

One pair nesting in a tree hole about twelve metres above the ground by the Boemi River. Rand and Gilliard (1967) did not know of any nest of this species; however Bell (1972) found nests in a tree trunk thirteen metres high and in the base of a tree-fern *Asplenium* sp thirty metres high.

Corvus orru Torresian Crow

Common on Biak and at the Boemi River. This species frequently gave a dying call 'caw caw caw caaaawwww', which is not recorded by Rand and Gilliard (1967), who state that the 'voice is a weak "caw" or "ka"', and Hoogerwerf (1971) notes that 'the call resembles those of other corvids, "kaaaa-kaaaa", often quickly repeated'. Ripley (1964) notes that 'this species has a dull, low rattling croak in the nesting season, as well as the deep, harsh raven-like caw of the species'. The only record of a call similar to that recorded by us is given by Goodwin (1976) who states that Heinroth, who kept a hand-reared individual of *C. o. insularis*, noted that 'the usual call resembled the native name for this species, "kottkott", but it also offered a kind of song, "krah, krah, kraaaaa" with a comical emphasis on the drawn out final syllable.'

Ptiloprora erythropleura and **P. perstriata** Red-sided and Black-backed Streaked Honeyeaters

Several specimens of both species were seen on the forest edge at Enarotali and one specimen of *P. perstriata* was mist-netted at Dauwagu, near the lower limit of the moss forest. The capture is of particular interest in relation to the question of the status of *P. p. incerta*, which is known from only one specimen in the area of the Wissel Lakes. It has been suggested that this form may be a hybrid between *P. p. perstriata* and *P. erythropleura dammermani*; on the other hand Junge (1953) pointed out that specimens of *P. e. dammermani* but not of *P. p. perstriata* were taken in the Wissel Lakes. *P. p. perstriata* is known to occur west of the Wissel Lakes in the Weyland Mountains (Stein 1936 in Diamond 1969) and is common to the east in the Snow Mountains; however, this appears to be the first record from the area of the Wissel Lakes.

ACKNOWLEDGEMENTS

I wish to thank J. M. Diamond for his useful comments concerning these records and S. Marchant for his improvement of the manuscript.

REFERENCES

- ANON. 1970a. No title. New Guinea Bird Soc. NL 50.
 ANON. 1970b. No title. New Guinea Bird Soc. NL 53.
 BELL, H. L. 1972. Notes on the Yellow-faced Mynah. *Emu* 72: 110.
 DIAMOND, J. M. 1969. Preliminary results of an ornithological exploration of the North Coastal Range, New Guinea. *Am. Mus. Novit.* (2362): 45-57.
 — 1972. Avifauna of the Eastern Highlands of New Guinea. Publ. Nuttall Orn. Club (12).
 GOODWIN, D. 1976. Crows of the World. London: BMNH.
 GYLDENSTOLPE, N. 1955. Birds collected by Dr. Sten Bergman during his expedition to Dutch New Guinea 1948-1949. *Ark. Zool. ser.* 2(8): 183-397.
 HANSEN, J. 1976. Notes on the field identification of terns in Papua New Guinea. *New Guinea Bird Soc. NL* 124: 5-8, 125: 14-15.
 HERON, S. J. 1977. The Knot—second record for the New Guinea area. *New Guinea Bird Soc. NL* 131: 8.
 — 1978. Waders of the New Guinea region. *New Guinea Bird Soc. NL* 149-150: 8-15.
 HOOGERWERF, A. 1964. On birds new for New Guinea or with a larger range than previously known. *Bull. Br. Orn. Club* 84: 70-77, 94-96, 118-124, 142-148, 153-161.
 — 1971. On a collection of birds from the Vogelkop, near Manokwari, north-western New Guinea. *Emu* 71: 1-12, 73-83.
 JUNGE, G. C. A. 1953. Zoological results of the Dutch New Guinea Expedition, 1939, (5). *The Birds. Zool. Verh. Leiden* 20: 1-77.
 KING, B. 1979. New distributional records and field notes for some New Guinean birds. *Emu* 79: 146-148.
 MAYR, E. 1941. List of New Guinea Birds. New York: AMNH.
 —, and E. T. GILLIARD. 1954. Results of the American Museum of Natural History Expeditions to New Guinea in 1950 and 1952. *Birds of Central New Guinea. Bull. Am. Mus. nat. Hist.* 103: 311-374.
 MÖRZER BRUYN, W. F. J. 1965. Birds seen during west to east trans-Pacific crossing along equatorial counter-current around Latitude 7°N in the autumn of 1960. *Sea Swallow* 17: 57-66.
 RAND, A. L., and E. T. GILLIARD. 1967. Handbook of New Guinea Birds. London: Weidenfeld & Nicolson.
 RIPLEY, S. D. 1964. A systematic and ecological study of the birds of New Guinea. *Bull. Peabody Mus. Nat. Hist.* 19: 1-87.
 SCHODDE, R., G. F. VAN TETS, C. R. CHAMPION and G. S. HOPE. 1975. Observations on birds at glacial altitudes on the Carstensz Massif, western New Guinea. *Emu* 75: 65-72.
 SHUNTOV, V. P. 1974. Sea birds and the biological structure of the ocean. Tunis: Agence Tunis, Public Relations.
 STEIN, G. H. W. 1936. Ornithologische Ergebnisse der Expedition Stein 1931-1932. V. Beiträge zur Biologie papuanischer Vögel. *J. Orn., Lpz.*, 84: 21-57.
 VAURIE, C. 1965. The Birds of the Palaearctic Fauna, 2. Non-passeriformes. London: Witherby.
 YAMASHINA, Y. 1970. Birds collected by Kyoto University West Irian Scientific Expedition, 1963-1964, in the central highlands of West New Guinea. *Misc. Rep. Yamashina Inst. Orn.* 6: 1-15.

DAVID MELVILLE, c/o Agriculture and Fisheries Department, 393 Canton Road, Kowloon, Hong Kong.

Received 25 January 1979; accepted 28 May 1979.

PRIMITIVE WEAPONRY IN BIRDS: THE AUSTRALIAN BRUSH-TURKEY'S DEFENCE

Many writers, even recent ones, give the impression that the Australian Brush-turkey *Alectura lathami* is restricted to rainforest. This is not so. Brush-turkeys were once common at least as far as the western edge of the Darling Downs in southern Queensland and seem to have been eradicated there by man's destruction of their habitat. Even today, remnants of incubation mounds can be found in these western districts. Although

presumably always common in the foothills just west of Brisbane, in the past few years numbers of Brush-turkeys have been increasing in suburban regions such as St Lucia and Indooroopilly, where they are often mentioned in the local press. In fact, the species has become a pest in many gardens.

I have been studying Brush-turkeys at my home in Upper Brookfield where the dry sclerophyll woodland is

mainly regrowth about 40 years old, largely dominated by *Eucalyptus maculata* with *Tristania conferta* on southern slopes. There is at least one active nest mound on my land. Brush-turkeys visit the house regularly to feed on kitchen scraps. I have seen as many as eleven birds there at one time. Six Brush-turkeys individually marked with coloured plastic leg bands are regular visitors. The first was banded on 6 February 1974. The open vegetation and tameness of the birds makes observation easy.

Another common resident is the Lace Monitor *Varanus varius*, which also partakes of the food supplied. I first saw a feeding Brush-turkey approached by one of these Goannas on 12 December 1976. The Brush-turkey was a large banded male; the Goanna about 1.5 metres long. As the Goanna rapidly approached the feeding site, the Brush-turkey turned his back on the Goanna and suddenly set up a barrage of sand, stones and litter with alternate powerful strokes of the legs. This halted the Goanna's advance. The Brush-turkey then turned its right flank to the Goanna and, while watching it with more direct gaze, proceeded with a series of sideways kicks, like a logrunner, to fire quite accurately another jet of debris into the face of the Goanna. The incident lasted six minutes, during which time the Brush-turkey held the Goanna at bay. Most of the kicking was done from the left or right flank, with about seven rapid kicks between changing sides. When the Goanna retreated, the Brush-turkey followed, resuming to kick sand in the face of the Goanna when it turned towards the food.

I thought this an interesting but isolated event until 17 March 1977 when I saw the performance repeated by an unbanded male to a different Goanna. To date, I have noted this defensive behaviour directed against Goannas by five Brush-turkeys, both males and females, on fourteen occasions. Thus it may well be a significant form of defence used by the species.

The barrage of litter and debris and its effectiveness are not to be underestimated. Goannas recoiled under such attack and quickly retreated. The Goanna's behaviour was of interest too in these circumstances. Normally the tail is held straight, close to or dragged on the ground, as it is when chased by a human. As soon as a Goanna turned away from a Brush-turkey, the tail was held in a tight curl as the beast made an ungraceful exit. Once I saw a Brush-turkey peck the tip of the tail of a less careful Goanna.

The same behaviour was not used against aerial predators. On three occasions when I saw the same Brush-turkeys suddenly approached by a swooping Grey Goshawk *Accipiter novaehollandiae*, the escape pattern was similar. The Brush-turkey immediately started a

rapid but weaving run for dense vegetation with wings drooped and head held low with neck extended horizontally.

It is interesting not only that Brush-turkeys have learned to use this defensive behaviour against Goannas but that Goannas have learned to withdraw their vulnerable appendage, which suggests that such interactions are far from rare. The Brush-turkey's use of simple but effective weaponry is startling when first encountered but on reflection not unpredictable because precisely the same motor patterns are used by these birds in building their nest mounds. Certainly over much of the Brush-turkey's range outside rainforest, goannas of this or other species would be encountered and could well be major predators of eggs or chicks dug from the mound. Thus the use of such a simple weapon could be a significant adaptation against a specialized ground predator.

I have been unable to find any published account of this anti-predator behaviour in wild Brush-turkeys. Fleay (1937) described a captive male that '... deliberately showered me with dirt and leaves and persisted in doing so, no matter which side of the mound I endeavoured to approach.' Tool-using has been described in a variety of birds (Chisholm 1972). Most writers usually exclude passive or fixed features such as anvils, etc, as true examples of tools (e.g. Thomson 1964; Van Tyne and Berger 1976). The use of sticks and stones as weapons is another matter, suggesting even greater insight. A Common Raven *Corvus corax* in North America was reported to have tossed stones from a cliff top onto observers near its nest below (Janes 1976). The same species in Newfoundland has been seen driving a Black-legged Kittiwake *Rissa tridactyla* from its nest with the same technique and a Fish Crow *Corvus ossifragus* has been seen dropping vegetation while hovering above a Laughing Gull's *Larus atricilla* nest in New Jersey (Montevicchi 1978). The use of even such primitive weapons by animals is doubtless rare and thus poses little challenge for what may be the only biologically unique feature of mankind.

REFERENCES

- CHISHOLM, A. H. 1972. Tool-using by birds: a commentary. *Aust. Bird Watcher* 4: 156-159.
- FLEAY, D. H. 1937. Nesting habits of the Brush-turkey. *Emu* 36: 153-163.
- JANES, S. W. 1976. The apparent use of rocks by a Raven in nest defense. *Condor* 78: 409.
- MONTEVECCHI, W. A. 1978. Corvids using objects to displace gulls from nests. *Condor* 80: 349.
- THOMSON, A. L. 1964. *A New Dictionary of Birds*. London: Nelson.
- VAN TYNE, J., and A. J. BERGER. 1976. *Fundamentals of Ornithology*. 2nd ed. New York: Wiley.

DOUGLAS D. DOW, *Department of Zoology, University of Queensland, St. Lucia, Q 4067.*
23 March 1979.