

# First observation of a Brolga *Antigone rubicunda* preying on eggs and of ‘water-kicking’ behaviour by Australasian Grebes *Tachybaptus novaehollandiae* as a nest-defence

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**Abstract.** We report a novel observation of Australian waterbird behaviour: a Brolga *Antigone rubicunda* preying on eggs of the Australasian Grebe *Tachybaptus novaehollandiae*, the first record of birds’ eggs in the diet of a crane in Australia. We also report ‘water-kicking’ by the Australasian Grebe, the first record of this anti-predator behaviour in the species. Neither Brolga diet nor display behaviours of the Australasian Grebe have been systematically investigated, and we suggest avenues for further studies of egg predation and parental defence behaviours in waterbird breeding wetlands.

## Introduction

Cranes are opportunistic omnivores (Mirande & Harris 2019), and the Brolga *Antigone rubicunda* is one of several species that consume a significant proportion of animal foods (Gowland 1983; Marchant & Higgins 1993), especially in the breeding season (Sundar *et al.* 2019). We found eight published records of cranes (all in the genus *Antigone*) preying on birds’ eggs, but to date eggs have not been reported in the diets of cranes in Australia.

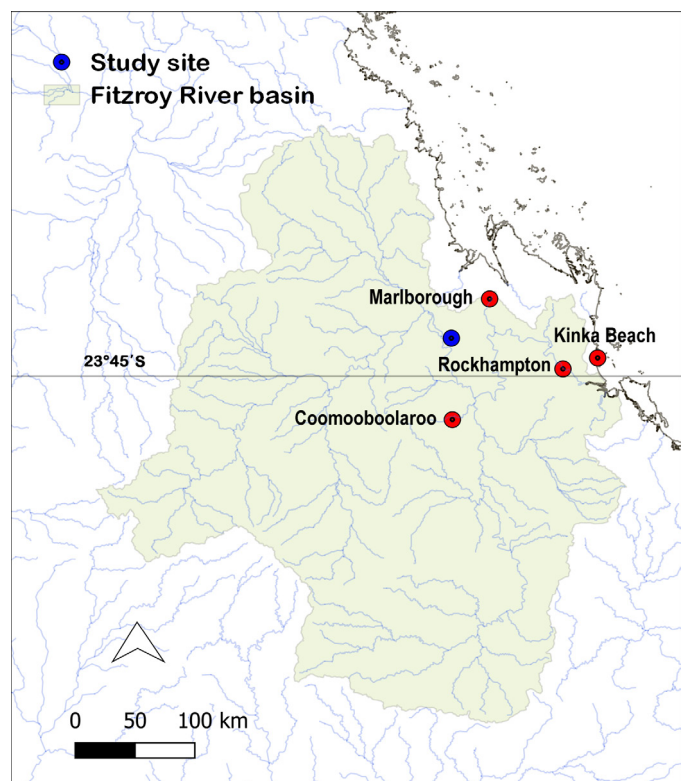
Nesting of the Australasian Grebe *Tachybaptus novaehollandiae*, including nest-defence, is not well-studied (Marchant & Higgins 1993; Mo & Waterhouse 2015). Observers have reported opportunistic observations that when disturbed at the nest by people or machinery, Australasian Grebes usually cover the eggs with vegetation and then swim rapidly and quietly away (e.g. Ashby 1933; McDonald 1939). When waterbirds near the nest are perceived as a threat, Australasian Grebes dive and attack the intruder from underwater, or pursue them across the water, flapping wings and calling loudly (Walters 1979). They engage in the same behaviour as a brood-defence, together with ‘crash diving’ (diving with a loud splash: Mo & Waterhouse 2015). Raising the feet above water to cause a splash (‘water-kicking’) occurs during conflict between Australasian Grebes, usually followed by a ‘crash dive’ (J. Fjeldså in Marchant & Higgins 1993). Prolonged ‘water-kicking’ as a distraction display against a perceived predator—alternating between the feet, then with both feet simultaneously, but with no subsequent ‘crash dive’—was observed by Peter (2008) when he approached an incubating Hoary-headed Grebe *Poliocephalus poliocephalus*, but this has not been described for the Australasian Grebe.

In this note, we describe a Brolga feeding on eggs of the Australasian Grebe. We also describe the Grebes engaging in ‘water-kicking’ as a distraction display to defend the nest both when disturbed by Brolgas while nest-building (and possibly incubating), and during Brolga predation of eggs. We also discuss the implications of these observations for

studies on Brolgas foraging, and for our understanding of distraction displays in the Australasian Grebe.

## Study site

Observations were made over 2 days in February 2019 at ‘Mt Benmore’, a cattle-grazing property at 150 m asl, 100 km north-west of Rockhampton (23°22’S, 150°30’E: Figure 1). The area has a subtropical climate with annual rainfall of 800 mm, concentrated from December to March (Bureau of Meteorology 2019) and is a major centre for



**Figure 1.** Study site in central Queensland showing Fitzroy River Basin and Tropic of Capricorn.



**Figure 2.** Brolga removing egg from the nest of a pair of Australasian Grebes amongst floating vegetation. The Brolga selected the third egg while one Grebe performed a furtive upright appeasement display (arrowed). The bulge in the Brolga's neck is from the previous egg swallowed. Photo: Helen I. Dunne



**Figure 3.** Brolga manipulating the third Australasian Grebe's egg in its bill. The Grebes are arrowed. Photo: Helen I. Dunne

production of beef cattle and cropping (Id Community 2020). The site is a semi-permanent dam used for watering of stock, covering ~2.5–3 ha in an 'L'-shape and ~100–150 m wide at any given point. Trees around the dam are mostly Brigalow *Acacia harpophylla* but also include White Bauhinia *Bauhinia hookeri*, Yellow-wood *Terminalia oblongata* subsp. *oblongata*, and eucalypts *Eucalyptus* spp., with a few dead trees scattered in the water. The dam margins support fringing vegetation, mostly sedges (Cyperaceae) and wetland grasses (Poaceae) (Calvert & Liessmann 2014) to 50 cm high. In February 2019, floating and emergent vegetation, particularly Water Primrose *Ludwigia peploides*, covered ~25% of the water surface area from the edges to a width of 1–1.5 m. Rains in December 2018 had replenished property dams, which supported a diversity of waterbirds with several species breeding (Appendix 1).

Brolgas and Australasian Grebes are common breeding residents in the Fitzroy Basin and adjacent coastal areas near Rockhampton (Longmore 1978; Catterall & Woinarski 2003; eBird 2020). Australasian Grebes are present all year on the property; Brolgas are often found on the property's dams in pairs or with fledged young of the year, and on occasion have bred there (HID pers. obs.). At the time of the observations, at least two Brolgas had been seen regularly foraging in the surrounds of the focal dam.

## Observations

On 6 February 2019, HID (with A. Dunne) observed two Australasian Grebes collecting and adding vegetation to a nest. A pair of Brolgas was wading nearby in water up to and just above their tarsal joints (~30 cm deep: Blackman 1971). When the foremost Brolga was within 3 m of the nest, the Grebes became agitated, issued alarm calls (Marchant & Higgins 1990), and began 'water-kicking' at the Brolga in an effort to move it from the nesting area. This behaviour continued for c. 5 minutes until both Brolgas had slowly passed. The Brolgas appeared to notice the Grebes but made no move towards them or the nest.

At the same dam on 9 February, HID revisited the Grebe nesting site: the nest seen on 6 February had been dismantled with very little of the mounded vegetation remaining. Two Brolgas were observed on the dam margins, one was flicking weeds into the air and wing-flapping. They passed within 5–10 m of a Pied Stilt *Himantopus leucocephalus* nest with two eggs. Both Stilts began 'jumping' or launching themselves into the air with one or two quick wing-beats to a height of ~50 cm, as described by R.J. Pierce in Marchant & Higgins (1993). This was in a direction slightly towards the Brolgas and combined with a head-bobbing action, repeated several times. Throughout this display, the Stilts emitted loud alarm calls. The Brolgas walked past without actively going near or searching for this nest and continued to wade and feed around the dam margins.

About 30 minutes later, HID noticed two Australasian Grebes at a nest ~30 m from the nest seen on 6 February. The Brolgas approached close to the nest and both Grebes issued alarm calls while 'water-kicking' as previously observed on 6 February. One of the Brolgas began tearing at, and flicking nesting material from, the Grebe nest and proceeded to collect and eat each of the three eggs. The Brolga tossed each egg along the length of its bill twice before slightly throwing back its head to swallow. As the Brolga selected the third egg from the nest, with the second egg showing as a bulge in the neck (Figure 2), the Grebes continued alarm calls and one displayed appeasement behaviour: a "furtive upright posture with elongated neck inclined slightly forward and rear end of body deep in water" (J. Fjelds  in Marchant & Higgins 1990, p. 96). The Brolga manipulated the third egg in its bill, the previous egg still bulging in the neck (Figure 3). The pair of Brolgas remained for a short time, the predator bird still closely inspecting the site of the dismantled Grebe nest, with no bulge now visible in its neck. The Grebes remained but appeared to have given up the defence of the nest. In the following weeks, the Brolgas were still seen intermittently around the dam, and a successful Australasian Grebe nest was observed in deeper water (80–100 cm deep).

## Discussion

This ‘water-kicking’ nest-defence (without subsequent diving) is the first record of this behaviour in Australasian Grebes and could have evolved from aspects of intraspecific conflict behaviour (Humphreys & Ruxton 2020; and see Introduction). Conspicuous (‘distraction’) displays in defence of a nest have potential risks as well as benefits to the birds, so are more likely to occur during or after, rather than before, laying (Humphreys & Ruxton 2020). This suggests that although no eggs were observed on 6 February, the Grebes were probably already incubating at least one egg, while adding vegetation to the nest as laying progressed, which is usual for the species (e.g. Ashby 1933). We can therefore state that ‘water-kicking’ occurred during incubation (at nest observed on 9 February) and during nest-building, perhaps while incubation was already in progress at the nest observed on 6 February.

Our description of Brolga food-handling behaviour with eggs is similar to that reported for Sarus Cranes *A. a. antigone* in India (Sundar 2000) but is the first description of this behaviour in the Brolga. There are no records of egg predation by the Australian Sarus Crane *A. a. gillae*. Egg fragments can be detected in crane stomachs (Harvey *et al.* 1968), but were not reported by Gowland (1983) from his examination of the stomach contents of 54 Brolgas, the only significant published record of Brolga diet from stomach contents. However, like other cranes (Mirande & Harris 2019), Brolgas consume grit and large pebbles [Chisholm 1944; British Museum (Natural History) & Hall 1974] to facilitate digestion of tough plant and animal foods, and even if eggs were eaten, eggshell could have been ground away before specimens were collected.

There have been no comprehensive studies of Brolga diet and it is difficult to assess whether eggs might be a regular dietary item for at least part of the Brolga population, for part of the year. Many Brolgas frequent wetlands when other waterbirds are breeding (Marchant & Higgins 1990, 1993) but although predation of birds’ nests and eggs is common it is rarely observed except by camera-traps (Noske & Coates 2018). The few previous records of cranes taking eggs have all been made by biologists undertaking detailed fieldwork on waterbirds, including the

intensively studied Sandhill Crane *A. canadensis* (Table 1; Mirande & Harris 2019). The scarcity of records of nest-depredation may be because incubation periods of prey species (hence the availability of eggs as prey) are short, and because cranes (as opportunistic predators) might have chosen other foods while under direct observation.

In the incidents that we describe, the Brolgas passed two nests without approaching closer despite conspicuous displays by the parent birds. This suggests that the subsequent predation event was purely opportunistic rather than individually learned foraging behaviour (to search for eggs), although the cause of the failure of the first Australasian Grebe nest between 6 and 9 February is unknown. The successful Australasian Grebe nest observed some weeks later was in deeper water (80–100 cm). Maximum water depth for foraging by large wading birds, including the highly aquatic Siberian Crane *Leucogeranus leucogeranus*, is constrained by leg length (Powell 1987; Jiang *et al.* 2014). There are no studies reporting the depths of water where Brolgas forage: feeding wetlands are generally described as ‘shallow’ (e.g. Marchant & Higgins 1993). In southern Australia, Brolgas nest in water usually <50 cm but up to 72 cm deep (Herring 2005), and communal non-breeding wetland roosts are <50 cm deep (King 2008). This suggests that the third Grebe nest could have been in deeper water than the usual foraging zone for Brolgas at the dam.

The observations from this brief study have added to knowledge of Brolga diet and foraging behaviour, and of nest-defence behaviour in the Australasian Grebe. Brolga foraging zones in wetlands in relation to water depth, leg length and available food resources, as well as nest-depredation and nest-defence behaviour of sympatrically breeding waterbirds, could be monitored using motion-triggered video or timed still photography (e.g. Kross & Nelson 2011; Brandis *et al.* 2014). In addition, observers could film waterbird nest-defence behaviour opportunistically by smartphone during wetland surveys undertaken for a range of programs. Shed Brolga feathers could be collected from several sites in the study area, in both the breeding and non-breeding seasons, and the extent of protein in the diet investigated using stable-isotope analysis (Sundar *et al.* 2019; K. Brandis pers. comm.).

**Table 1.** Records of predation of birds’ eggs by cranes, in date order.

Common name	Scientific name	Reference
<b>Indian Sarus Crane</b> <i>Antigone antigone antigone</i> (India)		
Red-wattled Lapwing	<i>Vanellus indicus</i>	Mukherjee (1999)
Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	Sundar (2000)
Indian Skimmer	<i>Rynchops albicollis</i>	B. Roland in Sundar & Choudhury (2003)
Spotted Dove	<i>Spilopelia chinensis</i>	P. Gole in Sundar & Choudhury (2003)
<b>Sandhill Crane</b> <i>A. canadensis</i> (North America)		
Snow Goose	<i>Anser caerulescens</i>	Harvey <i>et al.</i> (1968)
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	C.D. Littlefield in Mullins & Bizeau (1978)
Canada Goose	<i>Branta canadensis</i>	Hoffman (1980)

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**Appendix 1.** Waterbirds recorded at the study site, north-west of Rockhampton, Queensland. Names and order are from BirdLife Australia (2019). \* = species known to be nesting in early 2019, \*\* = species known to have nested on the property, and o = occasional visitor in dry periods.

<i>Common name</i>	<i>Scientific name</i>
**Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>
Pink-eared Duck (o)	<i>Malacorhynchus membranaceus</i>
Cotton Pygmy-goose (o)	<i>Nettapus coromandelianus</i>
**Australian Wood Duck	<i>Chenonetta jubata</i>
Hardhead	<i>Aythya australis</i>
**Pacific Black Duck	<i>Anas superciliosa</i>
**Grey Teal	<i>Anas gracilis</i>
*Australasian Grebe	<i>Tachybaptus novaehollandiae</i>
Black-tailed Native-hen (o)	<i>Tribonyx ventralis</i>
**Brolga	<i>Antigone rubicunda</i>
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>
Yellow-billed Spoonbill	<i>Platalea flavipes</i>
Royal Spoonbill	<i>Platalea regia</i>
Straw-necked Ibis	<i>Threskiornis spinicollis</i>
Australian White Ibis	<i>Threskiornis moluccus</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Cattle Egret	<i>Bulbulcus ibis</i>
White-necked Heron	<i>Ardea pacifica</i>
Intermediate Egret	<i>Ardea intermedia</i>
White-faced Heron	<i>Egretta novaehollandiae</i>
Little Egret	<i>Egretta garzetta</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Australasian Darter	<i>Anhinga novaehollandiae</i>
*Pied Stilt	<i>Himantopus leucocephalus</i>
*Black-fronted Dotterel	<i>Eiseyornis melanops</i>
*Masked Lapwing	<i>Vanellus miles</i>
Red-kneed Dotterel (o)	<i>Erythronys cinctus</i>
Comb-crested Jacana	<i>Irediparra gallinacea</i>
Latham's Snipe	<i>Gallinago hardwickii</i>