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Waterbirds: identification, rehabilitation and management

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Abstract

All waterbirds and other bird species associated with wetlands, are described including how habitats are used at ephemeral and permanent wetlands in the south east of Australia. Wetland habitat has declined substantially since European settlement. Although no waterbird species have gone extinct as a result some are now listed as endangered. Reedbeds are taken as an example of how wetlands can be managed.

Introduction

Australia has a unique suite of waterbirds, many of which are endemic to this, the driest inhabited continent on earth, or to the Australasian region with Australia being the main stronghold for the species. Despite extensive losses of wetlands across the continent since European settlement no extinctions of waterbirds have been recorded from the Australian mainland as a consequence. However, there have been some dramatic declines in many populations and several species are now listed as threatened including the Australasian Bittern, *Botaurus poiciloptilus* (nationally endangered).

It is clear that a serious attempt is needed to protect and restore our key wetlands systems at a time when climatic changes are taking place and increasing pressure is put on land use. It is heartening that the River Murray-Darling to the sea has recently been listed as a nationally protected ecological community.

The report focuses on south-east Australia and particularly on urban environments. It should be noted, however, that some species are highly mobile, particularly during droughts when there are inevitable movements between inland wetlands and coastal drought refuges. As a result there can be essential links to wetlands across Australia for these species. For example, local populations of waterfowl in Australia are highly variable, dependent on rainfall and food supply. During periods of drought huge numbers of waterbirds might descend on coastal wetlands that provide a drought refuge. The number of suitable refuges has declined since European settlement, with many permanent swamps and lakes being drained for agricultural use.

Approximately 14 families of birds regularly associate with wetlands for one or more stages of their life cycle, and most are completely dependent on wetlands for survival.

Brief Description of Australian waterbirds

Podicipedidae – grebes

The three species of grebes in Australia are completely dependent on wetlands. They are almost incapable of walking on land other than to shuffle between their floating nest and the water. They prefer relatively deep water bodies but in the case of the Australasian Grebe and Hoary-headed Grebe are often found in quite small areas of water

such as farm dams and ponds. In contrast, the Great-crested Grebe is usually associated with large lakes and deep reservoirs.

The legs of grebes are set far back on the body making them very efficient swimmers. They forage almost completely underwater pursuing fish and aquatic arthropods such as insects and crustaceans. They are strong fliers but are poor at manoeuvring in flight and generally prefer to dive underwater to escape avian predators or when disturbed by humans. Flights between wetlands, some times over great distances, are carried out under the cover of darkness when it is safe from attack by most birds of prey.

Grebes make a floating nest from aquatic plant material and usually anchor this to emergent or floating water plants to prevent it from moving with water flows or wind. The grebes' eggs are camouflaged but the birds cover them with plant material from the nest when departing for better protection.

Pelecanidae – Pelicans

The Australian Pelican is nomadic and subject to wide and erratic fluctuations in populations. The species is associated with large breeding events at ephemeral wetlands of inland Australia, often flying great distances to reach an area just when conditions are right to breed. It is important that peak conditions occur when the birds are feeding their young to ensure survival. Occasionally the wetland dries up earlier than the birds anticipate, in which case the birds abandon their eggs or young and leave for more permanent wetlands, often on the coast. Such major breeding failures are more likely to occur as a result of human interference with river flows by water extraction creating conditions birds cannot understand or adjust for.

Some birds that took to the coast during drought events are now permanently established there and nest regularly on offshore islands, an example being the Five Islands off Wollongong in NSW. Pelicans are now a familiar sight waiting for handouts from returning fishermen at boat ramps or fish co-ops along the coast, or in city parks.

Nests vary from a mere scrape on the ground using whatever material is on hand to line the nest, to an elaborate construction of sticks, grass, leaves, feathers or even carcasses of dead birds from past failed breeding events. Nests may also be built in bushes or lignum at inland wetlands.

Table 2.9.1. Australian waterbirds.

Family	Scientific name	English name
Anseranatidae	<i>Anseranas semipalmata</i>	Magpie Goose
Anatidae	<i>Dendrocygna eytoni</i>	Plumed Whistling-Duck
Anatidae	<i>Dendrocygna arcuata</i>	Wandering Whistling-Duck
Anatidae	<i>Biziura lobata</i>	Musk Duck
Anatidae	<i>Stictonetta naevosa</i>	Freckled Duck
Anatidae	<i>Cereopsis novaehollandiae</i>	Cape Barren Goose
Anatidae	<i>Cygnus atratus</i>	Black Swan
Anatidae	<i>Tadorna radjah</i>	Radjah Shelduck
Anatidae	<i>Tadorna tadornoides</i>	Australian Shelduck
Anatidae	<i>Chenonetta jubata</i>	Australian Wood Duck
Anatidae	<i>Malacorhynchus membranaceus</i>	Pink-eared Duck
Anatidae	<i>Nettapus coromandelianus</i>	Cotton Pygmy-goose
Anatidae	<i>Nettapus pulchellus</i>	Green Pygmy-goose
Anatidae	<i>Anas querquedula</i>	Garganey
Anatidae	<i>Anas rhynchotis</i>	Australasian Shoveler
Anatidae	<i>Anas gracilis</i>	Grey Teal
Anatidae	<i>Anas castanea</i>	Chestnut Teal
Anatidae	<i>Anas platyrhynchos</i>	Mallard
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck
Anatidae	<i>Aythya australis</i>	Hardhead
Anatidae	<i>Oxyura australis</i>	Blue-billed Duck
Podicipedidae	<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
Podicipedidae	<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe
Podicipedidae	<i>Podiceps cristatus</i>	Great Crested Grebe
Anhingidae	<i>Anhinga novaehollandiae</i>	Australasian Darter
Phalacrocoracidae	<i>Microcarbo melanoleucos</i>	Little Pied Cormorant
Phalacrocoracidae	<i>Phalacrocorax carbo</i>	Great Cormorant
Phalacrocoracidae	<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant
Phalacrocoracidae	<i>Phalacrocorax varius</i>	Pied Cormorant
Phalacrocoracidae	<i>Phalacrocorax fuscescens</i>	Black-faced Cormorant
Pelecanidae	<i>Pelecanus conspicillatus</i>	Australian pelican
Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork
Ardeidae	<i>Botaurus poiciloptilus</i>	Australasian Bittern
Ardeidae	<i>Ixobrychus dubius</i>	Australian Little Bittern
Ardeidae	<i>Ixobrychus flavicollis</i>	Black Bittern

Table 2.9.1. (cont.) Australian waterbirds.

Family	Scientific name	English name
Ardeidae	<i>Ardea pacifica</i>	White-necked Heron
Ardeidae	<i>Ardea modesta</i>	Eastern Great Egret
Ardeidae	<i>Ardea intermedia</i>	Intermediate Egret
Ardeidae	<i>Ardea sumatrana</i>	Great-billed Heron
Ardeidae	<i>Ardea ibis</i>	Cattle Egret
Ardeidae	<i>Butorides striata</i>	Striated Heron
Ardeidae	<i>Egretta picata</i>	Pied Heron
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron
Ardeidae	<i>Egretta garzetta</i>	Little Egret
Ardeidae	<i>Egretta sacra</i>	Eastern Reef Egret
Ardeidae	<i>Nycticorax caledonicus</i>	Nankeen Night-Heron
Threskiornithidae	<i>Plegadis falcinellus</i>	Glossy Ibis
Threskiornithidae	<i>Threskiornis molucca</i>	Australian White Ibis
Threskiornithidae	<i>Threskiornis spinicollis</i>	Straw-necked Ibis
Threskiornithidae	<i>Platalea regia</i>	Royal Spoonbill
Threskiornithidae	<i>Platalea flavipes</i>	Yellow-billed Spoonbill
Gruidae	<i>Grus antigone</i>	Sarus Crane
Gruidae	<i>Grus rubicunda</i>	Brolga
Rallidae	<i>Porphyrio porphyrio</i>	Purple Swamphen
Rallidae	<i>Lewinia pectoralis</i>	Lewin's Rail
Rallidae	<i>Gallirallus philippensis</i>	Buff-banded Rail
Rallidae	<i>Porzana pusilla</i>	Baillon's Crake
Rallidae	<i>Porzana fluminea</i>	Australian Spotted Crake
Rallidae	<i>Porzana tabuensis</i>	Spotless Crake
Rallidae	<i>Tribonyx ventralis</i>	Black-tailed Native-hen
Rallidae	<i>Tribonyx mortierii</i>	Tasmanian Native-hen
Jacanidae	<i>Irediparra gallinacea</i>	Comb-crested Jacana
Laridae	<i>Hydroprogne caspia</i>	Caspian Tern
Laridae	<i>Chlidonias hybrida</i>	Whiskered Tern
Laridae	<i>Chroicocephalus novaehollandiae</i>	Silver Gull
Alcedinidae	<i>Ceyx azureus</i>	Azure Kingfisher
Alcedinidae	<i>Ceyx pusilla</i>	Little Kingfisher



Figure 2.9.1. Darter (*Anhinga novaehollandiae*).

The Australian Pelican feeds mainly on fish but also crustaceans and occasionally on amphibians, small birds or carrion. They are capable of long flights and may soar at 3000 m or more especially on afternoon thermals, giving them an ideal perspective of surrounding wetlands and food sources.

Anhingidae – Darters

Superficially darters are similar to cormorants and some taxonomists still include them within the Phalacrocoracidae. However darters differ from cormorants in many ways, including a long flexible neck that facilitates an extremely sudden forward thrust of the pointed, spear-like, bill used for spearing fish (Figure 2.9.1). The fish is then tossed into the air and swallowed. The simultaneous moulting of all flight feathers renders darters temporarily flightless for some weeks. Their pursuit of prey underwater is a more cautious behaviour than the rapid chasing of fish by cormorants. In flight the Darter is distinctive with a long thin neck and habit at times of soaring often at great heights.

Darters feed almost entirely on fish but may supplement their diet with small crustaceans and aquatic insects. They occur on extensive wetlands, rivers and lagoons as well as coastal bays and estuaries. Nests are built in

trees, usually over water, a flimsy platform of sticks and twigs often lined with leaves.

Phalacrocoracidae – Cormorants

Cormorants are characterised by their relatively long necks and bodies, webbed feet and slender hooked bill ideal for catching and retaining slippery fish (Figure 2.9.2). Four of the five species of cormorant that occur in south east Australia are mainly associated with inland wetlands and freshwater systems as well as coastal rivers, estuaries and bays. The fifth, the Black-faced Cormorant, is totally marine and restricted to the south coasts of Australia and is not covered here.

The four cormorant species covered are similar in behaviour and choice of feeding habitats. They all build substantial nests of sticks and twigs with a lining of leaves, usually in a tree in or over water. The Great Cormorant may also nest on the ground on small islands or on cliff ledges when breeding in coastal locations.

Cormorants are very accomplished fishers, feeding mainly on fish but opportunistically on crustaceans and amphibians. They are considered pests by many aquaculturists around the world who may have to erect protective nets over fishponds to protect their livelihood in extreme cases.

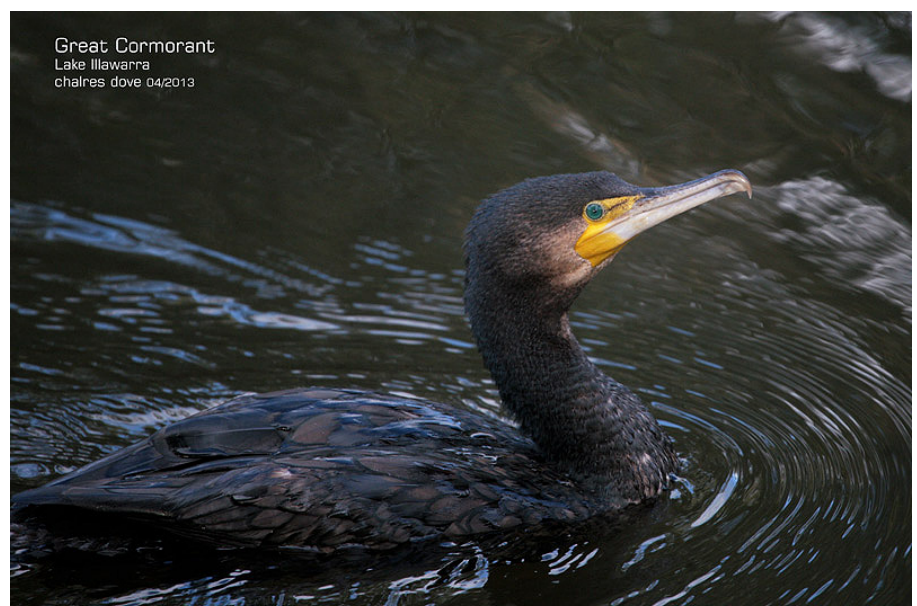


Figure 2.9.2. Great Cormorant (*Phalacrocorax carbo*).



Figure 2.9.3. Nankeen Night Heron (*Nycticorax caledonicus*).

Ardeidae - Herons, egrets and bitterns

Eleven species of herons, egrets and bitterns occur in south east Australia. Of these the 'herons and egrets' are conspicuous in their behaviour, often seen stalking prey in shallow water in a slow determined manner and suddenly darting at an aquatic animal with their dagger-like bill while straightening their long curved neck. The Little Egret (*Egretta garzetta*) is more energetic in its pursuit of prey and can often be seen chasing fish in an erratic fashion. This group includes the White-faced Heron (*Egretta novaehollandiae*), White-necked Heron (*Ardea pacifica*), Eastern Great Egret (*Ardea modesta*), Intermediate Egret (*Ardea intermedia*) and Little Egret.

Cattle Egrets (*Ardea ibis*) behave in a different way in that they spend much of their time associated with farm livestock waiting for terrestrial invertebrates to be disturbed by the grazing animals rather than hunting by wading in water.

Hérons and egrets generally build rather untidy, sometimes flimsy nests of sticks and twigs as a flat platform. Eggs are usually whitish in colour, quickly becoming soiled during incubation. Although sometimes solitary nesting these birds tend to nest in small to very large colonies often in association with other herons and egrets, cormorants, spoonbills and ibis, in any combination.

The Nankeen Night-Heron (*Nycticorax caledonicus*), as its name implies, tends to be crepuscular or nocturnal in behaviour spending the day roosting

communally in trees in or close to water. They also nest in colonies, in similar or the same location as the roost sites. The breeding season is mainly between September and April.

The Striated Heron (*Butorides striata*), also known as the Mangrove Heron, appears more like a bittern, especially in the streaked juvenile plumage, as it stalks prey along the edges of mangrove lined creeks or occasionally more prominently in the open at the water's edge in estuaries. The Australasian Bittern (*Botaurus poiciloptilus*)

and Australian Little Bittern (*Ixobrychus dubius*) frequent dense reedbeds, foraging along the edge of channels and areas of open water within the reedbeds. The Black Bittern on the other hand is associated more with mangrove-lined creeks and rivers around the coast of Australia.

Bitterns tend to be very cryptic and secretive birds, only very occasionally seen in the open. They feed on fish, amphibians or aquatic invertebrates found in or close to reed cover. Nesting is usually in a well-concealed location some distance in from the edge of a reedbed.

The decline in the numbers of Australasian Bittern is most likely due to degradation of their habitat as a result of drainage of wetlands and water extraction, which change the character of the reedbeds. It is not generally understood that bitterns and many other waterbirds require relatively deep free water within the reedbeds to allow passage of aquatic fauna on which they feed. Many areas of reeds are drying out in response to the disruption of natural water flows and a build up of dead and decaying reeds creating a dry land situation. This is often noticeable when trees and blackberries start appearing across the reedbeds. Reedbed management is important for protecting the Australasian Bittern and is discussed below.

Ciconiidae – Storks

The Australian subspecies of Black-necked Stork (*Ephippiorhynchus asiaticus australis*) is widespread in coastal and sub-coastal northern and eastern Australia as well as New Guinea. In NSW, the species becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney. Since 1995 the species has been recorded breeding as far south as Buladelah.

The Black-necked Stork is largely found on shallow permanent freshwater wetlands and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. It also occurs on adjacent grasslands and open savannah woodlands. The species also forages in estuaries along intertidal shorelines, including saltmarshes, mudflats and sandflats as well as mangrove vegetation. It feeds on a variety of prey, including eels and other fish, frogs, turtles, snakes, and invertebrates such as crabs and insects.

Nesting usually takes place between June and December, and clutches are usually present from May to September. Black-necked Storks usually nest in a tall, isolated trees, or lower shrubs within wetlands. The nest is a large platform, 1-2 m in diameter.

Threskiornithidae - Ibises and spoonbills

Despite the considerable difference in shape of bill between ibis and spoonbills they are sufficiently closely related to be included in the same family. Ibis and spoonbills often occur together in large numbers in the same colonies and at times with other waterbirds, such as cormorants or egrets.

Australian White Ibis (*Threskiornis molucca*) traditionally nest in large colonies at inland wetlands (usually in association with other waterbirds). However they are probably best known for their habit of foraging in public parks, either feeding in rubbish bins, taking handouts from people or helping themselves to food on unattended tables. It is not quite clear how these birds became acquainted with cities but one theory is that it all started with the release of birds from Taronga Zoo in Sydney. The species has now become well established in cities from Wollongong northwards to Townsville, including Coolangatta where it became a major threat to aircraft safety and numbers had to be controlled.

The city-dwelling birds initially looked for vegetation that resembled lignum used at many of the colonies in the interior of Australia (where

huge colonies form in good years). In the urban environment they have since taken to nesting in tall trees, in particular Phoenix Palms, in many city parks and more recently in casuarina and even Eucalypts (John Martin pers. com.).

The Straw-necked Ibis *Threskiornis spinicollis* is more terrestrial than the Australian White Ibis and is associated with grazing properties over much of Australia where it feeds on a wide variety of Arthropods. These birds are often referred to as 'the farmer's friend' due to their habit of descending on large swarms of locusts and other insect pests, much to the delight of farmers. Nesting takes place in large colonies, in association with Australian White Ibis at large inland wetlands when conditions are right.

The Glossy Ibis (*Plegadis falcinellus*) is the smallest of three species, and is dark brown, often appearing black at a distance. It is global in distribution and is the most aquatic of the three species of ibis in its choice of habitat, preferring swamps and flooded areas of the Murray-Darling basin. It is particularly numerous in northern Australia. As with the other ibis it is considered a useful bird, feeding on a wide variety of insects, molluscs and crustaceans.

Anseranatidae - Magpie Goose

The Magpie Goose (*Anseranas semipalmata*) is listed by many in a family of its own (Anseranatidae) (e.g. Christidis and Boles (2008)). Its appearance and behaviour is quite different from any other species of waterfowl and appears to represent a cross between a goose and a duck; this is reflected in its scientific name of *Anseranas*, which basically means 'goose duck'. Unlike the Anatidae, the Magpie Goose moults its flight feathers progressively, enabling the bird to retain the power of flight throughout the year.

The Magpie Goose is listed as a vulnerable species under the NSW Threatened Species Conservation Act (TSC Act). This waterbird species was once widespread throughout coastal northern and eastern Australia, found in freshwater wetlands, floodplains and wet grasslands. It was considered a major pest during attempts to establish major rice growing areas in the Northern Territory and was shot in large numbers. Habitat alteration since white settlement has also contributed to the decline of this species. Conservation efforts have resulted in an increase in NSW as a result of habitat enhancement and artificial rearing and feeding.

Anatidae - Ducks, geese and swans

Ducks, geese and swans, also known as waterfowl, are unique among bird families in that during moult they lose all of their flight feathers at the same time and are therefore flightless for several weeks. This is an important consideration when managing wetlands because the birds require an expanse of water and the cover of aquatic vegetation at this time to avoid predators. Waterfowl also differ from most other birds, but resemble shorebirds in that within a day or two of hatching young birds

are able to feed themselves with no assistance from their parents. The exceptions are the Magpie Goose, Musk Duck (*Biziura lobata*) and among the shorebirds the Pied and Sooty Oystercatchers, that all feed their young. These exceptions may have a basis in the type of prey that forms the diet of the respective species (mainly shellfish), which would be difficult for hatchlings to manage.

Most ducks feed by sifting food from the water and mud through their bills, working their tongue like a piston, drawing water up the bill and driving it past rows of lamellae along the edges of the bill, retaining food items but expelling water (Straw 1997).

Dabbling Ducks

Grey Teal (*Anas gracilis*), Chestnut Teal (*Anas castanea*), Pacific Black Duck (*Anas superciliosa*) and the introduced Mallard (*Anas platyrhynchos*) are typical dabbling ducks, feeding on the surface of the water on small aquatic animals, floating seeds or stripping seeds from over-reaching grasses and other plants. They are also frequently seen up-ending with the tail sticking out of the water feeding on submerged plants and small mud dwelling animals, which they sift through their bills. They occur in a wide variety of wetlands from large permanent wetlands, rivers, ponds, farm dams and, especially the Chestnut Teal, in coastal waters including bays and estuaries.



Figure 2.9.4. Freckled Duck (*Stictonetta naevosa*).

The Pacific Black Duck is highly adaptable and is as much at home in a city park, often in company with its introduced and closely related cousin the Mallard, as in outback wetlands. It is found on lakes, ponds, inland swamps and lagoons as well as coastal wetlands with abundant vegetation. One of the most serious potential threats to the Pacific Black Duck is hybridization with the Mallard as this species becomes more established. The closely related New Zealand Grey Duck has already been severely impacted due to hybridization with Mallards, introduced as a wild game duck in that country.

The Freckled Duck (*Stictonetta naevosa*) is endemic to southeast and southwest Australia, occurring only as a vagrant elsewhere in Australia. The Freckled Duck is listed as a vulnerable species under the TSC Act. This species is relatively sedentary, found mostly on inland permanent or semi-permanent densely vegetated swamps and lakes. During severe droughts this bird moves in search of other wetlands, frequently moving to coastal wetlands which form important drought refuges. Freckled Duck nest in dense vegetation such as lignum, building a well-formed cup-shaped platform of finely woven twigs. The breeding season varies depending on rainfall and other climatic conditions, but is generally June to December.

Australasian Shoveler (*Anas rhynchos*) is a surface feeding dabbling duck found in a variety of wetlands, preferring large open freshwater swamps



Figure 2.9.5. Hardhead (*Aythya australis*).

fringed by abundant aquatic vegetation. Breeding is synchronised with flooding rains, and the bird nests in the hollows of trees standing in water.

An extreme, when it comes to a surface dabbling duck is the Pink-eared Duck (*Malacorhynchus membranaceus*) with a highly specialized beak that has a flap on either side that gives the bird a broad sweep while sifting its microscopic invertebrate prey from the water.

The Pink-eared Duck is named after an insignificant spot of pink feathers on the side of the drake's head; the female lacks this spot.

It is easily recognizable by the dark mask around its eyes and the zebra-like stripes along its body.

This species is rare near the coast but occurs in large flocks on inland wetlands, where its distinctive chirruping call can be heard, especially when in flight. It is found in timbered areas near water. It prefers shallow, temporary waters, though open wetlands support large flocks. It is a highly dispersive and nomadic species.

Breeding can take place all year round and is dependent on floodwaters. The nest is a rounded mass

of down placed in a hollow or on a stump above the water. Pink-eared Ducks usually take over nests built by other birds, especially the Eurasian Coot and the Black-tailed Native Hen.

Diving Ducks

Diving ducks inhabit deep, permanent freshwater lakes and swamps, obtaining much of their food by diving for as long as a minute at a time. They have a varied diet, feeding on seeds, aquatic insects, molluscs and crustaceans. Diving ducks nest in dense reeds, close to and often above water. Nests are constructed of woven reeds, sedges or lignum stems, and the birds often pull stalks together to form a canopy above the nest.

Hardhead (*Aythya australis*) (Figure 2.9.5), Musk Duck and Blue-billed Ducks (*Oxyura australis*) are seldom seen on land. Hardheads are usually found on large swamps with plenty of reed beds, but are also found on lakes, coastal swamps and sewage farms (Straw 1997). Until 1900, Hardhead outnumbered all other waterbird species on the coasts of New South Wales and Victoria. Numbers have since declined and it is now much less common on the coast of New South Wales. Many Hardhead now rely on the Murray-Darling basin; however, this species is largely nomadic (Serventy *et al.* 1985).



Figure 2.9.6. Wandering Whistling Ducks (*Dendrocygna arcuata*).

The Blue-billed Duck is listed as vulnerable under the TSC Act. This species is almost exclusively aquatic, often congregating in large flocks on large, deep open freshwater dams and lakes. The Blue-billed Duck is found in southeastern and southwestern Australia, usually flocking along the lower Murray River during winter and dispersing to breed in summer. It is mostly recorded inland but utilises coastal sites at times of drought.

Although once widespread from the Hunter River to north Queensland, the Cotton Pygmy-goose *Nettapus coromandelianus* is now only a rare visitor to NSW and is listed as endangered under the TSC Act. It inhabits deep, permanent coastal lagoons and large freshwater lakes with abundant aquatic vegetation.

Whistling-Ducks

Whistling ducks look different from most other ducks in having longer necks and legs. This reflects their different behaviour, as they spend more time than other ducks roosting out of the water and feeding away from the margins of wetlands. During the nonbreeding dry season they often congregate in flocks of thousands in northern Australia.

The Plumed (or Grass) Whistling-Duck (*Dendrocygna eytoni*) feeds on grasses and spends less time on the water than the Wandering Whistling-Duck (*Dendrocygna arcuata*), which feeds more on water plants. Whistling-Ducks nest away from the water's edge in long grass, often under bushes, or sometimes in reeds at the edge of a swamp (Straw 1997).

Swans

The Black Swan (*Cygnus atratus*) inhabits a variety of wetlands from large inland brackish to slightly saline lakes to coastal wetlands to small ponds across most of Australia. Black swans will nest close to each other on islands at large inland wetlands, sometime only a metre or so apart where there are large areas for foraging. On small wetlands only one pair may be present during nesting; other swans are not tolerated and are driven off, and where there is insufficient habitat for the number of breeding pairs Black Swans will kill each other's cygnets (JD awes pers comm). Non-breeding birds may concentrate in large flocks of up to tens of thousands of birds, but more commonly in smaller concentrations often in estuaries or coastal lakes. Black Swans appear to feed mainly on submerged plants such as *Ruppia* in fresh to marine habitats, *Vallisneria americana*, *Potamogeton*,

and *Azolla* (particularly in winter) and many other aquatic plants as well as grasses and other pasture plants (Marchant and Higgins 1990).

Shelducks

Two species of Shelduck occur in Australia. The Radjah Shelduck (*Tadorna radjah*) is mainly found in coastal wetlands across the north of the Northern Territory and Queensland. The other species is the Australian Shelduck (*Tadorna tadornoides*), which mainly occurs as two populations, one in the south east of Australia including Tasmania, southern NSW, Victoria and south east South Australia and the other in western West Australia.

The Australian Shelduck occurs over a wide variety of habitats including estuarine mudflats and muddy shores of large fresh to brackish wetlands, as well as grasslands, pastures and irrigation areas. It feeds mainly on aquatic vegetation including green algae, couch grasses and duckweed, including *Azolla*, as well as aquatic insect larvae, crustaceans and molluscs (Serventy *et al.* 1985).

Australian Wood Duck (*Chenonetta jubata*)

The Australian Wood Duck, also known as Maned Goose, belongs to a monotypic genus that is endemic to Australia. It is unlike other ducks in that it has a small bill ideally suited to grazing grasses, clover and other herbs, more like a small goose than a duck. It is generally found in grasslands, open woodlands, wetlands, and flooded pastures as well as along the coast in inlets and bays. It is a species that has adapted well to artificially created wetlands such as farm dams, sewage ponds and urban parks. The Australian Wood Duck spends little time on water but will readily take to water with its ducklings to evade terrestrial predators. This species, in common with some other Australian ducks, nests in tree hollows up to many hundred metres from any water. When the ducklings have hatched they are encouraged to tumble down to the ground, often from great heights, and bounce on the ground usually without harm.

Rallidae - Rails, crakes, gallinules and coots

Rails and crakes are secretive birds rarely seen other than a brief glimpse as they dart for the cover of dense emergent vegetation, skulk along the muddy edge of wetlands or walk on water plants along the margins of reed beds. An example is the Australian Spotted Crake (Figure 2.9.7). Gallinules, including the Purple Swampphen, Black-tailed Native-hen and Tasmanian Native-hen, spend more time in the open than the rails and crakes. They walk on floating vegetation or on the grassy margins



Figure 2.9.7. Australian Spotted Crake (*Porzana fluminea*).

of wetlands or parks feeding on grasses, seeds or invertebrates. The Purple Swamphen has the unusual habitat of grasping stems of aquatic plants with its foot while eating them. They particularly like the fresh tender new growth, sometimes encountering the wrath of groundsmen of parks and gardens or wetlands landscapers. The Eurasian Coot is more gregarious than gallinules and is more likely to be found on open water, where it often dives to feed on submerged vegetation and can spend a minute or more submerged.

Rails and crakes nest within the dense emergent vegetation in inaccessible places while gallinules and coots tend to nest more in the open on floating vegetation or on branches or logs in or around a water body.

Gruidae – Cranes

Two species of crane are found in Australia. The Brolga is the best known and more widespread than the similar looking Sarus Crane, which is restricted to far north Queensland and parts of coastal Northern Territory.

The Brolga occurs across northern Australia southwards throughout inland and coastal Queensland and northern NSW to central and western NSW and Victoria. It occurs in large open wetlands, grassy plains and irrigated croplands

and occasionally in estuarine wetlands. Brolgas are omnivorous but primarily feed on tubers as well as some crops, and occasionally on insects, molluscs and amphibians.

Brolgas are thought to mate for life with pair bonds strengthened during elaborate courtship rituals, including their legendary 'dancing' displays. Nesting territories are isolated from those of other brolgas and vigorously defended by both birds. Nests consist of a rough mound of vegetation on a small island or in shallow water.

The nesting season for southern populations is September to December, and usually involves a clutch of two eggs and an incubation period of about 32 days. Non-breeding birds form flocks varying from a few individuals to a hundred birds, and some are partially nomadic or migratory.

Jacanidae - Jacanas

The Comb-crested Jacana (*Irediparra gallinacea*) occupies coastal and sub-coastal regions from the Northern Territory round to northern NSW as far south as the Hunter River catchment.

Jacanas are similar in appearance to shorebirds but behave like a gallinule and build their nests on floating vegetation such as water lily leaves. The bird's splayed toes and claws are so long that its weight is spread over a large area, exerting very



Figure 2.9.8. Whiskered Tern (*Chlidonias hybrida*).

little pressure per square centimetre and enabling it to walk on floating vegetation without having the vegetation sink beneath it. A female Comb-crested Jacana may mate with several males, while the male alone builds the nest, incubates the eggs and cares for the young. The male also has a remarkable behaviour of tucking its young under its wings to carry them out of way of danger if the need arises. The nest is a raft of grass and plant stems, moored amongst floating vegetation such as lilies.

Jacanas feed on aquatic insects taken from floating vegetation or the surface of the water as the bird walks on floating vegetation or along shallow shorelines. It also feeds on seeds and aquatic plant material.

Laridae - Terns

Most terns and gulls are marine dwelling species. However, some terns breed solely on freshwater wetlands, such as the Gull-billed Tern and 'marsh terns' belonging to the genus *Chlidonias*.

Whiskered Terns are a group of terns often referred to as 'marsh terns' due to the habitats they use - various freshwater and brackish wetlands in inland and coastal regions. They can be seen patrolling back and forth over the wetland hunting mainly small fish, amphibians, crustaceans, insects and their larvae (Figure 2.9.8). Their distinctive hawking and dipping at the surface of the water is quite different from the foraging behavior of sea terns that usually plunge-dive after fish, although marsh terns do occasionally also plunge-dive.

The breeding season of the Whiskered Tern is erratic, depending on climatic conditions. The species breeds in loose colonies in large, often temporary, inland swamps and marshes. The nest is a rough floating raft of vegetation.

Gull-billed Terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands. Although they occur over most of Australia they are only found nesting in the southern half of the continent, rarely north of 25°S, but only occur as a vagrant in Tasmania.

Gull-billed Terns nest in colonies on dry ground on small islands in a lake or marsh. As with many birds nesting in Australia their breeding season is flexible, depending on location.

The diet of the Gull-billed Tern is extremely varied, consisting mainly of small fish, reptiles, amphibians, crustaceans, small mammals, insects and their larvae. When foraging, the Gull-billed Tern glides down to the surface of the water and takes prey with only the tip of the bill penetrating the water instead of diving like most terns.

Alcedinidae - Kingfishers

Australia has eleven kingfishers. However, of these only two Alcedinid kingfishers are truly aquatic in nature, the Azure Kingfisher and the Little Kingfisher. The other nine Halcyonid kingfishers include the Kookaburra and other semi-terrestrial kingfishers.

The Azure Kingfisher is associated with rivers and lakes along the coastal regions of northern Australia and down the east coast into Victoria and Tasmania. It can be seen as an iridescent blue streak as it dashes over the water at great speed. Otherwise it sits quite still and is easily overlooked unless it plunges into the water after a fish. The Azure Kingfisher nest is an excavated tunnel about a metre long in a riverbank above the waterline.

The Little Kingfisher that is restricted to rivers and lakes in the far north of the Northern Territory and the Cape York peninsula.

Other wetland-dependent species

Other wetland dependent species of bird include the old world warblers such as the Golden-headed Cisticola, Australian Reed Warbler and Little and Tawny Grassbirds that associate with reeds or tall grasses in or around wetlands, drainage channels etc. The presence of free water is not essential to these birds though it does deter predators which can be an advantage in nest survival.

Some birds of prey are associated with wetlands, more typically the Osprey and White-bellied Sea-Eagle which are found in close proximity to large wetlands, bays, estuaries and rivers. Either of these birds may nest close to or some distance from water. They both catch prey while on the wing, flying close to the surface of the water after spotting their prey from a height.

The Marsh Harrier is usually seen gliding low over reedbeds looking for prey on which it pounces with the aid of its long legs and talons. This species feeds on small mammals, birds, reptiles, amphibians, fishes and insects. Nests are built on the ground in dense cover or over water in reeds.

The Whistling Kite forages over a variety of habitats but is often associated with freshwater wetlands and estuaries, while the Brahminy Kite tends to occur more along beaches and estuaries. Both these kites are opportunistic feeders and take carrion if fish are not readily available. Both species build untidy stick nests in trees.

Wetland Rehabilitation and Management for Waterbirds

Types of wetland for waterbirds

Some ephemeral wetlands provide unique conditions for major breeding events as a result of unpredictable flooding. In central Australia parched inland wetlands are occasionally fed by river systems that may have flowed thousands of kilometres and taken months to reach the distant wetlands.

Human influence on these wetlands that interfere with the intensity and/or longevity of flood events can have catastrophic effects on waterbird populations, resulting in the abandonment of nests, eggs or young birds. Maintaining such environmental flows is essential if long-term survival of waterbird populations are to be secured for future generations.

Ephemeral wetlands also include systems that are fed by more local cyclonic rains that provide quite different conditions, suiting species

such as the Banded Stilt which may breed only once every five to ten years or at even longer intervals. The conditions in these wetlands produce a high density of brine shrimp that allows thousands of Banded Stilts to nest simultaneously. Once hatched, chicks gather into huge crèches cared for by small numbers of adults allowing subsequent clutches to be laid by the bulk of the adults if conditions permit.

Permanent and semi-permanent wetlands provide habitats for many species of waterbird where cyclic events are not important for breeding events. Such wetlands can be critically important during periods of severe drought when thousands of birds may descend on these wetlands. The maintenance of high water levels at such wetlands is obviously important and should be allowed for as part of site management plans.

Wetland habitat loss

The human perception of wetlands is changing, with wetlands now slowly becoming regarded as valuable natural resources. The importance of wetlands to humans in maintaining water quality and wildlife populations is finally being realised.

Wetlands have long been regarded as wastelands presenting a challenge to agricultural practices and urban expansion. More than half of the wetlands in Australia have disappeared since European settlement, and the degradation of the remaining floodplain wetlands is still increasing (Gall 1995). Wetlands in heavily populated areas of coastal Australia have been particularly susceptible to human impacts. They have been drained, in-filled and altered for agricultural use and industrial and urban expansion (de Jong 1997).

Waterbirds have declined in line with habitat loss, particularly in south east Australia. The loss of Brolga and Magpie Geese, once wide-ranging across the region, are examples, as is the Hardhead, a diving duck relying on deep freshwater wetlands. The Hardhead outnumbered all other waterbird species on the coasts of New South Wales and Victoria but is now much less common on the coast of New South Wales. The degradation of Lake Innes, near Port Macquarie, is one example in NSW of the loss of crucial habitat. Lake Innes was probably the most important coastal freshwater wetland in the state and attracted flocks of 4000 Hardhead in 1933. Attempts to drain it for agricultural land in the 1930s changed its character completely, and it now functions as an ICOLL (Intermittently Closed and Open Lakes and Lagoons) with its freshwater

characteristics apparently lost forever. It now has little value to the waterbirds that were once very abundant at the lake.

Reedbeds

Reedbeds provide important habitat for many species of bird including bitterns, crakes and rails, gallinules and coots as well as many small passerines. They also provide nesting habitat for ibis, spoonbills and ducks as well as birds of prey such as the swamp harrier. Water levels across large reedbed wetlands are less obvious to the untrained eye and many may be in an unnoticed state of decay resulting in loss of quality habitat for waterbirds.

Reedbed Management

Reedbeds in Australia have undergone reduction and structural changes since European settlement. However, few studies have been carried out to determine the impact of these changes on waterbirds that rely on them for breeding. Some waterbirds have declined to the extent that they have now been listed as endangered under the *Federal Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These include the Australasian Bittern and the Australian Painted Snipe. Although BirdLife Australia has been conducting national surveys of both these species no research has been carried out of management requirements. However, unless habitat requirements are addressed by site managers declines in the populations of these species will continue.

Recognition of threatening processes and the development of strategies for management of habitats are essential prerequisites for successfully halting population decline. While the precise habitat requirements for the Australian Painted Snipe and what affects their movements remain much of a mystery, habitat management for the Australasian Bittern can be better understood from research in other parts of the world on very similar species and habitats.

Without intervention to hold or reverse habitat succession, either through management or natural dynamics, a reedbed will tend to dry out and turn into a dry land habitat such as woodland. This will result in the loss of characteristic reedbed species that depend on wetter conditions associated with early stages of reedbed succession, such as the Australasian Bittern, being the first to be lost.

Natural process can be accelerated by drainage, water extraction or isolation from natural watercourses.

Management for waterbirds, and most other wildlife dependent on reedbeds, needs to be primarily concerned with two main issues: the water regime and the vegetation.

Water regime and quality

Major threats include poor water quality and the poor management of the water resource through increased water extraction, drainage or interruption of water flows to or through the reedbeds. It is likely that these deleterious effects are the main cause of the decline of the Australasian Bittern, now listed as endangered in Australia.

The two aspects of water management that are important for birds such as bitterns as well as for the passage of fish and many other aquatic animals (on which bitterns depend for food) are the water regime (levels, duration and timing) and the water quality.

The depth of water will influence reed growth in relation to that of other plants and will affect the rate of litter break-down. A build-up of litter, including layers of dead reed stems, excludes access by many aquatic wildlife species. Water depth along with selective reed cutting is important to provide open water habitats such as channels and pools to allow movement and refuges for fish and other important prey species for bitterns and other reed-dwelling birds.

Bitterns, especially, require wet reedbeds that provide not only adequate feeding opportunities but also a safe nesting site.

It is preferable to retain sufficient surface water within the reedbed with water depths of up to 1 metre, least during the breeding season. However stagnant water may result in problems with reed quality and reedbed degeneration over long periods of time.

The availability of water at the right time is one of the biggest obstacles to wetlands management in many parts of Australia. Where the water regime can be controlled it is optimal to allow drawdown in autumn to assist in promoting oxidisation of reed litter at a time of higher temperatures, while increasing the water level again during winter so that the throughput of water will assist with the flushing of organic material.

Maintaining the water quality of a wetland is facilitated by removing nutrients from a site. This can be achieved where practicable by designing part of the reedbed receiving water inflow as a water treatment system to provide phosphate stripping.

In addition it is desirable to reduce or reverse the natural succession of a reed swamp to scrub or woodland by the removal of litter accumulation, while stimulating the production of new reed, either by cutting or burning the reeds a section at a time.

The commercial cutting of reeds is carried out in many parts of the world where the cut reeds are used for thatching or fencing. However, the demand in Australia for cut reed appears to be very low and is not commercially viable unless the reeds are converted into a secondary product. One possibility is the production of garden mulch as carried out at some nature reserves in the UK (pers. obs.).

The possibility of using this method as a management strategy at the Hunter Wetlands Centre was investigated as part of an offset for the loss of bittern habitat resulting from industrial development. However, this project has not passed the feasibility phase. At Sydney Olympic Park, recycling macrophytes for mulching has become a regular practice of late and it seems to have been beneficial (S. Paul pers. comm.).

Management through burning

Burning is an alternative way of disposal of dead reed stems to reduce the accumulation of litter. If this method is adopted it should be carried out in a controlled manner taking out sections of reed growth on a rotational basis to ensure sufficient healthy growth of reeds for wildlife habitat.

Burning is a traditional management technique undertaken in late winter when the reed is dead and dry. There appears to be no literature that shows an impact worse than cutting if the burn is carefully controlled. It has been shown that burning small plots has no long-term detrimental effect on invertebrate populations as rapid re-colonisation occurs from unburnt areas. In fact it has been shown that burning led to an increased diversity of plants and greater flowering and seed production of the reed itself. Burning has also been shown to increase early shoot emergence and density and assist the dominance of reed. Timing, frequency of burning and water regime may influence the precise effect (White *et al.* 2006).

Management by grazing

Management of wetland vegetation using grazing by various animals including cattle and horses is used widely in Europe and other parts of the world but is avoided in Australia where hoofed animals, which damage the fragile structure of Australian soils, are not part of environmental management policies.

The importance of artificially created wetlands for waterbirds

With the loss of natural wetland systems through human activities, artificially created water bodies can provide important oases in a dry environment for many waterbird species.

Sewage treatment works (a favourite haunt for birdwatchers), use settling ponds as part of sewage management can provide habitat for hundreds, sometime thousands, of waterbirds of all types. The nutrients in the various concentrations of sewage, a bad omen for natural wetlands, are actively processed to avoid stagnant ponds. These provide food for a wide variety of invertebrates and algae, which in turn provide food for waterbirds.

Stormwater management systems also provide an opportunity to provide habitat for waterbirds with creative design on the part of ecologists and engineers on behalf of local and states authorities managing runoff. This includes macrophyte beds and open pools.

Open water bodies from a farm dam to a large reservoir can provide a variety of valuable habitats for fish and crustaceans and in turn for a wide variety of waterbirds.

Management of artificially created wetlands should include reducing disturbance to waterbirds as well as monitoring populations during various seasons to understand the values of these habitats.

Summary

Approximately fourteen bird families depend entirely on freshwater wetlands for their survival although some populations are also found in the marine environment as an alternative, especially during periods of drought affecting ephemeral wetlands. These groups of birds include: Ducks, geese and swans; grebes; cormorants; darters; pelicans; storks; herons, egrets and bitterns; ibises and spoonbills; cranes; crakes, rails, gallinules and coots; terns; and, kingfishers. Other birds that use freshwater habitats for at least part of their life

cycle includes some birds of prey (sea-eagles and ospreys) for food and some small passerines that nest in reedbeds.

The loss of wetlands since European settlement has resulted in a substantial decrease in waterbirds populations through development of wetland habitat and water extraction industries. Although no waterbird species have gone extinct in Australia several species are now listed as endangered and face potential extinction either at the state or national level.

It is important that wetland function is fully understood so that waterbird habitat can be managed to secure future populations and where necessary the need for habitat rehabilitation be recognised and implemented. Reedbed habitats are taken as an example of how critical habitat can be managed to ensure the survival of endangered species such as the endangered Australasian Bittern.

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