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MANAGEMENT OF RIVER RED GUMS FOR WATERBIRD NESTING

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In order to breed, waterbirds require appropriate sites for their nests. Most nests of waterbirds (families Pelecaniformes, Ciconiiformes) in River Red Gum wetlands were in clumps of live, mature trees next to open water. Often these Red Gums had branches leaning over the water. Retention of these nest trees is essential for waterbird conservation. The Red Gum wetlands of the Murrumbidgee River, which contain more mature trees than the Millewa and associated Red Gum wetlands of the Murray River, provide extensive and valuable breeding habitat for waterbirds.

INTRODUCTION

To breed successfully waterbirds require: (i) suitable places in which to build their nest; and (ii) appropriate water regimes in feeding areas at the nest site or nearby. The aim of this paper is to describe the characteristics of River Red Gums *Eucalyptus camaldulensis* in which waterbirds in the families Pelecaniformes and Ciconiformes construct their nests. Specifically, the paper: (i) reports our observations on the characteristics of Red Gums in which waterbirds nested along the middle section of the Murrumbidgee River; (ii) synthesizes our results and those of others (Vestjens 1975; Chesterfield *et al.* 1984; Kahl 1988; Maher 1988, 1990; Lowe 1989; Magrath 1992) on the characteristics of Red Gums used as nest trees by waterbirds in the Murray Darling basin; and (iii) derives recommendations for managing River Red Gums for nesting waterbirds. Recommendations for managing water regimes in River Red Gum wetlands for waterbird

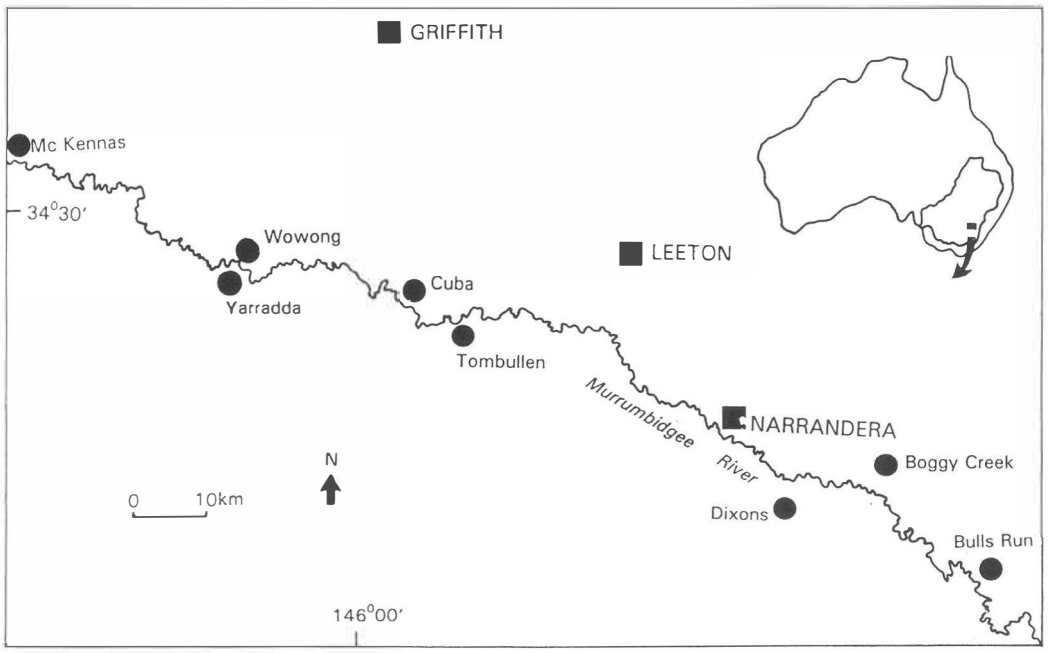

Figure 1. *Map of study sites in middle section of the Murrumbidgee River.*

breeding will be presented in a future paper (also see Briggs *et al.* 1994).

STUDY AREA AND METHODS

Twelve wetlands containing River Red Gums and open areas along the Murrumbidgee River between Wagga Wagga and Hay were surveyed for waterbird nests approximately every six weeks from July 1991 to January 1992, and from July 1993 to February 1994. The wetlands were flooded during these periods. The waterbirds of interest, in the families Pelecaniformes and Ciconiiformes, bred at eight (Table 1, Fig. 1) of the 12 surveyed wetlands.

In addition to our own observations on waterbirds nesting in Red Gums in the middle section of the Murrumbidgee River, we consulted primary sources of written information about characteristics of nest sites of waterbirds in Red Gums elsewhere in the Murray Darling basin (Fig. 2). We then checked our generalizations from these studies against the material reported in Marchant and Higgins (1990). Finally, we asked relevant experts to comment on the draft paper.

We subjectively classified River Red Gum trees in our study area in the middle Murrumbidgee into three categories: mature, pole and squat trees. Mature trees were large, spreading Red Gums of the type referred to by Forestry Commission of New South Wales (1986) as veteran. Pole trees were tall, straight trees without low branches, which are classed as pole, pile and mill trees by Forestry Commission of New South Wales (1986). Squat trees were small to medium sized trees, with low branches (the first branch was typically ≤4 m above ground level) and medium crown spread. Squat Red Gums do not conform with any of the classes listed in Forestry Commission of New South Wales (1986). Dimensions of typical mature, pole, and squat Red Gums in the study area are shown in Table 2. Scientific names of waterbirds referred to in the paper are listed in the Appendix.

RESULTS

Middle Murrumbidgee study

Darter, three species of cormorant, Pacific Heron, Great Egret, Australian White Ibis and Yellow-billed Spoonbill nested in sufficient numbers (>50 nests) at the middle Murrumbidgee study sites for the characteristics of their nest trees to be summarized. Fifty per cent of waterbird species (n = 8) breeding in the River Red Gum wetlands of the middle Murrumbidgee River built nests only in mature trees, and the rest nested in squat Red Gums as well as in mature ones (Table 3,

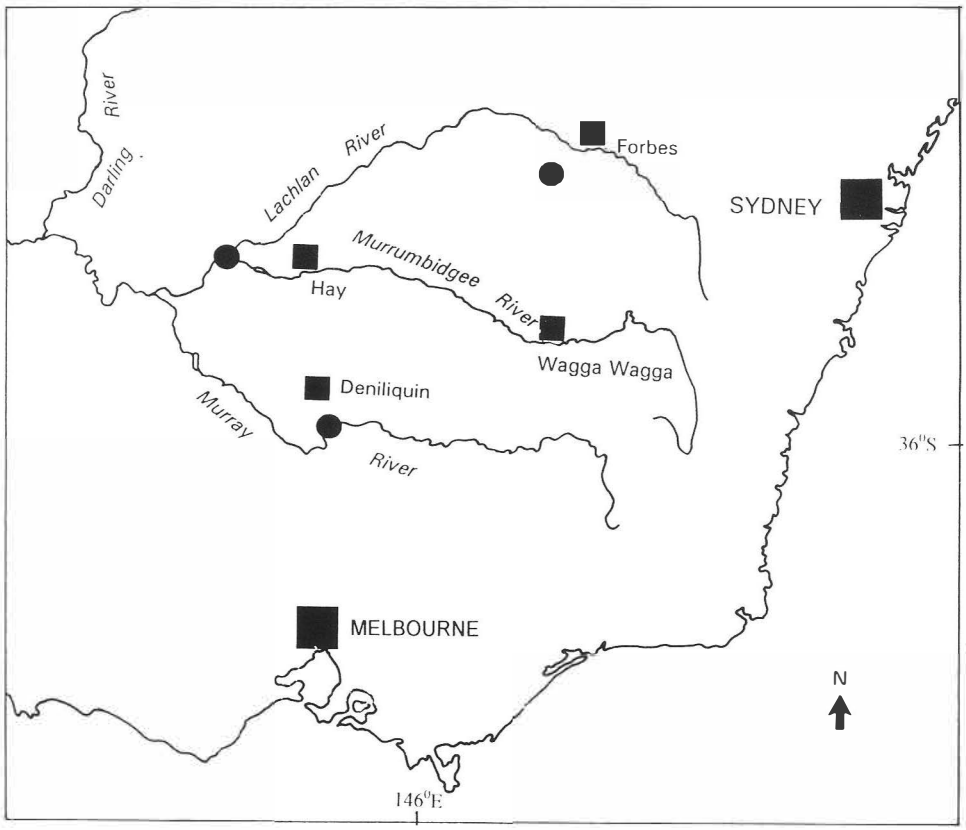

Figure 2. *Map showing locations (●) of other studies referred to in the text. From west to east the locations are the lower Lachlan and Murrumbidgee Rivers, the Murray River sites and Lake Cowal. The squares show the locations of towns.*

TABLE 1

Landforms and maximum inundated areas of the study wetlands where waterbirds nested in the middle section of the Murrumbidgee River. Locations are shown in Figure 1. Maximum inundated areas were determined by the methods given in Thornton and Briggs (1994). Gum refers to River Red Gum.

			Percentage		
Site	Landform	Area (ha)	Open Water	Live Gum	Dead Gum
Bulls Run	Depression	168	57	43	0
Boggy Creek	Spreading creek	83	52	46	2
Dixons	Dammed creek	242	2	71	27
Tombullen	Depression	309	48	1	51
Cuba	Oxbow lagoon	390	8	82	10
Wowong	Oxbow lagoon	256	0	100	0
Yarradda	Oxbow lagoon	297	16	84	0
McKennas	Oxbow lagoon	139	11	89	0

TABLE 2

Heights, crown widths, height: width ratios and diameters at breast height (DBH) ($\bar{X}$ ± S.D.) of River Red Gums in the middle section of the Murrumbidgee River. DBH, diameter of trunk at breast height. The trees were measured in June 1994.

Dimension (m)	Category of tree		
	Mature	Pole	Squat
n	23	22	13
Height	30±6	28±5	16±3
range	18–40	16–36	11–22
Width	28±5	9±4	9±2
range	19–35	4–15	5–12
Ht: Width	1.1±0.2	3.8±1.5	1.8±0.5
range	0.8–1.5	1.7–8.0	1.2–2.8
DBH	1.8±0.4	0.5±0.2	0.6±0.2
range	1.1–2.5	0.2–1.0	0.5–1.0

Fig. 3). No waterbirds nested in tall, straight Red Gums (pole trees). Five species invariably nested in live Red Gums, and all but one usually did so. Only Darter, Great Cormorant and Pacific Heron nested in dead trees. Except for a few nests of Great Cormorant, Pacific Heron and Yellow-billed Spoonbill, waterbird nests were always in trees adjacent to open water (see Fig. 3, and Briggs *et al.* 1993). Heights of nests in trees varied between species, with three species nesting low in trees, three species nesting high, and two species displaying no fixed preference (Table 3). The waterbirds which nested low in trees often nested on branches over flooded open areas (Fig. 3).

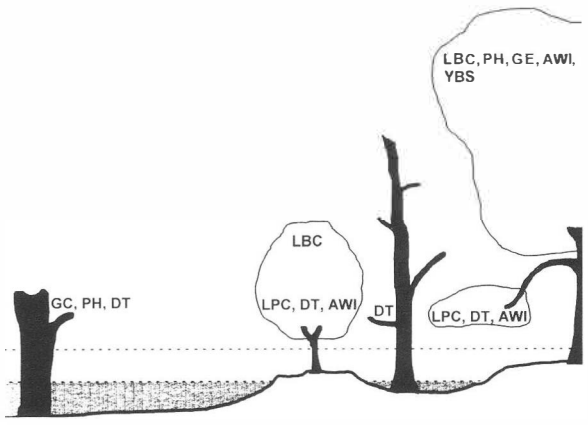

Figure 3. *Positions of nests, types of trees (mature, squat, live, dead), and locations of River Red Gums used by waterbirds as nest sites in the middle section of the Murrumbidgee River. The dead trees were originally mature trees. DT, Darter; GC, Great Cormorant; LBC, Little Black Cormorant; LPC, Little Pied Cormorant; PH, Pacific Heron; GE, Great Egret; AWI, Australian White Ibis; YBS, Yellow-billed Spoonbill. The shaded area shows permanent water. The dashed horizontal line is average flood height.*

Other studies

The results from the other studies extended the species list by providing information on characteristics of nest sites of White-faced Heron, Little Egret, Intermediate Egret, Rufous Night Heron and Royal Spoonbill in River Red Gums (Table 4). Results from all the studies showed

TABLE 3

Characteristics of River Red Gums used as nest trees by waterbirds in the middle section of the Murrumbidgee River in 1991/1992 and 1993/94, and relative heights of nests in the trees. All results are based on observations of >100 nests at ≥3 sites, except Great Egret (>100 nests at 2 sites) and Yellow-billed Spoonbill (>50 nests at 5 sites).

	Tree characteristics		
Waterbird species	Type[1]	Live/Dead	Nest height[2]
Darter	Mature, squat	Live, sometimes dead	Low
Great Cormorant	Mature	Dead	Low
Little Black Cormorant	Mature, squat	Live	High
Little Pied Cormorant	Mature, squat	Live	Low
Pacific Heron	Mature	Live, sometimes dead	High, low
Great Egret	Mature	Live	High
Aust. White Ibis	Squat, mature	Live	Low, high
Yellow-billed Spoonbill	Mature	Live	High

[1]Mature, approximately 20–40 m high; Squat, approximately 10–20 m high (see Table 2);
[2]Usual position of nest in tree; Low, ≤ 5 m; High > 5 m.

that 46 per cent of the waterbird species (n = 13) generally nested in mature Red Gums, while 54 per cent nested in both mature and squat trees (Table 4). All species except Darter, Great Cormorant and Pacific Heron always or virtually always nested in live trees. Nests of 38 per cent of waterbird species were low in trees, 31 per cent of species generally nested high, and 31 per cent of species showed no fixed height preference (Table 4).

DISCUSSION

The Red Gum wetlands of the middle and lower Murrumbidgee River are extensive (see Beck 1991; Thornton and Briggs 1994), and support large numbers of breeding waterbirds (Maher 1990; Magrath 1992). The State Forests of the Murrumbidgee River contain a higher proportion of mature River Red Gums than do the State Forests of the Murray River (Forestry Commission of New South Wales 1985, 1986). The value of the Murray Red Gum forests and associated wetlands for waterbird breeding has declined in the last 25 years (Chesterfield *et al.* 1984; Maher 1993). Maher (1993) noted that 'The Murrumbidgee and Lachlan wetlands now contain the majority of remaining colonies (of breeding waterbirds)'. The Red Gum wetlands in the middle section of the Murrumbidgee River (Wagga Wagga to Hay) cover 470 sq. km (Thornton and Briggs 1994), and Red Gum wetlands occupy approximately 450 sq. km in the Lowbidgee in the lower Murrumbidgee River (see Beck 1991). There are further areas of Red Gum between Hay and Maude, where the Lowbidgee starts, and outside the Lowbidgee between Maude and Balranald. Murrumbidgee wetlands appear to be an important, if undervalued resource for breeding waterbirds.

The requirements of waterbirds for certain types of nest trees have implications for silvicultural and water management of River Red Gum wetlands. Some recommendations for managing Red Gum wetlands for breeding waterbirds in the families Pelecaniformes and Ciconiiformes are as follows:

(i) Do not kill mature Red Gums adjoining open areas of temporarily or permanently inundated wetland by permanent flooding (more than 18 months of continuous water,

TABLE 4

Characteristics of River Red Gums used as nest trees by waterbirds in the middle section of the Murrumbidgee River, Lake Cowal (Lachlan River), lower Lachlan and lower Murrumbidgee Rivers, and Moira Lake, Gulpa Creek, and Barmah forest (Murray River). Data are from Vestjens (1975), Chesterfield *et al.* (1984), Kahl (1988), Lowe (1989), Maher (1988, 1990), Magrath (1992), Briggs *et al.* (1993), and this study. These characteristics are based on the substantial majority of records, checked against Marchant and Higgins (1990).

	Tree characteristics			
Waterbird species	Type[1]	Live/Dead	Nest height[2]	Location[3]
Darter	Mature, squat	Live, dead	Low	Adj OA, In OW
Great Cormorant	Mature	Dead, occasionally live	Low	In OW
Little Black Cormorant	Mature, squat	Live	High	Adj OA
Little Pied Cormorant	Mature, squat	Live	Low	Adj OA, In WD
Pacific Heron	Mature	Live, dead	High, low	Adj OA, In OW
White-faced Heron	Mature	Live	High, low	In WD, Adj OA
Great Egret	Mature, squat	Live	High	Adj OA
Little Egret	Squat, mature	Live	Low	Adj OA
Intermediate Egret	Squat, mature	Live	Low	Adj OA
Rufous Night Heron	Mature	Live	High, low	Adj OA
Aust. White Ibis	Squat, mature	Live	Low, high	Adj OA
Royal Spoonbill	Mature	Live	High, low	Adj OA
Yellow-billed Spoonbill	Mature	Live	High, low	Adj OA, In OW

[1]As stated by authors; Mature corresponds to Large; Squat corresponds to Small or Young;
[2]Usual position of nest in tree; Low, ≤ 5 m; High > 5 m;
[3]Location of nest tree; Adj OA, adjacent to open area which is temporarily or permanently inundated, nest tree is inundated during floods; In OW, standing in permanent open water; In WD, in woodland or forest away from open area, nest tree is inundated during floods.

Leitch 1989). Most waterbirds nest in live trees. Killing live Red Gums removes their breeding habitat.

(ii) Do not remove River Red Gums in which waterbirds nest. Pelecaniformes and Ciconiiformes build nests of sticks which stay in place in the tree for some months. Their nest trees can consequently be identified and marked.

(iii) Do not clear forest or woodland behind or adjacent to nest trees. Such hinterland trees provide a buffer area. Most nests in the middle Murrumbidgee were in Red Gums which had forest or woodland behind them (Fig. 4, also see Magrath 1992). Red Gum forest or woodland behind the nest trees can be selectively logged or thinned for commercial or management purposes. A buffer area should be left between nest trees of waterbirds that favour high tree densities (Rufous Night Heron, Intermediate and Little Egrets, see Magrath 1992) and logging or thinning operations.

(iv) Retain some squat Red Gums (short trees with low branches and a spreading habit) near current nest trees and adjacent to open water, even if they do not contain nests. As they mature these trees will replace currently mature Red Gums, which will eventually die.

(v) Consider managing some young Red Gums near current waterbird nest sites and adjacent to open water, so that they will become good nest trees for waterbirds in the future. To produce trees with spreading branches, Red Gums need to be thinned while young (sapling stage or smaller, see Forestry Commission of New South Wales 1986). The River Red Gums that are retained and managed to produce good nest trees for waterbirds in the future should be near current nest trees, because these sites are most likely to have sufficient durations of flooding (5–10 months, Briggs *et al.* 1994) for successful breeding.

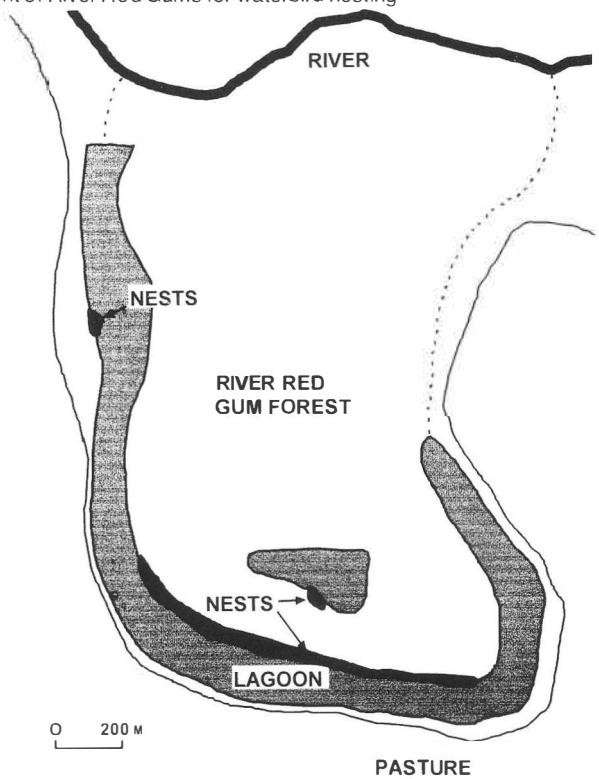

Figure 4. *Typical locations of waterbird nest sites on an oxbow lagoon. Note that most of the nests are in River Red Gums next to the open water which have extensive areas of River Red Gums behind.*

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APPENDIX 1

Scientific names of waterbirds referred to in text and tables.

Common name	Scientific name
Darter	*Anhinga melanogaster*
Great Cormorant	*Phalacrocorax carbo*
Little Black Cormorant	*P. sulcirostis*
Little Pied Cormorant	*P. melanoleucos*
Pacific Heron	*Ardea pacifica*
White-faced Heron	*A. novaehollandiae*
Great Egret	*Egretta alba*
Little Egret	*E. garzetta*
Intermediate Egret	*E. intermedia*
Rufous Night Heron	*Nycticorax caledonicus*
Australian White Ibis	*Threskiornis aethiopica*
Royal Spoonbill	*Platalea regia*
Yellow-billed Spoonbill	*P. flavipes*

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SURVIVAL OF BROWN AND STRIATED THORNBILLS IN THE BRINDABELLA RANGE, AUSTRALIAN CAPITAL TERRITORY

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Brown and Striated Thornbills were banded at New Chums Road in the Brindabella Range, Australian Capital Territory from 1961 to 1982. Both species appeared to be sedentary once they established territories although there is some indication that the territories of Striated Thornbills were held by small groups. The mean annual survival rate of adult Brown Thornbills was 59 per cent and Striated Thornbills 68 per cent. The oldest Brown Thornbill recaptured was 13 years and 7 months and the oldest Striated Thornbill was 15 years and 7 months.

INTRODUCTION

Compared with birds of north temperate regions, Australian passerines appear to have very different life histories. The limited data available to date indicate that Australian passerines produce small clutches (Woinarski 1985) and typically have low reproductive success (Robinson 1990). Compensating for this low productivity, they appear to be long-lived and exhibit high annual survival (Rowley and Russell 1991). However, there are relatively few published data on survival of Australian birds.

A banding study of the birds of the Brindabella Range, Australian Capital Territory, was conducted between April 1961 and 1982, initially to contribute to an understanding of movements of passerines (Lamm and Wilson 1966; Horey and Wilson 1971; Tidemann *et al.* 1988). The work commenced