

The Shorebirds and Waterbirds of Mambo Wetlands Reserve, Salamander Bay NSW

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A study of the shorebirds and waterbirds that utilise the shoreline and waters of Salamander Bay and the adjoining tidal wetland areas of the Mambo Wetlands Reserve was conducted using survey data from 1999-2023. Thirty-five species were identified that utilised the study area. Six were migratory species that are threatened or near-threatened. Three of these were shorebirds: Far Eastern Curlew *Numenius madagascariensis*, Bar-tailed Godwit *Limosa lapponica baueri* and Grey-tailed Tattler *Tringa brevipes*; and three were terns: Little Tern *Sternula albifrons*, Common Tern *Sterna hirundo* and White-fronted Tern *Sterna striata*. One endemic shorebird, Masked Lapwing *Vanellus miles*, also used the area. The most common 10 species had reporting rates of 20% or more.

The shorebirds and waterbirds were present across three separate habitats: tidal flats, mangrove forest and an estuarine saltmarsh complex. The presence of these threatened and near-threatened species further supports the case for the permanent protection of the wetlands at Salamander Bay and the associated shorebird and waterbird habitats.

INTRODUCTION

This study documents the results of a study of the shorebirds and waterbirds that utilise the shoreline and waters of Salamander Bay and the adjoining tidal wetland areas of the Mambo Wetlands Reserve. It complements previous studies of avian species within the reserve that focussed mainly on the woodland birds (Fraser 2018a; Fraser 2018b).

Salamander Bay is an integral part of the Port Stephens estuary and birds that are present there are also found in other parts of the estuary. The estuary's birds have been documented in a number of previous articles (Stuart 2004; Stuart 2005; Stuart 2011; Wooding and Stuart 2013).

However, Salamander Bay is unusual in having an isolated section of tidal flats that are used by shorebirds. Extensive areas of tidal flats are present elsewhere in Port Stephens west of Soldiers Point and around the mouth of the Myall River. Salamander Bay is the only area of tidal flats and mangrove forest, outside of these areas, that is continually used by shorebirds.

This study has been prepared to provide further support for the actions of the Mambo Wanda Wetlands Ramsar Working Group to have the Mambo Wetlands Reserve and the Wanda Wetlands Reserve listed as Wetlands of International Importance under the Ramsar Convention.

Site Description

The Mambo Wetlands Reserve is composed of 175 hectares of coastal forest and saltwater and freshwater wetlands. It drains into Salamander Bay via Mambo Creek. The reserve is bounded to the north by the Salamander Bay shoreline, to the west by Port Stephens Drive, to the south by Salamander Way and to the east by Sandy Point Road. Residential properties adjoin the reserve to the southwest, south and east, while the Salamander Bay shopping and council precinct adjoins to the southeast. Shoreline Drive runs parallel to the northern boundary of the reserve (**Figure 1**). Joe Redman Reserve is located on the foreshore at the western end of the Mambo Wetland Reserve and Roy Wood Reserve is located on the eastern foreshore.

Salamander Bay (32° 43' 38"S, 152° 05' 44"E) is a semi-circular, north-facing bay with shallow, protected waters on the southern shore of Port Stephens (**Figure 1**). Water depth is mostly less than 10 m. The bay extends over 3 km from Corlette Point in the east to Wanda Head in the west. Rocky headlands mark the extremities and sandy beaches are present along the eastern and western shorelines. The central section of the bay supports a mangroves forest and an extensive area of tidal flats.

Wanda Wetlands Reserve is 15 ha and is located 300 m north of the Mambo Wetlands Reserve. It forms

an integral part of the wetlands system and provides habitat for some of the birds that use Salamander Bay. Its waters drain west to Cromarty Bay. Several of the waterbirds regularly present in Salamander Bay roost and breed around the permanent water section of this wetland.

Mambo Creek flows into Salamander Bay through the middle of the mangrove forest and provides sediment and nutrients for the mangroves, tidal flats and surrounding waters. Around 400 m of the northern section of the creek is affected by tidal saltwater interchange. The creek is fed by a large permanent freshwater source originating in the Gahnia swamp forest and adjoining Sandpiper Reserve to the south. Local stormwater drains channel urban runoff towards the eastern and western ends of the mangrove forest where the waters become brackish and ultimately saline.

The headland and ridge at the eastern end of the bay provide sheltered mooring for yachts and other watercraft. There are additional moorings in the west of the bay. The shallow, protected, nutrient-rich waters that cover the tidal flats provide ideal conditions for aquacultural purposes and oyster racks are present over most of the tidal area.

All the waters in Port Stephens are part of the Port Stephens - Great Lakes Marine Park (Department of Primary Industries 2019). The shoreline and tidal flats north of the Mambo Wetlands Reserve, and areas of tidal inundation along the northern section of Mambo Creek, are classified as a sanctuary zone within the marine park. This includes the mangrove forest, tidal flats and saltmarsh.



Figure 1. Location map. Salamander Bay, Mambo and Wanda Wetland Reserves and avian habitats. (Image from Google Earth)

Habitat Descriptions

There are three distinct habitats used by birds within the study area: an estuarine saltmarsh complex; mangrove forest; and tidal flats. Each of these is described separately below.

Estuarine Saltmarsh Complex

The estuarine saltmarsh complex is bounded by the mangrove forest to the north and Black Casuarina *Allocasuarina littoralis* of the mahogany paperbark swamp complex to the south (**Figure 2**). It covers an area of about 8 ha. Areas periodically inundated by tidal water are covered by Samphire *Sarcocornia quinqueflora*, Saltwater Couch *Sporobolus virginicus* and Grey Mangrove *Avicennia marina*.

The surrounding areas of brackish water are covered with Common Rush *Juncus usitatus*. The substrate is silty mud.

The area of saltmarsh has expanded recently following the destruction of the Mambo Creek culvert under Foreshore Drive in March 2021 and its replacement by a bridge. The newly installed bridge allows a larger tidal prism to enter the wetlands resulting in an expansion of the area of Samphire and further encroachment of Grey Mangroves into the reserve.

Coastal saltmarsh in NSW is classified as an endangered ecological community under NSW Biodiversity Conservation Act 2016 (Office of Environment and Heritage 2022).



Figure 2. Samphire and grey mangroves, estuarine saltmarsh complex, Mambo Wetlands Reserve. View to the east. (Image by N. Fraser)



Figure 3. Mangrove forest at the mouth of Mambo Creek, Mambo Wetland Reserve. View to the south. (Image by N. Fraser)

Mangrove Forest

The Grey Mangrove (“mangrove”) forest is located along 800 m of the central section of the Salamander Bay shoreline (**Figure 3**). Immediately south of, and adjacent to Shoreline Drive, mangroves extend east-west for 1,200 m. The mangroves habitat is 10 - 150 m wide. It is present along the banks of Mambo Creek for 400 m. Shoreline Drive bisects the area of mangroves and Mambo Creek flows into Salamander Bay through the centre of the forest. The mangroves are mostly Grey Mangrove plus minor River Mangrove *Aegiceras corniculatum*. The substrate is dominantly mud with some sandy areas along the shoreline.

Mangrove forests are classified as protected marine vegetation under NSW Fisheries Management Act 1994 (Department of Primary Industries 2008).

Tidal Flats

The tidal flats cover an area of around 12.7 ha over the intertidal zone to the north of the mangrove forest. The flats extend for around 1000 m from west to east and the maximum width exposed at low tide varies from 100 - 180 m. They are composed of soft, muddy silt which is heavily bioturbated by benthic organisms. The most commonly seen invertebrate is the Soldier Crab *Mictyris longicarpus*, thousands of which are present on the flats at low tide.

Extensive sea grass meadows are present throughout the shallow waters of the bay. Eelgrass *Zostera capricornia* is present in shallower, near-shore waters and Fire-ball Weed *Posidonia australis* is present in slightly deeper waters.



Figure 4. Tidal flats with oyster racks (left) and mangrove forest (right), Salamander Bay, Mambo Wetlands Reserve. View to the east. (Image by N. Fraser)

METHODS

The information presented in this study is derived from 107 surveys of avian fauna conducted by multiple observers in Salamander Bay and the adjacent wetland areas of the Mambo Wetlands Reserve. Surveys were conducted from 1999 to 2023.

Records were extracted from the BirdLife Australia Birddata portal (<https://birddata.birdlife.org.au/home>), the Cornell Lab of Ornithology eBird Australia portal (<https://ebird.org/australia/home>) and the Hunter Bird Observers Club Annual Bird Reports for the Hunter Region of NSW for the years 1999 to 2019 (<https://www.hboc.org.au/publications/annual-bird-report/>). Additional unpublished data was sourced from individual observers.

To differentiate shorebirds from other waterbirds the following definition has been used: Shorebirds (also known as waders) are birds of the order Charadriiformes commonly found foraging along shorelines and mudflats. They generally have long legs in relation to their body size, do not have webbing on their feet and do not swim. The shape and size of the bill is adapted to their preferred diet and habitat. Shorebirds include both migratory and endemic species.

RESULTS

Thirty-five avian species were present in the study area at various times. For each species, the number of records, the overall reporting rate (RR%) and maximum and mean counts are summarized in

Table 1. The overall reporting rate is the ratio of the number of records over the study period to the total number of surveys, expressed as a percentage. The conservation status of the shorebirds and some other migratory species is summarised in **Table 2**. Six of the species are threatened or near-threatened. Three

of these are migratory shorebirds and three are terns. One endemic shorebird, Masked Lapwing *Vanellus miles*, was also identified. Ten species with reporting rates >20% are present most frequently (**Table 1**).

Table 1. Records, reporting rates (RR) and numbers of shorebird and waterbird species, Mambo Wetland Reserve years 1999-2023, presented in order of decreasing RR.

Common Name	Scientific Name	Records	RR%	Max	Mean
Australian White Ibis	<i>Threskiornis molucca</i>	58	54.2%	32	6
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	48	44.9%	107	27
Masked Lapwing	<i>Vanellus miles</i>	41	38.3%	8	3
Little Pied Cormorant	<i>Microcarbo melanoleucos</i>	40	37.4%	14	2
Grey-tailed Tattler	<i>Tringa brevipes</i>	37	34.6%	28	7
Australian Pelican	<i>Pelecanus conspicillatus</i>	36	33.6%	5	2
White-faced Heron	<i>Egretta novaehollandiae</i>	36	33.6%	7	3
Pied Cormorant	<i>Phalacrocorax varius</i>	31	29.0%	6	3
Far Eastern Curlew	<i>Numenius madagascariensis</i>	29	27.1%	5	2
Greater Crested Tern	<i>Thalasseus bergii</i>	29	27.1%	40	8
Black Swan	<i>Cygnus atratus</i>	15	14.0%	5	2
Great Cormorant	<i>Phalacrocorax carbo</i>	14	13.1%	2	2
Bar-tailed Godwit	<i>Limosa lapponica baueri</i>	11	10.3%	7	3
Eastern Great Egret	<i>Ardea alba</i>	10	9.3%	1	1
Chestnut Teal	<i>Anas castanea</i>	8	7.5%	7	3
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>	8	7.5%	4	2
Little Tern	<i>Sternula albifrons</i>	8	7.5%	83	32
Purple Swamphen	<i>Porphyrio porphyrio</i>	8	7.5%	2	1
Pacific Black Duck	<i>Anas superciliosa</i>	7	6.5%	4	2
Striated Heron	<i>Butorides striata</i>	5	4.7%	2	1
Royal Spoonbill	<i>Platalea regia</i>	4	3.7%	2	2
Australian Wood Duck	<i>Chenonetta jubata</i>	3	2.8%	2	2
Caspian Tern	<i>Hydroprogne caspia</i>	3	2.8%	5	3
Australasian Darter	<i>Anhinga novaehollandiae</i>	2	1.9%	2	2
Australasian Gannett	<i>Morus serrator</i>	2	1.9%	4	3
Common Tern	<i>Sterna hirundo</i>	2	1.9%	5	5
Dusky Moorhen	<i>Gallinula tenebrosa</i>	2	1.9%	5	4
Intermediate Egret	<i>Ardea intermedia</i>	2	1.9%	1	1
Little Egret	<i>Egretta garzetta</i>	2	1.9%	2	2
Australian Gull-billed Tern	<i>Gelochelidon macrotarsa</i>	1	0.9%	1	-
Buff-banded Rail	<i>Gallirallus philippensis</i>	1	0.9%	1	-
Cattle Egret	<i>Ardea ibis</i>	1	0.9%	4	-
Lewin's Rail	<i>Lewinia pectoralis</i>	1	0.9%	1	-
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	1	0.9%	1	-
White-fronted Tern	<i>Sterna striata</i>	1	0.9%	16	-

Table 2. Conservation status of migratory shorebirds and terns, and endemic shorebirds, Mambo Wetlands Reserve.

Species	Biodiversity Conservation Act 2016	EPBC Act 1999	IUCN 2023	Action Plan for Australian Birds 2020
Far Eastern Curlew	-	Critically endangered	Endangered	Endangered
Grey-tailed Tattler	-	Migratory species	Near-threatened	Least concern
Bar-tailed Godwit	-	Vulnerable	Near-threatened	Endangered
Little Tern	Endangered	Migratory species	Least concern	Vulnerable
Common Tern	-	Migratory species	Least concern	-
White-fronted Tern	-	-	Near-threatened	Endangered
Masked Lapwing	-	-	Least concern	-

Conservation Status

Several of the species are threatened and their conservation status is shown in **Table 2**. All are international migrants. In NSW, threatened species are listed under the *Biodiversity Conservation Act 2016* (BC Act). Little Tern, classified as endangered, is the only one of the above species listed under the BC Act. Five species are listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Of these, the most highly threatened is the critically endangered Far Eastern Curlew *Numenius madagascariensis* while the Bar-tailed Godwit *Limosa lapponica baueri* is classified as vulnerable. These species are also listed under the JAMBA, CAMBA and ROKAMBA Agreements between the Australian Government and the Governments of Japan, China and Republic of Korea respectively. Grey-tailed Tattler *Tringa brevipes*, Little Tern *Sternula albifrons* and Common Tern *Sterna hirundo* are listed as migratory species under the EPBC Act.

The IUCN classifications are from the BirdLife International (2023) Red List for species and reflect their global conservation status. The other classifications are from The Action Plan for Australian Birds 2020 (Garnett & Baker 2021). While some species are listed as least concern or near-threatened, the populations of all species in **Table 2**, except for Common Tern and Masked Lapwing, are declining to varying extents. A significant factor in the population decline of migratory species from the northern hemisphere is the loss of foraging habitat along parts of the East Asian-Australasian Flyway (Hansen *et al.* 2016).

Species Accounts

Waterfowl

Black Swan *Cygnus atratus*

Black Swan is regularly recorded in shallow waters of Port Stephens, sometimes in large numbers. Numbers vary from year to year depending upon conditions in inland areas and local sea grass meadow conditions. In Salamander Bay, 15-20 birds are present at times foraging on the sea grass meadows, mainly in the western end of the bay (L. Wooding pers. comm.).

Status: Common resident, breeding.

Australian Wood Duck *Chenonetta jubata*

Australian Wood Duck is commonly seen around freshwater wetlands and other water bodies in Port Stephens. The birds forage mainly in grassy paddocks often some distance from water bodies. In the Mambo Wetland Reserve, pairs of birds are occasionally observed foraging around the freshwater sections of the storm water drains.

Status: Common resident, breeding.

Chestnut Teal *Anas castanea*

Chestnut Teal is widespread around the coast and inland river systems. At times, they are present in large numbers around coastal areas where there are freshwater and saltwater wetlands. Numbers vary considerably depending on conditions on inland waterways. In Salamander Bay, up to 5 birds are occasionally present on Mambo Creek, or in the shallow waters or on the exposed shoreline.

Status: Common resident. Breeding.

Pacific Black Duck *Anas superciliosa*

Pacific Black Duck is the most common duck species in Australia. They are widespread throughout coastal and inland wetlands, rivers and dams. They are mainly present on freshwater bodies. In the Mambo Wetlands Reserve, 1-4 birds

are occasionally present in the freshwater sections of the wetland.

Status: Common resident. Breeding.

Gannets, Darters, Cormorants and Pelicans

Australasian Gannet *Morus serrator*

Australasian Gannet is dominantly a winter migrant that breeds in dense colonies on off-shore islands in Victoria and Tasmania. When not breeding, it prefers coastal waters, large bays and harbours and may forage offshore as far as the continental shelf. In Port Stephens it is most frequently recorded in July, when it is not uncommon to observe 2-4 juvenile birds foraging over the waters of Salamander Bay.

Status: Common winter migrant, non-breeding.

Australasian Darter *Anhinga novaehollandiae*

Australasian Darter is widespread as pairs or single birds around the coastline and less frequently along inland rivers and wetlands. In Salamander Bay, 1-2 birds occasionally roost on the oyster racks.

Status: Common resident, breeding

Little Pied Cormorant *Microcarbo melanoleucos*

Little Pied Cormorant is common around coastal areas and on inland wetlands and waterways. It is the most common of the four cormorant species present in Port Stephens. In Salamander Bay, birds roost on the oyster racks or moored yachts, and forage in shallow waters. Some birds breed and roost nocturnally in the adjacent Wanda Wetlands Reserve. Maximum number recorded was 14 birds although usually only 2-4 birds are present.

Status: Common resident, breeding.

Great Cormorant *Phalacrocorax carbo*

Great Cormorant is common in small numbers around coastal areas and occasionally on inland wetlands and waterways. In Salamander Bay 1-2 birds are occasionally observed roosting on moored yachts or oyster racks, or foraging in shallow waters. Some birds breed and roost nocturnally in the adjacent Wanda Wetlands Reserve.

Status: Common resident, breeding.

Little Black Cormorant *Phalacrocorax sulcirostris*

Little Black Cormorant is common around coastal areas and occasionally on inland wetlands and waterways. Flocks of several hundred birds are present in Port Stephens around the mouth of the Myall River. It is the least common of the four cormorant species in Salamander Bay. Here 1-4 birds are occasionally present roosting on moored yachts or foraging in shallow waters. Some birds breed in the adjacent Wanda Wetlands Reserve.

Status: Common resident, breeding.

Pied Cormorant *Phalacrocorax varius*

Pied Cormorant is common around coastal areas and occasionally on inland wetlands and waterways. In Salamander Bay up to 5 birds are occasionally present roosting on moored yachts or oyster racks, or foraging in shallow waters. Some birds breed and roost nocturnally in the adjacent Wanda Wetlands Reserve.

Status: Common resident, breeding.

Australian Pelican *Pelecanus conspicillatus*

Australian Pelican is common around coastal areas and occasionally on inland wetlands and waterways. In Salamander Bay up to 5 birds are occasionally present fishing in the shallow waters, or roosting on the oyster racks, moored yachts or beaches.

Status: Common resident breeding.

Herons, Egrets, Ibis and Spoonbills

Eastern Great Egret *Ardea modesta*

Eastern Great Egret is widespread around shallow wetlands and coastal estuaries where it is usually seen in low numbers. When foraging, it is usually solitary. In Salamander Bay, single birds are occasionally present foraging along the banks of Mambo Creek, in the mangrove forest and on the tidal flats. Birds roost in the mangrove forest at high tide.

Status: Common resident, breeding.

Intermediate Egret *Ardea intermedia*

Intermediate Egret is widespread in small to moderate numbers throughout the eastern part of the Hunter Region, most commonly around wetlands. Single birds were recorded foraging amongst the mangrove forest at Salamander Bay on two occasions.

Status: Moderately common resident, breeding.

Cattle Egret *Ardea ibis*

Cattle Egret is widespread in small flocks on estuarine floodplains, usually associated with grazing cattle and horses. It is mainly found in the eastern part of the Hunter Region. In summer, birds congregate in large numbers to breed in colonial rookeries, usually around a wetland, then disperse in winter. Four birds were recorded on the shore of Salamander Bay on one occasion.

Status: Common summer resident, dispersing in winter. Breeding.

Striated Heron *Butorides striata*

Striated Heron is occasionally observed as a single bird, or less commonly in pairs, in coastal and estuarine mangroves, and on adjacent tidal flats. In

Salamander Bay, 1-2 birds are present, roosting in the mangrove forest or on the oyster racks, or foraging on the tidal flats.

Status: Relatively common resident, breeding.

White-faced Heron *Egretta novaehollandiae*

White-faced Heron is widespread around the coastline, estuaries, wetlands and watercourses in small flocks or as single birds. In Salamander Bay, up to 7 birds were present foraging on the tidal flats or around the margins of the mangrove forest. At high tide, some birds relocate to forage on the samphire flats on the southern side of Foreshore Drive. They also roost in the mangrove forest.

Status: Common resident, breeding.

Little Egret *Egretta garzetta*

Little Egret is widespread around coastal estuaries and wetlands but is most frequently observed as solitary individuals. In Salamander Bay, single birds were observed on two occasions foraging on the tidal flats and around the margins of the mangrove forest.

Status: Common resident, breeding.

Australian White Ibis *Threskiornis molucca*

Australian White Ibis is the most frequently recorded waterbird in Mambo Wetlands Reserve. The species is common to abundant in small to large flocks around coastal estuaries, wetlands and surrounding floodplains where they forage during the day. They congregate in large numbers at nocturnal roosts. Some birds breed and roost nocturnally in the adjacent Wanda Wetlands Reserve. In Salamander Bay, up to 32 birds were observed foraging around the margins of the mangrove forest and on the tidal flats. At high tide, some birds relocate to forage on the samphire flats on the southern side of Foreshore Drive. They also roost in the mangrove forest.

Status: Common resident, breeding.

Straw-necked Ibis *Threskiornis spinicollis*

Straw-necked Ibis is widespread across Australia, particularly in grassy paddocks in floodplain areas, sometimes in large flocks. They are not as common in coastal areas. Some birds migrate internally or are nomadic, adjusting their seasonal movements in response to varying water conditions. In Salamander Bay a single bird was observed foraging on the tidal flats.

Status: Common resident and part internal migrant. Non-breeding.

Royal Spoonbill *Platalea regia*

Royal Spoonbill is frequently observed in small numbers in both saltwater and freshwater wetlands, on intertidal mud flats and wet grasslands. In

Salamander Bay, 1-2 birds were present foraging at low tide in the shallow pools amongst the mangroves, and on the tidal flats at low tide. They roost in the mangroves at high tide.

Status: Common resident, breeding.

Rails and Swamphens

Lewin's Rail *Lewinia pectoralis*

Lewin's Rail is a cryptic species, typically observed as single birds around densely vegetated wetland margins. In Mambo Wetlands Reserve, it is rarely observed but occasionally heard around the mangrove forest and reed beds, and within storm water drains. One bird was observed foraging around the margins of the mangrove forest. Due to its secretive nature, the species is probably more common than records indicate.

Status: Uncommon resident, breeding.

Buff-banded Rail *Gallirallus philippensis*

Buff-banded Rail is a cryptic species typically observed as single birds around densely vegetated wetland margins. Within the Mambo Wetlands Reserve it is occasionally observed around the muddy margins of the mangrove forest and within storm water drains. Although the species is infrequently observed, it is probably more common than records indicate.

Status: Uncommon resident, breeding.

Purple Swamphen *Porphyrio porphyrio*

Purple Swamphen is common and widespread throughout freshwater wetlands. In the Mambo Wetlands Reserve 1-2 birds are present in the freshwater areas of the gahnia swamp complex and amongst cumbungi *Typha latifolia* reed beds in the freshwater drains.

Status: Common resident, breeding.

Dusky Moorhen *Gallinula tenebrosa*

Dusky Moorhen is common and widespread throughout freshwater wetlands. In the Mambo Wetlands Reserve up to 5 birds are present in the freshwater areas of the gahnia swamp complex and amongst cumbungi reed beds in the freshwater drains.

Status: Common resident, breeding.

Migratory Shorebirds

Bar-tailed Godwit *Limosa lapponica baueri*

Bar-tailed Godwit subspecies *Limosa lapponica baueri* breeds in west Alaska and north-east Siberia and overwinters in coastal estuaries and mud flats in northern and eastern Australia. It migrates via the East Asian-Australasian Flyway. Port Stephens is a nationally important site for the species with over

0.1% of the world population present over summer (Stuart 2004). In Salamander Bay, 1-7 birds are present in summer, foraging on the tidal flats. The species is classified as vulnerable under the EPBC Act, near-threatened by the IUCN and endangered by The Action Plan for Australian Birds 2020 (Table 2).

Status: Moderately common summer migrant with some young birds overwintering, non-breeding. Vulnerable.

Far Eastern Curlew *Numenius madagascariensis*

Far Eastern Curlew is the largest of the migratory shore birds and overwinters in coastal estuaries and mud flats around Australia. It breeds in Russia, Mongolia and north-eastern China and migrates via the East Asian-Australasian Flyway. Port Stephens is an internationally important site for the species with over 1% of the world population present over summer (Stuart 2004). In Salamander Bay, up to 5 birds were present foraging across the exposed tidal flats. The species is classified as critically endangered under the EPBC Act and endangered by the IUCN and The Action Plan for Australian Birds 2020 (Table 2).

Status: Moderately common summer migrant with some young birds overwintering, non-breeding. Critically endangered.

Grey-tailed Tattler *Tringa brevipes*

Grey-tailed Tattler breeds in Siberia and overwinters in coastal estuaries and mud flats around the Australian coastline. It migrates via the East Asian-Australasian Flyway. In Salamander Bay, up to 28 birds are present in summer foraging around the margins of the mangrove forest or on the tidal flats, and at high tide, roosting on oyster racks and in the mangrove forest. The species is classified as migratory under the EPBC Act, near-threatened by the IUCN and of least concern by The Action Plan for Australian Birds 2020 (Table 2).

Status: Moderately common summer migrant with some young birds overwintering, non-breeding. Near-threatened.

Endemic Shorebirds

Masked Lapwing *Vanellus miles*

Masked Lapwing is widespread throughout eastern and northern Australia and is regularly present throughout Port Stephens. In Salamander Bay, 1-4 pairs are present foraging on the exposed tidal flats and beaches. At high tide, some birds relocate to the samphire flats on the southern side of Foreshore Drive.

Status: Common resident, breeding.

Gulls and Terns

Little Tern *Sternula albifrons*

Little Tern migrates from east Asia to beaches and estuaries around the Australian coastline in summer. In Port Stephens the species frequently nests on Corrie Island or at Winda Woppa, at the mouth of the Myall River. They also nest on the Worimi Conservation Lands section of Stockton Beach. On completion of breeding in the region, dispersing birds assemble in Salamander Bay during January and February prior to their northern migration. Up to 83 birds were present, roosting on oyster racks. The species is listed as a migratory species under the EPBC Act and is listed as endangered in NSW under the BC Act.

Status: Relatively common summer migrant, breeding. Endangered.

Australian Gull-billed Tern *Gelochelidon macrotarsa*

Australian Gull-billed Tern is relatively common and widespread in small numbers around beaches, coastal rivers and wetlands. It is somewhat nomadic and at times irruptive. A single bird has been recorded in Salamander Bay.

Status: Relatively common resident with seasonal movements, non-breeding.

Caspian Tern *Hydroprogne caspia*

Caspian Tern is the largest of the local terns and is relatively common and widespread in small numbers around beaches and estuaries. Numbers are higher in summer and it is occasionally irruptive. In Salamander Bay, up to 5 birds are present in summer.

Status: Relatively common resident, or partly dispersive. Breeding.

White-fronted Tern *Sterna striata*

White-fronted Tern is a New Zealand migratory species that spends winter on the beaches and estuaries of south-eastern Australia. It is an uncommon visitor to Port Stephens. There is a single record of 16 birds in Salamander Bay.

The birds that are present around the NSW coast in winter are part of the non-breeding Australian population and are classified as near-threatened by the IUCN and by The Action Plan for Australian Birds 2020.

Status: Uncommon winter migrant, non-breeding. Near-threatened.

Common Tern *Sterna hirundo*

Common Tern is a migratory species from Eurasia and North America that is present in offshore waters, ocean beaches and estuaries around Australia's northern and eastern coasts in summer.

It is regularly observed in Port Stephens. In Salamander Bay, 4 and 5 birds were observed on two separate occasions.

Status: Relatively common summer migrant, non-breeding.

Greater Crested Tern *Thalasseus bergii*

Greater Crested Tern is a mainly pelagic seabird that is present around the coastline. Large flocks are frequently recorded in Port Stephens. It breeds on off-shore islands in winter. In Salamander Bay flocks of 5-40 birds commonly roost on oyster racks at low tide. Small flocks and individual birds are observed foraging in shallow waters of the bay.

Status: Common resident, breeding.

Silver Gull *Chroicocephalus novaehollandiae*

Silver Gull is widespread around the coastline and across inland areas. Large flocks are frequently recorded in Port Stephens and 20-100 birds are regularly present in Salamander Bay. The birds forage across the exposed tidal flats at low tide and in the shallow waters of the bay. They form small flocks on the beaches at high tide. They breed on off-shore islands in winter.

Status: Common resident, breeding.

DISCUSSION

Most of the 35 species are found in similar habitats elsewhere in Port Stephens. Two of the six threatened or near-threatened species had been previously noted (Fraser 2018b). These were Far Eastern Curlew and Bar-tailed Godwit. Four additional threatened or near-threatened species were identified from the current study: Grey-tailed Tattler, Little Tern, Common Tern and White-fronted Tern.

Although the Grey-tailed Tattler was the most common of the four species, their numbers have decreased considerably over the past 15 years. Ten or more birds were usually recorded during 2008-2013; now most records are of a single bird. This may reflect a change in the nature of the sediments in the bay, and consequentially the foraging habitat that makes up the tidal flats. An increasing proportion of sand may be replacing the finer silt and mud (L. Wooding pers. comm.). The extent of waterfront mangroves at the northern end of the mangrove forest is also receding as the substrate becomes increasingly sandy. This more likely reflects changes in sand distribution within Port Stephens rather than a changed sedimentation regime from Mambo Creek.

The decline in records and numbers of Grey-tailed Tattlers in Salamander Bay may also reflect a decline in the species population. The populations of all migratory species that use the East Asian-Australasian Flyway are declining (Hansen *et al.* 2016). This includes Far Eastern Curlew, Bar-tailed Godwit and Grey-tailed Tattler, all of which overwinter in Salamander Bay. Changes in land use, particularly loss of intertidal staging habitat in the Yellow Sea, is the single greatest cause of the decline in Australasian shorebird populations.

CONCLUSION

This study has demonstrated the importance of the Mambo Wetlands and Wanda Wetlands Reserves in supporting threatened and near-threatened shorebird and tern species. While the number of threatened species using Salamander Bay is currently relatively small, the tidal flats and associated mangrove forest and saltmarsh are an essential part of the estuarine ecosystems that support these migrants throughout Port Stephens. The area of suitable habitat is sufficient to sustain a larger population should it occur here in the future. International actions to reverse the loss of migratory shorebird staging areas along the East Asian-Australasian Flyway have commenced (BirdLife International 2022). Similar action is required locally to permanently protect the tidal flats, mangrove forest, saltmarsh and associated wetlands at Salamander Bay, and ensure survival of the threatened and near-threatened species that depend on these habitats.

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