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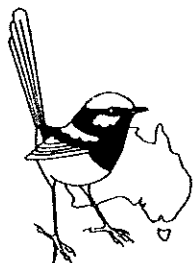
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COVER:
Royal Spoonbills *Platalea regia*.
The Narran wetland in New South Wales is an
important breeding area for this species.
Plate 25 Photo: G.A. Cumming

NOTES FOR CONTRIBUTORS

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Waterbirds at Narran Lake Nature Reserve, New South Wales, in 1996

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Summary

Waterbird breeding was documented during 1996 in the Narran wetlands in northern New South Wales, concentrating on the Narran Lake Nature Reserve. The wetlands filled twice during the year, in January and June, after 40 months without a flood. After the first flood, a major waterbird breeding event took place in the Nature Reserve: Darters *Anhinga melanogaster*; Pied *Phalacrocorax varius*, Little Black *P. sulcirostris* and Great Cormorants *P. carbo*; Great Egrets *Ardea alba*; Glossy *Plegadis falcinellus*, Australian White *Threskiornis molucca* and Straw-necked Ibis *T. spinicollis*; and Royal Spoonbills *Platalea regia* established colonies. Breeding was confirmed for a further 11, non-colonial, species. Breeding was also observed during December on Narran Lake, which lies outside the boundary of the Nature Reserve. The Nature Reserve included the site of the largest colony of Straw-necked Ibis ever recorded, and with 102 000 nests in 1996 had the third largest ibis colony documented. It is also particularly important for breeding Little Black Cormorants and Royal Spoonbills. Narran Lake Nature Reserve is one of the most highly ranked wetlands of the Murray-Darling Basin for species diversity, number of breeding species and total number of birds. The wetlands have held nationally and internationally significant populations of Palearctic migrants, and provide habitat for 11 species covered by international treaties. The waterbirds in the Narran wetlands have been little studied, and much more needs to be done to document the importance of the area, which is under threat from water extraction for irrigation upstream.

Introduction

The wetlands associated with Narran Lake, between Walgett and Brewarrina in the Western Division of New South Wales, are a series of areas of open water, known as Back, Clear and Narran Lakes, connected by thickets of lignum *Muehlenbeckia florulenta* separated by channels. The lakes are terminal lake-beds of the Narran River, a tributary of the Balonne River system which originates in Queensland and is within the Murray-Darling Basin. The lakes are fringed by River Red Gum *Eucalyptus camaldulensis* and River Cooba *Acacia stenophylla* (Magrath 1991, Smith 1993). The northern section of the wetlands, including Back and Clear Lakes, is protected as the Narran Lake Nature Reserve. Narran Lake itself is south of the Nature Reserve (Figure 1).

Historically, the wetlands have flooded about once every two years, with Back and Clear Lakes holding water for 4-6 months and Narran Lake for about nine months. In 25% of years more than one flood has occurred (Magrath 1991). The development of irrigation schemes upstream may have recently affected water flows into the wetlands (Smith 1993).

Until 1996, 34 species of waterbirds were recorded breeding in the Narran Lake Nature Reserve (Smith 1993). Most breeding events have been documented poorly, if at all, although the ibis colonies of 1989 and early 1990 were visited regularly by National Parks and Wildlife Service personnel (Magrath 1991). Smith (1993) listed 10 years between 1971 and 1991 in which breeding took place, but provided comprehensive lists of breeding species and estimated numbers of nests only for 1971, 1988, 1989 and 1990. She listed a breeding event in late 1983 which included the largest ibis colony ever reported in Australia (Marchant & Higgins 1990), but for that year listed only the three species of ibis, even though other species of waterbirds were presumably present. Beruldsen (1985) visited the area in May 1984 when a large breeding event was under way.

Brooker (1993) conducted aerial surveys of birds on Narran Lake from 1977 to 1981, and provided some information on birds at Clear Lake. Hodges (1981) reported

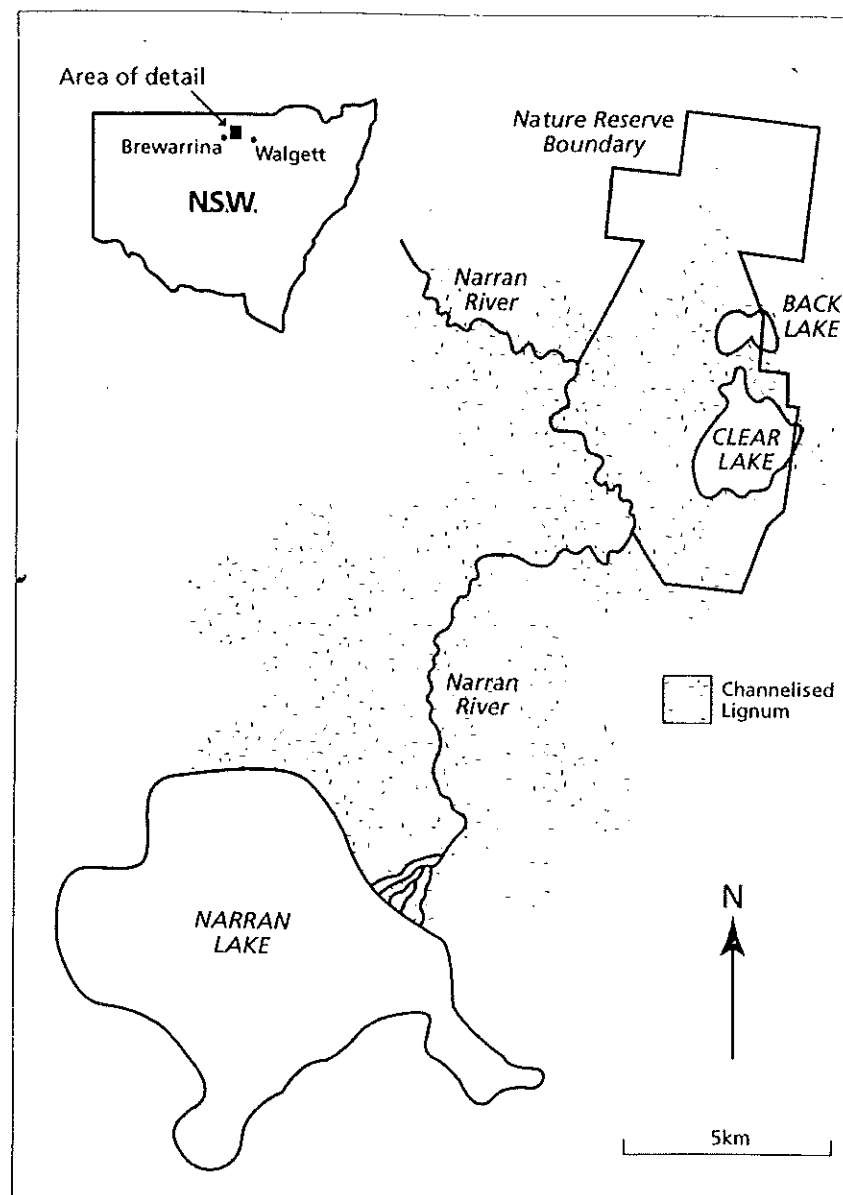


Figure 1. Location and layout of the Narran wetlands.

on a proposal to create the Narran Lake Nature Reserve, which subsequently occurred in 1988.

The Narran wetlands are a major waterbird breeding site but are little documented. They challenge resource managers constrained by political boundaries because they are dependent on water flows from Queensland. Given the expansion of irrigation

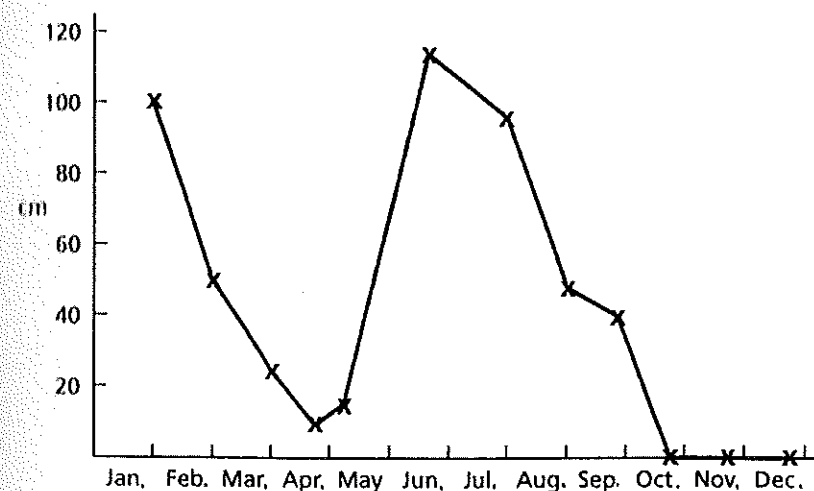


Figure 2. Water level at the Back Lake gauge during 1996.

In semi-arid Australia, information on use of these wetlands by waterbirds in New South Wales is critical so that informed decisions can be made regarding the allocation by Queensland authorities of a scarce resource.

Methods

Ten visits were made to the wetlands following their inundation in January 1996 after a 40-month dry period. During each visit the water level on the gauge at the northern edge of Back Lake was recorded (Figure 2).

Observations of waterbirds were made from a boat, a canoe and from the shore at the northern edge of Back Lake and the eastern edge of Clear Lake. Not all breeding areas were studied in detail during each visit because of the vulnerability of some species to disturbance at critical times and the difficulties of access at low water levels. However, it was always possible to assess the general progress of the colonies. The extent of breeding of each species was mapped on sketch maps or onto photocopies of a 1:16 000 aerial photograph of Back Lake and its surrounds, including the northern section of Clear Lake.

Attempts were made to count or estimate the numbers of breeding pairs of each species. The difficulty of this varied between species as some nested in compact groups and others were more scattered in space and time. For the ibis, the large size of the colony made it difficult to estimate numbers, although this was overcome by using aerial photographs (see below). During some visits numbers of each species present on Back and Clear Lakes were counted.

On 21 March vertical, 35 mm photographs were taken at 1220 m and 305 m above sea level. From the smaller-scale photographs the extent of the ibis colony was mapped. Nesting densities within the colony were assigned to three classes — high, low and zero. These were determined using patterns on the photographs and were validated on the ground. The high-density category was characterised by almost continuous white colouring (from trampled, faeces-covered lignum) with small black dots (the birds). Low-density areas had scattered occurrences of the above separated by untrampled lignum. Areas with no nests were patches of untrampled lignum. The areas of each category were measured by planimeter. The larger-scale photographs sampled only part of the colony but included examples of all classes of nesting density which could be estimated by counting nests within a 25 m radius of 10 points located randomly within each category, obtaining a mean and scaling according to total area of each category. The totals for both categories were summed to give the final estimate (M. Maher pers. comm.).

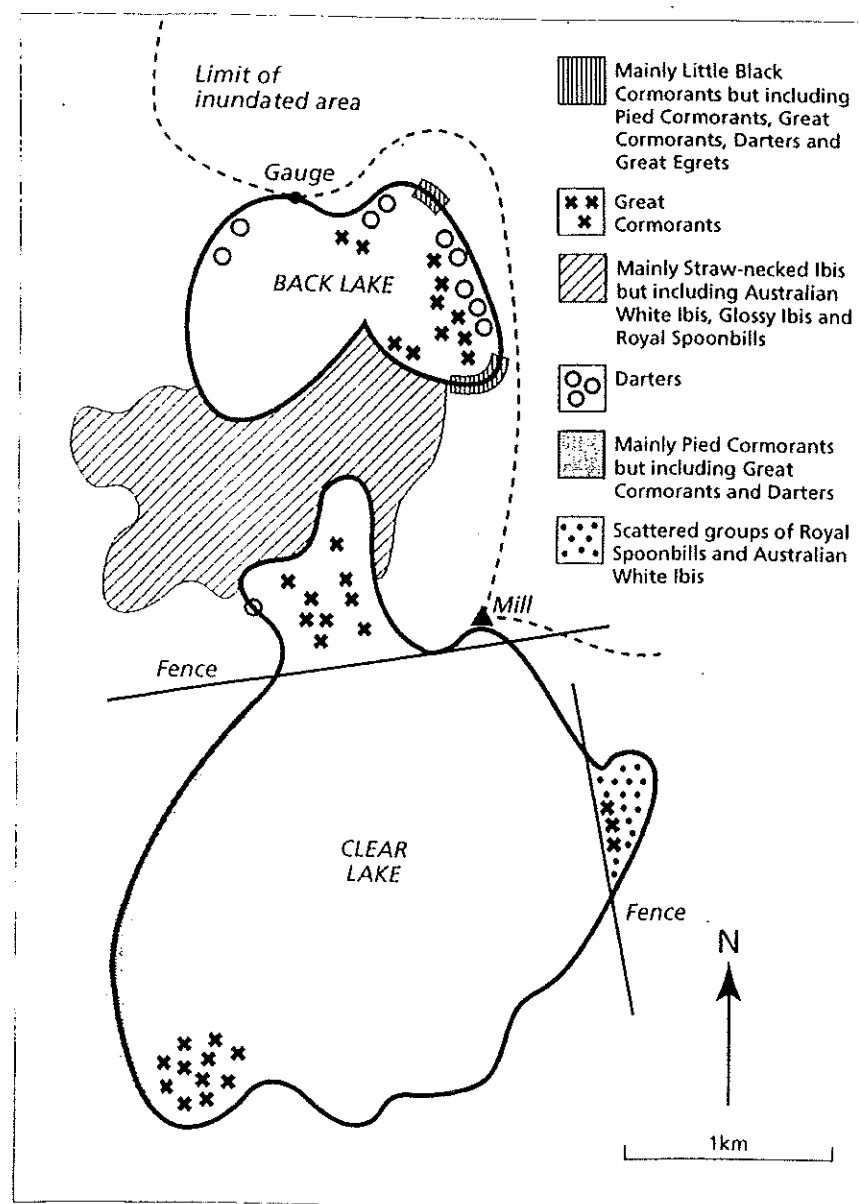


Figure 3. Nesting locations of colonial breeding waterbirds at Back and Clear Lakes during 1996.

On 9 December an aerial survey of the entire wetland allowed an estimation of numbers of some breeding species and overall numbers of birds on Narran Lake.

Incidental observations were also made of other waterbird species, including non-breeding Palaearctic migrants.



Female Darter *Anhinga melanogaster*

Plate 26

Photo: Bob Shepherd



Male Darter

Plate 27

Photo: G.A. Cumming



Female Darter feeding young

Plate 28

Photo: G.A. Cumming

Results

Water levels at the gauge in Back Lake are close to the depth of water under the main ibis breeding areas. The wetlands filled in January but the water level fell steadily and on 29 April, with the gauge reading 11 cm, areas of mudbank became exposed in Back Lake, making boating virtually impossible. The level rose 8 cm in early May during a period of rain. The wetlands then flooded for the second time, and water backed up into the runnels which carry local run-off into Back and Clear Lakes. By October the water had receded from the gauge (Figure 2).

Sixty-two species of waterbirds have been recorded in the Narran wetlands, 56 of which were recorded in 1996 (see Appendix 1 for records and scientific names).

Colonially nesting species

The main breeding event in the Nature Reserve in 1996 took place in the first half of the year, after the first flood. Peak breeding occurred during February, March and April. No significant breeding was observed after the second flood in June.

Nine species of colonially nesting waterbirds bred in different locations in the Narran Lake Nature Reserve in 1996 (Figure 3).

Darter About 200 pairs nested, either singly or in small groups. Most nests were in large River Red Gums, sometimes several to a tree; a few were in trees which also supported nests of Little Black Cormorants. A few nests were in isolated River Coobas, which were sometimes shared with Great or Pied Cormorants. In the River Red Gums, nests were usually on leafy branches and incorporated leafy twigs, but sometimes were on large bare limbs closer to the water. Nesting activity declined as water levels fell in the middle of the year, and the last nesting activity recorded

was in October when about 20 nests contained almost-fledged young. At this time the water had receded from the nest trees.

Pied Cormorant A total of 750 pairs nested in the Nature Reserve. Most nests were in 58 River Coobas along almost 2 km of the western edge of Clear Lake. These trees held an average of 12 nests each, and were shared with smaller numbers of Great Cormorants. About 50 nests were at Back Lake, in the middle levels of the River Red Gums occupied by nesting Little Black Cormorants. On 7 April the nests along the edge of Clear Lake were active, but by mid June breeding had finished, very few adults were seen anywhere in the area, and about half of the nests contained dead nestlings.

Little Black Cormorant About 2500 pairs nested in trees which supported at least 100 nests each. The nests were all in large River Red Gums fringing the eastern section of Back Lake except for one small colony which was in a medium-sized River Red Gum on the southern edge of Back Lake. Also nesting in these trees were smaller numbers of Pied and Great Cormorants, Darters and Great Egrets. Breeding was under way in February, peaked in April and by mid June the nests were unoccupied and no further breeding was recorded.

Great Cormorant About 400 pairs nested. Approximately half of the nests were in the south-western corner of Clear Lake in River Coobas also occupied by Pied Cormorants. Elsewhere, most River Coobas, including isolated trees, contained at least one nest. Some nests were in large lower branches of the River Red Gums occupied by Little Black Cormorants, and some were in River Red Gum saplings, including isolated plants or stands of saplings in the south-eastern corner of Back Lake. Incubation was observed during all visits up to May. As the water level fell during the first half of the year, Great Cormorant nests were built in newly exposed sites, including low in River Red Gum saplings and on fallen timber. Some may have subsequently failed due to inundation when the wetlands refilled in June. As with the Pied Cormorant, many nests contained dead young birds in mid June.

Great Egret About 50 pairs nested in February and March in the tops of some of the River Red Gums occupied by Little Black Cormorants.

Glossy Ibis Bred on lignum within the main ibis colony.

Australian White Ibis About 500 pairs nested, mostly in scattered groups throughout the large colony of Straw-necked Ibis, and often in association with nesting Royal Spoonbills; one small group was among scattered groups of Royal Spoonbill nests in the eastern corner of Clear Lake. All nests were built on lignum. Although nesting was finished by June, in late October two groups, of three and five nests respectively, including some containing eggs, were at the edge of Back Lake in about the same place where the main ibis colony had become established earlier in the year. The groups were about 50 m apart.

Straw-necked Ibis The main colony was between Back and Clear Lakes, and all nests were on trampled lignum. The aerial photographs taken on 21 March showed that 102 000 nests were present. The colony was well established on 7 February when the oldest nests, at the southern edge of Back Lake, already contained small young. Although the colony later expanded south towards Clear Lake, the size of the population may not have changed much because young were fledging as new nests were being built. Large numbers of birds arrived at and left the colony in early May, presumably feeding young, but by mid June the breeding was finished and few birds were present. In mid August many flocks of birds flew in from the south and circled over the colony, possibly prospecting for nest-sites, but no further nesting took place.



Straw-necked Ibis *Threskiornis spinicollis*

Plate 29

Photo: Bob Shepherd



Flock of Straw-necked Ibis

Plate 30

Photo: Andrew J. Ley

Royal Spoonbill About 150 pairs bred in scattered groups, mainly on lignum in the main ibis colony, but also among more widely spaced clumps of lignum at the eastern corner of Clear Lake. Breeding had finished by June, except for a single active nest with three eggs observed at Back Lake in late October.

Other species for which breeding was confirmed

Black Swan Nine broods of dependent young were counted in the Nature Reserve in September.

Australian Wood Duck A pair with six small young was at an earth tank at the northern edge of the wetland in September.

Pink-eared Duck Several broods of newly hatched young were present at Clear Lake in April.

Hoary-headed Grebe Dependent young were present in the first half of the year.

Yellow-billed Spoonbill A single bird was observed carrying nesting material at Back Lake in March. No further evidence of breeding of Yellow-billed Spoonbills was obtained.

Whistling Kite Several pairs bred in River Red Gum beside Back Lake.

Red-capped Plover Adults with young were observed on mudflats at Back Lake at the end of October and at Clear Lake in December.

Black-fronted Dotterel A nest containing three eggs was found on the shore of Back Lake in late October.

Red-kneed Dotterel Although no nests were found, sometimes many juveniles were present. A distraction display was performed on mudflats among lignum at Back Lake in late October.

Banded Lapwing Up to 100 birds were often seen on sparsely vegetated flats near the northern edge of the wetland, and nests were common; dependent young were present in March.

Masked Lapwing A nest with eggs was seen in September.

Waterbirds not previously recorded in the Nature Reserve

During 1996 the following species were added to the list of Smith (1993): Chestnut Teal, White-bellied Sea-Eagle, Swamp Harrier, Australian Spotted Crane, Latham's Snipe, Curlew Sandpiper and Australian Pratincole.

Counts of selected species

Freckled Duck About 200 birds were present on Back and Clear Lakes in the middle of the year, coinciding with the second flood; they had left by mid August when the water level was low.

Pink-eared Duck Numbers in the Nature Reserve built up early in the year and peaked at 6000 in early May.

Great Crested Grebe Two birds were present in flooded lignum at Clear Lake in February but apparently left without breeding.

Marsh Sandpiper Seventy birds were seen feeding on mudflats among lignum north of Back Lake in March; 200 were present with many Sharp-tailed Sandpipers and a few Curlew Sandpipers on exposed mud and in shallow water at Back and Clear Lakes in late October.

Sharp-tailed Sandpiper Two thousand were seen at Back and Clear Lakes in late October.

Black-winged Stilt Three hundred birds were counted on Clear Lake in December.

Red-necked Avocet The highest count was 930 at Clear Lake during December.

Birds on Narran Lake, December 1996

A breeding colony containing about 500 Straw-necked Ibis nests, 100 Australian White Ibis nests and 100 Royal Spoonbill nests was active in the channelised lignum where the Narran River enters the lake. The only indication of the stage of breeding was that some of the ibis nests contained large young. About 200 nests of Little Black Cormorants were in River Red Gums lining the channels. About 10 nests of Magpie Geese and many nests of Black Swans were in emergent vegetation in the lake next to the mouth of the river. A colony of Australian Pelicans was present on a rise on the southern shore of the lake. It is not known whether this was an island when the water level was higher. About 500 pairs were nesting and, while some were probably incubating, many large young were present.

Very large numbers of birds were present around the lake on extensive mudflats and shallows exposed by the falling water level. The most numerous species, each present in thousands, were: Australian Pelican; Black Swan; terns, particularly Whiskered but also many Gull-billed; small waders; and most numerous of all, ducks, mainly the Pink-eared Duck, Grey Teal and Australian Wood Duck. A single pair of Brolgas was present on the mudflats. The estimated total population was 50 000 but, given a tendency to underestimate numbers when many birds are present (Kingsford 1995), there may have been many more.

Discussion

During the Murray-Darling Basin Waterbird Project, run by the Southern N.S.W. and A.C.T. Group of Birds Australia between 1994 and 1996, the Narran wetlands was one of the most highly ranked sites for species diversity, number of breeding species and total number of birds (M. Hutchison pers. comm.). In his aerial surveys of wetlands in arid Australia, Kingsford (1995) made only two counts of waterbirds exceeding 100 000 birds and only one, at Lake Eyre North, had more birds than were supported by the Narran Lake Nature Reserve in 1996. With more than 200 000 birds present in 1996, Narran Lake is highly ranked in world listings: very few wetlands support more than 50 000 birds (M. Hutchison pers. comm.).

The Narran Lake Nature Reserve is especially important for the breeding of several species. The Straw-necked Ibis colony at the Nature Reserve is the largest reported anywhere, with 200 000 pairs present in 1983. This was a mixed colony with Australian White Ibis, but was presumably overwhelmingly composed of Straw-necked Ibis. Only one other colony (150 000 pairs at Bool Lagoon in South Australia) has exceeded the 102 000 pairs at the Nature Reserve in 1996 (Marchant & Higgins 1990). The 1983 count was originally published incorrectly as 400 000 nests of Straw-necked and Australian White Ibis combined (Lindsey 1985) and the error was subsequently repeated (Marchant & Higgins 1990, del Hoyo et al. 1992). The colony of Little Black Cormorants recorded in 1996 was the largest recorded from the Nature Reserve and contained more than twice as many breeding pairs as the largest colony reported by Marchant & Higgins (1990). The Nature Reserve is also a major breeding site for Royal Spoonbills. Marchant & Higgins (1990) reported only six breeding localities for this spoonbill in New South Wales, with the most nests anywhere being at least 80 at the estuary of the Flinders River in Queensland.

It is unclear why large-scale breeding did not take place after the second 1996 flood in the Nature Reserve, although the rapid fall in the water level (25 cm in two weeks after mid June) may have been a factor. That the second flood occurred in mid winter may also have militated against the resumption of breeding. Straw-necked Ibis attempting to breed in the Nature Reserve during winter in 1989 and 1990 were mostly unsuccessful, despite high water levels (Magrath 1991).

Previous colonies of Straw-necked Ibis at the Nature Reserve have been in the same general area as the colony of 1996, although the precise locations have varied. Previous cormorant colonies have been recorded in River Red Gums along the eastern edge of Back Lake (Magrath 1991) where the large Little Black Cormorant colony formed in 1996. The mixed colonies along the western edge and in the eastern corner of Clear Lake have not previously been documented.

The composition of mixed colonies of waterbirds at Narran Lake Nature Reserve varies between breeding events. The colony observed by Beruldsen (1985) also contained Intermediate and Little Egrets, Little Pied Cormorants, Nankeen Night Herons and Australian Pelicans. With the exception of Australian Pelican, these species were either absent or very scarce here in 1996, although they all nested at the Gwydir wetlands west of Moree, N.S.W., between January and April in association with large numbers of Straw-necked Ibis and smaller numbers of Australian White and Glossy Ibis, Great Egrets and Royal Spoonbills (pers. obs.).

In waterbird colonies in River Red Gums along the Murrumbidgee River and elsewhere, in wetlands lacking lignum, both Australian White Ibis and Royal Spoonbills nested in living River Red Gums, while Great Cormorants mainly chose large dead trees (Briggs & Thornton 1995). At Narran Lake Nature Reserve, the two former species nested exclusively on lignum, although River Red Gums were available, while Great Cormorants, in the absence of many dead trees, nested mainly in River Coobas and sapling River Red Gums, although a few nests were on fallen dead timber. In 1996, Australian White Ibis nested in River Coobas at the Gwydir wetlands (pers. obs.) but did not use these as nest-sites at Narran Lake Nature Reserve. Briggs et al. (1993) noted that most colonially nesting waterbird species preferred trees adjacent to open water, and suggested that the absence of trees indicated water of sufficient depth to last at least long enough to allow young to fledge. The trees chosen as nest-sites at the Nature Reserve were generally in or near the open water of Back and Clear Lakes, so the same factor may apply. An alternative explanation for some species, including Pied Cormorant, may be that the birds have difficulty taking off from the nest and become airborne by jumping into the water and taking off from there. Pied Cormorants require three or four jumps to take off from level ground and up to 10 m or more to take flight from water (Johnsgard 1993).

While bird activity in the Narran Lake Nature Reserve is generally poorly documented, even less is known about the waterbirds of the rest of the wetlands to the south and west of the Nature Reserve. The numbers of waterbirds and the active colonies on Narran Lake during December emphasise the importance of considering the wetland as a whole: at the time of these observations the lakes in the Nature Reserve were virtually dry and supported few birds. Large numbers of birds were recorded from Narran Lake by Brooker (1993) who counted 39 243 individuals during an aerial survey in 1978. In 1978 a small nesting colony of less than 100 Glossy Ibis was recorded near where the Narran River enters the main lake (Brooker 1993), the site of a mixed colony in 1996. Other species previously recorded breeding on Narran Lake include Black Swan (J. Foster pers. comm.), Gull-billed Tern and Australian Pelican, which nested near the south-east corner of the lake on the walls of earth tanks isolated by floodwaters (G. Beruldsen pers. comm.).

Table 1

Waterbirds recorded from the Narran wetlands and of particular conservation concern in the Western Division of New South Wales (adapted from Smith et al. 1995).

A. Threatened species.

E = endangered, V = vulnerable, P = possibly threatened, S = probably secure.

Species	Status		
	Western Division N.S.W.	N.S.W.	Australia
Magpie Goose	E	V	S
Blue-billed Duck	P	S	S
Freckled Duck	P	P	P
Brolga	P	P	S
Latham's Snipe	P	S	S

B. Waterbirds breeding at the Narran wetlands with populations regarded as 'secure' but with restricted breeding distributions in the Western Division of New South Wales.

Great Crested Grebe
Darter
Pied Cormorant
Great Cormorant
Australian Pelican
Little Egret
Great Egret
Intermediate Egret
Nankeen Night Heron
Glossy Ibis
Australian White Ibis
Straw-necked Ibis
Royal Spoonbill
Gull-billed Tern

There has been a previous sighting of the Magpie Goose in the Narran wetlands (Clancy 1985) but the record in 1996 is the first breeding record for the species, which is classified as Vulnerable in New South Wales (Smith et al. 1995). The breeding birds were first seen in November (W. Dornbusch pers. comm.). Although the Magpie Goose had become extinct in New South Wales by early this century (Marchant & Higgins 1990), there have been recent breeding records in the Macquarie Marshes in 1983 (Clancy 1985), 1989 (Morris & Burton 1992) and 1990 (Burton & Morris 1993), and in the Gwydir wetlands in 1983 (Clancy 1985) and 1996 when at least eight nests (and over 200 birds) were seen (R. McCosker pers. comm.).

During aerial surveys, Brooker (1993) observed 'large numbers' of unidentified waders on mudflats at Narran Lake during summer and autumn 1978-79. Among the Palaearctic waders, all of which are covered by international treaties, he confirmed the presence of Common Greenshank and Sharp-tailed Sandpiper. Both species had previously been recorded from the Nature Reserve along with Black-tailed Godwit, Bar-tailed Godwit and Marsh Sandpiper (Smith 1993). The 1996 counts of Marsh Sandpipers and Sharp-tailed Sandpipers in the Nature Reserve, new records of Latham's Snipe and Curlew Sandpiper, and the large numbers of small waders on Narran Lake in December confirm Brooker's (1993) suggestion that the Narran wetlands are important for Palaearctic waders. According to the criteria used by

Watkins (1993), and based on the 1996 counts of 2000 Sharp-tailed Sandpipers and of 200 Marsh Sandpipers, the Narran wetlands comprise a site of national and international importance for waders. Other species recorded in the Nature Reserve and covered by international treaties are Caspian Tern, Great Egret, White-bellied Sea-Eagle and Glossy Ibis.

The Narran wetlands are also important for Australian waders: the large numbers of Black-winged Stilts and Red-necked Avocets recorded during 1996 in the Nature Reserve and by Brooker (1993) on Narran Lake, and counts of Red-kneed Dotterels in 1981 (Brooker 1993) and 1996 suggest that the Narran wetlands may be a site of national and international importance for these species (Watkins 1993).

Five of the species occurring in the Nature Reserve and in the wider Narran wetlands are of 'conservation concern' in the Western Division of New South Wales and 14 of the breeding species have restricted breeding distributions in the Western Division (Smith et al. 1995) (see Table 1). The length of this list emphasises the importance of the Narran wetlands on a regional, state and national level.

The Narran Lake wetland system is of national and probably international importance. It is a major waterbird breeding site which is not well documented. It assumes a special significance given its relatively unspoilt condition compared with some other wetlands in western New South Wales and nationally, such as the Macquarie Marshes (Kingsford & Thomas 1995). It would be tragic if it is allowed to decline. It is important to document the interactions between the Narran Lake Nature Reserve, the rest of the Narran Lake wetland, and other regionally important wetlands — the Gwydir wetlands and the Macquarie Marshes. All are under serious threat from changes to hydrology in their catchments (Kingsford & Thomas 1995). Further investigation will enhance the already documented importance of the Narran Lake area. Only by knowing what we have can we argue authoritatively for the preservation of the environmental values in the face of increasing pressures for expanded development for irrigated agriculture.

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Appendix 1

Waterbirds recorded from the Narran wetlands. Based on observations during 1996, and on the list published by Smith (1993), which contained species from the families Podicipedidae, Phalacrocoracidae, Anhingidae, Pelecanidae, Ardeidae, Gruidae, Threskiornithidae (previously Plataleidae), Anatidae, Rallidae, Charadriidae, Scolopacidae, Rostratulidae, Recurvirostridae and Laridae; to these have been added Glareolidae and the more-or-less aquatic members of the Accipitridae.

Species		Recorded 1996	Breeding 1996	Previous breeding
Magpie Goose	<i>Anseranas semipalmata</i>	+	+	
Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>			
Blue-billed Duck	<i>Oxyura australis</i>			+
Musk Duck	<i>Biziura lobata</i>	+		+
Freckled Duck	<i>Stictonetta naevosa</i>	+		+
Black Swan	<i>Cygnus atratus</i>	+	+	+
Australian Wood Duck	<i>Chenonetta jubata</i>	+	+	+
Pacific Black Duck	<i>Anas superciliosa</i>	+		+
Australasian Shoveler	<i>Anas rhynchos</i>	+		+
Grey Teal	<i>Anas gracilis</i>	+		+
Chestnut Teal	<i>Anas castanea</i>	+		
Pink-eared Duck	<i>Malacorhynchus membranaceus</i>	+	+	+
Hardhead	<i>Aythya australis</i>	+		+
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>	+		
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	+	+	
Great Crested Grebe	<i>Podiceps cristatus</i>	+		
Darter	<i>Anhinga melanogaster</i>	+	+	+
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	+		+
Pied Cormorant	<i>Phalacrocorax varius</i>	+	+	+
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	+	+	+

Appendix 1 continued

Species		Recorded 1996	Breeding 1996	Previous breeding
Great Cormorant	<i>Phalacrocorax carbo</i>	+	+	+
Australian Pelican	<i>Pelecanus conspicillatus</i>	+	+	+
White-faced Heron	<i>Egretta novaehollandiae</i>	+		+
Little Egret	<i>Egretta garzetta</i>			
White-necked Heron	<i>Ardea pacifica</i>	+		+
Great Egret	<i>Ardea alba</i>	+	+	+
Intermediate Egret	<i>Ardea intermedia</i>	+		+
Cattle Egret	<i>Ardea ibis</i>			
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	+		+
Glossy Ibis	<i>Plegadis falcinellus</i>	+	+	+
Australian White Ibis	<i>Threskiornis molucca</i>	+	+	+
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	+	+	+
Royal Spoonbill	<i>Platalea regia</i>	+	+	+
Yellow-billed Spoonbill	<i>Platalea flavipes</i>	+	+	+
Whistling Kite	<i>Haliastur spheerulus</i>	+	+	
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	+		
Swamp Harrier	<i>Circus approximans</i>	+		
Brolga	<i>Grus rubicunda</i>	+		
Australian Spotted Crane	<i>Porzana fluminea</i>	+		
Purple Swamphen	<i>Porphyrio porphyrio</i>	+		+
Dusky Moorhen	<i>Gallinula tenebrosa</i>	+		+
Black-tailed Native-hen	<i>Gallinula ventralis</i>	+		+
Eurasian Coot	<i>Fulica atra</i>	+		+
Latham's Snipe	<i>Gallinago hardwickii</i>	+		
Black-tailed Godwit	<i>Limosa limosa</i>			
Bar-tailed Godwit	<i>Limosa lapponica</i>			
Marsh Sandpiper	<i>Tringa stagnatilis</i>	+		
Common Greenshank	<i>Tringa nebularia</i>	+		
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	+		
Curlew Sandpiper	<i>Calidris ferruginea</i>	+		
Black-winged Stilt	<i>Himantopus himantopus</i>	+		+
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	+		
Red-capped Plover	<i>Charadrius ruficapillus</i>	+	+	
Black-fronted Dotterel	<i>Elsayornis melanops</i>	+	+	+
Red-kneed Dotterel	<i>Erythronyx cinctus</i>	+	+	+
Banded Lapwing	<i>Vanellus tricolor</i>	+	+	+
Masked Lapwing	<i>Vanellus miles</i>	+	+	+
Australian Pratincole	<i>Stiltia isabella</i>	+		
Silver Gull	<i>Larus novaehollandiae</i>	+		
Gull-billed Tern	<i>Sterna nilotica</i>	+		+
Caspian Tern	<i>Sterna caspia</i>	+		
Whiskered Tern	<i>Chlidonias hybridus</i>	+		

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The Response of Waterbirds to the 1997 Flood in the Narran Lake Nature Reserve, New South Wales

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Summary

The occurrence and breeding of waterbirds in the Narran Lake Nature Reserve were documented during 1997. The wetlands in the Nature Reserve flooded in March, but only nine species of waterbirds bred there, and only in small numbers. This was in marked contrast with the major breeding event which followed the flood of early 1996, which involved 18 species, some of which bred in very large numbers. The Narran wetlands are of international importance and further monitoring is required to expand our knowledge of their use by waterbirds.

Introduction

The wetlands associated with Narran Lake, including the Narran Lake Nature Reserve, between Walgett and Brewarrina in the Western Division of New South Wales, have been described previously in an account of a major waterbird breeding event in the Nature Reserve in 1996 (Ley 1998). Within the Nature Reserve, the wetlands consist of two areas of open water, known as Back and Clear Lakes, which are connected by channelised lignum *Muehlenbeckia florulenta* and fringed by River Red Gums *Eucalyptus camaldulensis* and River Coobas *Acacia stenophylla*. This paper documents the use by waterbirds of the wetlands in the Nature Reserve during 1997, and contrasts this with the event of the previous year.

Methods

Eight visits were made to the Nature Reserve during 1997. During each visit the water level on the gauge at the northern edge of Back Lake was recorded, the numbers of waterbirds present were counted and all indications of breeding were noted. Observations were made with the aid of binoculars from a canoe, and from the shoreline using binoculars and a spotting scope.

Observations were extended to include a series of claypans and a small permanent waterbody, known locally as Salt Lake, which are just outside the Nature Reserve but which, because they flood when Back Lake overflows, are an integral part of the wetland.

Results

Water level

The wetlands in the Nature Reserve had dried out after being inundated twice in 1996. However, water began spreading out over the dry beds of Back and Clear Lakes during February; by late March the lakes were full, with the gauge at Back Lake reading over 1 m. The water level declined to 0.1 m on 1 July, and by early August the water had receded from the gauge.

The birds

Fifty-six species of waterbird were recorded during the year (Appendix 1), of which nine were confirmed as breeding, and one more possibly bred. Breeding was recorded as follows.

Hoary-headed Grebe Two broods of dependent young were seen in April.

Darter Active nests were observed during April, July and August, with a peak of 30 nests counted during April. Nesting may have been continuous during this period.

some birds were incubating at each visit, and large young were present in both July and August. Nests were at Back Lake in River Red Gums and River Coobas.

Little Pied Cormorant Several nests were active in early July, and a nest containing large young was observed in August. These nests were in River Coobas at Back Lake.

Pied Cormorant Twenty nests were active in mid April; the number of nests had increased to about 40 in July, and nesting continued in August. Nests were in a mixed colony with Great Cormorants, in River Coobas in the south-western corner of Clear Lake.

Great Cormorant Ten nests were observed in April, and about 50 were present in July; all were part of a mixed colony with Pied Cormorants.

Straw-necked Ibis A colony became established on trampled lignum between Back and Clear Lakes. Birds had begun to flatten the lignum in mid March, and 150 nests were present with incomplete clutches at the end of March. By mid April the colony was deserted and few ibis were seen anywhere in the wetland.

Yellow-billed Spoonbill Approximately 30 pairs bred. Nesting was under way in April, continued in July, and was almost complete in August, with only a few nests still active and containing almost fully grown young. The nests were in a loose colony in River Red Gums at Back Lake.

White-bellied Sea-Eagle A juvenile was present during the first half of the year during this time a large stick nest was built, probably by this species, in a River Red Gum at Clear Lake, but may not have been used. Breeding remains unconfirmed.

Brolga A pair with one dependent young was present at Salt Lake in February.

Banded Lapwing A nest with four eggs was observed on open ground north of the wetland during August.

Discussion

The small scale of waterbird breeding in the Narran Lake Nature Reserve in 1997 was in marked contrast with the breeding event of the previous year (Ley 1998). Only nine species bred in 1997, compared with 18 in 1996, and the scale of the breeding event was greatly reduced for most of the colonial species. Only small numbers of Pied and Great Cormorants bred in 1997, compared with the major colonies present in 1996, while Little Black Cormorants, Great Egrets, Glossy and Australian White Ibis, and Royal Spoonbills did not breed there at all in 1997. Most notably, only a few pairs of Straw-necked Ibis attempted to breed in 1997 and all were unsuccessful. 102 000 pairs were present in 1996. In contrast, a few pairs of Little Pied Cormorants bred in 1997; this species was virtually absent and did not breed the previous year.

Apart from the colonially breeding species, populations of individual species which varied markedly between the two years included the Freckled Duck, only three of which were recorded in 1997, compared with 200 in 1996; and the Pink-eared Duck, with a peak of 230 counted in 1997, compared with 6000 in 1996. High counts in 1997 included 1500 Pacific Black Ducks in a loose flock at Clear Lake in July, 800 Black-winged Stilts at Clear Lake in November, and 900 Whiskered Terns flying back and forth between Clear Lake and Salt Lake, also in November. A flock of 100 Black-tailed Godwits present in March was a larger group than had previously been seen at the wetland (Brooker 1993, M. Maher pers. comm.).

The colonies of 1997 were in more-or-less the same places as those of 1996, but were much less extensive. The mixed colony of Pied and Great Cormorants at Clear Lake and the nests of Darters at Back Lake were in some of the same trees which had been used the year before; the loose colony of Yellow-billed Spoonbills at Back

Lake was in River Red Gums which had been used by Little Black Cormorants and other species in 1996; the abortive Straw-necked Ibis nesting attempt took place very near where the large ibis colony had first formed in 1996.

During 1997 one species, the White-winged Black Tern, was added to the list of waterbirds recorded from the Narran wetlands (Ley 1998), taking the total to 63. Of the 56 species recorded during 1997, five were not recorded during 1996 despite the extensive waterbird activity in that year. These were Plumed Whistling-Duck, Blue-billed Duck, Little Egret, Black-tailed Godwit and White-winged Black Tern.

The presence of large numbers of Black-tailed Godwits and White-winged Black Terns emphasises the importance of the Narran wetlands, both on a national and international basis. Both species, which were probably in transit to the Northern Hemisphere when they were seen in the Nature Reserve in late March, are covered by international treaties (Japan-Australia Migratory Birds Agreement and China-Australia Migratory Birds Agreement) to which Australia is a signatory, and which require the parties to 'preserve and enhance' the environment of the listed species. In November 1997, the total of 500 Marsh Sandpipers (which are also covered by these treaties) constituted a nationally significant population (see Watkins 1993).

The importance of the Narran wetlands to species of conservation concern in the Western Division of New South Wales was also emphasised during 1997. The Blue-billed Duck, present in good numbers during the first half of the year is 'possibly threatened' in the Western Division, as is the Brolga (Smith et al. 1995), which was confirmed as a breeding species in the wetlands during 1997.

The wetlands associated with Narran Lake are a major site for waterbirds in New South Wales and Australia, and their importance will be emphasised by further investigation. Although the Narran Lake Nature Reserve possibly encompasses the major waterbird breeding sites in the wetland, it is important that future monitoring should document waterbird use of the Narran Lake system as a whole, as well as its relationship with other major wetlands of the region, including the Macquarie Marshes and the Gwydir Wetlands.

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