non-English speaking residents of Anatahan. Ben Igisiar and Ben Taisacan freely shared their knowledge of Anatahan with us. Transportation on the 1988 trip was provided by the U.S. Coast Guard cutter *Cape George*, Lieutenant Dan Christovich commanding. This project was supported by the Pittman-Robertson Federal Aid to Wildlife Restoration Program to the CNMI Division of Fish and Wildlife (project W-1R-8).

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Synchronous Breeding of Land Birds On Barrow Island, Western Australia, After Cyclonic Summer Rains

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Breeding responses of single species of birds to heavy rains in the Australian arid zone are well documented, e.g. the Emu *Dromaius novaehollandiae* (Davies 1979, 1982), Budgerigar *Melopsittacus undulatus* (Wyndham 1980), White-browed Scrubwren *Sericornis frontalis* (Ambrose & Davies 1989), Zebra Finch *Taeniopygia guttata* (Serventy 1971; Davies 1977, Zann & Straw 1984) and Black-faced Woodswallow *Artamus cinereus* (Immelmann 1963). Most studies of the extent of breeding by bird communities after desert rains have concentrated on gonadal responses by examination of carcasses (e.g. Keast & Marshall 1954; Keast 1959, 1968), whereas only a few studies (e.g. Carter 1889; Carnaby 1954; Serventy & Marshall 1957) have recorded the actual timing of such nesting. The occurence of breeding after rainfall have been discussed further by Immelmann (1963, 1971) and Davies (1976).

This paper presents breeding notes on 10 of the 15 species of land birds observed during a visit to Barrow Island (20°43′S, 115°28′E) from 4–21 May 1992 after the desert island had experienced cyclonic summer rains.

Barrow Island is located about 62 km north of Onslow, mainland Western Australia, and is vegetated mainly by spinifex *Triodia* spp. Its average annual rainfall is 324 mm, 74% falling mostly as cyclonic rain between February and June inclusive. Only 122.4 mm of rain fell during 1990, making this the driest year record-

ed on the island. Although 257.3 mm of rain fell during 1991, 169.3 mm of this fell in July alone, with no cyclonic rain in summer. However, the island received substantial rainfall from two cyclones in the summer 1991–92; 301.6 mm of rain fell from 1 February to 30 April inclusive, with a further 49.4 mm during our visit to the island in May.

Species exhibiting mating or breeding behaviour, or possessing brood patches were as follows.

Spinifexbird *Eremiornis carteri:* In May, Spinifexbirds were observed as pairs or family groups that defended territories, chasing intruders and singing from the top of small shrubs and spinifex clumps. This contrasted with our observations in December 1991 when fewer Spinifexbirds exhibited territorial behaviour and those that were colour banded and/or carried radio-transmitters wandered widely throughout our study site.

Of the 19 Spinifexbirds banded in May, four were juveniles, identifiable by their distinct yellow gape, short tail and the good condition of flight feathers. One juvenile, caught in a pitfall trap set for reptiles, was still unable to fly and had probably fledged that morning. The other three juveniles were caught together in the same spinifex clump with two adults suggesting that they were one family group. Four of the adults mist-netted had well-vascularised brood patches.

On several occasions Spinifexbirds carried insects in their bills (mainly grasshoppers with appendages removed and small caterpillars). The food was usually taken into a spinifex clump suggesting that nestlings or recent fledglings were being fed.

Behavioural observations of one family group, and histological examination of the ovaries of one female, suggest that Spinifexbirds can produce more than one brood in a breeding season. For instance, one pair of birds was observed constructing a new nest or repairing an old one while a juvenile was still dependent on at least one of the adults for food. The nest was 25 cm off the ground in the centre of a spinifex clump. It was cup-shaped, about 6 cm deep and 8 cm across the rim, constructed of fine dry grasses woven into the surrounding spinifex, and had no lining.

The ovary that we examined contained two follicles that were 3 mm in diameter and both showed advanced stages of vitellogenesis (Fig. 1). Avian follicles grow quickly (Guraya 1989), suggesting that this female would soon have laid two eggs. The presence of corpora lutea in the ovary would have indicated that ovulation also occurred earlier in the season, but none were found. However, Jones & Baxter (1987) state that corpora lutea often regress in birds before the eggs are laid. The presence of large primary oocytes in the ovary suggests further follicular development could have occured later in the breeding season.

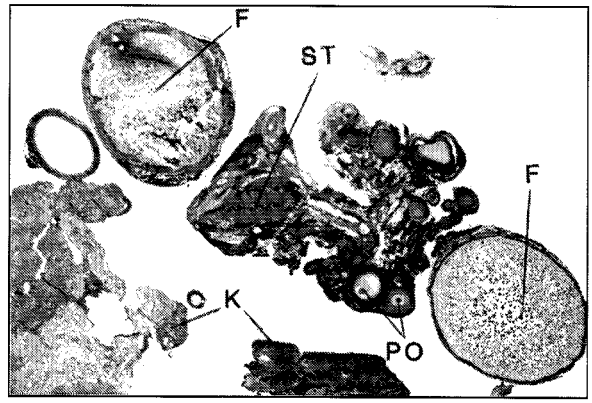

Figure 1 Section through a Spinifexbird ovary showing two large follicles (F) in advanced stages of vitellogenesis, stromal tissue (ST) containing primary oocytes (PO) and a portion of kidney tissue (K).

Although Spinifexbirds were not holding territories in December 1991, nine of the 23 birds banded then were immatures and the adults were moulting. Several also had old brood patches, suggesting that breeding may have occurred some weeks or months earlier.

Osprey *Pandion haliaetus*: New sticks were being added to three nest platforms inspected. At one nest, observed for about two hours on 20 May, a female Osprey was sitting next to the nest on a rock ledge while the male was collecting sticks for the nest; on two separate occasions the male mounted the female and attempted copulation as she was arranging sticks in the nest.

Black-shouldered Kite *Elanus notatus*: One pair was observed nesting on a rock ledge, 2 m below the cliff top. The nest had one egg on 16 May and two on 19 May. Black-shouldered Kites usually nest in the foliage near the top of trees (Serventy & Whittell 1976; Beruldson 1980; Cupper & Cupper 1981; Hollands 1984). The pair we observed may have selected a rock ledge because trees or tall, robust bushes are scarce on the island.

Brahminy Kite *Haliastur indus*: One bird was seen sitting on a nest in mangrove swamps on the southern tip

of the island. The contents of this nest were not investigated.

Australian Kestrel *Falco cenchroides*: No nesting was recorded, but one bird was seen chasing and swooping above and below another falcon in flight, coming within several centimetres of body contact with each swoop; the display was accompanied by a rapid 'chattering' by both birds. This display continued for the two hours that they were observed and is likely to have been courtship behaviour (P. Olsen pers. comm.).

Bar-shouldered Dove *Geopelia humeralis*: No nests were found but several birds were observed in courtship display and/or copulation. One male flew to a low, almost horizontal and open *Ficus platypoda* branch, faced another pigeon and repeatedly bobbed the body up and down so that the belly almost touched the branch. The bobs were accompanied by loud 'cooing' and a ruffling of throat feathers. Such a display is defined by Frith (1982) as courtship behaviour.

Horsfield's Bronze-Cuckoo *Chrysoccocyx basalis*: This migratory species was seen and heard calling, suggesting that it may have been breeding on the island. White-winged Fairy-wrens, hosts of this brood-parasite (Brooker & Brooker 1989), were breeding on Barrow Island (see below).

White-winged Fairy-wren *Malurus leucopterus edouardii*: Two nestlings were flushed from a nest located in *Acacia coriacea* in coastal dunes whilst mist-netting on 15 May. Well-vascularised brood patches were present in three females that were banded.

Singing Honeyeater *Lichenostomus virescens:* A nest containing one nestling and two eggs was found on 16 May, about 150 cm above the ground in a small *A. coriacea* bush. The two eggs hatched sequentially on 17 and 18 May.

A further three nests were found, similarly located in *A. coriacea* bushes. One of these nests contained two eggs, the other nests were freshly lined, but empty.

White-breasted Woodswallow *Artamus leucorhynchus*: No nests were found but two of the three woodswallows netted on 8 May had well-vascularised brood patches.

We did not observe any signs of breeding by Little Eagles *Hieraaetus morphnoides*, Spotted Harriers *Circus assimilis*, Welcome Swallows *Hirundo neoxena*, Tree Martins *Cecropis nigricans* or Budgerigars *Melopsittacus undulatus* (the latter were probably blown from the mainland by strong winds). They could have been breeding on parts of the island that we did not visit.

That at least 67% of the land bird species bred in May provides a good example of an avian community's synchronous response to cyclonic rains in an Australian desert environment. At least one species, the Spinifex-bird, appears to have bred in spring/early summer 1991, and again in autumn 1992, lending support to Davies' (1982) claim that some Australian desert bird species are seasonal as well as opportunistic breeders.

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Matched Song and Duetting by a Breeding Pair of Golden Whistlers *Pachycephala pectoralis*

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Birds are well known to react to their reflections in bright surfaces although not often in windows. At one of our house windows where a bottlebrush has grown to within 10 cm of the window panes, honeyeaters and small insecivores foraging in the bottlebrush sometimes respond to, or appear aware of, their reflected images. The species that has reacted most vigorously and persistently was the Golden Whistler *Pachycephala pectoralis*, a pair of which have nested on our 2 ha property (at the above address) since 1988, but not near the house. Between 2 May and 9 June 1991 the male and female were at the window both singing and displaying at their respective reflections, singly or as a pair, at least once each day. Their visits were audible throughout the house and called attention; both birds were individually colour-banded.

Song and display sessions varied from a few minutes to 35 minutes. The earliest visit was at 0645 h and the latest 1715 h; most were before 1330 h. Of the 91 episodes observed 55 (60%) were by the female and 36 (40%) by the male. Rain had no observable effect but fewer visits of shorter duration were made on dull days. After the appearances at the window ended the pair remained on the property to nest.

In display the Golden Whistlers used a stretched posture, with feathers fluffed, head up and beak pointing to the sky and chest forward followed by a bow; this was interspersed with fluttering flights towards