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Conserving tropical waterbirds

Report prepared for NSW NPWS and submitted to ***eriss*** for information as part of a collaborative project on the conservation of tropical water birds.

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November 2000

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Conserving Tropical Waterbirds

A progress report prepared for the New South Wales National Parks and Wildlife Service

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Introduction

Information on these species is part of a project to asses causes of decline of tropical waterbirds in Australia, with special reference to the southern end of their distribution. In this study, we use a combination of literature review, field observation and mapping of historical and current atlas observations. Sources for map points include our own observations and those from the atlases of Birds Australia New South Wales National Parks and Wildlife Service, the Australian Museum and historical literature. We follow recommendations by Caughley and Gunn (1996) for procedures of assessing declines.

Following are brief summaries for four of the five species under study: Wandering Whistling Duck *Dendrocygna arcuata australis*, Magpie Goose *Anseranas semipalmata,* Comb-crested Jacana *Irediparra gallinacea* and Green Pygmy Goose *Nettapus coromandelianus*. These are meant to supplement information provided at the seminar at NSW NPWS on 23 November, 2000, and should be considered work in progress. Please do not quote them without permission from the authors.. The fifth species, the Black-necked Stork, *Ephippiorhyncos asiaticus*, is addressed in an article, enclosed, which is currently in press in *Emu.*

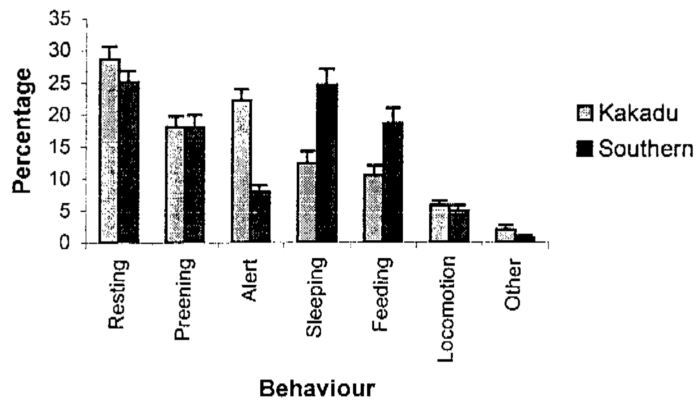
Eric Dorfman
23 November, 2000

Wandering Whistling Duck *Dendrocygna arcuata australis*

Since populations are scarce in New South Wales, we increased the robustness of our sampling by comparing aspects of this species' biology for 28 hours each in northern New South Wales/southern Queensland and Kakadu National Park. We studied somatic (non-breeding) behaviour and microhabitat use at 4 locations in Kakadu and 4 in New South Wales and Queensland.

Prior to 1900, this species was recorded throughout New South Wales and Victoria (Hall 1909), however its similarity with the more widely distributed Plumed Whistling Duck (*D. eytoni*) and its inconspicuousness make it difficult to determine the full extent of its range during this time. Market records for this species from the Clarence River region in the 1880s demonstrate its relative historic abundance. Atlases of the time noted regular breeding within this catchment whereas currently the species occur irregularly within this area, extending to 32°S primarily confined to coastal wetlands. Recent sighting of vagrants, however, in the Lower Murray-Darling catchments during the 1990s and at the Macquarie Marshes in 1998 suggest that the historical range has been markedly reduced.

Because populations of Wandering Whistling Ducks are scarce in south of their range in New South Wales, we compared somatic (non-breeding) behaviour and microhabitat use of populations in northern New South Wales/southern Queensland with the abundant population within Kakadu National Park (4 locations and 28 hours of observations in each study region).



Preliminary diurnal behaviour results for Wandering Whistling Ducks

It has been suggested that some Wandering Whistling Ducks move north during winter (Queensland Atlas) with reporting rates in eastern Queensland south of 25°S (summer 3.0%, winter 0.5%) and fluctuating populations may always have been present. However, the birds also move in response to rainfall, flooding and food (Morton *et al.* 1990). Initially, species decline may be attributed to a combination of over hunting, and habitat destruction (Frith 1967), however, the nests of the Wandering Whistling Duck consist a small depression in the ground screened by vegetation, beside swamps, making them extremely vulnerable to predation from introduced species such as foxes but also prone to trampling from grazing animals. The ongoing concern for this species and recognition of range decline over the last century has led us to consider recommending its inclusion as a vulnerable species in New South Wales.

Magpie Goose *Anseranas semipalmata*

Prior to European settlement in Australia, the Magpie Goose was spread throughout eastern and southern Australia and up to the 1900s there were breeding colonies located on the Clarence River in New South Wales, at Darlington and Westernport and Lake

Boga, Victoria, and at Bool Lagoon in South Australia as well as on inland swamps along the Lachlan, Murrumbidgee and Murray Rivers (Stone 1913, Frith 1967). By 1911 the species had vanished from Victoria and South Australia and soon afterwards from all other southern regions. This decline has been attributed to reasons including hunting, poisoning and habitat alteration for agriculture and by grazing animals (Frith and Davies 1961).

Currently, the species extends along the coast (up to 300km inland) from near Broome, Western Australia to approximately Brisbane. However, since the 1980s, small to moderate-sized flocks (<100) have begun establishing themselves on the estuarine swamps of coastal eastern Australia south to the lower Clarence River and erratically beyond with attempted breeding at the Macquarie Marshes and Seham, Newcastle (Clancy 1985, New South Wales Atlas). Magpie Geese have been successfully reintroduced to the Tower Hill Game Reserve, Serendip Sanctuary in Victoria, Bool Lagoon in south-eastern South Australia and Shortland Wetland Centre in New South Wales, and occasionally there are reports of hundreds of Geese residing on these and surrounding wetlands (Parker *et al.* 1985). The possibility of a natural range extension and the successful reintroduction of the species to the southern parts of Australia may result in a general long term increase in numbers to it former distribution.

Although the presumed increasing trend in southern parts of this species range appears favourable, noted declines and increases in the northern population during the period between 1958-1980 show that the species is still relatively unstable (Tulloch and McKean (1983). Hence, comparative data were collected on the threatened southern populations and non-threatened northern populations to determine differences in behavioural characteristics and micro-habitat use between the two areas. 30-35 hours of behavioural and microhabitat data were collected in northern New South Wales/southern Queensland and Kakadu National Park, at 4 locations in each region.

Cotton Pygmy Goose *Nettapus coromandelianus*

The Cotton Pygmy Goose, which appears to have been recently extirpated from New South Wales, may never have been abundant in the state. The New South Wales Atlas lists only eight sightings between 1971 and 1999. However, the closely related Green Pygmy Goose (*N. pulchellus*), which currently extends only as far south as about Rockhampton (Slater et al. 1989), was collected from Woolooware Bay, Sydney in 1910 (Hoskin 1991). This, coupled with early sightings by Gould (1865) of Cotton Pygmy Geese as far south as the Hunter River, strongly suggests a steady northward-moving restriction in range and a possible pre-European range of at least as far as Sydney. Sightings of vagrants in Victoria as recently as 1982 (Victorian Atlas) support the notion of a current range that is vastly reduced.

Because of the paucity of data available for this species, and because of the lack of animals in New South Wales, formation of a list of possible threatening processes requires concerted investigation of its natural history. To date, concerted effort to find Cotton Pygmy Geese in New South Wales has been fruitless. Therefore, this project will be conducted as an Honours degree at the University of Sydney, with the student (James Perry) traveling to Queensland to carry out investigations of microhabitat use and behaviour. These will be related to land use changes in New South Wales, to gain a better understanding as to possible reasons for decline. Insights thus far indicate that wetland draining is probably the most critical factor, although this was probably exacerbated by hunting during the 19th and early 20th Centuries.

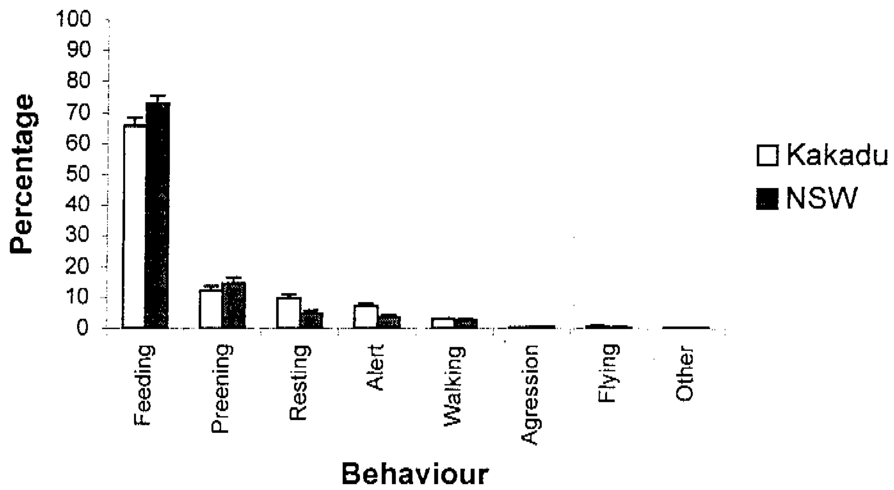
Comb-crested Jacana *Irediparra gallinacea*

Prior to 1900 only two records of this species had been recorded below 32°. Since 1900 however, the Comb-crested Jacana has been recorded as far south as Bilpin 33°S 150°E (1939) and the Hawkesbury River Region (1930-1950) (Aust. Atlas). Comb-crested Jacanas can move considerable distances to occupy recently flooded wetlands at beginning of wet season in the north (Crawford 1979) however, in the south extreme variations of climate can displace smaller populations permanently (Hinwood and Hoskin 1954). This species bred in the Hawkesbury

River region between 1930 and 1949, until drought in 1940 and flooding in 1949 decimated the population from which the population never recovered. Currently this species does not extend to the latitudes however the number of new records since 1900 suggests that habitat required for this species has increased with an increase in artificial impoundments (reservoirs and dams) with suitable floating vegetation.

In north-eastern New South Wales, Schodde and Manson (1996) noted that Jacanas were frequently found on water bodies with floating vegetation greater than 1-2ha. in surface area. All water bodies of less than 1 ha. lacked this species no matter the coverage of floating vegetation. This indicates minimum foraging range requirements in these areas.

The processes that shape population distribution for this species are still little understood hence, comparative data were collected on the threatened southern populations and non-threatened northern populations to determine differences in behavioural characteristics and microhabitat use between the two areas. 25-30 hours of behavioural and microhabitat data were collected in northern New South Wales/southern Queensland and Kakadu National Park, at 4 locations in region. Preliminary results are shown below. These will be related to threatening processes and land use changes in New South Wales, to gain a better understanding into the processes that have shaped historical and current population trends.



Comparison of behaviours between Kakadu and southern populations of the Comb-crested Jacana

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Foraging behaviour and success of Black-necked Storks *Ephippiorhynchus asiaticus* in Australia: implications for management

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The Black-necked Stork *Ephippiorhynchus asiaticus*, Australia's only species of stork, was once widespread throughout southeast Asia and Australia, and has more recently declined in or been extirpated from most of its world range (Kahn 1987). The species has been considered "quite secure" in Australia (Luthin 1987), however, since the 1980s the species has declined in the southern end of its range and is now listed as Endangered in New South Wales, and Rare in Queensland under the Threatened Species Conservation Act (1995). It is also scheduled to be gazetted globally as Near Threatened in the Upcoming Birds To Watch III, published by the World Conservation Union (IUCN; N. Collar, pers. comm.). The species currently ranges from India, Sri Lanka and South East Asia, South to Papua New Guinea and Australia. In many places, however, populations have reached critically low levels. For instance, in the Fly River Region of Papua New Guinea, as few as 13 individuals have been counted on a comprehensive survey (Gregory *et al.* 1996). Currently, the world's largest known population of Black-necked Storks resides in the Northern Territory, around the Alligator Rivers Region, including Kakadu National Park, with an estimated population of about 1800 birds (Morton *et al.* 1993). There are currently no subspecies recognised.

Despite Black-necked Storks' size (to 1.5m), ease of identification and sighting, importance as an icon wetland species and its conservation status, very little has been recorded of its natural history, leading to differing opinions about aspects of their biology. For instance, in Australia, Black-necked Storks are either said to be nomadic (Draffan *et al.* 1983), or to exhibit strong site fidelity (Salmon 1965; Morton *et al.* 1993). In addition, except for some information on diet (Crawford 1972; Barker and Vestjens 1984) and anecdotal observations of foraging (e.g. Kahl 1973; Whiting and Guinea 1999), the behaviour and habitat use of Black-necked Storks have largely escaped attention. This information is essential for conservation efforts, as it will help to identify key habitat components, potentially threatening processes and appropriate strategies for conservation (Caughley and Gunn 1996). In this paper, we gain insight into habitat requirements by describing foraging behaviour and success rates of Black-necked Storks in Kakadu National Park and one site in northern New South Wales. Because possible threats in Australia are poorly known, we also provide a selective review of threats to storks world-wide, to facilitate *a priori* hypotheses for further work on this species.

Study area and methods

Foraging Microhabitats and Behaviour

The initial design for this work included three sites in the Northern Territory, in Kakadu National Park, and three sites in northern New South Wales, to allow quantitative comparison between regions. This proved impossible, however, because storks were too clumped at sights within Kakadu, and too scarce in New South Wales. Observations for New South Wales are for the only individual found after two weeks of intensive ground searches as well as contact with local naturalists.

Foraging behaviours were recorded onto High 8 video at two sites (Yellow Water and Malabanjbanjdju) in Kakadu (13°00'S; 132°30'E; Fig. 1), and in Little Broadwater Swamp, New South Wales, (30°30'00''S; 153°03'00''E; Fig. 1). Yellow Water is a blind tributary of the South Alligator River system. Water depth varied between 0.5 and 3.0 m, and the shallows contained numerous snags and lush aquatic vegetation, including the water lilies *Nymphaea macrosperma* and *N. violacea.* Malabanjbanjdju Swamp, is an ephemeral wetland that was drying at the time of study. Its water was extremely turbid and shallow, ranging between 0.2 and 0.8 m in depth. Although reeds and sedges surrounded the swamp, the water's surface was clear of floating vegetation. Little Broadwater Swamp was a paperbark (*Melaleuca* sp.) between 0.1 and 0.5 m deep.

We counted 21 individuals in all areas during direct observations before and after recording (one at Little Broadwater Swamp, nine at Yellow Water and eleven at Malabanjbanjdju). A total of 292.3 minutes of observations was made on foraging storks. Storks were filmed at distances of between 80 and 150 metres, with a 200mm zoom lens and a 2x converter, between 7a.m. and 5 p.m. in November 1997 at Kakadu National Park and Little Broadwater Swamp in February 1998. Storks were filmed in a total 51 foraging bouts. A foraging bout was considered to be the length of time a stork remained foraging on tape. A bout was ended if the individual stopped foraging (e.g. to begin preening) or disappeared from view. The number of individuals recorded is not known because it was not possible to keep track of a stork after it had left the camera's field of view.

Analysis of Foraging Success

Behaviours were transcribed from video onto data sheets. "Aggression" was defined as an attempt to drive away another bird, irrespective of species, by threat or direct assault. "Foraging" was defined as an attempt to gather food, irrespective of the method of collection, or the type of prey.

During foraging, "strike" was any attempt by a stork to capture a prey item when the beak contacted the water, irrespective of success. Foraging was not observed on land. Successful strikes were "captures" where the prey was swallowed. The ratio "strikes/capture" was the basic unit of comparison among sites. This ratio was used instead of a measurement based on time (e.g. captures per minute), because handling time was highly variable, and depended on prey size. To avoid pseudoreplication, we made the assumption that the behaviour of all individuals within a given location was comparable, and did not perform statistical analyses on inter-individual differences within a location.

The individual at the Little Broadwater Swamp site was not successful at feeding during recording, so this observation was excluded from the analysis. Overall foraging success from the remaining two sites (n = 47 bouts at Malabanjbanjdju and n = 6 bouts at Yellow Water) were compared using a Student t-test. Data were bootstrapped prior to analysis to account for differences in sample size (99 bootstrap replications per site; bootstrap sample size = 3; see Efron and Tibshirani 1993 pp. 48 & 202).

Results

At Malabanjbanjdju, the level of aggression was high. Storks defended small depressions of deep water, presumably holding higher-densities of fish. They exhibited agonistic behaviour toward conspecifics, as well as Great and Intermediate Egrets *Egretta alba*; *E. intermedia* and Pied Herons *Ardea picata* by jabbing with their beaks and occasionally flapping their wings. Fish at this site were generally small < 10 cm, but identification was not possible.

Foraging rate at Yellow Water was slightly higher that at Malabanjbanjdju (an average of one strike every 12.5 seconds vs. one strike every 15.4 seconds, respectively). Storks at Malabanjbanjdju struck directly at prey, whereas storks at Yellow Water hunted by speculation, striking repeatedly in the water 10 to 20 times, apparently attempting to feel prey through chance encounter. Storks at Yellow Water commonly collected clumps of filamentous vegetation to sort on the shore for small fish.

Size of prey at Yellow Water and Little Broadwater Swamp was more varied, and often larger than those at Malabanjbanjdju. Although the individual at Little Broadwater Swamp was unsuccessful, for several minutes it attempted to consume a dead unidentified fish of approximately 35 cm length, before giving up. Storks at Yellow Water fed on eels, catfish and other large prey items. Despite only minor differences in strike rate, storks at Malabanjbanjdju were considerably more successful than those at Yellow Water (for bootstrapped data: Malabanjbanjdju: average = 89.54 strikes/capture, SE = 0.877, n = 99 foraging sessions; Yellow Water: average = 283.33 strikes/capture, SE = 12.118, n = 99 foraging sessions; $t = -7.982$; $df = 198$; $P < 0.001$; Figure 2). Because feeding Black-necked Storks were present at only two sites in this study, it was not possible to test the causes of the observed site-specific differences in foraging success.

Discussion

Individual Black-necked Storks probably travel regularly from Malabanjbanjdju to Yellow Water (25 km), and it is likely that there is nothing inherently different about the individuals there, suggesting that differences observed were due to the comparative ease of capturing fish in the two areas. Malabanjbanjdju was smaller, less complex, and more discrete area than Yellow Water, where fish had less opportunity to escape predation. The swamp was empty within a week of this study, so this condition would have increased.

The individual at Little Broadwater Swamp could have been unsuccessful because, being a juvenile, its inexperience reduced its foraging success. For instance, it may have been distracted by the dead fish that was too large to swallow. Productivity of the area was probably comparable to those in the Northern Territory, as evidenced by the approximately 200 breeding egrets *E. alba* and *E. intermedia* that were present at the wetland, but further a more complete comparison remains to be made.

Foraging behaviour of Black-necked Storks ranges from speculative hunting, observed in the American Wood Stork *Mycteria americana* (Kahl & Peacock 1963), to sorting through aquatic vegetation (this study) and chasing down large mobile prey such as grebes (G. Barrett pers. comm.) and sea turtle hatchlings (Whiting & Guinea 1999). This behavioural plasticity seems appropriate in light of the broad range of prey that Black-necked Storks consume (e.g. insects, fish including mullet, catfish and eels, tortoises, file snakes *Acrochordus* spp., small waterbirds and others, Barker & Vestjens 1989; Marchant and Higgins 1990; this study). The individuals observed in this study exhibited behaviours which are consistent with observations elsewhere (see review by Kahl 1973), although the high level of aggression as well as the variety of methods for locating fish have not been reported previously.

Implications for Management

Differences in foraging success at different locations suggest that not all sites are equally suitable for Black-necked Storks, and that loss of preferred foraging habitat could be a contributing factor in their decline. Vegetation characteristics have been demonstrated to influence distribution of Wood Storks (Cox 1991) and White Storks (Carrascal *et al.* 1993), and habitat loss has been strongly implicated in the decrease of a number of stork species globally (Table 1). The degree to which habitat fragmentation or loss might affect Black-necked Storks is related, in part, to their movements, about which almost nothing is known. Following individuals using satellite telemetry would greatly assist in conservation efforts.

Other factors are also likely to contribute to the decline of Black-necked Storks in Australia. Many of these have already been demonstrated to have contributed to the decline of other species of storks worldwide (Table 1), and any of these could effect Black-necked Storks in some part of their range. For instance, hunting poses a substantial threat to Asian Openbill and Greater Adjutant Storks, which overlap in range with Black-necked Storks (Table 1). Similarly, Asian Openbills are effected by human disturbance in Southeast Asia and India, and Black-necked storks could be as well. Additionally, power lines, a significant to populations of White Storks in Spain (Table 1), have been responsible for the deaths of several Black-necked Storks in New South Wales (G. Clancy pers. comm.; R. Kingsford pers comm.). Thus, all threats should be considered when planning management strategies, although some may be more important outside of Australia.

An additional threat to Australian Black-necked Storks is likely to come from the cane toad *Bufo marinus* which was introduced into Australia from South America in 1935. Cane toads are toxic to many Australian animals (Catling *et al.* 1999), and because the diet of Black-necked Storks includes frogs and toads (Barker and Vestjens 1989), cane toads' effect on Black-necked Storks is of concern. In addition, in the next few years, cane toads are likely to enter Kakadu National Park, potentially threatening what is likely to be the world's last healthy population of storks (Storrs and Finlayson 1997). The cane toad might also threaten the Black-necked Storks that remain in northern New South Wales (EJD and AL pers. obs.).

Modification of habitat has been severe in many areas where Black-necked Storks were once abundant. Cotton, sugar cane, bananas and non-cereal forage crops all utilise land that was once habitat for storks. Sugar cane alone has increased from 162,619 ha in 1920 (Light Railway Research Society of Australia, pers. com.) to 415, 000 ha in 1997 (Australian Bureau of Statistics 1999). In addition to reducing the cover of wetlands, intensive farming reduces the temporal and spatial heterogeneity of the landscape, and it may be the variability that creates sufficient rich patches for Black-necked Storks to forage. Wetland variability has been demonstrated to be of great importance to a variety of Australian waterbirds, including Pink-eared Ducks *Malacorhynchus membranaceus*, Grey Teal *Anas gracilis* (Kingsford 1996) and cormorants *Phalacrocorax* spp. (Dorfman and Kingsford in press). These species take advantage of 'boom' and 'bust' periods that occur naturally as part of the highly variably hydrological cycles in Australia (Kingsford *et al.* 1999).

Although the Australian Government recognises the existence of problems associated with natural resource management (e.g. Vaile 1999), decisive action will be needed to achieve any real conservation benefits.

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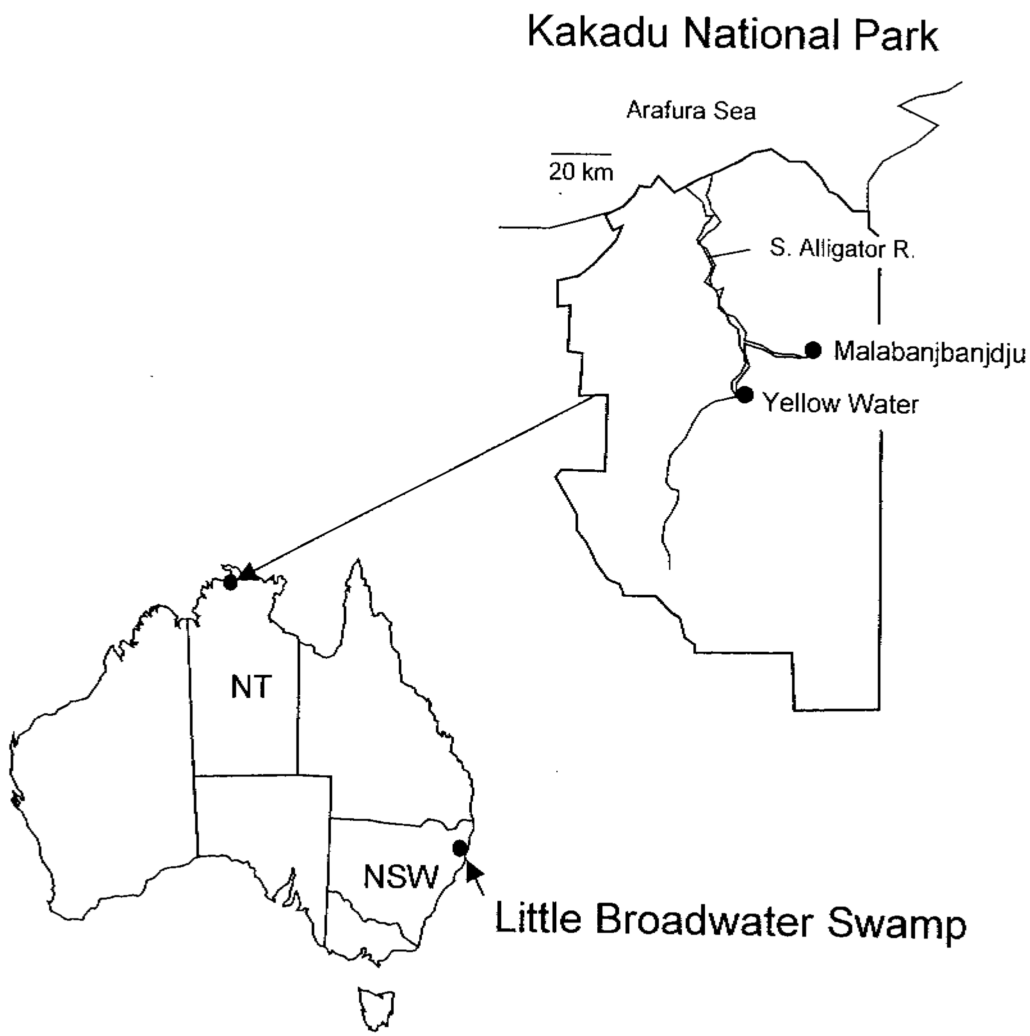

Kakadu National Park
Arafura Sea
20 km
S. Alligator R.
Malabanjbanjdju
Yellow Water
NT
NSW
Little Broadwater Swamp

Table 1 Potential threats to Black necked Storks, based on a selective review of literature for other species.

Potential Threat	Species Affected	Locality	Source	Comments
Drought	White Stork	Sahel region, Africa	Kanyamibwa *et al.* 1990	
	Wood Stork	Georgia, USA	Coulter and Bryan 1995	
Environmental Pollutants	Wood Stork	Florida, USA	Fleming *et al.* 1984.	Mercury and DDE present in eggs
Habitat loss or fragmentation	Black Stork	Europe, Russia	Luthin 1987	
	Greater Adjutant Stork	Bangladesh	Kahn 1987	
	Jabiru	Central America	Luthin 1987	
	White Stork	Western Europe	Luthin 1987, Carrascal *et al.* 1993	
	Wood Stork	Florida & Georgia, USA	Ogden and Patty 1981	
	Woolly-necked Stork	Thailand	Bain and Humphrey 1980	
Human disturbance	Asian Openbill Stork	Southeast Asia, India	Datta and Pal 1993	
Hunting	Greater Adjutant Stork	Bangladesh	Kahn 1987	
Parasites	Wood Stork	Florida & Georgia, USA	Snyder *et al.* 1984	*Dermestes nidum*: Coleoptera
Power lines	White Stork	Spain	Carrascal *et al.* 1993	
Predation	Wood Stork	Georgia, USA	Coulter and Bryan 1995	By raccoons *Procyon lotor*
Sea Level Rise	Wood Stork	South Carolina, USA	Daniels *et al.* 1993	
Temperature changes	White Stork	Spain	Carrascal *et al.* 1993	
	Wood Stork	Georgia, USA	Coulter and Bryan 1995	

Figure Caption.

Figure 1 Study sites in Kakadu National Park and New South Wales.