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Front cover: Buff-breasted Button-quail illustration © by Lloyd Nielson

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Indicators for Buff-breasted Button-quail *Turnix olivii* ?

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Abstract

Endangered Buff-breasted Button-quail *Turnix olivii* are cryptic, shy, rare and somewhat difficult to locate. Observations from a site of occurrence provide potentially useful indicators for aiding location. The species occurred in low woodland on metamorphic hills dominated by *Eucalyptus tardecidens* with scattered *E. cullenii* and *Corymbia clarksoniana*, with a mid-canopy including *Melaleuca stenostachya*, *Terminalia platyptera*, *Gardenia vilhelmii* and *Petalostigma pubescens* and with a sparse shrub layer of *Grewia retusifolia* and *Dodonaea physocarpa*. Ground cover was estimated at 50 % or less with significant bare soil exposed. The Regional Ecosystem was R.E. 9.11.25. Forty-seven species of plant in 23 families were identified within this habitat. Twenty-nine plant species, including 17 species of grass (Family Poaceae) and one sedge (Family Cyperaceae), occurred in the ground layer. Most grasses were in seed. Cicadas and grasshoppers were abundant. These insects and presence of nutritious grass seeds from the grass genera of *Eragrostis* sp., *Panicum* sp. and *Setaria* sp., could feasibly constitute food items taken by Buff-breasted Button-quail. A low number of observed circular scrapes could have either been feeding platelets made by Buff-breasted Button-quails or resting locations.

Introduction

The endangered Buff-breasted Button-quail *Turnix olivii* of Cape York Peninsula, north Queensland, Australia, has been most frequently reported from stony and/or grassy woodlands and forests (White 1922a,b, Storr 1984, Squire 1990, M.T. Mathieson and G.C. Smith *pers. obs.*, S. Garnett *pers. comm.*, L. Nielsen *pers. comm.*), commonly with a *Melaleuca* mid-storey (L. Nielsen *pers. comm.*). This habitat is widespread across the Cape, yet Buff-breasted Button-quail are scarce. The species is cryptic and shy, so this may explain rarity, although numbers are thought to have declined over the past century, due to anthropogenic pressures (Mathieson and Smith 2009). The habitat requirements of Buff-breasted Button-quail within the broad vegetation type are also thought to be highly specific, with the amount of ground cover being one important aspect. All sightings have been from very sparsely grassed areas with no sightings from denser grass cover (Nielsen 2015).

Ground vegetation is probably significant for Buff-breasted Button-quail in providing nesting substrate, shelter and a food source. Nests have been typically associated with grass stools and consist of narrow blades of long, dry grass and short, dry grass, with dead leaves from an ironbark and grass in the egg chamber (White 1922a,b, McLennan 1923, L. Nielsen *pers. comm.*). Little research has been invested in determining the food of Buff-breasted Button-quail. This is because observing feeding or acquiring gut samples of Buff-breasted Button-quail are problematic. The gut contents of four birds collected near Coen in the early 1920's were broadly comprised of insects, seeds and coarse sand (McLennan 1923, Marchant and Higgins 1993). Other than this scant historical information, it is known that Australian Button-quail, other than Buff-breasted Button-quail and Black-breasted Button-quail *Turnix melanogaster* (a dry vine forest specialist), feed on plant seeds from the monocot families Poaceae (grasses) and Juncaceae (sedges), and the dicotyledonous families Fabaceae, Geraniaceae, Malvaceae, Mimosaceae (acacias), Polygonaceae and Portulacaceae. Gut contents have also included Orthoptera (grasshoppers), Hemiptera (bugs), Coleoptera (beetles), Diptera (flies), Lepidoptera (caterpillars), Hymenoptera (ants) and Blattodea (cockroaches) (Barker and Vestjens 1990).

Here we describe in some detail the habitat and plant species occurring where Buff-breasted Button-quail were observed in early 2016. We furthermore identify potential food sources in this area in an attempt to address the paucity of information available on the diet of this species. This included an inventory of seeding ground vegetation and some casual observations of insect abundance.

Study Area and Methods

Potential habitat was searched for Buff-breasted Button-quail, on 12-19 January and 24 February-3 March, in locations broadly circumscribed (in clockwise direction) by the townships of Mt Carbine, Mt Molloy, Mareeba, Dimbulah, Petford and the geographic landmark of Mt Mulligan, within the Einasleigh Uplands bioregion (REDD 2013) of north Queensland, Australia. Potentially suitable habitat has been described as stony and/or grassy, sparse woodlands and forests on plains and slopes, often dominated by Melaleuca species (such as *M. viridiflora* and *M. minutifolia*) in the mid storey, well-drained and frequently on slight-sloping bases of hills (Mathieson and Smith 2009; L. Nielsen *pers. comm.*)

We gathered information on habitat characteristics, and collected and identified all plant species over an area of approximately 12 ha in which Buff-breasted Button-quail were seen during January-early March 2016 at Mt

Mulligan Station to the west of Mareeba. Other fauna was noted including bird species and obvious, abundant arthropods.

Results

Buff-breasted Button-quail were observed at Mt Mulligan Station on five different occasions over four days. It is possible that four birds (two males and two females) occurred at this site.

Habitat at the Mt Mulligan site (Plate 1) was comprised of low woodland on metamorphic hills dominated by *Eucalyptus tardecidens* with scattered *E. cullenii* and *Corymbia clarksoniana* also present (Table 1). The mid-canopy included *Melaleuca stenostachya*, *Terminalia platyptera*, *Gardenia vilhelmii* and *Petalostigma pubescens*. The shrub layer was extremely sparse with *Grewia retusifolia* and *Dodonaea physocarpa* the most commonly encountered species. The ground layer was dominated by a wide variety of sparsely distributed grasses. Ground cover was estimated at 50 % or less with significant bare soil exposed. Forty-seven species of plant in 23 families were identified from this locality (Table 1). At this site the mapped Regional Ecosystem polygon contained 9.11.3a and 9.11.25, with 9.11.25 fitting the vegetation most closely (Queensland Herbarium 2013). On the basis of the canopy and sub-canopy species alone, the habitat fits to previous descriptions of Nielsen (2015; *pers. comm.*), albeit with a different species of Melaleuca the structure of the woodlands is essentially identical.

Twenty-nine species of plant comprised the ground layer at the Mt Mulligan site, including 17 species of grass (Family Poaceae) and one species of sedge (Family Cyperaceae). All the grasses were seeding to some extent at the time of our visit.

Two introduced plant species (4.2% of species) included the shrub *Stylosanthes scabra* and one ground-dwelling herb *Mesosphaerum suaveolens*. The introduced stylo *Stylosanthes scabra* was numerically more dominant and appeared to be overtaking native vegetation. This species was introduced to Australia as fodder for cattle.

Two arthropods were particularly evident at the Mt Mulligan site. Cicadas (Order Hymenoptera, Family Cicadidae) and, to a lesser extent, locusts/ grasshoppers (Order Orthoptera, Family Acrididae) occurred in very large numbers in January; although they had virtually disappeared by the end of February.

Sixty-eight bird species other than Buff-breasted Button-quail were seen at the Mt Mulligan site. During January the Melaleucas were in flower and Little Friarbirds *Philemon citreogularis* were a conspicuous component of the

avifauna, although numbers were much reduced by late February. Ten other ground-feeding, granivorous bird species were observed, including: the Australian Brushturkey *Alectura lathami*, Squatter Pigeon *Geophaps scripta*, Common Bronzewing *Phaps chalcoptera*, Peaceful Dove *Geopelia placida*, Bar-shouldered Dove *Geopelia humeralis*, Pheasant Coucal *Centropus phasianus*, Red-backed Button-quail *Turnix maculosus*, Painted Button-quail *Turnix varius*, Black-throated Finch *Poephila cincta* and Double-barred Finch *Taeniopygia bichenovii*.

Discussion

Three of the grass genera observed at the Mt Mulligan site are broadly categorised as millets, which provide a food source for humans (Verma *et al.* 2015). The genera *Eragrostis* sp., *Panicum* sp. and *Setaria* sp. are essential food sources for humans in a number of Asian countries. They are nutritious compared to the major cereals such rice (Verma *et al.* 2015) and wheat (Awadalla and Slump 1974). They contain low phytic acid and are rich in dietary fibre, iron, calcium, and B vitamins (Barbeau and Hilu 1993). Millet seeds are particularly high in percentage soluble carbohydrate (Kelrick *et al.* 1986). Soluble carbohydrate is a water-efficient energy source and its percentage is a good indicator of the digestible energy available in a food item.

Kelrick *et al.* (1986) have also shown that shrubs, such as sagebrush *Artemisia tridentata*, contribute to the diet of shrub-steppe rodents, birds and ants of North America, but the role of shrub seeds as food for Buff-breasted Button -quail remains speculative, even though other Australian button-quail eat the seeds of various shrub species (Barker and Vestjens 1990).

McLennan's analysis of the guts of Buff-breasted Button-quail also showed the presence of arthropods (White 1922 a,b, McLennan 1923). It is likely that arthropods may be key components of the diet and also an easy catch for birds when they are in abundance, a situation that prevailed during our January 2016 field trip. Barker and Vestjens (1990) have recorded grasshoppers in the diets of other Australian button-quail, but not cicadas. Cicadas can constitute a major food source for insectivorous birds, however the factors that cue timing of emergence are not clear and therefore cicadas may be an unreliable food source (Strehl and White 1986; Wolda 1989; Smith *et al.* 2006). Nevertheless records of insectivorous birds converging on seasonal abundances of insects, such as flying termites, moths and psyllids, are well documented (Recher and Davis 1997; 2002; 2013).

Sparse vegetative ground cover, key fruiting grasses, insect abundance and the presence of other granivorous birds are likely to be good indicators for

Buff-breasted Button-quail in their preferred habitat. Platelets are unlikely to be useful signs of Buff-breasted Button-quail (cf. McConnell and Hobson 1995) as there is a distinct lack of depressed circular feeding scrapes, known as platelets, among Buff-breasted Button-quail and Painted Button-quail in the north (Nielsen 2000). However we noted a small number of circular depressions in deep leaf litter at the Mt Mulligan site during January 2016 (Plate 2), while Painted Button-quail and Red-backed Button-quail were absent, which could have been feeding platelets, but which were more likely to have been scrapes associated with resting behaviour. We also flushed a bird from the protective cover of a native shrub *Grewia retusifolia* where after closer inspection a partially cleared circular depression was found (Plate 3; MTM and GCS *pers. obs.*) which also may have been a feeding scrape, but was more likely to have been a retreat from the heat, which can be extreme at this time of year.

Targeted searching of sites that have habitat structure similar to that described in this paper, combined with seed availability and arthropod abundance may assist searches for and monitoring of Buff-breasted Button-quail.

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Plate 1. Habitat at the Mt Mulligan site. Photo M.T. Mathieson.

Plate 2. Circular scrape noted in association with Buff-breasted Button-quail sightings. Photo G.C. Smith.

Plate 3. Grewia shrub where a Buff-breasted Button-quail was found sheltering in the heat of the day. Photo M.T. Mathieson.

Table 1. The plant species recorded at a site of known buff-breasted button-quail occurrence. ‡ = Ground layer plants include low shrubs, herbs and forbs. * = weed. Bold = dominant. + = genera of millets.

Structural Layer	Family	Species
Canopy	Caesalpiniaceae	*Erythrophleum chlorostachys* (F.Muell.) Baill.
	Myrtaceae	*Eucalyptus cullenii* Cambage
		***Eucalyptus tardecidens* (L.A.S.Johnson & K.D.Hill) A.R.Bean**
		Corymbia clarksoniana (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson
Mid-canopy	Celastraceae	*Denhamia cunninghamii* (Hook.) M.P.Simmons
	Combretaceae	***Terminalia platyptera* F.Muell.**
	Myrtaceae	***Melaleuca stenostachya* S.T.Blake**
	Picrodendraceae	*Petalostigma pubescens* Domin
	Pittosporaceae	*Bursaria incana* Lindl.
	Proteaceae	*Grevillea glauca* Banks & Sol. ex Knight
	Rubiaceae	***Gardenia vilhelmii* Domin**
	Santalaceae	*Santalum lanceolatum* R.Br.

Shrub	Euphorbiaceae	*Croton minimus* P.I.Forster
	Fabaceae	***Stylosanthes scabra* Vogel***
	Malvaceae	*Hibiscus meraukensis* Hochr.
	Sapindaceae	***Dodonaea physocarpa* F.Muell.**
	Sparrmanniaceae	***Grewia retusifolia* Kurz**
	Thymelaeaceae	*Pimelea sericostachya* F.Muell. *subsp. sericostachya*
Ground‡	Asteraceae	*Lagenophora sp.* (Forty Mile Scrub R.J.Fensham 1113)
	Caesalpiniaceae	*Chamaecrista longipes* (Domin) Pedley
	Convolvulaceae	*Bonamia media* (R.Br.)Hallier f.
		Ipomoea plebeia R.Br.
		Jacquemontia sp. (Fairview R.W.Johnson 4026)
		Xenostegia tridentata (L.) D.F.Austin & Staples
	Cyperaceae	*Scleria brownii* Kunth
	Fabaceae	*Galactia tenuiflora var. macrantha* Domin
		Tephrosia juncea Benth.
	Helicteraceae	*Helicteres sp.* (Normanby River J.R.Clarkson+ 7697)
	Lamiaceae	*Mesosphaerum suaveolens* (L.) Kuntze*
	Malvaceae	*Melhania brachycarpa* Domin
	Poaceae	*Alloteropsis cimicina* (L.) Stapf
		Aristida calycina var. praealta Domin
		Aristida hygrometrica R.Br.
		Bothriochloa bladhii (Retz.) S.T.Blake *subsp. bladhii*
		Brachyachne convergens (F.Muell.) Stapf
		Chloris lobata Lazarides
		Chrysopogon fallax S.T.Blake
		Enneapogon virens (Lindl.) Kakudidi
		Eragrostis elongata (Willd.) J.Jacq.+
		Eriachne ciliata R.Br.
		Heterachne gulliveri Benth.
		Heteropogon contortus (L.) P.Beauv. ex Roem. & Schult.
		Heteropogon triticeus (R.Br.) Stapf
		Panicum decompositum var. tenuius F.M.Bailey+
		Paspalidium rarum (R.Br.) Hughes
		Perotis rara R.Br.
		Setaria surgens Stapf+

A preliminary checklist of the birds of the Meandu Creek Dam in the South Burnett region of south-eastern Queensland.

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Abstract

We present a preliminary checklist of avifauna recorded at the Meandu Creek Dam, a large body of water within the Tarong Power Station complex, Nanango. This current survey, part of a wider, ongoing, project (Tarong Energy, 2009), is designed to collate and describe an inventory of birds present on the dam, its associated reed beds and surrounding woodlands. While it is not now possible to accurately itemize a list of birds that inhabited the area around Meandu Creek Dam prior to the building of the dam, and therefore impossible to make significant pre- and post-construction comparisons, it is hoped that this survey, when completed, will at least establish a starting point for future reference. In spite of the inherent difficulties we do make tentative comparisons and are of the opinion that, certainly in terms of waterbirds, the dam has provided additional suitable habitat, encouraging species diversity and abundance.

Introduction

While it has been argued that dam construction impacts deleteriously on various forms of fauna (e.g. see Baxter, 1977; Reitan & Sandvik, 1996; Avakyan & Podol'skii, 2002) it has also been noted (e.g. Bergkamp *et al.*, 2000; McAllister *et al.*, 2001) that post-construction, dams can have some beneficial effects, especially on waterfowl.

Undoubtedly this appears to be the situation with the Meandu Creek Dam at Tarong where, for example, Black Swan *Cygnus atratus* has been observed in numbers approaching a hundred pairs (pers. obs.) and Eurasian Coot *Fulica atra* in substantially large rafts (pers. obs). It remains doubtful that such tallies would have been possible when Meandu Creek ran its comparatively short, narrow and intermittent course, from source in its upper reaches between Tarong National Park and Yarraman State Forest (approximately 26° 49' 37"S, 151° 53' 07"E) to its confluence with the more dominant Barkers Creek at Barkers Creek Flat (26° 38' 39"S, 151° 57' 51"E). Certainly in recent visits to the creek, between the wall and the Nanango-Tarong Road, no waterbirds were noted.

Prior to the construction, and full operation of the dam, Meandu Creek, with a 51km^2 catchment (Parsons Brinckerhoff, 2005), had an ephemeral flow, subject to storm torrents (Caffery & Groves, 2007) and reliant on the "wet" season

generally (Harold Thompson, 6th generation farmer in the locality, pers. comm.). During the "dry" it remained a series of isolated waterholes (QEGB, 1980).

Even at Meandu Lagoon (26° 41' 51"S, 151° 54' 34"E), off Brooklands Road, where Meandu Creek widens to become a water reserve, while the current species richness tally approaches that recorded at the dam (Bielewicz & Bielewicz, unpubl. data), Eurasian Coot has never been recorded here by the authors and Black Swan has been noted singly or in pairs only (pers. obs.). At the slightly more distant, but larger, "wide" of Broadwater (approximately centred on 26° 29' 29"S 152° 02' 22"E), a camping and recreation reserve along Barkers Creek, off the Nanango-Goomeri Road species diversity again approaches that at the Meandu Creek Dam and is comparable to Meandu Lagoon diversity (Bielewicz & Bielewicz, unpubl. data) but at both reserves species abundance pales in comparison to numbers recorded at Meandu Creek Dam (Bielewicz & Bielewicz, unpubl. data).

Nevertheless, given the lack of comprehensive avifaunal records, confident comparisons between pre- and post-construction dam periods are not possible. At best one can only infer from species data at adjoining and/or similar, habitats in the immediate neighbourhood.

The original *Environmental Impact Study* (QEGB, 1980) failed to conduct a faunal survey, offering only a simple, unsupported, indication of the vertebrates, including the more common birds, most likely to be found throughout the entire area (Table 1). The EIS does not specifically identify birds at the dam, nor indeed does it predict the presence of any particular waterbird species.

In his extensive survey of the avifauna of Nanango, Templeton (1992) refers specifically to ten species at, or clearly near, the "Tarong Powerhouse," of which three are directly associated with water: Great Crested Grebe *Podiceps cristatus*, Black-winged Stilt *Himantopus himantopus* and Silver Gull *Chroicocephalus novaehollandiae*. The other seven are terrestrial species. There is no mention at which of the power station's several dams or terrestrial habitats these birds were observed. Nor does Templeton, whose records date back to the mid-1940s, indicate which species, aquatic or otherwise, were recorded in the area prior to the construction of the power station in the early 1980s (Caffery & Groves, 2007; Tarong Energy, pers. comm.).

The subsequent *Fauna Conservation Action Plan* (BAAM, 2006), conducted over three days (two nights) in June 2006, focused only on "Conservation Significant Species," species listed as rare, vulnerable or critically endangered under the *Naure Conservation Act 1992* and/or the *Environment Protection and Biodiversity Conservation Act 1999*. It also included those species listed as migratory under the latter legislation. Given the brevity of the survey period, BAAM relied on

existing data and public databases to compile its list (Table 1). BAAM does not however cite either QEGB (1980) or Templeton (1992), nor does it specify which public databases were consulted.

Given the presence of large, manmade, "lagoons" at Tarong, coupled with Templeton's (1992) oft repeated references to species "found on most dams and lagoons", it was considered highly probable that he recorded other waterbirds as present in the immediate area of the dam. It has not however been possible for the general public, including experienced birdwatchers, to systematically survey the area to confirm sightings here as admittance to Tarong Power Station has been severely restricted following the 2001 "9/11" attack on New York and the few existing private records (e.g. by the small group ROBYNS -Reporting Birds of Yarraman and Nanango, pers. comm.) are basically limited to sightings from the recreational area on the banks on the Cooling Dam and from a walking track leading off from here (Tahlia Guerin, South Burnett resident and PhD candidate, pers. comm.). These too would have ceased once the electronic gates went up.

Table 1. Species observed (plain text) or predicted (italics) to occur in the general Tarong Power Station area by QEGB (1980), Templeton (1992) and BAAM (2006).

(c) species subsequently confirmed in the general Tarong Power Station area by the authors.

(m) species subsequently confirmed in the Meandu Creek Dam area by the authors.

QEGB (1980)	**Templeton (1992)**	**BAAM (2006)**
Australian Brush-turkey (c)	Great Crested Grebe (m)	*White-throated Needletail* (m)
Bar-shouldered Dove (m)	Tawny Frogmouth	*Eastern Great Egret* (m)
Black-shouldered Kite (c)	Whistling Kite (c)	*Cattle Egret*
Galah (c)	Bush Stone-curlew	*Grey Goshawk*
Sulphur-crested Cockatoo (c)	Black-winged Stilt (m)	White-bellied Sea-eagle (m)
Laughing Kookaburra (m)	Painted Button-quail	Black-breasted Button-quail[1]
Australian Magpi (c)	Silver Gull (c)	Caspian Tern
Torresian Crow (m)	Variegated Fairy-wren (m)	*Glossy Black-Cockatoo*
Magpie-lark (m)	Grey Shrike-thrush (c)	*Powerful Owl*
Welcome Swallow (m)	Rose Robin (c)	Rainbow Bee-eater (c)
		Yellow-tufted Honeyeater
		Black-chinned Honeyeater
		Black-faced Monarch
		Spectacled Monarch (c)

[1] Platelets observed by authors.

Table 2. An initial list drawn up of "possible" wetlands/waterbirds indicated by Templeton's (1992) use of the phrase "found on most dams and lagoons," cited by BAAM (2006) and found both the EPA "Wildnet" and DEH online databases and noted by the authors as present in the South Burnett region.

Common names in italics are species yet to be recorded at Meandu Creek Dam by the authors.

Common Name	Scientific Name
Magpie Goose	*Aneranas semipalmata*
Plumed Whistling-Duck	*Dendrocygna eytoni*
Black Swan	*Cygnus atratus*
Australian Wood Duck	*Chenonetta jubata*
Grey Teal	*Anas gralcilis*
Pacific Black Duck	*Anas superciliosa*
Hardhead	*Aythya australis*
Australasian Grebe	*Tachybaptus novaehollandiae*
Australasian Darter	*Anhinga novaehollandiae*
Little Pied Cormorant	*Microcarbo melanoleucos*
Little Black Cormorant	*Phalacrocorax sulcirostris*
Australian Pelican	*Pelecanus conspicillatus*
Eastern Great Egret	*Ardea modesta*
Intermediate Egret	*Ardea intermedia*
Cattle Egret	*Ardea ibis*
White-faced Heron	*Egretta novaehollandiae*
Little Egret	*Egretta garzetta*
Australian White Ibis	*Threskiornis molucca*
Straw-necked Ibis	*Threskiornis spinicollis*
Royal Spoonbill	*Platalea regia*
Yellow-billed Spoonbill	*Platalea flavipes*
Purple Swamphen	*Porphyrio porphyrio*
Dusky Moorhen	*Gallinulla tenebrosa*
Eurasian Coot	*Fulica atra*
Black-fronted Dotterel	*Elseyornis melanops*
Masked Lapwing	*Vanellus miles*
Australian Painted Snipe	*Rostratula australis*
Latham's Snipe	*Gallinago hardwickii*
Azure Kingfisher	*Ceyx azureus*

Study Area

Plate 1. The Study Area—Meandu Creek Dam

Meandu Creek Dam is one of two large water storage dams used by Tarong Energy at its Tarong and Tarong North Power Stations (usually referred to in the singular, pers.obs.) outside Nanango in the South Burnett region, some 200km WNW of the Queensland state capital, Brisbane.

Besides being fed by the waters of Meandu Creek itself, the dam also sources water, via a 78km pipeline (Caffery & Groves, 2007), from Wivenhoe Dam (in the Moreton catchment). Further supplies are sourced via water recycled from the Cooling Tower "blowdown" (waste water), either directly into the dam or from the adjacent Tarong Mine which first uses the "blowdown" before pumping it into Meandu Creek Dam. (http://www.water.gov.au/RegionalWaterResourcesAssessments/SpecificGeographicRegion/TabbedReports.aspx?PID=QLD_SW_13. Last accessed 20.06.2010).

With a surface area of approximately 65.7ha (Tarong Energy, pers. comm.) it is the larger of the water storage dams in use. The Ash Dam, which, as its name

suggests, is the area used for the disposal of waste slurry (burnt coal ash), is larger but only three species, and in sparing numbers, have been noted here.

The dam wall stands at 13.5m and runs 430m from end to end (QEGB, 1980). It has a maximum capacity of 31GL (Fentie et al., 2006) which, together with its height, classifies it as a "large dam" according to International Commission on Large Dams (ICOLD) definitions (Rosenberg, 1997; Palmieri et al., 2001; but also note views expressed by Shah & Kumar, 2008).

While its near neighbour, the Cooling Water Dam, is essentially a rectangle (pers. obs.), the topography of Meandu Creek Dam, with its indentations, or bays, presents as a more "natural" habitat (pers. obs.). Its shoreline, with the exception of the retaining wall itself, is well vegetated with reed beds and is surrounded by open woodland (pers. obs.).

Methods

Four point count stations have been established to ensure fairly complete coverage of the dam. Initially, counting was conducted only from a structure on the eastern side, together with a vantage point off Nobby Smith Drive to access birds on the western shore. Permission was later giving to monitor the dam from its retaining wall (north) and even more recently from the shallow end (south).

The initial pilot count, accompanied by a Tarong Energy Environment Officer, was conducted on 15 April 2009. Eleven subsequent counts, up until 22 May 2010, have covered all seasons; at least 2 per season. All station counts were of 20-minute duration.

All birds seen or heard on, near or flying over the dam, both aquatic and terrestrial, are recorded. Observations are made using telescopes and 8x40 binoculars.

Nomenclature follows Christidis & Boles (2008). Scientific names appear on initial citation only.

Results

A year into this long-term, on-going, monitoring program, 84 species (Table 3), representing 38 avian families in 13 orders, have been recorded as being present on the water, along the shoreline, flying over or in terrestrial habitats immediately adjacent to Meandu Creek Dam. For comparative purpose, figures from Meandu Lagoon and Broadwater (Bielewicz & Bielewicz, unpubl. data) are included (Fig. 1).

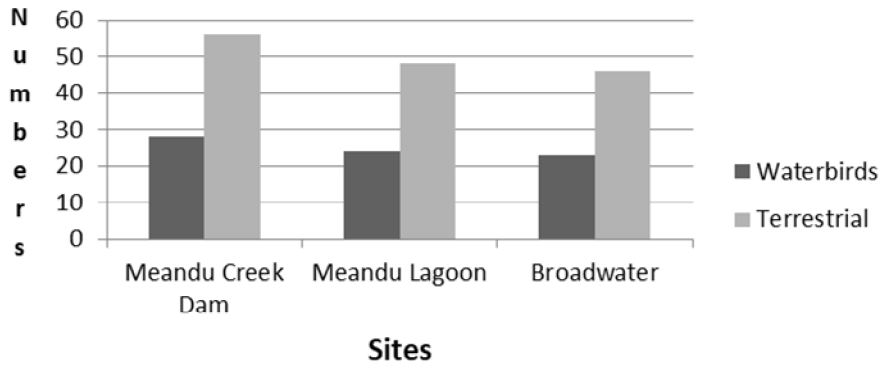

Figure 1. A comparison between the number of water and terrestrial birds recorded at the three sites

Birds observed on water (e.g. Chestnut Teal *Anas castanea*), wading along the shoreline (e.g. Black-winged Stilt) or those closely associated with water (e.g. Australian Reed-Warbler *Acrocephalus australis*) account for 33.33% of all birds recorded at Meandu Creek Dam. Terrestrial species account for 66.67% of the total tally. This level of waterbird/terrestrial bird species diversity shows a remarkable similarity with ratios recorded at the two nearby "natural lagoons" of Meandu Lagoon (33.33/66.67%) and Broadwater (35.21/64.79%). In simple terms, each site returned a 1:3 waterbird/terrestrial bird ratio (1:2.84 at Broadwater).

As could be expected, given the aquatic nature of the habitat, six of the 13 orders recorded in the area are directly allied with water; a further two species are closely associated with water (Australian Reed-Warbler and White-bellied Sea-Eagle *Haliaeetus leucogaster*). Twelve of the 37 families are associated with water. Of the seven terrestrial orders (representing 25 families), Passeriformes dominate (Fig. 2).

The Meliphagidae (honeyeaters) dominate the Passeriformes while the Acanthizidae (thornbills and allies) are also reasonably well represented in terms of species abundance (Fig. 3).

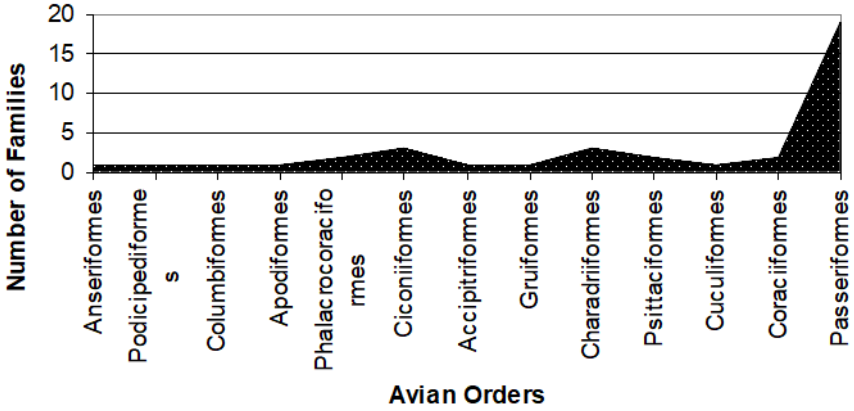

Figure 2. Avian orders present at Meandu Creek Dam

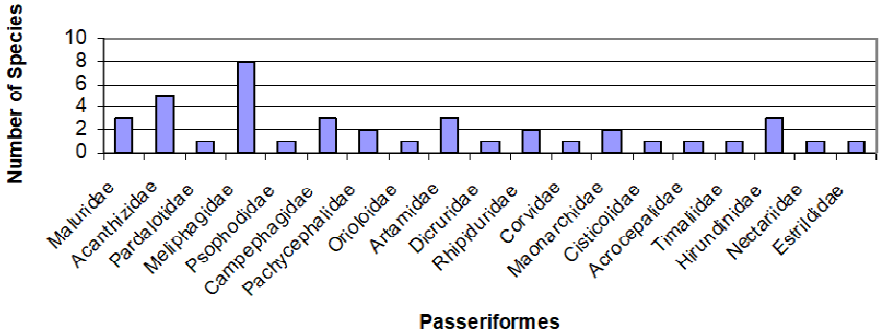

Figure 3. Passeriformes distribution at Meandu Creek Dam

Again, given the aquatic nature of the site, a closer analysis of those birds associated with water is of interest. Fig. 4 presents a simple comparison of the water-related families recorded at the three sites.

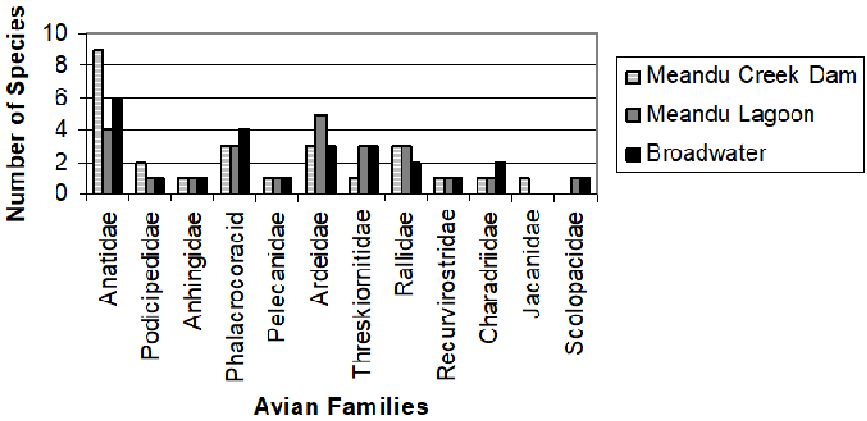

Figure 4. Distribution of aquatic families across the three sites

The Anatidae dominate on all three sites. No Scolopacidae (Latham's Snipe *Gallinago hardwickii*) have been recorded at the Meandu Creek Dam. Conversely the Jacanidae (Comb-crested Jacana *Irediparra gallinacea*) have been found only at Meandu Creek Dam. The Anhingidae, Pelecanidae and Recurvirostridae are represented at all three sites by a single species; Australasian Darter *Anhinga novaehollandiae*, Australian Pelican *Pelecanus conspicillatus* and Black-winged Stilt respectively.

Table 3. Species recorded on or immediate around Meandu Creek Dam relative frequency.

Species	Relative Frequency %	Species	Relative Frequency %
Plumed Whistling-Duck	10%	Dollarbird	10%
Musk Duck	40%	Superb Fairy-wren	10%
Black Swan	100%	Red-backed Fairy-wren	10%
Maned Duck	10%	Variegated Fairy-wren	10%
Grey Teal	10%	White-browed Scrubwren	20%
Chestnut Teal	10%	Weebill	20%

Pacific Black Duck	100%	White-throated Gerygone	20%
Hardhead	50%	Yellow-rumped Thornbill	10%
Blue-billed Duck	10%	Striated Pardalote	50%
Australasian Grebe	80%	Speckled Warbler	10%
Great Crested Grebe	70%	Lewin's Honeyeater	10%
Peaceful Dove	10%	Yellow-faced Honeyeater	30%
Bar-shouldered Dove	10%	Noisy Miner	10%
White-throated Needletail	10%	Brown Honeyeater	30%
Australasian Darter	70%	White-throated Honeyeater	10%
Little Pied Cormorant	10%	Noisy Friarbird	30%
Great Cormorant	10%	Little Friarbird	10%
Little Black Cormorant	50%	Striped Honeyeater	30%
Australian Pelican	30%	Eastern Whipbird	20%
Eastern Great Egret	10%	Black-faced Cuckoo-shrike	30%
Intermediate Egret	10%	Ground Cuckoo-shrike	10%
White-faced Heron	30%	Cicadabird	20%
Glossy Ibis	20%	Rufous Whistler	20%
White-bellied Sea-Eagle	30%	Grey Shrike-thrush	10%
Little Eagle	10%	Olive-backed Oriole	20%
Purple Swamphen	30%	Pied Butcherbird	20%
Dusky Moorhen	50%	Australian Magpie	60%
Eurasian Coot	60%	Pied Currawong	50%
White-headed Stilt	10%	Spangled Drongo	10%
Masked Lapwing	70%	Grey Fantail	20%
Comb-crested Jacana	30%	Willie Wagtail	40%
Galah	10%	Torresian Crow	50%
Rainbow Lorikeet	20%	Leaden Flycatcher	10%
Scaly-breasted Lorikeet	10%	Magpie-lark	50%
Australian King-Parrot	10%	Golden-headed Cisticola	20%
Pale-headed Rosella	10%	Australian Reed-Warbler	10%
Pheasant Coucal	20%	Silvereye	50%
Eastern Koel	20%	Welcome Swallow	30%
Channel-billed Cuckoo	10%	Fairy Martin	40%
Fan-tailed Cuckoo	30%	Tree Martin	10%
Laughing Kookaburra	30%	Mistletoebird	40%
Sacred Kingfisher	20%	Double-barred Finch	30%

Discussion

In a simple, nominal, checklist of birds found in any particular area there is little need for detailed discussion. This is further emphasized at Meandu Creek Dam by the absence of any comprehensive, published, pre-construction inventory of the avifauna in the immediate area of the dam reservoir, reed beds and adjoining woodland, leaving little possibility of discussing the true impact of the dam. At best, one can do little more than surmise from what has been gleaned post-construction.

There are 84 species currently accounted for; 28 closely associated with water, 56 described as terrestrial. Whether, or how, these differ from pre-construction figures is difficult to comment upon.

Pre-construction species would surely have departed the immediate area during excavation work on the dam, leaving us to surmise that some species, especially terrestrial birds, may simply have returned to former ranges while others, particularly the waterbirds, are almost undoubtedly new colonists, attracted by the increased water surface and/or the regrowth of flora over the years.

Meandu Creek is a relatively minor watercourse, running a few kilometres from its upper reaches between Tarong National Park and Yarraman State Forest to its confluence with Barkers Creek. Prior to the building of the dam it would have run undisturbed until reaching Meandu Lagoon, one of a number of "wides" along its length between the dam and its confluence with Barkers Creek (Google Earth); these presently remain inaccessible on private property (pers. obs.). Such "wides" would be the only areas capable of holding significant numbers of waterfowl and yet, as is eminently clear from survey returns, neither species diversity (72 compared to 84), nor species abundance matches that at Meandu Creek Dam (Bielewicz & Bielewicz, unpubl. data).

Further, if one compares the Meandu Creek Dam figures with those for the Broadwater "wide", albeit larger and a little more distant than Meandu Lagoon, again species diversity, 71/84, and species abundance fail to match figures for Meandu Creek Dam (Bielewicz & Bielewicz, unpubl. data).

Tallies for these two more "natural" lagoons, while admittedly far from conclusive in the absence of pre-construction bird inventories, do at least indicate the probable levels of diversity and abundance that occurred in the area. They do not match levels currently reached at Meandu Creek Dam.

The current returns (2009 – 2010) for Meandu Creek Dam lead us to support McAllister et al. (2001). We believe that the construction of this dam, with its subsequent, comparatively undisturbed, regime (all the more so since the exclusion of the general public following the 2001 attack on New York City)

has had a beneficial effect on the local avifauna, especially for those birds closely associated with water.

Future

This is no more than a preliminary report; much remains to be done over the next few years. As part of a long-term project, covering large areas of the 1500ha property (with additional hectares of Hoop Pine plantation and open grazing land "off-site"), monitoring of Meandu Creek Dam is by necessity part of a planned program. Other areas require similar sustained effort and time and while Meandu Creek Dam remains an important and integral element within the overall scheme it must take its turn alongside all the other areas that need attention. Completion will take a few years more yet.

Access to the "shallow end" (south), where Meandu Creek flows into the reservoir created by the retaining wall, has only recently been approved. The topography of this newly-established point count station presents as good wader habitat and should eventually provide further species to the overall tally.

Much of the surrounding woodland, particularly below the dam wall, remains to be explored and monitored. Better access to the reed beds is being sought. Nocturnal counts have yet to be formalized. There has been some discussion between the authors and Tarong Energy towards emulating Koskimies & Poysa (1989) who conducted "round counts" on Finnish lakes, using boats.

Given almost a decade of public prohibition, it is pleasing to note Tarong Energy's enthusiasm for the project: it augers well for the future.

Acknowledgements

Thanks are expressed to Birds Australia Southern Queensland under whose auspices the current research is being conducted. Gratitude is extended to Tarong Energy who granted permission to conduct the survey. Special thanks are extended to the Environment Office at Tarong Energy which has been unstinting in its help and attention to often unusual requests. Last, but by no means least, special thanks are extended to Environment Officers who have not only pointed out several interesting bird habitat areas but accompanied the authors on a number of occasions to ensure that they never became geographically disorientated.

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Nocturnal foraging by a pair of Welcome Swallows (*Hirundo neoxena*) under artificial light in semi-arid Queensland

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The Welcome Swallow (*Hirundo neoxena*) is ubiquitous in Australia and is commonly seen foraging on the wing around rural or urban human habitations (Higgins *et al.* 2006). All swallow species forage primarily diurnally and on the wing, although cases of ground-foraging (Fitzsimons & Thomas 2012) and nocturnal foraging (Hobbs 1966) have been recorded. Welcome Swallows construct mud cup nests, held together with dried grass, often in anthropogenic structures such as among the rafters of buildings, under bridges, or in mine shafts; or inside caves or large tree hollows (Higgins *et al.* 2006).

Between the 26th and 30th of September 2016, I undertook field research at Bowra Wildlife Sanctuary, with colleagues from Griffith University. It is situated in the semi-arid zone, c. 15 km northwest of Cunnamulla, in south-central Queensland. An old, unused shearing shed was our living and dining quarters for the duration of the stay at the sanctuary. On the first night of dining in the shearing hall we noticed a pair of Welcome Swallows darting around the rafters of this old building.

The swallows had constructed a typical nest on the rafters and were feeding at least one nestling. The birds would alternate parental roles: one adult would leave the nest, and the other would remain with the nestling/s. The fluorescent lights illuminating our dining hall were swarming with insects of various taxa (macro- & micro-lepidoptera, diptera, etc.). The active bird would circle the area, flying swiftly between and around the wooden beams and struts, to catch insects. The birds often collided with the surrounding structures (i.e. light tube and roof beams), although this didn't seem to bother them notably. The active bird would then return to the nest, feed the vocalising nestling, and then alternate roles with the second parent. This occurred every night that we remained at the sanctuary and throughout the time spent in the building (c. 1800 until 2200).

Hobbs (1966) reported similar nocturnal feeding behaviour in this species and, consistent with his observations, the most active feeding I observed occurred

throughout the night in association with artificial illumination. However, it is notable that I also observed feeding activity continuing throughout the day.

Hobbs (1966) stated that little diurnal foraging occurred but both my study and his were based on qualitative observations, so it is impossible to determine whether there was a similar or greater level of diurnal foraging at Bowra compared with Hobbs' (1966) study.

Swallows and other hirundines use significantly less energy whilst flying than other birds of their size (c. 60 to 70 % - Hails 1979), making the presumed extended foraging time unsurprising.

My observations are consistent with the birds occupying (at least opportunistically) the "night light niche", an emergent property of widespread, and now commonplace, ecological light pollution (Longcore & Rich 2004). I mention opportunity because I am doubtful that these lights are always illuminated, and were most likely switched on for the sake of our research party. The birds could have previously been foraging diurnally, as normal. These birds were readily able to utilise artificial illumination, in an adaptive manner, to have easy access to insect prey during nocturnal hours.

Acknowledgements

I am grateful to: the Australian Wildlife Conservancy for allowing me to conduct research at Bowra; Dr. J. Guy Castley and the Griffith University School of Environment; and to an anonymous referee for comments on this note.

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Arboreal Foraging of Albert's Lyrebird

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Received 29 July 2017; accepted 30 August 2017

On the morning of 2 July 2017, I was walking along the main track in The Witches Falls section of the Tamborine National Park when, at about 8:30am, my attention was drawn to a loud scratching noise (and the sound of raining debris) coming from near the canopy above me and off to one side. I discovered a female Albert's Lyrebird *Menura alberti* was very busy scratching into the dense litter within the 'bowl' of a very large epiphyte (possibly *Asplenium australasicum*) that completely encircled a Piccabeen Palm *Archontophoenix cunninghamiana* approximately 15m above the ground. This section of rainforest was completely flat and located at least 50m from sloping land. For a period of about 10 minutes I observed the bird facing into the trunk, periodically scratching out the litter away from the trunk, pausing to feed in the 'bowl' with a typical 'head-down' attitude and then repeat this action, slowly rotating itself around the full extent of the circular epiphyte. Much debris was strewn over the ground at the end of the observation. I was in a good position to observe its overhanging tail, strong leg action and periodically its head when it was in a raised position, using Swarovski EL 10x42 binoculars.

At the conclusion of this feeding activity, the bird leapt onto a neighbouring branch of a large rainforest tree (species unknown) and could be heard walking along the branches. The dense leaf cover of that tree prevented good sightings of precisely what activity was being undertaken. After a period of about 3 minutes, the bird flew in a horizontal direction away from me, maintaining its height above ground of about 15m. It was clear that it was not headed back to the ground, but to some predetermined position of similar height. It then disappeared into the rainforest and I did not observe it again.

I am quite familiar with the Albert's Lyrebird, having observed them (generally from a distance) over a period of about 25 years, mostly in various sections of the Lamington National Park. All my prior observations of this species were that it is a ground-dwelling bird, which is consistent with the available literature for this species. Higgins *et al.* (2001) reports that they "Feed on the ground, preferring areas with deep moist leaf litter and fallen logs."

Reference

Higgins, P.M., Peter, J.M., & Steele, W.K. (eds). 2001. Handbook of Australian, New Zealand and Antarctic Birds. Volume 5. Oxford University Press: Melbourne.

Book Review

Australasian Eagles and Eagle-like Birds

by Stephen Debus

Published by CSIRO Publishing, 2017
Paperback, 192 pages
AU$ 49.95
http://publish/csiro.au

Reviewed by Jon Norling

Stephen Debus should be well known to most birders. He has undertaken research on and written about raptors for nearly 35 years. He worked on the raptor sections of the *Handbook of Australian, New Zealand and Antarctic Birds (HANZAB)*, Volume 2, authored *Birds of Prey of Australia: A Field Guide* and published more than 130 ornithological papers. He received Birdlife Australia's D.L. Serventy Medal in 2015 for ornithological publication. He is thus well qualified to contribute the latest research into a select group of birds.

It has been 24 years since the publication of *HANZAB*, Volume 2, which presented the most comprehensive analysis of Australasian raptors as at 1993. Much additional research has been undertaken since then, sufficient to justify a scientific update to *HANZAB*, Volume 2, in relation to a select group of raptors. This monograph is based upon more than 400 research papers published since 1993, 15% of which Stephen Debus either authored or co-authored.

Debus aptly describes his latest book as a popular-scientific monograph. Like *HANZAB*, Volume 2, it summarises the scientific results of a large number of research papers, but does it in a way that is more readable than *HANZAB*, Volume 2.

Ten species are documented in this monograph, of which seven are Eagles and six occur within Australia (White-bellied Sea-Eagle, Wedge-tailed Eagle, Little Eagle, Black-breasted Buzzard, Square-tailed Kite and Red Goshawk). The latter three "eagle-like birds" have been included by Debus because they are sufficiently *"eagle-like, and are remarkable Australian endemics worthy of highlighting."* These three are highly predatory, with the Buzzard and Kite being Pernine Kites and recent genetic studies indicating that the Red Goshawk is not a Hawk, but related to the *Accipiters* (Hawks) and *Circuses* (Harriers). This monograph defines Australasia as including Australia, New Guinea and the Solomon Islands.

The non-Australian raptors included in the monograph are the: Sanford's Sea-Eagle, which is very similar to our White-bellied Sea-Eagle and has been proposed as a sub-species to it (but not by Debus); New Guinea Harpy Eagle; Gurney's Eagle, which has been recorded in the Torres Strait; and Pygmy Eagle, which is very similar to our Little Eagle and has previously been regarded as a subspecies of it.

The monograph introduces the results of recent studies that update the following key subjects in respect of the following Australian raptors:

- White-bellied Sea-Eagle: population; food; social organization; social behaviour; breeding; and weight;
- Wedge-tailed Eagle: geographical variation; distribution; population; food; social organization; social behaviour; breeding; and weight;
- Little Eagle: population; food; breeding; and threats;
- Black-breasted Buzzard: food; social behaviour; breeding; and weight;
- Square-tailed Kite: distribution; food; social behaviour; voice; and breeding;
- Red Goshawk: seasonal movement; population; social behaviour; voice; and breeding.

This is not a book for the casual birder or the birder seeking information on raptor identification (Debus's excellent *Birds of Prey of Australia: A Field Guide*, 2nd Edition is for you). This popular-scientific monograph on a special group of Australasian birds is more suited to the serious birder and those who wish to be kept up to date with the latest research into these species. This monograph is intended to update *HANZAB*, Volume 2, rather than be a replacement for it. It should be read in conjunction with the 1993 treatise.

The Sunbird

Our scientific journal, *The Sunbird*, is as old as the Queensland Ornithological Society - Birds Queensland. The Society was formed in October 1969 and the first issue of *The Sunbird* was published in March 1970.

This issue – Volume 47 – will be the final issue of *The Sunbird* in the current format.

Birds Queensland is planning a 'new' *Sunbird* which will incorporate a change in direction while still being a scientific journal. Full details are expected to be available in the first half of 2018. At that time, Birds Queensland members and current subscribers will be notified and, if appropriate, subscriptions accepted.

Thank you for your past support of *The Sunbird* and we hope to be able to welcome current readers as readers and subscribers of the future *Sunbird*.