



PORT of TOWNSVILLE
Nexus North Queensland

Appendix V Avifauna Assessment – Report by Peter Driscoll for GHD

Townsville Marine Precinct Project
Environmental Impact Statement



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Executive summary

Bird communities

Fieldwork at the mouth of the Ross River was undertaken to determine the importance of the area for birdlife and the possible impacts on local bird communities from the Port of Townsville Marine Precinct project. Considerable past information on shorebirds is available for the area, which has been incorporated into the assessment of the status of local shorebird communities through comparisons with data from other sites in the same region and with information from other regions in the State.

Shorebirds are of particular importance at the site because they dominate the bird communities that may be impacted by the development, and because there are many migratory species in the area that are subject to international conservation agreements, which is of concern to both State and Commonwealth Governments. Most of these migratory shorebirds breed in the arctic taiga and tundra. Other birds have also been considered including both marine and terrestrial species.

Shorebird behaviour is determined by the tide, regardless of the time of day. The birds require intertidal, low tide feeding habitat as well as places at high tide that they can use to rest when they are not feeding. These high tide roost sites are habitually used by shorebirds, have particular features and are an important habitat requirement that allows shorebirds to utilise local food resources at low tide. Counts of birds were undertaken on intertidal feeding areas and on the main roost site in the area. Also, in order to describe all bird local communities close to the development site, transect counts were undertaken through nearby eucalypt and mangrove woodlands. Brief surveys were also made of the banks of the Ross River upstream of the mouth to better understand the extent of a local egret and ibis rookery and to identify possible movements patterns of birds between the river mouth and further upstream.

The egret and ibis rookery beside the Ross River, about 1.5 km from the mouth, caters for many birds that travel out to neighbouring areas in several directions. At least for the time the fieldwork was being done, there did not appear to be a strong connection between birds using of the intertidal flats at the mouth of the river and birds that utilise the rookery.

Eucalypt and mangrove woodland bird communities are unlikely to suffer from changes caused directly by the Marine Precinct project. However, they will be vulnerable to cumulative impacts from the Port Access corridor through habitat destruction of eucalypt woodland and possible indirect impacts on mangroves in the area. The eucalypt woodland is substantially degraded and under the circumstances exhibited reasonable bird species diversity. The local mangrove woodland is in a far more pristine condition and contained a good number of species that are characteristic of mangroves.

Site significance

Shorebirds and other bird species use the sand bank out from the mouth of the Ross River at high tide for roosting. Almost the full length (800 m) of the bank remains partially exposed, even on the highest spring tides. The site offers a secure location for over 3000 shorebirds, isolated by water from mammalian predators. The site has all the features of a good high tide roost site. The birds that use the site are those that use the neighbouring intertidal feeding areas but, in addition, birds that feed farther away to the south east, also roost on the site and make up more than a third of the total number of total roosting birds. The sand bank roost site would easily rank in the top forty roost sites for shorebirds along the east coast of Queensland and is critical for the use of neighbouring intertidal feeding flats by shorebirds.

Summary data for 29 sites in the region was compiled from datasets belonging to the Australasian Wader Studies Group, the Queensland Wader Study Group and the Townsville Region BOC (Bird Observation and Conservation Australia) and used with data for the Ross River mouth to highlight regional importance shorebird sites. The Ross River mouth ranks highest in the region in terms of the maximum shorebird count and the highest average summer count over a period of 25 years. Of the six highest ranking sites, four are very close to the Ross River mouth and actually represent the same community of shorebirds that utilise the sand bank at the mouth of the river as a high tide roost site.

Shorebirds occurred at markedly different densities on the three low tide feeding areas that were investigated. The highest density of feeding birds was on the flat on the southeast side of the river mouth while the extensive flats along the shoreline farther to the south east was used less intensively. The site of lowest density of feeding birds was Lot 773 on the north west side of the river, which is planned as the site for the marine precinct development. The possible reason for the relative lack of shorebirds here is the high level of disturbance by people and their dogs on the site. It is currently a de facto recreational area for the local community.

Most abundant species

Over time, 23 species of migratory shorebird, 8 species of resident shorebird and 34 non shorebird species have been recorded on intertidal areas at the mouth of the Ross River. On any single visit to the site about 12 shorebird (9 migratory and 3 resident) and 4 other species of birds are present. Amongst the non shorebird species, seven species of tern, Little and Great Egrets, cormorants, ibis, and several birds of prey regularly use the site. Of particular note are Little Tern and Beach Stone-curlew.

In order of overall abundance at the site the following nine species of migratory shorebird make up 85% of the total number of birds counted there: Great Knot, Red-necked Stint, Bar-tailed Godwit, Sharp-tailed Sandpiper, Eastern Curlew, Whimbrel, Lesser and Greater Sandplovers and Grey-tailed Tattler. Each species displays its own pattern of seasonal abundance at the site because of differences in migration behaviour and distribution within Australia.

Species of significance

The mouth of the Ross River is recognised under the EPBC Act as being internationally significant for the number of Lesser Sandplover and Eastern Curlew that have been recorded there and nationally significant on the basis of the number of Whimbrel. Also, the site arguably has international significance on the basis of numbers of Great Knot and Red-necked Stint. Furthermore, migratory shorebirds generally are subject to international conservation agreements between Australia and three other countries. Species of particular interest on the basis of State Legislation are the Beach Stone Curlew, Eastern Curlew and Little Tern.

Recommendations

Given the significance of the environs of the Ross River mouth for birdlife, particularly the sand bank roost site for shorebirds, the following measures are recommended to ameliorate against adverse impacts from the Marine Precinct project and other developments in the area:

1. Changes to intertidal bird feeding habitat should be restricted to Lot 773. There should be no direct or indirect consequences of the development on the nature of, or level of interference with other intertidal flats in the area.
2. Mangroves on the southeast bank of the Ross River are in good condition with an intact mangrove bird community and should be protected as an important adjunct to neighbouring estuarine habitat.
3. Breakwater placement and design should be such that there are no medium or long term threats to the integrity of the offshore sand bank, its extent or its height. A breakwater should not compromise the condition of the sand bank as being separate from the mainland as an island refuge at high tide for roosting shorebirds. Visitation rates by people should not increase.
4. If there is to be any interim access to the sand bank during construction of a breakwater then that access needs to be subject to stringent conditions under an Environmental Management Plan to minimise disturbance to birds at the site.
5. The roost site needs to be carefully monitored in the future to ensure that its integrity does not come under threat from unpredicted changes in sedimentation patterns etc from new marine structures including the Marine Precinct and any breakwater.
6. Much is already known about important, typical features of high tide roost sites for shorebirds and it is possible to engineer, or artificially create many of these features. This knowledge should be put to use if detrimental changes to the roost site do start to occur.
7. The cumulative consequences of the Port Access Corridor, the Marine Precinct and other developments in the area should be acknowledged through cooperative

planning by all parties involved to protect bird habitat at the mouth Ross River. Appropriate management of access by people to this area should be put in place.

8. The community should be informed of the significance of the area for shorebirds with appropriate signage and community consultation, including a cooperative approach to continued monitoring of birdlife at the site using organisations such as TRBOC, QWSG and AWSG.
9. Recognition of the area for shorebirds should be made through its listing with the *Shorebird Site Network* under the *Asia Pacific Migratory Waterbird Strategy* as noted in the Commonwealth *Wildlife Conservation Plan for Migratory Shorebirds*.

1. Introduction

The Marine Precinct project being proposed by the Port of Townsville has the potential to impact upon birdlife and bird habitats in the vicinity of the mouth of the Ross River. The objective of this report is to determine the importance of the bird communities that may be affected by the planned development and to propose management strategies to help ameliorate any potential impacts to important birdlife. Emphasis is given to migratory shorebirds, which are particularly prevalent within the environs of the river mouth, although other bird groups were also investigated

The *Environment Protection and Biodiversity Conservation Act 1999 (Cth)* and the *Nature Conservation Act (Qld)* form the basis for the regulatory framework for assessing possible threats to birdlife and for evaluating management strategies designed to ameliorate any impacts. The bird communities of interest have been investigated previously in relation to a new port access road (NRA 2005a,b) and in relation to the marine precinct project (Maunsell 2008, NRA 2008). Field data gathered during these studies have not been used in this report but the results are discussed. Nevertheless, much other historical data has been sourced and used in the analyses presented here.

Specific issues and concerns raised within the Terms of Reference for the study are addressed in the report and the numbers of migratory shorebirds using the study area is considered in the context of local, regional, national and international populations. Furthermore, the effects of indirect disturbance on shorebirds are discussed, as are opportunities for bird habitat reconstruction and management that could be used to ameliorate possible adverse impacts to birdlife from the proposed Marine Precinct project.

1.1 Shorebirds

Shorebirds, which are alternatively known as waders, include a large collection of long range, international migratory species that migrate to and from Australia every year, and a smaller grouping of resident species that breed and live within Australia. The majority of shorebird species belong to the family Charadriidae (plovers, dotterels) or to the family Scopacidae (curlews, godwits, sandpipers). However, other families are represented in the "shorebird" grouping (Appendix A). Over 65% of the 55 species of shorebird that regularly occur in Australia are migratory and subject to international conservation agreements. Also, some of the resident, or non-migratory shorebirds appear on one or another list of species with conservation concerns (Appendix A).

In discussing the results, the focus will be on shorebirds generally although consideration will be given to individual species. While in Australia, during their non-breeding season, many migratory shorebird species exhibit similar roosting and feeding habitat requirements and operate as part of mixed species flocks. Also, they

are commonly considered as a group for the purposes of population and distribution analyses and for habitat management.

The two main habitat requirements for shorebirds on the non-breeding grounds are sites for feeding and roosting. The birds' needs revolve around feeding on intertidal flats at low tide and roosting while the tide is high. The use of feeding grounds may be affected by their proximity to roost sites and vice versa because minimising the flight distance between feeding and roosting sites conserves important energy reserves (Piersma et al 1993, Rogers 2003). Shorebirds regularly congregate and roost in large mixed species flocks on high tide where they can be counted. The sites used for roosting are used habitually by the birds, have particular characteristics and serve as a safe haven for the birds to rest.

1.2 Other birds

Many other wetland or marine bird species, which are not also considered shorebirds, were recorded in the study area and included Gulls and terns (Laridae), and spoonbills, ibis, herons and egrets (Ardeidae). The marine environments were sampled at both low and high spring tides using a telescope at selected locations in an attempt to count all the birds in an area.

In contrast, transect counts were used to sample mangrove and eucalypt woodland habitats. Transect counts give an index of abundance and do not represent absolute counts of birds in an area. Even though mangroves have marine characteristics, data for mangrove and eucalypt woodlands are considered together because the sampling technique was the same and because mangrove bird communities tend to have a large contingent of typical eucalypt woodland bird species. The species recorded during transect counts belonged to a broad range of families, primarily from the order Passeriformes (Appendix A).

1.3 Sampling methods and study area

The areas around the Ross River mouth that were investigated are shown in Figure 1. Four bird survey techniques were used as outlined below and access to sampling sites was on foot, by boat.

a) High tide roost counts of shorebirds, seabirds and waterbirds

Roosting birds were counted on the sand bank (boat access only) on four occasions 1.5 hours either side of spring high tides between 15 October and 15 November using a 25x telescope and tripod. At this period of the tide, birds are resting in flocks, as their feeding habitat is underwater. Other local areas were inspected as potential high tide roost sites. Bird numbers often needed to be estimated because of the concentrated nature of the roosting flocks and because of difficulties in approaching and sighting such large flocks of birds along a long, thin sand bank.

b) Low tide scan counts of feeding shorebirds and waterbirds

Three intertidal flats (A, B & C in Figure 1) were walked on spring low tides to count birds using a 25x telescope on a tripod. The low tide scan counts were replicated as one count within 2 hours prior to low tide and one count up to 2 hours after low tide within four days of one another. Access was by foot around the flats and sighting positions were chosen to best record actual numbers of birds. At times, the distance to birds and movements of flocks limited the accuracy of counts. However, the technique is the best available for rapid assessment of bird numbers and is an accepted survey method.

c) Station based transect counts of mangrove and eucalypt woodland birds

Transect counts involve counting birds seen or heard over a period of 5 mins within a 50 m radius at each of 20 stations spaced 100 m apart within a habitat. The counts represent an index of abundance and cannot be used as estimates of absolute abundance, at least not in this instance. Each transect was visited twice, on one morning and one evening within a five day period.

d) Late evening and early morning inspection of waterbird rookery and river bank

The egret and ibis rookery in mangroves upstream on the Ross River was visited on two occasions by boat and on foot to observe the extent of the rookery; the species using it and the direction of movements of birds to and from the rookery were noted.

Observations were also made on local bird movements and usage patterns of the area, associated with tidal, diurnal and seasonal influences. Seasonal usage patterns are considered in this report using ancillary data that are from the same area from as much as 25 years ago. Summary data from historical records for sites within 70 km of Townsville (Figure 2) are also used in interpreting results of the fieldwork.



Areas A (Lot 773), B and C were visited on spring low tides to count birds using exposed intertidal flats. Roosting birds were counted on the sand bank during spring high tides and the transect routes through mangrove and eucalypt woodland were walked to sample woodland bird communities. The extent of the ibis/egret rookery was determined through site inspections at dawn and dusk.

LEGEND

- Eucalypt woodland transect route
- Mangrove woodland transect route
- ▨ Extent of ibis/egret rookery
- ▨ High tide bird roosting positions
- Survey Area
- ▨ Proposed Marine Precinct

1:20,000 (at A4)

0 100 200 300 400 500

Metres

Map Projection: Universal Transverse Mercator
 Horizontal Datum: Geocentric Datum of Australia 1994
 Grid: Map Grid of Australia, Zone 55

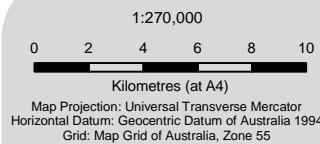
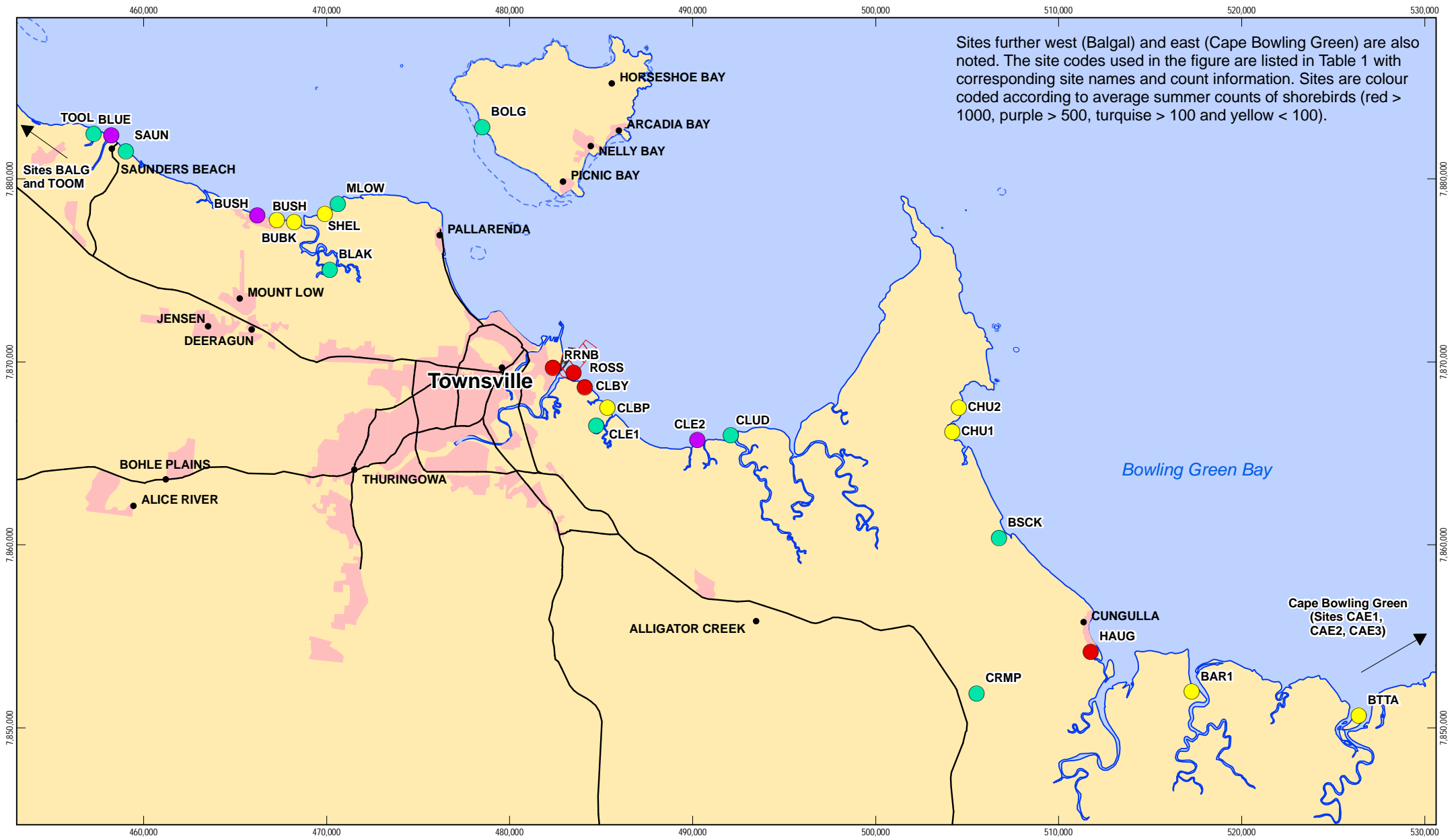


Port of Townsville
Marine Precinct EIS

Job Number 42-15399
 Revision A
 Date 01 July 2009

**Ross River Mouth
Bird Sampling Locations**

Figure 1



LEGEND

- Average Summer Counts of Shorebirds**
- > 1000
 - > 500
 - > 100
 - < 100

- ▭ Project Area of Interest
- ▭ Builtup Area



Port of Townsville
Marine Precinct EIS

**Wetland Bird Sampling Sites
in the Vicinity of Townsville
from Toolakea to Barratta Creek**

Job Number 42-15399
Revision A
Date 01 July 2009

Figure 2

2. Information Review and Results

2.1 Shorebird information

2.1.1 Queensland

Counts of shorebirds at the mouth of the Ross River began in late 1983 as part of amateur bird watching activities organised through the Royal Australasian Ornithologists Union (RAOU), now known as Birds Australia (BA). From 1980, organised counts of shorebirds were made throughout the country, either twice yearly as part of a Population Monitoring Project, or monthly as part of a Regular Counts Project. The latter project was terminated in 1990, but the Population Monitoring Project continues to this day under the auspices of the Australasian Wader Studies Group (AWSG, affiliated with BA) and the Queensland Wader Study Group (QWSG, affiliated with Birds Queensland). Also, more recently The Townsville Region branch (TRBOC) of Bird Observation & Conservation Australia or BOCA (formerly known as the Bird Observers Club or Australia) has also collected shorebird data. Many TRBOC members in the past collected data on behalf of the AWSG or the QWSG. Much of these data are incorporated into the analyses of the results from the present study but a short review of the significance of the Townsville region and the Ross River area is given below.

Between 1981 and 1985 counts of shorebirds were broadly allocated to regions and much of the information on exactly where counts were made is difficult to decipher. Like other regions in Queensland, the coastline from Ingham to Bowen was not well monitored for shorebirds during those years, there being only 90 occasions when counts were made of shorebirds for a total of under 12,000 birds at an unknown number of locations. The species most commonly counted were Bar-tailed Godwits, Red-capped Plover, Great Knot, and Red-necked Stint, which made up 50% of the total counts. For counts made after 1985, there was better information on site location and these data have been more useful in the analyses presented in later sections of this report.

Estimates of the density of birds per kilometre of coastline for 13 coastal regions in Queensland are presented in Driscoll (1997). The data was drawn from all available sources including special surveys conducted in 1996 and 1997 of parts of the coastline that had not been well monitored in the past, including the Townsville region (Pell and Lawler 1996).

The shorelines of Halifax and Cleveland Bays have similar numbers of shorebirds per kilometre as other parts of the Queensland coastline to as far south as Hervey Bay. However, the south east Gulf of Carpentaria, the Great Sandy Strait, Moreton Bay, parts of the Mackay coastline and Shoalwater Bay have higher densities than elsewhere. The southeast Gulf of Carpentaria has by far the highest numbers of coastal shorebirds with an estimated 50% of the State total. Two of the three most

common species that occur in the Gulf, the Black-tailed Godwit and Red Knot, are very poorly represented anywhere else along the Queensland coastline.

Reference will be made later to this State-wide assessment of coastal shorebird numbers in relation to findings at, and near the Ross River mouth.

2.1.2 Townsville region

Summary historical data shown in Table 1 come from 29 sites (see Figure 2) between Rollingstone, northwest of Townsville, and Cape Bowling Green to the southeast. The table gives the maximum count of shorebirds, the average summer and the average winter count and the number of occasions on which a count has been made.

Other sites not in the table have been sampled with fewer than 50 shorebirds being recorded. These sites include five on Magnetic Island (Horseshoe Lagoon & Bay, Arcadia Bay, Nelly Bay, Picnic Bay, Cackle Beach), a few sub-coastal sites (Mt St John's Sewage Treatment Plant, Sapphire Drive Mangroves and Mudflats, Ross River Wetlands) and foreshore sites at Cape Pallarenda, Rowes Bay and Rollingstone.

Table 1 Summary results for Townsville region shorebird sites

Site name	Site code	Max. count	Av. summer count	Av. winter count	Occasions site counted
Ross River mouth	ROSS ^s	6459	1925	622	122
Cleveland Bay nth - Tns	CLBY	3843	1805	601	7
Haughton River	HAUG ^s	2779	1531	77	11
Cape Bowling Green 1	CAE1	7137	1411	3566	21
Ross River north bank & foreshore	RRNB ^s	1950	1143	63	7
Cleveland Bay 2	CLE2	921	921		1
Bushland Beach east to Bohle R.	BUSH ^s	3970	831	93	84
Bushland Beach west to Black R.	BUBK ^s	4700	712	158	46
Bluewater Creek	BLUES	1618	566	30	27
Blakey's Crossing Tns	BLAK	808	271	217	65
Black Soil Ck Bowling Green Bay	BSCK	962	247	129	32
Cleveland Bay 1	CLE1 ^s	4040	197	389	49
Cluden Flats	CLUD	280	167	152	6
Mt Low Beach	MLOW	261	162		2
Saunders Beach	SAUN ^s	1026	157		7
Cape Bowling Green 2	CAE2	802			2
Cleveland Rd mud flat (AIMS)	CRMF	324	120		26
Bolgers Bay, Magnetic Is	BOLG ^s	324	110	43	16
Toolakea Beach	TOOL ^s	374	106	26	28
Cleveland Bay STP	CLBP ^s	227	79	29	49
Shelly Beach, Cape Pallarenda	SHEL ^s	228		20	3
Barratta Creek	BTTA	214			2
Cape Bowling Green 3	CAE3	178			1

Bohle River mouth	BOHL [§]	144			3
Chunda Bay 1	CHU1	140	74	140	2
Balgol Beach	BALG	72	51		6
Toomulla Beach	TOOM [§]	92	39	31	33
Chunda Bay 2	CHU2	64			1
Barramundi Creek 1	BAR1	54			1

[§] indicates currently being monitored by TRBOC

There are large areas of mangroves and seagrass beds in the Hinchinbrook Channel but limited feeding areas for shorebirds (Pell and Lawler 1996). Shorebirds feed along the shores of Halifax Bay where localised intertidal areas and adjoining mangroves occur, mostly in the context of small estuaries. A number of moderately sized roost sites are located along the shoreline of Halifax Bay.

Four major estuaries empty into Cleveland Bay and there are extensive intertidal flats with associated mangroves and salt marsh in an area of fairly high density of waders. The sewage outfall in the vicinity of Sandfly Creek (at approximately CLBY in Figure 2) contributes to a rich food resource for the birds (Pell and Lawler 1996). This nutrient enrichment will lessen in years to come with the upgrading of the Cleveland Bay Sewage Treatment Plant, which may affect the current balance of shorebird numbers in the area. Some species may be disadvantaged and others advantaged by this change (see Thompson, 1993) and there could conceivably be a lowering of the overall density of shorebirds.

A major high tide roost site (ROSS, Table 1) is at the mouth of the Ross River and is the site sampled in the present study.

Forty four counts were made at the Ross River mouth (ROSS) between July 1983 and December 1987 with over 2000 shorebirds often being recorded in late spring and early summer. There are no data available for the site for the period between 1988 and 1993. However, from 1993 until 2005 there are about twice-yearly records and since 2005 the site has been counted at more than six times a year. The site appears to have been counted for shorebirds more often than any other site in the region and it has the highest average summer count and highest maximum count of shorebirds than any other site (Table 1).

Periodic high numbers and regular medium numbers of shorebirds occur at other sites including around the mouth of the Haughton River, on the inside of Cape Bowling Green and to a lesser extent along parts of the northern beaches.

It should be noted that the high counts for Cleveland Bay 1 (CLE1), Cleveland Bay 2 (CLE2), Cleveland Bay north (CLBY) and Ross River northwest bank and foreshore (RRNB) are all linked to the same high level of shorebird activity at the mouth, and to the southeast of the mouth, of the Ross River. Counts at CLE1, CLE2 and CLBY have generally been made on intertidal flat on a falling or rising tide and there is no known, consistently used high tide roost of large numbers of birds at these locations. Most of the birds counted at these sites have been using the sand banks at the mouth of the

Ross River as a high tide roost site. Similarly, the single high count of shorebirds (1874 birds in February this year) for the Ross River northwest bank and foreshore (RRNB) is likely to have been birds temporarily alighting on the foreshore on this side of the river before moving on or off the main sand bank roost site on the southeast side of the river.

Results are presented below for the three areas of investigation, birds roosting at high tide on the sand banks, birds feeding on intertidal flats, and birds in mangroves and woodland on the southeast side of the river.

2.2 Results

2.2.1 Miscellaneous records

Inspections of the banks of the Ross River and small creeks flowing into the river were made on a low and a high tide. The extent of the well known ibis rookery is mapped out in Figure 1. Much of the bird movement to and from this rookery was to the south, east and west and not necessarily towards the mouth of the river. Great and Little Egrets do use the rookery and some did move out to feed towards the mouth of the river but there is not a strong, discernible link between bird activity at the rookery and feeding activity on the intertidal study areas.

Also, there was very little upstream river bank feeding by shorebirds; it was primarily limited to very few Whimbrel and Eastern Curlew. The river banks may be favourably habitat for Grey-tailed Tattlers at other times of the year when the species is more plentiful (see Section 2.3.4) or for Terek Sandpipers that can occur in isolated small flocks on upstream tidal banks of creeks and can be readily missed (pers. obs.). However, there was no indication of such activity during the present study.

2.2.2 Eucalypt woodland transect counts

This woodland habitat is considerably degraded and variable. Some is regrowth and some is remnant tall forest. Woody weeds have affected much of the area. Nevertheless, there are features of the habitat that continue to attract and sustain a reasonably diverse bird community.

Thirty nine species were recorded from 223 counts of birds made during transects through eucalypt woodland (Figure 1, Table 2, Appendix A). Fifteen of these species were not recorded elsewhere during the fieldwork. Noteworthy species unique to the habitat included the Red-tailed Black-Cockatoo, Blue-winged Kookaburra, White-throated Honeyeater and Fairy Gerygone. The latter species was found to be breeding in vegetation close to mangroves and is better known as a species of mangroves or rainforest rather than eucalypt woodland.

Table 2 Results from eucalypt and mangrove woodland transect counts.

(See full species list Appendix A for scientific names).

Transect and time of day-->	Woodland AM	Woodland PM	Woodland Total	Mangrove AM	Mangrove PM	Mangrove Total
	30-Oct	27-Oct		31-Oct	28-Oct	
Date (2008)-->						
Australian Brush-turkey	1	1	2		2	2
Brown Quail		10	10			
Peaceful Dove	13	8	21	3	5	8
Bar-shouldered Dove	4	6	10	2	3	5
Pied Imperial-Pigeon				2		2
Eastern Great Egret					1	1
Striated Heron				2		2
Little Egret				2		2
Australian White Ibis				1	2	3
White-bellied Sea-Eagle		1	1			
Whistling Kite	10	8	18	4	1	5
Brahminy Kite	1	1	2			
Black Kite		1	1			
Brown Goshawk	2		2			
Peregrine Falcon					2	2
Bush Stone-curlew		3	3			
Masked Lapwing		6	6			
Whimbrel				8	4	12
Grey-tailed Tattler				2		2
Red-tailed Black-Cockatoo	3		3			
Rainbow Lorikeet	12	6	18	6		6
Pheasant Coucal		2	2			
Blue-winged Kookaburra	2	1	3			
Rainbow Bee-eater	9	12	21		12	12
Great Bowerbird	3	1	4	2	3	5
Red-backed Fairy-wren	6	16	22		2	2
Mangrove Gerygone				8		8
Fairy Gerygone	5		5			
Mangrove Honeyeater				9	6	15
Yellow Honeyeater	14	9	23	1	1	2
Brown-backed Honeyeater		4	4			
Rufous-throated Honeyeater	2	2	4		1	1
Dusky Honeyeater	4	2	6		1	1
Brown Honeyeater	20	7	27	18	13	31
White-throated Honeyeater	6	5	11			
Little Friarbird				1		1
Black-faced Cuckoo-shrike	2		2		1	1
Varied Triller	9	3	12	4	4	8
Little Shrike-thrush	9	1	10	1		1
Australasian Figbird	7		7		2	2
White-breasted Woodswallow	3	1	4	4		4
Black Butcherbird				3	2	5
Australian Magpie	3		3			

Spangled Drongo	2		2	3		3
Australian Raven	2		2	3		3
Leaden Flycatcher	6	1	7	15	8	23
Shining Flycatcher				2	1	3
Black-faced Monarch					1	1
Magpie-lark	3		3			
Welcome Swallow				5		5
Mistletoebird	3	2	5	2	1	3
Olive-backed Sunbird	13		13	2		2
Double-barred Finch	4	10	14			
Nutmeg Mannikin		10	10			
Total species recorded	31	29	39	27	24	37
Total counts of birds	183	140	223	115	79	194

2.2.3 Mangrove woodland transect counts

The habitat generally had a closed canopy and varied from dense low trees (3 m) to taller woodland (12 m). The transect route ran just inside the perimeter of the habitat (Figure 1). Closer to the edge of the habitat and nearer the foreshore, the canopy was far less dense with scattered trees.

Thirty seven species were recorded from 194 counts of birds made during transects through mangrove woodland (Table 2, Appendix A). Nine of these species were not recorded elsewhere during the fieldwork and included the Mangrove Gerygone, Mangrove Honeyeater, Black Butcherbird, Shining Flycatcher and Black-faced Monarch. The first four of these species are characteristic of mangrove woodland and their presence all together suggests that the local mangroves are functioning well as bird habitat. There are few signs of habitat degradation.

2.2.4 Low tide counts

Birds were counted on two low tides on intertidal flats within the study area, and a tabulation of the results for each subarea (A, B & C) is given in Table 3 and for each low tide in Table 4. A general assessment of the differences in shorebird counts between subareas A, B and C (Figure 1) is given below. Subarea A is intertidal flat on the northwest side of the river, Subarea B lies between the sand banks, the mangroves and the river mouth on the southeast side of the river, and Subarea C is the extent of intertidal flat to the southeast of the mangroves to as far as the first creek entrance. The size of each subarea has been estimated from aerial photographs as 20, 23 and 103 ha respectively.

The average shorebird counts per survey, for subareas A, B and C were 60, 1137 and 1223 birds respectively Table 3. The shorebird feeding densities, expressed with respect to the subarea size estimates, were 3, 49 and 12 shorebirds per ha for subareas A, B and C respectively. That is, the data show a sixteen-fold difference in feeding densities of birds between subareas A and B (B higher) and a four fold difference between subareas C and B (B higher). This suggests that the optimal feeding area during the period of the study was out from the river mouth on the

southeast side of the river between the mangroves and the sand banks (area B). The second most used feeding area was farther to the south east along the foreshore (area C) and the least used site was area A (Lot 773).

The concentration of birds in subarea B was pronounced and the substrate here was generally very muddy with an obvious proliferation of benthic invertebrates. Also, counts of birds in subarea B have been understated because, unlike subareas A and C, this area was difficult to traverse due to deep, soft mud and feeding flocks were mostly counted from farther away than at the other two sites and birds would have been missed in the counts. The high number of birds here was also apparent on the rising tide when birds began to congregate into flocks ready for moving onto the high tide roost.

Table 3 Average counts over two low tides of shorebird species counted on intertidal areas A, B & C, Figure 1

Area Label -->	A	B	C
Area (ha)	20	23	103
Aust. Pied Oystercatcher	2		2
Pacific Golden Plover		2	2
Grey Plover			3
Red-capped Plover	9		7
Lesser Sand Plover	7	9	33
Greater Sand Plover		1	59
Bar-tailed Godwit	24	60	37
Whimbrel	10	1	17
Eastern Curlew	8	2	20
Terek Sandpiper			1
Grey-tailed Tattler		8	9
Common Greenshank		4	1
Great Knot		750	89
Red Knot		2	2
Red-necked Stint		127	720
Sharp-tailed Sandpiper		172	225
Total	60	1137	1223
Total birds/ha	3	49	12

Table 4 Results for each day of sampling: high tide roost and low tide feeding counts.

	Tide -->				Counts of roosting birds at high tide using the sand bank (Figure 1)			Species totals
	Date (2008)-->		Low (Areas A, B & C)	Low (Area A only)	15-Oct	16-Oct	24-Oct	
Australian Pelican			14		3	3		20
Eastern Great Egret			2		1	8		11
White-faced Heron					1	1	1	3
Little Egret		1			6	9	1	17
Australian White Ibis					2	2		4
Royal Spoonbill						1		1
Eastern Osprey			1					1
Whistling Kite		1		1				2
Black Kite				3				3
Peregrine Falcon			2					2
Pied Oystercatcher	3	3	3		2	1	2	14
Pacific Golden Plover					3	4		7
Grey Plover	8	9		5	2	3		27
Red-capped Plover	1		4	3	10	4	9	31
Lesser Sand Plover				35	31	3	8	77
Greater Sand Plover				65	33	16		114
Sand Plover sp.	184	85	285	455	79	41		1129
Masked Lapwing							3	3
Bar-tailed Godwit	303	268	96	226	107	96	16	1112
Whimbrel	41	30	104	47	17	19	9	267
Eastern Curlew	18	1	46	29	27	17	8	146
Terek Sandpiper	1				1			2
Grey-tailed Tattler	6			7	17	16		46
Common Greenshank	13	2	10	10	8	2		45
Great Knot	1497	965	1824	2317	1303	375		8281
Red Knot	35	39	25	30		7		136
Red-necked Stint	910	550	530	976	487	1205		4658
Sharp-tailed Sandpiper	327	11	311	11	350	443		1453
Little Tern	15	8	58	14	4	3		102
Gull-billed Tern			18		1			19
Caspian Tern	3	1	1	2	1	2		10
Lesser Crested Tern	17	19		12	11	15		74
Crested Tern	5	2		3	9	4		23
Silver Gull	16	47			16	50	5	134
Migratory shorebird spp.	11	9	8	12	13	13	4	14
Resident shorebird spp.	2	1	2	1	2	2	3	3
Other species	5	7	7	6	11	11	3	16
Total species recorded	18	17	17	19	26	26	10	33
Mig. shorebird count	3343	1960	3231	4213	2465	2247	41	17500
Res. shorebird counts	4	3	7	3	12	5	14	48
Counts of other birds	56	79	96	35	55	98	7	426
Total counts of birds	3403	2042	3334	4251	2532	2350	62	17974

2.2.5 High tide and counts

Birds were concentrated at high tide along the exposed sand bank near the mouth of the Ross River (Figure 1) The approximate locations where they were most concentrated is shown but their positioning can vary depending upon the tide height, weather conditions, the current shape of the sand bank and whether the flocks have been disturbed or forced to move by people, boats or natural predators. No other high tide roosts were located in the study area except for the probable use by birds of the bunded areas within the Port boundary where works were in progress (see Discussion).

During the fieldwork, four high tide roost counts were undertaken on the sand bank and 31 species were recorded. The high tide counts confirmed the importance of the site for shorebirds and a full appraisal of the latest roost counts is made together with past data in the sections to follow.

2.2.6 Comparison with low tide scan counts

Shorebirds that feed in an area generally roost nearby and there is expected to be a correlation between birds counted roosting at high tide and those counted at low tide feeding. However, this correlation of numbers of birds roosting and feeding is influenced greatly by difficulties of sampling, by the mobility of the birds, by the large areas that can be available for feeding and often by the availability of alternative roost sites. Nevertheless, the link between the numbers of roosting and feeding birds around the mouth of the Ross River is quite reasonable (Table 4) and clearly suggests that birds that forage nearby are using the roost site. Large numbers of birds were also observed moving from the feeding areas to the roost on rising tides. Of the 35 bird species recorded from either the roost site or from the intertidal flats, 25 species were recorded in both sets of data. Of the species of shorebird, which made up for over 95% of total counts, 14 out of the 16 species were recorded from both roost site counts and from low tide feeding counts.

It is usual for shorebirds to feed and to roost at sites within 8 km of each other. Because the roost counts of shorebirds was higher than the feeding counts (Table 4), the data suggest that even more birds were using the roost site than were feeding on the neighbouring flats (higher counts on the roost site). It is most probable that shorebirds that feed even farther away along the shoreline of Cleveland Bay to the southeast return to roost on the sand bank at the Ross River mouth. There are many records of high feeding densities of birds at sites farther to the southeast of the sand bank, that is, at CLE1 (Section 1), 4 km from the roost site.

2.3 Summary of past and present shorebird records

Since 1983 there have been over 120 visits to the mouth of the Ross River for the primary purpose of recording the number and species of shorebirds there. Over 180,000 counts of mostly shorebirds have accumulated but the visits have not always

been on a high tide and have been made by different people. Even though the sand banks, in one form or another, seem to have always been a feature of the site, it is unclear exactly what area was covered during the early period of counting and at what stage the tide was at when the count was done. This creates a degree of uncertainty in comparing data from many years ago with that from the present.

Nevertheless, the data can be used to give a long-term perspective on shorebird, waterbird and seabird activity at, or near the present day site of the Ross River sand banks. The records include the high tide counts from the present study and data sourced from various bird study groups (Section 2.1). It does not include data gathered specifically for the recent studies on the Port Access Corridor, which are discussed in Section 4.

Overtime, 66 bird species have been recorded for the site, including 23 species of migratory shorebird, 8 species of resident shorebird and 34 non-shorebird species. However, on average only 16 species (st. dev. of 6) have been recorded on any one visit. Normally there are about 9 species of migratory shorebird, 3 species of resident shorebird and 4 other species, but these numbers can vary appreciably from time to time, especially the number of non shorebird species. The number of this group of species varies so much from visit to visit because these additional species are often incidental sightings of birds nearby. The emphasis of data collection for the site has been on shorebirds.

In considering the shorebird data, a distinction is made between summer and winter records. The summer records are taken to be those made between the last half of November and first half of March and winter records are taken to be those made between the last half of May and the first half of September. These times of the year are the periods when migratory shorebirds generally occur in more stable numbers in Australia, either as overwintering non breeding populations (southern summertime) or as birds that have not returned to the northern hemisphere to breed. At other times of the year there can be rapid changes in shorebird numbers as populations are undergoing migration with different species migrating at different rates and at different times.

2.3.1 Non shorebird species

Numerically, shorebirds dominate the estuarine bird community (see Section 2.3.3) at the mouth of the Ross River, but there are always other species there, usually seabirds and waterbirds. On average there are 4 other species represented by an average of 100 individuals birds.

However, despite the mostly moderate number of non-shorebird species, on several occasions there were significant numbers of species of tern including Little Tern (240), Gull-billed Tern (70), Caspian Tern (45), White-winged Black Tern (59), Lesser Crested Tern (168), and Crested Tern (242). Tern don't necessarily concentrate on high tide roost sites the same way as shorebirds do and can be found roosting at high

concentrations other than during high tide. The importance of the banks to terns is not especially highlighted through the style and timing of data collection that has been undertaken there, which has primarily targeted shorebirds. For example, the Little Tern uses the current sand bank as a breeding site (Section 4).

Australian Pelicans regularly occur on the bank, resting in groups of 30 or more birds and as many as 130 birds have been recorded at the one time. Also, Australian White Ibis often group there in low numbers and there are occasional occurrences of Straw-necked Ibis and Royal Spoonbills. Great Egrets and Little Egrets are invariably in the vicinity and less frequently Intermediate Egrets, White-faced Herons and Striated Herons are recorded.

There are irregular occurrences of the Australasian Darter, and the Pied and Little Pied Cormorants and very occasional large numbers of Little Black Cormorants. On just one occasion (Nov. 1994) a flock of over 2000 Chestnut Teal were reported from the site. Birds of prey including the Osprey, White-bellied Sea-eagle, Whistling Kite, Brahminy Kite and Black Kite have each been recorded a number of times at the site. There are single records of a Black-shouldered Kite and of a pair of Peregrine Falcons, which during the recent fieldwork, caused pandemonium amongst the flock of roosting shorebirds.

2.3.2 Resident shorebirds

There are invariably Red-capped Plover and Pied Oystercatchers at the site and these are the most typical resident shorebirds of coastal Queensland (Driscoll 1977). There can be between 2 and 30 Pied Oystercatchers (average of 6) at the site and over 50 Red-capped Plover have been recorded on 18 occasions. More Red-capped Plover are counted during winter. The summer and winter average numbers are 10 and 43 birds respectively, which reflects the tendency of Red-capped Plover to group in larger flocks during its non-breeding season.

A pair, and sometimes a family of Beach Stone-curlew is infrequently seen on the site and the sand bank would make suitable breeding habitat for the species, and for Pied Oystercatcher and Red-capped Plover. The presence of the Beach Stone-curlew is significant because it is a species listed as "vulnerable" under State legislation (Nature Conservation Act) and as near threatened under IUCN listing.

Masked Lapwing and Black-winged Stilt were two other resident shorebirds that, in the 1980s had a regular presence at the site, but have not been regularly recorded throughout the last decade. Two other species of resident shorebirds were recorded just once at the site and another, the Black-fronted Dotterel, has only been recorded on five occasions.

2.3.3 Migratory shorebirds: relative abundance

As noted earlier, about 9 species of migratory shorebird seem to occur on the sand bank on any high tide. The site is of particular significance for this group of species, which make up over 90% of the records of birds counted at the site.

Table 5 lists the 23 species of migrants and the relative numbers of each species recorded during the recent fieldwork and across all counts at the site. Six of the species are rarely or infrequently recorded and another four, Grey Plover, Marsh Sandpiper, Terek Sandpiper and Curlew Sandpiper each represent less than 1% of the total counts of migratory shorebirds for the site. Another 5 species each make up either 1% or 2% of the total count.

Table 5 Migratory shorebirds recorded from the site during the present study and from all site records.

Values are percentage contribution to total migratory shorebird counts (+: < 1%, blank: not recorded) (See full species list Appendix A for scientific names)

Migratory Shorebird	Present study	All records
Pacific Golden Plover	+	1
Grey Plover	+	+
Lesser Sand Plover	3	4
Greater Sand Plover	5	2
Black-tailed Godwit		1
Bar-tailed Godwit	6	9
Whimbrel	2	4
Eastern Curlew	1	5
Terek Sandpiper	+	+
Grey-tailed Tattler	+	2
Common Greenshank	+	1
Marsh Sandpiper		+
Great Knot	47	50
Red Knot	1	2
Red-necked Stint	27	12
Sharp-tailed Sandpiper	8	7
Curlew Sandpiper		+
<i>(Incidental records)</i>		
Little Curlew		+
Common Sandpiper		+
Ruddy Turnstone		+
Sanderling		+
Broad-billed Sandpiper		+
Ruff		+

The remaining nine species could be said to characterise the shorebird community at the site and include the Great Knot (50%), Red-necked Stint (12%), Bar-tailed Godwit (9%), Sharp-tailed Sandpiper (7%), Lesser and Greater Sand Plovers (6% together),

Eastern Curlew (5%), Whimbrel (4%) and Grey-tailed Tattler (2%). For these species, it is possible to consider regular seasonal changes in numbers (Appendix B) and, for migratory shorebirds generally, a year by year assessment of numbers is possible.

The year to year average summer count of all migratory waders at the site is illustrated in Figure 3. Whereas the average summer count of birds appears to have been around 1500 birds in the mid 1980s, and even lower in the late 1990s, average counts in the last 5 years have been closer to 2500 birds. However, after the year 2000 most of the counts (86%) were made at high tide, presumably on the roost site itself. Prior to 2000 only a small proportion of counts (13%) were made at high tide and the birds counted would not have included all of the individuals using the local roost site.

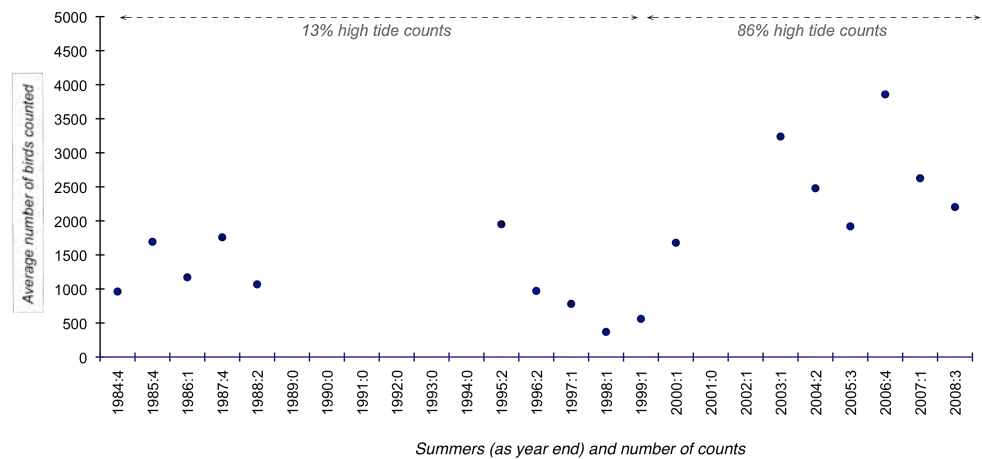


Figure 3. Year to year average summer counts of migratory shorebirds at the Ross River mouth

(The number of counts used in the average calculation for each year is shown on the x axis after the year label).

2.3.4 Migratory shorebirds: seasonal patterns

The seasonal change in numbers of all migratory waders together is illustrated in Figure 4 and Appendix B has graphs of seasonal abundance at the site for the main 9 species of migratory shorebird. The seasonal pattern exhibited in Figure 4 for all species combined is strongly influenced by the pattern for Great Knot (Appendix B) since this species outnumbers all others at the site. Numbers in winter are less than 20% of the November to December period when they are at a peak for the year. However, other species (Appendix B) exhibit different patterns because of the differences in migration patterns between species.

For example, Grey-tailed Tattlers and sand plovers show two peaks each year, one on southward migration and the other on northward migration. These species have populations that are centred at higher latitudes than the Great Knot and more birds are

likely to be using the coastline here during transit rather than as a place to stay for the summer. Sharp-tailed Sandpipers tend to use the area primarily on southward migration and use sub coastal or inland freshwater wetlands on northward migration after the northern wet season.

Rather oddly, Eastern Curlew exhibit higher numbers around Townsville in winter than at other times of the year, which is typical of this species at other Queensland sites. The primary reason is that young Eastern Curlew (< 3-5 years old) that are not going to migrate to breed in the northern hemisphere, are known to move part way up the east coast of Australia in winter to Queensland from Victoria and New South Wales (Wilson 2000).

The Ross River area is typical of other shorebird sites along the coast of Queensland in providing habitat for transitory populations of migratory birds as well as more permanent populations that may spend the whole summer in the same location. For the more transitory species, it is difficult to know how many individuals use the site and for how long. Certainly, many more birds are involved than what is recorded on a single count.

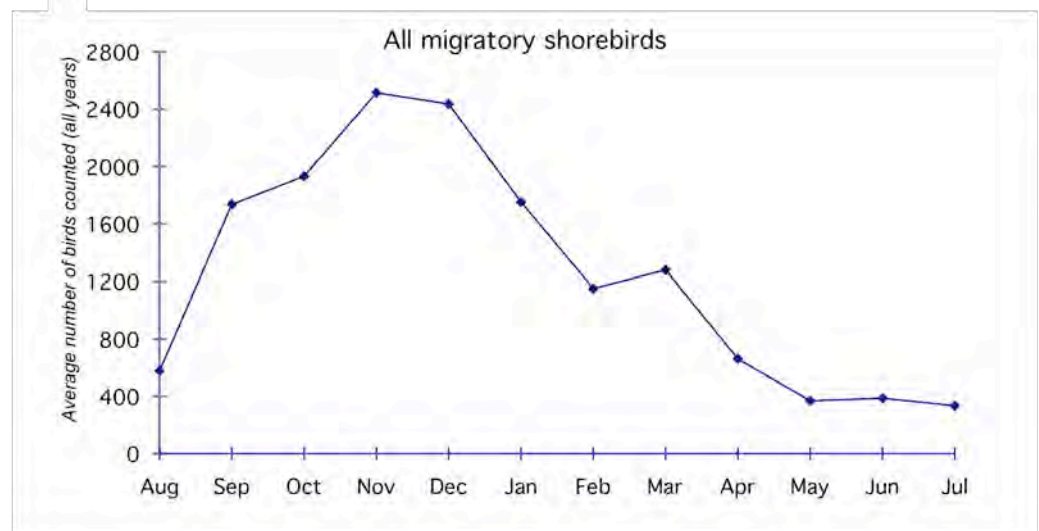


Figure 4. Monthly average number of migratory shorebirds counted at the Ross River mouth.

The Great Knot, which is the most abundant shorebird in the Ross River area, also exhibits the most stable numbers over the summer months and a higher proportion of the individual birds are likely to be moving to more southern parts of the country. In the non-breeding season, the world's population of Great Knot is centred in northern Australia with particularly high numbers in north west Australia and in the south east Gulf of Carpentaria. Substantial numbers also occur along the north Queensland coastline, as they do at the mouth of the Ross River.

3. Discussion

3.1 High tide shorebird roost sites

Most high tide roosts are either in coastal wetland or on foreshores. Shorebirds seek out suitable disturbance-free roosts, available on all high tide heights, within 8 km of feeding areas and preferably within a few kilometres or less (Geering et.al 2007, Finn et. al 2002). For most species, roosts need to be open areas at or adjacent to the foreshore, with a flat or gently sloping bare, even-surfaced beach to shallow water, with minimum 30m buffers to visual obstructions of 2m height (wider if obstructions are higher), and secure disturbance buffers (minimum of 100m). Offshore banks are best if they have beach fronts that face either into or away from prevailing weather and even better if they have alternative aspects to meet different climate conditions. Roosts are best if they are persistent and can survive a 1 in 50 year storm event. The shoreline slopes need to provide adequate roosting area (20 x 70 m minimum), be of gradients of 1:30 or less, which provides a “wadeable” zone as the tide comes and goes, and be broad enough to cater for all tides (Lawler 1995, 1996).

3.1.1 The Ross River sand bank roost

The Ross River sand bank offers over and above the minimum requirements of a high tide roost site. Because it is over 800 m long it provides space for flocks to move if they have been disturbed by predators or by people in boats or on foot. If disturbed, birds are able to reposition themselves on the bank rather than having to abandon the site.

Much of the Cleveland Bay foreshore is difficult to access and survey for shorebirds. However, the data that are available for near the Ross River mouth, confirm that it is highly significant for shorebirds. The relatively regular sampling that has occurred on the Ross River roost site and nearby intertidal flats up to 10 km away is making a valuable contribution to the knowledge of numbers and movements of shorebirds in Queensland. The remainder of Cleveland Bay is poorly known except on the basis of some specific surveys in 1996 and the occasional fieldtrip to search for shorebirds. No other major roost site has been located in the Bay.

The very regular summertime occurrence of around 2000 shorebirds at the site means that it is the most significant shorebird roost site regionally and easily rank among the top 40 roost sites along the east coast of Queensland (Driscoll 1997). In areas of generally higher shorebird activity such as Moreton Bay and the Great Sandy Strait, there are more roost sites in close proximity but any single roost site would not necessarily be used by more shorebirds than the Ross River bank (see Thompson 1990, Driscoll 1993).

3.1.2 Other possible sites

Shorebirds will roost at high tide on claypan/saltmarsh patches in the upper reaches of the tidal range. These areas can be bounded by mangroves and still be used provided they are large enough to allow easy flight access by the birds. However, there is limited availability of this style of roost site close to the mouth of the Ross River because the supratidal areas tend to be fully occupied by stands of mangroves (pers. obs. Figure 1). Such roost sites tend to be used more often after rain when more of the substrate will be moist.

With only one exception, shorebirds were not observed moving to and from a roost site other than the sand bank. The exception was the observation of birds moving towards newly reclaimed lands within the confines of the Port industrial area. Earlier studies NRA (2005, 2008) also report on shorebirds seemingly using this area but the extent to which this is happening cannot be ascertained without access to these areas to make observations of the birds at rest.

It is well known that shorebirds will use dredge spoil sites and expansive areas in the process of being reclaimed, as roosting habitat (Driscoll 1998). The Port of Brisbane has used this response by shorebirds to advantage in creating permanent artificial roosting habitat for shorebirds, which has been reported in a number of the Port annual reports. There is also a purpose built bird hide for public viewing of these roosting shorebirds.

3.2 Roost site protection

Wherever there is continuing urban coastal development in Queensland in areas that are intensively used by shorebirds, there has been loss of roosting habitat (Moreton Bay, Mackay, Great Sandy Strait). In Moreton Bay, about one out of six shorebird roost sites has been or is under threat of being lost and 60% are compromised by excessive disturbance (Miller 1997). Close proximity to a high-tide roost site is one of the most important factors determining the distribution of shorebirds on an intertidal flat. The few roost sites in an area that are available during spring high tides are especially important because they become the only locations where birds can retreat from the rising tide to rest during every single tide cycle. Disturbance free conditions at these roost sites is particularly important for maintaining local shorebird populations. (Geering et al. 2007)

The effect of lost roosting habitat can be increased density or marginalisation of feeding shorebirds resulting in reduced food availability for individuals, and the risk of decreased breeding success and increased mortality for the population. Preservation and management of natural roosts is the most cost-effective way to provide shorebird roosts, and coastal wetland protection has many other well-documented benefits (Lawler 1995).

It is important to note that shorebirds will adapt, to a degree, to human encroachment and persist in using a roost site, providing that encroachment doesn't diminish the quality of the roosting habitat.

Roost sites can be managed or recreated through an understanding of the needs of roosting birds. Special recognition of existing roost sites and even the construction of artificial roost sites have occurred in many parts of the country, especially in Moreton Bay (Harding et al. 1999), including at the Port of Brisbane, Manly Boat Harbour, Ormiston and Bribie Island.

Development that will displace or marginalise a major shorebird roost (natural or otherwise) should not be recommended. However, if a development were to displace roosting habitat, roost provision should be integrated into the plan from the outset and the cost factored in to the development cost. Also, construction processes should minimise environmental impact e.g. use of silt screens, progressive stabilisation, and rehabilitated after machinery leaves.

To allow for possible future modification of a prospective impacted roost, base-line data should be collected prior to construction, and monitoring of environmental impact and bird acceptance should continue for at least 3 years after completion.

Public participation can and should shape roost protection and provision strategies, locations, designs and construction. Extension facilities and programmes (e.g. bird hides and signage) and even commercial tours have the potential to benefit residents, tourists, the local economy, the birds and other wetland values.

3.3 Feeding habitat protection

The loss or alteration of foraging habitat is considered to be a major threat to shorebird conservation (Straw et al. 2006, Geering et al. 2007,). Any structural modification of the substrate, pollutants or impairments to access by birds, which detracts from the quality of the habitat or lowers food availability, will be detrimental to shorebirds. Near the mouth of the Ross River the primary threats to feeding habitat are disturbance by people or dogs, pollutants, compaction of sediments, or incursion of mangroves across the intertidal flat (see Straw and Saintilan 2006).

Human impacts are already apparent on Lot 773 (Area A, Figure 1) where the presence of people and their dogs tends to preclude or lessen the level of shorebird feeding activity (pers. obs.). NRA (2008) has also reported birds leaving the area after being disturbed during the day whereas night time observation of the site showed greater shorebird activity, presumably because there were fewer people and less disturbance to the birds.

3.4 Recognised importance

3.4.1 Shorebird species

Australia is involved in a range of activities that promote the conservation of migratory shorebirds, both within Australia and across the East Asian - Australasian Flyway. The *Wildlife Conservation Plan for Migratory Shorebirds* was formulated under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and contains the statutory elements as legislated by the Act. The *Plan* sets out management actions necessary to support survival of migratory shorebird species, which are not necessarily considered endangered or vulnerable, but would benefit from a nationally coordinated approach to conservation. All of the migratory shorebirds listed in Appendix A are listed in the *Plan*, which also acknowledges statutory requirements concerning these species under the EPBC Act.

Australia has entered into three international agreements specifically concerning the protection of migratory birds: the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA) and the Republic of Korea- Australia Migratory Bird Agreement (RoKAMBA). These treaties commit each country to take special measures to protect bird populations migrating between the countries and encourage a cooperative approach to conservation. The EPBC Act addresses Commonwealth obligations under these bilateral agreements. The species listed under each of the three agreements are indicated in Appendix A.

3.4.2 Site significance

The Ross River mouth site is already acknowledged in Watkins (1993) as internationally important for shorebirds on the basis of counts in the late 1980s of Lesser Sand Plover and Eastern Curlew and as nationally important on the basis of counts of Whimbrel. The sites listed in Watkins (1993) are specifically referred to on page 6 of the *Wildlife Conservation Plan for Migratory Shorebirds* as among those sites that are currently relevant under the EPBC Act.

Other species that are recorded for the site and which have a specific conservation listing are:

Species	IUCN listing	Qld Nature Conservation Act 1992
Beach Stone Curlew	near threatened	vulnerable
Eastern Curlew		rare
Black-necked Stork	near threatened	rare
Sooty Oystercatcher		rare
Black-tailed Godwit	near threatened	

Whereas the Sooty Oystercatcher and the Black-necked Stork would be infrequent visitors to the site, the other three species are more regular occupants.

Other recent appraisals of shorebirds using the Ross River mouth sand bank and associated feeding flats (NRA 2008, Maunsell 2008) have also highlighted the significance of the area for shorebirds and in particular the occasional very high counts of Great Knot and Red-necked Stint, which on at least 3 occasions for Great Knot and one occasion for Red-necked Stint, have been above 1% of the East Asian-Australasian Flyway population estimates for these species.

Such high counts add further evidence to the significance of the site and also have relevance in the context of the EPBC Act, and the associated Commonwealth *Wildlife Conservation Plan for Migratory Shorebirds*.

Attention has also been drawn to Little Tern breeding activity on the sand bank (NRA 2005, NRA 2008). The species nests across the top of the sand bank during the summer months. It is listed as endangered under the Qld Nature Conservation Act. However, a recent review (Dept of Environment 2008) of the status of the breeding populations of the particular subspecies of Little Tern (*Sterna albifrons sinensis*) that occurs in Australia may make the species ineligible for a conservation dependent status under the EPBC Act. Nevertheless, it is still a "marine" species in the context of the EPBC Act and the use of the Ross River sand bank for breeding is presumably important for maintenance of the population regionally. The species continues to exhibit a decline in breeding activity in southern parts of its range.

3.4.3 Actions under the EPBC Act

The Commonwealth *Wildlife Conservation Plan for Migratory Shorebirds* lists 31 actions under four main objectives for conserving migratory shorebird populations. The actions represent a framework to address threats to the various species and their habitats and are mostly measures that can be taken by governments or other interested parties. In the *Plan*, there are at least five actions, listed below, that arguably warrant assistance from the Port of Townsville in ameliorating any adverse consequences to shorebirds from the Marine Precinct project.

- Action 2.5. Identify threats to important habitat and develop conservation measures for managing them.
- Action 2.7. Encourage and support the development of appropriate management arrangements for important sites, particularly those identified as priority sites.
- Action 2.12. Include migratory shorebirds and their habitat in environment protection arrangements at Local, State and National level to avoid significant impacts on migratory shorebird populations.
- Action 3.6. Encourage ongoing population monitoring programs for species covered by this plan.
- Action 4.1. Promote public and community education and conservation awareness, through strategic programs and educational products.

3.5 Potential impacts of the development

3.5.1 Loss of feeding habitat Lot 773

The development of Lot 773 as a Marine Precinct would mean the permanent loss of about 20 ha of feeding habitat for shorebirds. There is six times this extent of intertidal feeding habitat within 2 km of the proposed Marine Precinct. Furthermore, the quality of Lot 773 as feeding habitat is already compromised by the regular use of the area at low tide by people traversing, often with their dogs, disturbing feeding birds. Without the prospect of the Marine Precinct, this disturbance could perhaps be minimised through controls on the activity of people on the flat. Nevertheless, preservation of Lot 773 as feeding habitat is not considered critical for maintaining the large numbers of shorebirds that frequent the area in general. On the south east bank of the river though, opposite Lot 773, there are important natural habitat features that are considered critical to local bird communities.

3.5.2 Offsite impact of the development on feeding habitat

The area of soft muds on the south east side of the river between the sand bank and the inner mouth of the river (Area B, Figure 1) can be used intensively by shorebirds and, for the period of this study, carried far more shorebirds per hectare than the feeding flats farther to the east. Alteration, diminution or disturbance that affected shorebird feeding on this section of intertidal flat would represent a significant loss of amenity for shorebirds that frequent the area. Physical changes to the substrate in this area through the encroachment of man made structures or through changed sedimentation patterns need to be minimised and carefully managed. Direct disturbance by people of shorebirds feeding here also needs to be managed but there is a natural safeguard that already exists in the form of deep, soft muds that form the local substrate, which practically precludes pedestrian access to anywhere other the edge of the site.

Even though the extensive feeding flats that extend to the south east of the sand bank (Area C and beyond, Figure 1) will not be directly affected by the Marine Precinct development, other infrastructure that is being planned for the area, including the Port Access Corridor and associated bridge across the river, will have the potential of giving far more people ready access to intertidal areas and will increase the likely levels of disturbance of feeding shorebirds by people and dogs. That is, all new infrastructure and plans for access to lands and marine areas on the south east bank of the river have the potential to detract from a very important site for shorebirds. Movements of people need to be carefully managed to avoid these potential impacts.

3.5.3 Threats to the sand bank roost site

The roost site is fundamental to the importance of the area for shorebirds. Without it, the nearby feeding flats will cater for far fewer birds. The roost site serves as a focal

point of shorebird activity and a secure place for birds to rest twice every day during periods of high tide.

Threats to the site include:

- a. loss or diminution of the extent of the high tide bank through changes in sedimentation patterns brought about by the breakwater(s) that may be built to protect the marine precinct,
- b. increased human access to the bank that may result from such a breakwater(s) of increased boating activity around the bank, and
- c. short term intense disruption of birds using the bank during periods of construction of the breakwater(s)

3.5.4 Clarification of impacts and measures to address them

In finalising the design for the Precinct and any associated breakwater careful modelling of the likely changes to the current integrity of intertidal feeding habitat (Area B) and the shape and extent of the sand bank should be undertaken. If changes are likely then consideration should be given to changing the design or allowing for measures that will compensate for any likely changes.

Possible changes to feeding habitat substrate (Area B) may be difficult to predict and to manage but should be identified and avoided.

The roost site itself may need to be engineered to offset any immediate alteration in its amenity for birds or to offset possible long term changes from altered sedimentation patterns in the area. If there were to be adverse changes to the roost site, known shorebird roosting requirements (Section 3.1 and Lawler 1995) would need to be matched against what amelioration measures could be taken given specific engineering, social and practical constraints at the site. There are several examples, noted in Section 3.2, of artificial roost site creation or roost site enhancement that have been effective in safeguarding against loss of important roosting habitat.

Similarly, various approaches are available for managing access by people to critical shorebird sites (Lawler 1995, 1996) and once final designs are available for the breakwater and any associated infrastructure then appropriate measures should be devised and incorporated into the design and management of the area. Shorebirds do have public appeal and community education and participation in measures to protect these species are already widely practiced in other parts of Australia.

4. References

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Appendix A: Bird Species List

Species recorded from the Ross River sand banks area since 1983 and species recorded from neighbouring mangrove & woodland during the present study. The columns represent:

Recorded previously: Species recorded only from previous records, not during the current study

Shorebird: Species recorded and indicated as migratory (M) or resident (R)

High tide, Low tide, Mangrove, Woodland: Species recorded in each of the sampling data sets

JAMBA, CAMBA, RoKAMBA: Species listed under each of the bilateral treaties

Habitat: Generalised habitat of each species – coded as letters, refer to key at end of the table

Total Counts: The number of total counts for species with greater than 1000 counts. Fewer counts indicated as less than ten (+), between 10 & 100 (++) , between 100 & 200 (+++), and between 200 and 1000 (++++)

% counts: The total count for the species as a percentage of the total for all species (180,000)

Species	Common name	Recorded previously	Shorebird	High tide	Low tide	Mangrove	Woodland	CAMBA	JAMBA	RoKAMBA	Habitat	Total counts	% counts
GALLIFORMES		<u>Megapodiidae</u>											
<i>Alectura lathami</i>	Australian Brush-turkey					X	X				RUW		
		<u>Phasianidae</u>											
<i>Coturnix ypsilophora</i>	Brown Quail							X			GFP		
ANSERIFORMES		<u>Anatidae</u>											
<i>Anas castanea</i>	Chestnut Teal	\$									FS	2023	1
<i>Anas superciliosa</i>	Pacific Black Duck	\$									F	++	
COLUMBIFORMES		<u>Columbidae</u>											
<i>Geopelia striata</i>	Peaceful Dove					X	X				TWGF		
<i>Geopelia humeralis</i>	Bar-shouldered Dove					X	X				TWMSF		
<i>Ducula bicolor</i>	Pied Imperial-Pigeon					X					RW	+	
PHALACROCORACIFORMES		<u>Anhingidae</u>											
<i>Anhinga novaehollandiae</i>	Australasian Darter	\$									FS	++	
		<u>Phalacrocoracidae</u>											
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant	\$									FS	++	
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant	\$									FS	++++	
<i>Phalacrocorax varius</i>	Pied Cormorant			X							FS	++	
CICONIIFORMES		<u>Pelecanidae</u>											
<i>Pelecanus conspicillatus</i>	Australian Pelican			X	X						FS	++++	
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	\$									FS	+	
		<u>Ardeidae</u>											
<i>Ardea modesta</i>	Eastern Great Egret			X	X	X		#	#		FSW	++	
<i>Ardea intermedia</i>	Intermediate Egret	\$									FSW	++	
<i>Butorides striata</i>	Striated Heron						X				M	++	
<i>Egretta novaehollandiae</i>	White-faced Heron					X					WFS	++	
<i>Egretta garzetta</i>	Little Egret			X	X	X					SFMP	+++	
<i>Egretta sacra</i>	Eastern Reef Egret	\$						#			S	+	
		<u>Threskiornithidae</u>											
<i>Threskiornis molucca</i>	Australian White Ibis				X	X					SF	1361	1
<i>Platalea regia</i>	Royal Spoonbill				X						SF	++	
ACCIPITRIFORMES		<u>Accipitridae</u>											
<i>Pandion cristatus</i>	Eastern Osprey			X							SF	++	

<i>Elanus axillaris</i>	Black-shouldered Kite	\$							SWP	+		
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle						X	#	FS	++		
<i>Haliastur sphenurus</i>	Whistling Kite		X	X	X				TWF	++		
<i>Haliastur indus</i>	Brahminy Kite							X	WMSF	+		
<i>Milvus migrans</i>	Black Kite		X		X				RTWFZ	++		
<i>Accipiter fasciatus</i>	Brown Goshawk							X	RTW			
FALCONIFORMES												
Falconidae												
<i>Falco cenchroides</i>	Nankeen Kestrel	\$							WZP	+		
<i>Falco peregrinus</i>	Peregrine Falcon			X	X				WTSPF	+		
CHARADRIIFORMES												
Burhinidae												
<i>Burhinus grallarius</i>	Bush Stone-curlew	R						X	WFHM			
<i>Esacus magnirostris</i>	Beach Stone-curlew	R	X						S	++		
Haematopodidae												
<i>Haematopus longirostris</i>	Aust Pied Oystercatcher	R	X	X					S	++++		
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	\$	R						S	+		
Recurvirostridae												
<i>Himantopus himantopus</i>	Black-winged Stilt	\$	R						FS	1115	1	
Charadriidae												
<i>Pluvialis fulva</i>	Pacific Golden Plover	M	X	X					WSPF	932	1	
<i>Pluvialis squatarola</i>	Grey Plover	M	X	X		#	#	#	S	+++		
<i>Charadrius ruficapillus</i>	Red-capped Plover	R	X	X					FS	2437	1	
<i>Charadrius mongolus</i>	Lesser Sand Plover	M	X	X		#	#	#	S	7093	4	
<i>Charadrius leschenaultii</i>	Greater Sand Plover	M	X	X		#	#	#	S	3334	2	
<i>Eseyornis melanops</i>	Black-fronted Dotterel	\$	R						FSP	++		
<i>Vanellus tricolor</i>	Banded Lapwing	\$	R						G	+		
<i>Vanellus miles</i>	Masked Lapwing	R		X	X				WFSP	++++		
Scolopacidae												
<i>Limosa limosa</i>	Black-tailed Godwit	\$	M			#	#	#	FS	2281	1	
<i>Limosa lapponica</i>	Bar-tailed Godwit	M	X	X		#	#	#	S	15259	8	
<i>Numenius minutus</i>	Little Curlew	\$	M			#	#	#	FSG	+		
<i>Numenius phaeopus</i>	Whimbrel	M	X	X	X	#	#	#	MS	6284	3	
<i>Numenius madagascariensis</i>	Eastern Curlew	M	X	X		#	#	#	S	7244	4	
<i>Xenus cinereus</i>	Terek Sandpiper	M	X	X		#	#	#	MSF	+++		
<i>Actitis hypoleucos</i>	Common Sandpiper	\$	M			#	#	#	FSM	++		
<i>Tringa brevipes</i>	Grey-tailed Tattler	M	X	X	X	#	#	#	SM	4496	2	
<i>Tringa nebularia</i>	Common Greenshank	M	X	X		#	#	#	FS	++++		
<i>Tringa stagnatilis</i>	Marsh Sandpiper	\$	M			#	#	#	FS	++		
<i>Arenaria interpres</i>	Ruddy Turnstone	\$	M			#	#	#	SF	+		
<i>Calidris tenuirostris</i>	Great Knot	M	X	X		#	#	#	S	80872	45	
<i>Calidris canutus</i>	Red Knot	M	X	X		#	#	#	S	2450	1	
<i>Calidris alba</i>	Sanderling	\$	M			#	#	#	S	+		
<i>Calidris ruficollis</i>	Red-necked Stint	M	X	X		#	#	#	FS	18907	11	
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M	X	X		#	#	#	FS	10618	6	
<i>Calidris ferruginea</i>	Curlew Sandpiper	\$	M			#	#	#	FS	+++		
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	\$	M			#	#	#	S	+		
<i>Philomachus pugnax</i>	Ruff	\$	M			#	#	#	F	+		
Laridae												
<i>Sternula albifrons</i>	Little Tern		X	X		#	#	#	S	1504	1	
<i>Gelochelidon nilotica</i>	Gull-billed Tern		X	X					FS	++++		
<i>Hydroprogne caspia</i>	Caspian Tern		X	X		#			FS	++++		
<i>Chlidonias leucopterus</i>	White-winged Black Tern	\$				#	#	#	FS	++		
<i>Thalasseus bengalensis</i>	Lesser Crested Tern		X	X		#			S	++++		
<i>Thalasseus bergii</i>	Crested Tern		X	X		#			S	1100	1	
<i>Chroicocephalus novaehollandiae</i>	Silver Gull		X	X					FS	2893	2	

PSITTACIFORMES	<u>Cacatuidae</u>			
<i>Calyptorhynchus banksii</i>	Red-tailed Blck-Cockatoo		X	WTF
	<u>Psittacidae</u>			
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	X	X	RTWZ
CUCULIFORMES	<u>Cuculidae</u>			
<i>Centropus phasianinus</i>	Pheasant Coucal		X	RWU
CORACIIFORMES	<u>Halcyonidae</u>			
<i>Dacelo leachii</i>	Blue-winged Kookaburra		X	TW
	<u>Meropidae</u>			
<i>Merops ornatus</i>	Rainbow Bee-eater	X	X	RTWM A
PASSERIFORMES	<u>Ptilonorhynchidae</u>			
<i>Ptilonorhynchus nuchalis</i>	Great Bowerbird	X	X	R
	<u>Maluridae</u>			
<i>Malurus melanocephalus</i>	Red-backed Fairy-wren	X	X	WURP
	<u>Acanthizidae</u>			
<i>Gerygone levigaster</i>	Mangrove Gerygone	X		MZRW
<i>Gerygone palpebrosa</i>	Fairy Gerygone		X	RM
	<u>Meliphagidae</u>			
<i>Lichenostomus fasciocularis</i>	Mangrove Honeyeater	X		MZ
<i>Lichenostomus flavus</i>	Yellow Honeyeater	X	X	TWMF
<i>Ramsayornis modestus</i>	Brown-backed Honeyeater		X	WM
<i>Conopophila rufogularis</i>	Rufous-throated Honeyeater	X	X	EW
<i>Myzomela obscura</i>	Dusky Honeyeater	X	X	RWM
<i>Lichmera indistincta</i>	Brown Honeyeater	X	X	TWMZ
<i>Melithreptus albogularis</i>	White-throated Honeyeater		X	TWR
<i>Philemon citreogularis</i>	Little Friarbird	X		TW
	<u>Campephagidae</u>			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	X	X	RTWA
<i>Lalage leucomela</i>	Varied Triller	X	X	RTWM
	<u>Pachycephalidae</u>			
<i>Colluricincla megarhyncha</i>	Little Shrike-thrush	X	X	RMTW
	<u>Oriolidae</u>			
<i>Sphecotheres vieilloti</i>	Australasian Figbird	X	X	RTZW
	<u>Artamidae</u>			
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow	X	X	RWTM P
<i>Cracticus quoyi</i>	Black Butcherbird	X		RM
<i>Cracticus tibicen</i>	Australian Magpie		X	WF
	<u>Dicruridae</u>			
<i>Dicrurus bracteatus</i>	Spangled Drongo	X	X	RTWMF
	<u>Corvidae</u>			
<i>Corvus coronoides</i>	Australian Raven	X	X	TWF
	<u>Monarchidae</u>			
<i>Myiagra rubecula</i>	Leaden Flycatcher	X	X	TRMW
<i>Myiagra alecto</i>	Shining Flycatcher	X		RM
<i>Monarcha melanopsis</i>	Black-faced Monarch	X		RT
<i>Grallina cyanoleuca</i>	Magpie-lark		X	WTPF
	<u>Hirundinidae</u>			
<i>Hirundo neoxena</i>	Welcome Swallow	X		RTWMZ F

	<u>Nectariniidae</u>		
<i>Dicaeum hirundinaceum</i>	Mistletoebird	X X	RTWM
<i>Nectarinia jugularis</i>	Olive-backed Sunbird	X X	R
	<u>Estrildidae</u>		
<i>Taeniopygia bichenovii</i>	Double-barred Finch	X	WZPF
<i>Lonchura punctulata</i>	Nutmeg Mannikin	X	ZP

Habitat codes:

R-rainforest	M-mangroves	W-woodland,savannah, grasslands
Z-towns etc	S-coastal	T-tall open forest
U-undergrowth	P-pasture, fields	F-freshwater swamps,creek banks

Appendix B: Seasonal changes in shorebird numbers

The following figures show the seasonal patterns of occurrence of the nine most commonly observed species of migratory shorebirds at the mouth of the Ross River. The data are accumulated from counts taken over a period of 25 years..

