usually about the northern shore.

\* Osprey *Pandion haliaetus*. A pair seen on most visits. Two nests were located at the south side of the island in *Rhizophora* and *Pandanus* trees; both approximately 5 m above the ground.

White-bellied Sea-Eagle *Haliaeetus leucogaster*. A single adult seen on three summer visits.

Buff-banded Rail *Gallirallus philippensis*. 1-3 adults seen on some visits; walking, running or flying short distances at the western and south-eastern sectors.

Bar-tailed Godwit *Limosa lapponica*. 1-2 seen in February 1993 and December 1994.

Whimbrel *Numenius phaeopus*. 1-5 recorded on all visits.

Tattler sp. *Heteroscelus* sp. Counts of 4-10 on each visit.

Ruddy Turnstone *Arenaria interpres*. Up to 42 noted resting at high tide and feeding on reef flats.

Red Knot *Calidris canutus*. 4-9 birds recorded on each summer visit.

Sharp-tailed Sandpiper *Calidris acuminata*. 2-4 seen on 1 January 1995 and 19 December 1996.

Beach Stone-curlew *Esacus neglectus*. 2-4 birds recorded on most visits.

Pied Oystercatcher *Haematopus longirostris*. A pair recorded on each visit.

Sooty Oystercatcher *Haematopus fuliginosus*. 3-5 seen on most visits.

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Pacific Golden Plover *Pluvialis fulva*. 1-5 birds counted on most visits.

Lesser Sand Plover *Charadrius mongolus*. Up to 45 birds seen in a single flock on all summer visits.

Greater Sand Plover *Charadrius leschenaultii*. 1-4 seen on some summer visits.

Silver Gull *Larus novaehollandiae*. Up to ten birds counted on each visit.

Caspian Tern *Sterna caspia*. A solitary bird on 22 September 1985 at the north-western spit.

\* Lesser Crested Tern *Sterna bengalensis*. On 19 December 1996, two separate colonies 8 m apart contained 45 and 35 single egg nests located on the southern side of the island. A maximum count of 120 birds on the above date; otherwise only one or two birds recorded on the other summer visits.

\* Roseate Tern *Sterna dougallii*. Three separate breeding colonies were located. The largest colony comprised of twelve mostly 2 egg nests, communal with nesting Black-naped Terns, located at the eastern side of the island, and five 2 egg nests were found at the southern side, both in December 1996; and eight nests and a few chicks were found at the northern side of the island in December 1994. All nests were located on coral shingle ridges and nests at the northern colony were lined with needles from nearby *Casuarina* trees. Up to 25 birds were seen in a single group in December 1994 and December 1996; two were noted in November 1992 and this species was absent in February 1993.

Crested Tern *Sterna bergii*. Up to 44 birds were seen on all visits.

\* Black-naped Tern *Sterna sumatrana*. Six separate breeding colonies were located in the northern, eastern and southern sectors of the island; three colonies in December 1994 (47 nests) and three colonies in December 1996 (61 nests), the majority of which contained 2 eggs. A few chicks were also observed. Almost all nests were on coral shingle ridges 0.5-1.5 m above high water. Counts of flocks in December 1994 and December 1996 were of up to eighty birds; while eleven were recorded in February 1993 and it was absent in November 1992.

Little Tern *Sterna albifrons*. Four resting on the reef flat at low tide and feeding offshore on 31 December 1994.

\* Bridled Tern *Sterna anaethetus*. Only 4-6 single egg nests were found, usually under grasses, herbage and creepers, on or near the north-western sandspit or in the western part of the island, in December 1994 and December 1996; counts were of between 60 and 200 birds.

Bar-shouldered Dove *Geopelia humeralis*. 2-10 were seen throughout the island on all visits.

Rose-crowned Fruit-Dove *Ptilinopus regina*. A solitary individual on 9 February 1993.

\* Pied Imperial-Pigeon *Ducula bicolor*. A prolific summer visitor which breeds primarily within the entire mangrove forest; except for February 1993, when only fifty birds were recorded and August 1983, when absent, thousands of birds were present, with vast numbers of nests, eggs and young.

Pheasant Coucal *Centropus phasianinus*. A single adult in non-breeding plumage was recorded on all visits except August 1983 and September 1985. It favoured mangrove vegetation and it was calling on 31 December 1994.

Large-tailed Nightjar *Caprimulgus macrurus*. A single individual was flushed from the vicinity of mangroves on 23 September 1985, 1 January 1995 and 19 December 1996. On the night of 19 December 1996 a single bird was heard 'chopping'.

Sacred Kingfisher *Todiramphus sanctus*. A single individual was recorded on 30 December 1994.

Collared Kingfisher *Todiramphus chloris*. Single birds were noted on 23 September 1985 and 14 November 1992.

Varied Honeyeater *Lichenostomus versicolor*. Small parties were seen on all visits; 15 birds together on 31 December 1994 were taking nectar from a large open *Scheffera actinophylla* tree on the northern side of the island.

Black-faced Cuckoo-shrike *Coracina novaehollandiae*. A single record of two birds on 22 September 1985.

\* White-breasted Woodswallow *Artamus leucorhynchus*. Small parties were encountered on all visits, particularly in the stand of *Casuarina* trees at the north-western spit. A fledgling was found floundering near the water's edge at the above spit on 19 December 1996.:

NOTES ON THE BREEDING SEASON DIET OF THE  
WEDGE-TAILED EAGLE *AQUILA AUDAX* IN IDALIA NATIONAL  
PARK, SOUTH-CENTRAL QUEENSLAND

ANDY SHARP

Only a few detailed studies exist on the diet of Wedge-tailed Eagles *Aquila audax* (Brooker & Ridpath 1980, Hull 1986, Leopold & Wolfe 1970), though there are many records of the type of prey taken by this species (e.g. Barker & Vestjens 1989, Brooker 1983, Cain 1976, Hobbs 1962, Marchant & Higgins 1993). These studies highlight the generalist nature of this predator and the diversity of prey items utilised, including many species of mammals, birds and reptiles. Rabbits *Oryctolagus cuniculus* often form a major constituent in the diets of Wedge-tailed Eagles except in areas of low Rabbit density, where juvenile macropods are often predominant in the diet (Brooker & Ridpath 1980, Hull 1986, Leopold & Wolfe 1970).

My data were collected in Idalia National Park, 85 km south-west of Blackall, south-central Queensland. A pair of breeding Eagles occupied a nest approximately 650m north-northeast of the Hill of Knowledge (726600N, 271800E; UTM) during the 1990 breeding season (July-August). The nest was in a Brigalow *Acacia harpophylla* growing along a small dry creek bed, at a height of 10m. The Hill of Knowledge area contains a variety of vegetation types, including low forests on the escarpments and tablelands (Mulga *A. aneura* and Bendee *A. catenulata*) and low open woodlands (Gidyea *A. cambagei* and Brigalow) and herblands on the flats. The area supports moderate densities of Red Kangaroos *Macropus rufus* and Euros *Macropus robustus* and low densities of Rabbits and Goats *Capra hircus*. Colonies of Yellow-footed Rock-wallabies *Petrogale xanthopus* are found on the scarps.

The nest was re-visited in February 1991 and all skeletal remains were collected from under the nest and under a nearby tree (10m away). The material was then sorted and the cranial material removed for identification. The cranial material was divided into two classes based on the apparent age of the material; i.e. fresh material (from the 1990 breeding season) and old material (from previous seasons). With the assistance of Steve Van Dyck (Queensland Museum), this material was then identified to species level (where possible) and the age of individual crania was estimated. The minimum number of individuals was calculated based on the number and combination of cranial bones found for each species. Monitoring continued on the nest during the breeding seasons of 1991-1994, but it was not recorded as active again. It was the only known active nest in the vicinity of the Hill of Knowledge during this period.

The results of these analyses are presented in Tables 1 and 2. Five species were

TABLE 1. Fresh skeletal material recovered from under a Wedge-tailed Eagle nest in Idalia N.P.

| Species                    | Cranial Material | Approx. age of individual | Number of cranial parts | Minimum number of individuals per species (percentage of total number of prey items in parentheses) |
|----------------------------|------------------|---------------------------|-------------------------|---|
| <i>Macropus rufus</i>      | skull            | juvenile                  | 1                       | 4(36.4%)  |
|                            | mandible         | juvenile                  | 8                       |   |
| <i>Macropus robustus</i>   | mandible         | juvenile                  | 3                       | 2(18.2%)  |
| <i>Petrogale xanthopus</i> | skull            | adult                     | 1                       | 1(9.1%)   |
|                            | mandible         | adult                     | 1                       |   |
| <i>Capra hircus</i>        | mandible         | juvenile                  | 1                       | 2(18.2%)  |
|                            | mandible         | adult                     | 2                       |   |
| <i>Pogona vitticeps</i>    | skull            | adult                     | 2                       | 2(18.2%)  |

TABLE 2. Old skeletal material recovered from under a Wedge-tailed Eagle nest in Idalia N.P.

| Species                    | Cranial Material | Approx. age of individual | Number of cranial parts | Minimum number of individuals per species (percentage of total number of prey items in parentheses) |
|----------------------------|------------------|---------------------------|-------------------------|---|
| <i>Macropus rufus</i>      | skull            | juvenile                  | 1                       | 1(14.3%)  |
|                            | mandible         | juvenile                  | 2                       |   |
| <i>Macropus robustus</i>   | mandible         | juvenile                  | 3                       | 2(28.6%)  |
| Unknown macropod           | mandible         | ?                         | 1                       | (1)   |
|                            | fragment         |                           |                         |   |
| <i>Petrogale xanthopus</i> | mandible         | adult                     | 1                       | 1(14.3%)  |
| <i>Capra hircus</i>        | skull            | juvenile                  | 1                       | 2(28.6%)  |
|                            | mandible         | ?                         | 4                       |   |
| <i>Pogona vitticeps</i>    | skull            | adult                     | 1                       | 1(14.3%)  |

recorded as prey items: Red Kangaroo, Euro, Yellow-footed Rock-wallaby, Goat and the dragon *Pogona vitticeps*. Macropods comprised the primary prey in both the fresh and old samples (63.6% and 57.2% respectively) with a predominance of juvenile individuals. The only non-mammalian prey recorded was *Pogona vitticeps*, which represented 18.2% and 14.3% of the samples. It is unlikely that the small bones of birds would survive the interval between breeding time and collection of bones (8 months), perhaps explaining their absence from the sample.

The absence of Rabbit remains from both samples reflects their general low abundance within the study site. Similar results were found by Brooker & Ridpath (1980) and Leopold & Wolfe (1970). In a study of three sites in Western Australia, Brooker & Ridpath (1980) found that in areas of high Rabbit density, Rabbits made up 92.2% of the prey items found in the Eagle's diet, while in areas of low Rabbit density, reptiles, birds and other mammals were the primary prey items, with Rabbits constituting only 9.6% of the diet. In both this study and that of Brooker & Ridpath (1980), the majority of kangaroo remains were those of juveniles. This suggests that young at foot and juvenile kangaroos are easier to catch due to their general inexperience and/or their small size.

Yellow-footed Rock-wallabies were found to constitute a relatively minor portion of the overall diet in both the fresh and old samples (one individual per sample; 9.1% and 14.3%, respectively). However, the level of predation on the Rock-wallabies deserves careful consideration, for this species is classified as "vulnerable to extinction" by Kennedy (1992). Lim (1987) reports Wedge-tailed Eagles making swooping attacks on Rock-wallabies at colonies in New South Wales and South Australia, although none were reported as being caught. Adult Rock-wallabies are of a comparable size to juvenile kangaroos (8-10kg), suggesting that they could easily be caught by Eagles. However, the high level of cover (low forest) at Rock-wallaby colony sites in the study area and the crepuscular/nocturnal behaviour of the Rock-wallabies suggest that it is unlikely that they frequently fall prey to Eagles. In addition, the molars of the individual Rock-wallaby found in the fresh sample showed considerable wear, indicating that it was relatively old and may have been taken while sick or dying, or taken as carrion. The level of predation on the Rock-wallabies appears to be low and is likely to have no significant impact on Rock-wallaby populations within the study area. Further studies are warranted on the impact of Wedge-tailed Eagle predation on Yellow-footed Rock-wallaby colonies situated in more open country.

#### ACKNOWLEDGEMENTS

This study was part of a broader project examining the ecology of the Yellow-footed Rock-wallaby which was funded by the Queensland Department of Environment. Particular thanks go to Steve Van Dyck for assistance in identifying the skeletal remains.



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