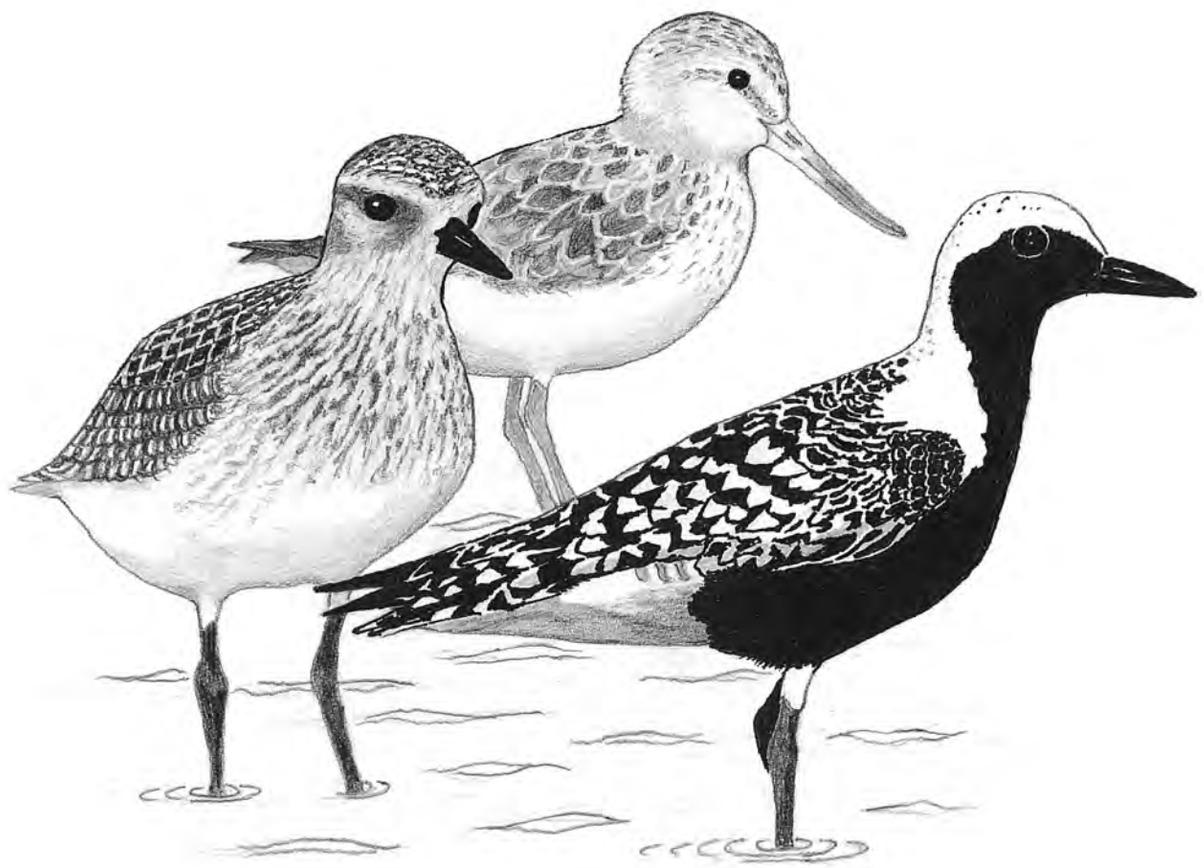
Stilt

The Journal for the East Asian-Australasian Flyway



AWSG
Australasian Wader Studies Group

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MISSION STATEMENT

To ensure the future of waders and their habitats in Australia through research and conservation programmes, and to encourage and assist similar programmes in the rest of the East Asian–Australasian Flyway.

OBJECTIVES

- To monitor wader populations through a programme of counting and banding in order to collect data on changes on a local, national and international basis.
- To study the migrations of waders through a programme of counting, banding, colour flagging and collection of biometric data.
- To instigate and encourage other scientific studies of waders such as feeding and breeding studies.
- To communicate the results of these studies to a wide audience through *Stilt*, the *Tattler*, other journals, the internet, the media, conferences and lectures.
- To formulate and promote policies for the conservation of waders and their habitat, and to make available information to local and national governmental conservation bodies and other organisations to encourage and assist them in pursuing this objective.
- To encourage and promote the involvement of a large band of amateurs, as well as professionals, to achieve these objectives.

MEMBERSHIP OF THE AUSTRALASIAN WADER STUDIES GROUP

Membership of the AWSG is open to anyone interested in the conservation and research of waders (shorebirds) in the East Asian–Australasian Flyway. Members receive the twice yearly bulletin *Stilt*, and the quarterly newsletter *The Tattler*. Please direct all membership enquiries to the Membership Manager at Birds Australia (RAOU) National Office, Suite 2-05, 60 Leicester St, Carlton Vic 3053, AUSTRALIA.
Ph: 1300 730 075, fax: (03) 9347 9323.
Email: membership@birdsaustralia.com.au

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AWSG WEB SITE:
awsg.org.au

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AUSTRALASIAN SHOREBIRD CONFERENCE NEWCASTLE, AUSTRALIA, 2007

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The AWSG Shorebird Conference was held in Newcastle, New South Wales, Australia from the 6th to the 8th of July 2007. The conference had a theme of '**Migratory Shorebirds in a Threatened Flyway**'. Through a series of excellent presentations on Migration Studies including the use of satellite technology, threats to habitats, shorebird population studies, management of shorebird sites and the challenges for government and communities, the delegates were updated on a number of issues related to the study and conservation of shorebirds. Shorebird specialists who joined the conference from China, South Korea, Japan, Thailand and New Zealand provided valuable insight into the pressures on habitats in other parts of the Flyway.

The Conference concluded that migratory shorebird populations continue to be under major threat because of the reclamation and loss of thousands of hectares of coastal habitat each year at the critical stopover locations in the Yellow Sea.

The meeting requested the AWSG committee, working with Birds Australia, to make representations to the Australian Government on this issue. The bilateral Migratory Bird Agreement meetings proposed for early 2008 in Australia, and the Ramsar CoP 10 in November 2008 in South Korea, provide significant opportunities for the Australian Government to promote collaborative activities to address habitat loss in coastal area in China and South Korea.

In addition to the approaches to the Australia Government, AWSG agreed to take the following action:

- Continue its engagement in collaborative shorebird conservation projects with non-government organizations in South Korea
- Actively contribute to the development of the Flyway Partnership and its program of activities
- Seek the reactivation of the Australian Wetland Alliance to provide for coordination of Australian NGO input into the 2008 Ramsar CoP in South Korea
- Seek assistance of the IWSG to raise awareness of the impact of coastal reclamation on shorebirds and to discuss a joint program of action for the Yellow Sea
- Continue the publication and distribution of the Tattler in a Flyway newsletter on shorebirds
- Support the development of the Asia-Pacific Shorebird Network to increase communication between shorebird researchers and conservationists in the region
- Re-develop the AWSG web site to increase awareness of shorebirds and their conservation needs

The Conference also heard of habitat loss that is occurring at some Australian coastal sites (such as the Hunter estuary) and in inland South-eastern Australia. Members requested the AWSG Committee approach the Commonwealth Government to discuss how the EPBC act could better address the loss of shorebird habitat loss in Australia.

ABSTRACTS OF TALKS

LAND-CLAIM ACTIVITIES ALONG THE CHINESE COASTLINE

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Quite correctly, considerable international attention is being given to the tragic loss of the very large Saemangeum wetland on the west coast of South Korea. However, cumulatively larger areas are being claimed or adversely affected by pollution and human disturbance on the Chinese coast. The coastal provinces are amongst the most densely populated within China and have fast economic growth rates and, consequently, the coastal wetlands are suffering greatly. Changes in river flows, as a result of water extraction and damming, are greatly affecting sediment and nutrient inputs to coastal areas with a consequent effect on biological productivity. A recent study into the effect of the Three Gorges Dam on the Yangtze River showed that sediment flow had declined by 65% and that the coastline at the river mouth was now eroding. Similar changes to productivity and intertidal area will probably be occurring at other estuaries along the coastline. With land claim rate accelerating and accretion rates decreasing, intertidal areas can be predicted to decline rapidly during future years. During the last northern winter we conducted waterbird surveys along the coasts of Jiangsu and Zhejiang provinces and were able to map our tracks along the current sea wall on six year old satellite images. Often we found we were all at sea! The intertidal areas along these coasts are very important for shorebirds during the migration and the non-breeding periods, and we should also focus international attention on the amount of land-claim occurring in China.

SHOREBIRDS IN EAST CHINA DURING THE NON-BREEDING PERIOD

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East China is well endowed with both coastal and inland wetlands capable of supporting large numbers of shorebirds during the non-breeding period. There are extensive intertidal areas along the coasts of the Yellow, East China and South China Seas, and very large wetlands along the Yangtze and Huai Rivers up to 1,500 km inland. Most of the region lies south of the average 1ºC January isotherm and is mild enough to provide suitable shorebird foraging habitat. During the last five northern winters we have been conducting waterbird surveys in the region and have collected much information on the distribution and abundance of shorebirds. The most commonly encountered shorebirds were Dunlin, Eurasian Curlew, Pied Avocet, Spotted Redshank and Grey Plover. Whilst the majority of shorebirds are located on the coast, the inland wetlands support large numbers of Dunlin and a variety of freshwater species such as Pied Avocet and Spotted Redshank. We were able to delineate the northernmost parts of the non-breeding ranges for some species normally migrating further south e.g. Lesser Sand Plover, Sanderling, Ruddy Turnstone, Marsh Sandpiper and Bar-tailed Godwit. Distribution maps for the main species will be presented and an attempt made to estimate the numbers of the species occurring in east China during the non-breeding season.

TECHNOLOGY, COMMUNICATION AND KNOWLEDGE: ADVANCING UNDERSTANDING OF THE WORLD'S GREATEST MIGRANT, THE BAR-TAILED GODWIT

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The migrations of birds have formed important components of human culture for millenia, but it is only from the 19th Century onwards that improved communication allowed biologists to start to piece together disparate knowledge about migratory species' annual cycles. For example, in New Zealand, the indigenous Maori had detailed knowledge about the seasonal occurrence of Kuaka, the Bar-tailed Godwit (*Limosa lapponica baueri*), on the non-breeding grounds, though they had no idea where the birds bred. Conversely, the Yup'ik in Alaska knew when to expect the annual appearance of Tevetevaaq on the breeding grounds but presumably had no knowledge of the birds for the rest of the year. In this address we explore the development of knowledge about the migrations of Bar-tailed Godwits. In many ways the road to understanding has been slow and uneven, affected by technology, scale, politics and the need to be in the right place at the right time. But the current quickness of communication, sophistication of technology and ease of long-distance travel mean that our ability to study migratory birds is greater now than ever before. We will discuss our attempts to gather direct information on flight time and migration routes in godwits, in particular by the use of satellite transmitters, and argue the case for the Bar-tailed Godwit being given the official title of "World's Greatest Migrant"!

THE PARTNERSHIP FOR THE CONSERVATION OF MIGRATORY WATERBIRDS AND THE SUSTAINABLE USE OF THEIR HABITATS IN THE EAST ASIAN – AUSTRALASIAN FLYWAY

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On 6 November 2006, the international efforts to conserve migratory waterbirds in the East Asian – Australasian Flyway moved into a new phase with the launch of the Partnership for the Conservation of Migratory Waterbirds and the Sustainable Use of their Habitats in the East Asian – Australasian Flyway in Bogor, Indonesia. The Partnership was negotiated over the preceding four years and is now the key international framework for conservation of migratory waterbirds and their habitats in the flyway.

The partnership represents an evolution of the previous decade of work conducted under the Asia-Pacific Migratory Waterbird Conservation Strategy and species-group Action Plans for migratory shorebirds, cranes, and Anatidae. The partnership builds on the successes of the strategy and action plans and strengthens the international mandate for the work by its strong links with the World Summit on Sustainable Development, the Ramsar Convention on Wetlands and

other international agreements. The partnership provides for countries and international organisations to endorse the partnership and signal their commitment to conserving migratory waterbirds and their habitat.

There have also been a number of changes to the arrangements in the transition from the strategy to the partnership. One of the most significant is the combining of the three site networks established under the strategy into an East Asian – Australasian Flyway Site Network under the partnership. Flyway countries have been asked to agree to the transfer of their shorebird, crane and Anatidae network sites into the flyway site network. This development is expected to increase the focus on sustainable use of internationally important sites for migratory waterbirds, and provide for more effective delivery of projects which are not related to a particular species group, such as wetland management capacity building.

To date, 17 countries and organisations have endorsed the partnership – Australia, Indonesia, Japan, Myanmar, the Philippines, Republic of Korea, Russia, Singapore, the United States, the Ramsar Convention, the Convention on Migratory Species, the Australasian Wader Studies Group, the International Crane Foundation, Wetlands International, WWF, the IUCN and BirdLife International. Other countries and international organisations in the Flyway are being encouraged to join. Australia and the Republic of Korea will serve as the first Chair and Vice Chair of the Partnership for a term of two years and one year respectively. A secretariat is to be established to support the Partnership, with the Australian Government providing this role in the interim.

This presentation will provide an overview of the partnership and its implementation strategy.

WADER POPULATIONS IN AUSTRALIA – WHERE ARE THEY HEADING? A BRIEF REVIEW AND FUTURE MONITORING NEEDS

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Throughout the world many wader populations appear to be declining. For populations with known trends, almost half have been reported to be decreasing. In the East Asian-Australasian Flyway, a disproportionate number of shorebird species have been classified as threatened, and the shorebirds using this flyway are under increasing threat from habitat destruction and loss. Although the East Asian-Australasian Flyway holds the highest number of wader populations of any flyway, unfortunately, there is limited information on current population or trends.

This presentation provides an overview of the Australasian Wader Studies Group's Population Monitoring Program (PMP) over the last 25 years at sites around Australia and reviews its ability to provide information on population trends in migratory waders that visit Australia. This is demonstrated by presenting a simple example of one kind of trend analysis that can be performed. Although the analyses presented are exploratory and limited to selected species found in southern Australia, the results highlight the declining population trend for Curlew Sandpiper *Charidris ferruginea* and suggest declining trends for several other species

The likely causes of population declines in the East Asian-Australasian Flyway are not well understood. Such knowledge can only be gained through long term demographic monitoring programs. For Arctic breeding species the most appropriate and most feasible region in which to conduct such studies is the non-breeding grounds where many species spend several months in the same area. Australia and New Zealand have largely stable wader numbers during the middle of the non-breeding season and these countries have the skilled volunteers required for monitoring. This has made Australasia an ideal region in which to contribute information on shorebird population dynamics. In fact it is the only region in the flyway where this level of monitoring can be done.

Information on population levels and trends is now increasingly required by governments at all levels to ensure long-term conservation of shorebird populations and to minimise impacts on their habitats. The PMP currently provides the only comprehensive long term data set on shorebird numbers in Australia available to planners and government agencies.

The presentation explores the limitations of this Program in its current form. It is proposed that future emphasis should be on collecting data sufficient to allow examination of all species whose population trends are wanted, to cover those species distributions sufficiently to determine if trends are widespread, and to ensure counts are conducted in such a way as to maximise a site's count continuity over time. Improvements in sampling, count methodology, and analysis techniques all may contribute to improved population trend data for more species in more regions with greater sensitivity to smaller changes. It is imperative that any future design changes to the PMP allow comparability with previous data while seeking to improve the existing program.

Finally some of the key strategies that have been formulated by the AWSG and Birds Australia to achieve these goals are outlined.

CARRIAGE OF AVIAN INFLUENZA VIRUSES BY SHOREBIRDS IN AUSTRALIA

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Migratory shorebirds represent by far the largest numbers of migratory birds that enter and leave Australia annually. Many of these birds breed in Siberia and northern Asia and migrate through and stop in many Asian countries that have been affected by recent outbreaks of the avian influenza virus (bird flu) AH5N1. Avian influenza viruses have been detected in shorebirds and these birds therefore have the potential to transmit such viruses into Australia. Over the past 3 years we have collected cloacal and faecal samples from around 5,000 migratory shorebirds from Newcastle, Victoria and North Western Australia. We have tested these samples for bird flu viruses and determined the subtypes of viruses that we have detected. Here we will report on the prevalence and subtypes of avian influenza viruses in migratory shorebirds in Australia.

MANAGING AND CONSERVING WADER ROOST HABITAT: LOCAL GOVERNMENT, THE FORGOTTEN LINK

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Local authorities throughout the East Asian-Australasian Flyway have an important role in planning the urban footprint for their subject area. Often it is local authorities where decisions are first made about the future use of a parcel land. The environmental values of shorebirds are not widely recognised as part of this level of government's biodiversity. With development pressure, local authorities in Australia are looking to provide coastal rural land owners an option to sell or develop their land for more intensive land use and retire. High tide roost sites that are maintained under low intensity agricultural uses such as grazing become threatened by the modifications to the environment that occur under more intense human activity. Protection of shorebird roost sites can be achieved by ensuring that these sites are not zoned for residential development. However, for this to occur, local authorities need to incorporate the spatial extents of high tide roosts within their area into their planning process.

The Queensland Wader Study Group (QWSG) is involved in a project to map the extents of shorebird high tide roosts along 400 km of the Queensland coast from Tannum Sands, near Gladstone to Tin Can Bay in the southern Great Sandy Strait. Often these roost sites are under threat from encroaching residential development as more people want to live on the coastal fringe. The quiet coastal towns along the Queensland coast are favoured by people looking for lifestyle choices. However, the expansion of these once quiet towns through new residential subdivisions results in an array of problems associated with intense urban development. These include dramatically increased levels of recreational use of waterways and conversion of roost sites to residential development.

During the project, QWSG has mapped and counted 35,000 shorebirds at over 250 roost sites. Nesting habitats of resident species of shorebird have also been identified and mapped. Threats to the use of each roost site by shorebirds have been documented and included in the GIS layer that has been produced. This GIS layer will sit alongside other physical features for consideration by local authorities in their future allocation of land for development. This project has been facilitated by the Burnett Mary Regional Group for Natural Resource Management Inc (BMRG) and is for the Burnett Mary region. The project will enable each local authorities in the region to have a spatial description of the shorebird values in their local area. This will improve awareness of shorebirds, provide a practical tool for development planning and has been done at minimal cost.

Recognition of the important role of the local authorities in land use development has largely been ignored by wader groups in the Flyway. Roosting and feeding habitats in many countries are lost incrementally as a result of decisions made by local authorities. Only by engaging with the decision-makers in these authorities and providing them with the tools to increase their awareness of the locations and extent of the critical shorebird habitats that many existing roost sites can be conserved.

HUNTER ESTUARY SHOREBIRD HABITATS – THE TROUBLE WITH MANGROVES

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The Hunter Estuary is in a state of ecological crisis. The diverse mosaic of vegetation communities that previously existed in the estuary is rapidly degrading into a mangrove monoculture with a consequent loss of biodiversity.

Migratory shorebirds have suffered a dramatic decline in numbers from about 10,000 birds (20,000 anecdotally) to about 3,500 today. The smaller shorebirds have declined in numbers more severely than the larger shorebirds, some becoming locally extinct. Mangroves have suddenly proliferated since the 1970s and have expanded over sandy beaches and mudflats in the estuary, restricting, and in many cases precluding, roosting and foraging activities. While mangroves are the immediate problem, they are merely a symptom of human-induced alterations to the hydrology of the Hunter Estuary.

It is concluded that deepening the harbour entrance and harbour channels by dredging, has led to a considerable increase in the tidal range within the estuary. This is considered the main mechanism responsible for the rapid landwards incursion of mangroves into, and displacing, the saltmarsh community. This situation will be exacerbated by additional harbour and channel dredging for the construction of another coal export terminal that will allow the next generation of larger displacement coal ships to enter the Hunter Estuary. In order to restore the balance between mangrove and saltmarsh communities, it is proposed that existing floodgates be managed adaptively to manipulate tidal inundation. In addition, in areas where critical shorebird habitat is under threat of mangrove encroachment, flow-control structures should be constructed to manage tidal flow into the remaining uncontrolled tidal creeks, downstream of Hexham Bridge.

OPTIMISING SHOREBIRD ROOST HABITAT BY HYDRAULIC MANIPULATION

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In the coastal zone of New South Wales, Australia, as elsewhere along the East Asian-Australasian Flyway, migratory shorebird habitat is in decline due to a range of factors including modification and degradation, disturbance, and global warming. In the Hunter estuary, NSW, the availability of roost habitat has been identified as a critical factor affecting migratory shorebird utilisation. The two major diurnal roosts in the estuary, at Kooragang Dykes and Stockton Sandspit, have a combined area of 3.9 ha; whilst the major night roost, at Windeyers Reach, has only 1.3 ha. Auxiliary habitat at Area E provides the single largest high tide roost area in the estuary; however, the distance from this site to major feeding grounds in Fullerton Cove requires increased shorebird energy expenditure. In 1995, hydraulic manipulation was undertaken at Area E to improve habitat for fisheries and migratory shorebirds by reintroduction of tidal flows. Analysis of shorebird roost habitat availability indicates that, prior to hydraulic manipulation (1993), approximately 31.5 ha at Area E were used by shorebirds. By 2004, the majority of habitat redistribution occurred by expansion of mangrove into saltmarsh and shallow tidal pools. This reduced shorebird habitat by 17% (5.4 ha). Based on the estimated expansion of mangrove, it is predicted that available shorebird habitat will be reduced by a further 26% (8.3 ha), leading to an estimated total reduction in habitat to 57% (18.0 ha) of pre-intervention availability. This analysis indicates that high tide roost habitat in the estuary is extremely limited and under threat from rising sea levels, erosion, mangrove expansion and urban development. Due to the extremely small topographic relief in these wetlands, even relatively minor changes in hydraulic controls (particularly invert level and discharge capacity) can lead to rapid and dramatic changes to migratory shorebird roost habitat Detailed baseline topographic survey and hydrodynamic modelling of alternative hydraulic control configurations, coupled with an understanding of the relationship between estuarine habitat distribution and flow characteristics, is required prior to removal of impediments to tidal flow in order to optimise shorebird roost habitat availability.

IS RAMSAR MEANDINGLESS IN KOREA?: KOREA'S IMPLEMENTATION OF AND COMPLIANCE WITH THE RAMSAR CONVENTION

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Coastal wetlands in Korea, noted as being of international importance, are under constant threat from increasing demand for more developable land. The threats include direct physical alterations such as reclamation under the Public Waters Reclamation Act 1962 and the Public Waters Management Act 1961; and also impact from land-based activities and pollution sources. Against this backdrop, Korea acceded to the Ramsar Convention in 1997 followed up with a major legislative development in 1999: the enactment of the Wetlands Conservation Act 1999 and the Coastal Management Act 1999 and the amendment of the aforesaid "public waters" Acts to embrace environmental considerations. Yet these laws did not entirely stop the ongoing destruction and further plans lie ahead.

In the face of an ongoing destruction of coastal wetlands, the author asks "is Ramsar meaningless in Korea?"

Understanding that the core problem lies in disparities between international and national laws, the dissertation explores the Ramsar Convention and the Korean legislative framework of both the pre- and post-Ramsar eras to give an account of what changes were made during these periods and how meaningful they were. More specifically, it attempts to: analyse how the Convention was translated and implemented domestically; test whether the Korean legislation is adequate to obey the Ramsar obligation of "wise use" of wetlands under the sustainable development framework; and propose some changes to improve the current national coastal wetlands conservation regime.

THE RED KNOT CONUNDRUM

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The Red Knot is the most intensively studied wader in the world yet new facts about its migrations are still being discovered and many mysteries still remain. Two subspecies occur in the East Asian-Australasian Flyway. *Rogersi* breed in Chukotka, in the far north-east of Siberia, and most are thought to spend the non-breeding season in eastern Australia and New Zealand. *Piersmai* breed in the New Siberian Islands, off the north coast of Siberia, with some also possibly nesting on the adjacent mainland in Yakutia. They are thought to mainly spend the non-breeding season in north-west Australia.

The slow accumulation of recoveries and the more recent much larger number of flag sightings have shown that the link between breeding origins and non-breeding locations is more complex. This is most strongly demonstrated by the now extensive data showing quite a marked link between Red Knot in north-west Australia and in New Zealand. *Rogersi* probably occur quite extensively in north-west Australia, at least at certain times of the year. And there is now growing evidence that some *piersmai* visit New Zealand. The movement patterns have added complexity with growing evidence that some immature birds from south-east Australia, and even New Zealand, may move northwards in winter to north-west Australia. And in addition to the well established pattern of many young Red Knots spending their first (and sometimes second also) year in south-eastern Australia before crossing the Tasman to establish their regular non-breeding area in New Zealand it now appears that some immature birds in north-west Australia may behave similarly.

Biometrics of Red Knot caught in south-east and north-west Australia have been examined, including on birds sexed by DNA, but do not appear to assist in the elucidation of movement patterns and in the determination of the non-breeding ranges of the two subspecies. This is probably the result of the quite small bill and wing length differences of the two subspecies and the fact that mixed populations occur in the sampling locations. Stable isotope and further DNA work are being considered to see if these can assist the resolution of this conundrum.

MOVEMENTS BASED ON RECOVERIES AND FLAG SIGHTINGS AND PARTICULARLY ILLUSTRATING THE KEY ROLE OF THE YELLOW SEA

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An analysis of the recoveries and flag sightings of 26 species of migratory wader which visit Australia showed that the migration pattern of almost every species was different. Almost all species however used at least some part of the Chinese coast as a stopover location, particularly on northward migration. There was a tendency for birds with non-breeding areas in eastern Australia to use a more easterly route through Asia than birds from Western Australia. In some species the northward and southward migration routes were markedly different. The breeding grounds of waders which spend the non-breeding season in Australia cover a very wide range, from 98°E to 149°W. Some individual birds recovered had travelled over 13,000 km. from the banding location.

THE SAEMANGEUM SHOREBIRD MONITORING PROGRAM: AIMING TO REVERSE THE TIDE

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While only one of many reclamation projects ongoing in South Korea, the 40 100 ha Saemangeum reclamation is the largest known coastal reclamation project in the world, leading to the loss of the single most important known shorebird site within the Yellow Sea, itself a core area within the East Asian-Australasian Flyway. Despite the site's extreme international importance, and South Korea's accession to international conventions and international agreements (such as the Korea-Australia Migratory Bird Agreement) no adequate monitoring program was in place to monitor the Saemangeum reclamation's impacts on shorebirds (or other biota). In 2006, Birds Korea partnered with the Australasian Wader Studies Group (AWSG) to conduct the Saemangeum Shorebird Monitoring Program (SSMP), assessing habitat changes and conducting shorebird counts throughout northward migration 2006-2008 at Saemangeum and the two adjacent sites of Gomso Bay and the Geum Estuary. The SSMP has been able both to confirm the extreme international importance of Saemangeum (up to 2006 especially) and the Geum Estuary, while recording the rapid degradation of the Saemangeum system, including the mass die-off of some shellfish beds, following completion of the 33-km long seawall in April 2006. By April and May 2007, probably close to 95% of the tidal-flats had either dried out or become permanently inundated, and almost all shell-beds had died, contributing to a 96% decline in Great Knot *Calidris tenuirostris* at Saemangeum between the two years. While monitoring impacts on shorebirds locally, the SSMP data are also being meshed into ongoing programs elsewhere, including the AWSG-led Monitoring of Yellow Sea Migrants in Australia, the Population Monitoring Program and related initiatives. This unique level of collaboration should enable significant changes in the population level of some shorebird species, such as Great Knot, to be detected not only locally, but also at the Flyway level. The SSMP fieldwork in South Korea has been supported by a large-number of awareness-raising activities, data dissemination and publication, and has already played a significant role in challenging the proposed reclamation of the adjacent Geum Estuary. Birds Korea believes that the SSMP, especially when combined with other well-focused initiatives, has the potential to help reverse the tide of coastal reclamation in South Korea – and over time throughout much of the Flyway.

LONG-TERM TRENDS IN SHOREBIRD NUMBERS IN EASTERN AUSTRALIA

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Shorebirds worldwide have undergone dramatic population declines. Of 200 populations for which trend data are available 45% are in decline, while only 16% are increasing. For 68% of shorebird populations in Australia no trend data are available. Here, we present temporal data on shorebird populations in eastern Australia. They were collected during annual aerial surveys (1983-2006) of waterbirds and wetlands in eastern Australia. The surveys are one of the largest and longest running wildlife monitoring projects worldwide, counting up to 50 waterbird species on about 2,000 wetlands along ten survey bands across eastern Australia. Numbers of shorebirds have declined significantly over the past 24 years. We identify ten wetlands in eastern Australia with high conservation value to shorebirds (>4,000 as maximum yearly count). We then examine how urbanization, changes in land use and water resource development have affected shorebird numbers by altering their wetland habitat. With shorebirds overwintering in Australia for about half the year, a major contributing factor to this striking decline in shorebird numbers is the degradation of rivers which reduce the frequency and extent with which wetlands are flooded. This contributes to shorebird mortality experienced on the Flyway from loss of habitat and hunting. Declining populations of shorebirds have implications for Australia's responsibilities under several international agreements to protect shorebird populations and their habitats.

SELECTION OF FEEDING AREAS BY WADERS AT THE WESTERN TREATMENT PLANT (WERRIBEE SEWAGE FARM), VICTORIA, AUSTRALIA.

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The Western Treatment Plant (WTP; also known to the birding community as Werribee Sewage Farm), is a large wetland complex south-west of Melbourne. Much of it consists of settling ponds and other freshwater lagoons now used for conservation purposes. It also has about 15 km of coastline, with tidal flats that are generally narrow but have been enriched by many years of sewage discharge and are now used by feeding areas by as many as 20,000 migratory shorebirds. The sewage treatment process at the WTP is currently being changed, in large part to comply with requirements to lower Nitrogen discharge into the sea, and there are concerns that this could influence the quality of

intertidal feeding areas for shorebirds. As part of a program to assess how shorebirds may be affected by these changes, this study was commisioned by Melbourne Water to investigate shorebird movements and habitat within the WTP, and its relationship to the abundance of zoobenthos. Results are presented for Red-necked Stint, the commonest shorebird species at the WTP. We investigated movements with a combination of radio-telemetry and a series of "simultaneous counts" in which c. 7 teams of volunteers carried out hourly counts at sites allotted to them. These counts also allowed us to calculate "bird-feeding hours per site", the best index of feeding habitat quality we can achieve in the WTP in the absence of detailed information on local shorebird diets. Our data show that Red-necked Stints at the WTP do most of their feeding in intertidal habitats, though a few individuals specialise in feeding on inland ponds, and nearly all individuals roost on inland ponds when the tide is high. Use of intertidal flats by Red-necked Stints is dynamic, with some sites being used mostly on ebbing tides while others are used throughout a low tide cycle; in addition, usage of particular feeding sites can change considerably from month to month. A benthos sampling program has shown that prey abundance along the coast is patchy and that distribution of the hotspots changes over time. These fluctuations in benthos abundance coincide well with changes in numbers of Red-necked Stints at specific sites, indicating that there is a link between benthos abundance at the WTP and that of shorebirds.

DOES REHABILITATION IMPROVE WETLAND HABITAT FOR SHOREBIRDS?

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Coastal wetlands are among the most threatened ecosystems in the world, largely due to draining, infilling, pollution and exploitation of their resources. Wetland managers now focus on rehabilitation and manipulation of habitat, often for waterbird species. The aim is to restore a wetland to some level resembling its natural state. Sometimes, the opportunity for habitat rehabilitation comes with removal of encroaching vegetation and sea walls, levees and culverts. In the Hunter River, New South Wales, culverts were removed in 1995 to improve tidal flushing in Ash Island, a wetland modified during the development of the port of Newcastle. The main aim was to rehabilitate habitat for shorebird and fish populations. Initial monitoring (1994–1997) indicated that the removal of culverts had not affected the total number of species, composition of waterbird community or numbers of waterbirds using the wetlands supplied by these creeks. By 2004–2006, total numbers of waterbirds and migratory shorebirds had increased since the 1994–1997 monitoring. Monitoring protocols remained the same. A maximum of 514 migratory shorebirds (10 species) were observed during low tide surveys of Ash Island in 1994–1997, while a maximum of 2,204 migratory shorebirds were recorded between 2004–2006, despite evidence of overall decline in the entire estuary. Numbers of migratory shorebirds were highly variable among years in both monitoring periods, reflecting regional changes in wetland availability, chance sightings of staging species, variations in breeding success in the northern hemisphere and loss of wetland habitat along the East Asian-Australasian flyway. There were also changes in the distribution of shorebird species between the two monitoring periods. Shorebirds tended to avoid freshwater wetlands and areas dominated by mangrove. Further rehabilitation work was carried out during 2005–06, with the removal of mangrove in three areas formerly used by shorebirds. As a result, more shorebirds used these areas in the spring/summer of 2006–2007.

PAST AND CURRENT RESEARCH ON SHOREBIRDS IN THE INNER GULF OF THAILAND

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The Inner Gulf of Thailand is the single most important shorebird habitats in the country and known as important staging and wintering sites for shorebirds in the East Asian-Australasian Flyway. Fifty-six shorebird species have been recorded, 49 species of winter visitors or passage migrants, while seven species breed locally. Two critically endangered species, Spoon-billed Sandpipers and Nordmann's Greenshank regular occur. Studies of shorebirds in the inner gulf date back to 1918 but observer coverage of the gulf improved strikingly after 1999. Since 2000, Philip D Round and colleagues began banding and larger scale surveys. Since September 2005 all shorebirds banded in the inner gulf have been marked with leg-flags. In addition to year 2005, the area attracted more attention and involvement from the government. Survey program of wetland birds and their habitats along the inner gulf conducted by The Thai National Park, Wildlife and Plant Conservation Department, they also plan to use satellite telemetry on a small numbers of waterbirds and shorebirds during the autumn migratory season of 2007. Additionally, a small area at the west side of Tha Chin river mouth will be declared as a National Non-hunting Area this year where the important species, the highest richness and highest abundance of shorebirds occur. The Bird Conservation Society of Thailand just established project called "The Inner Gulf of Thailand Conservation" in 2006 which contains a number of sub-projects for

monitoring shorebird populations and raising awareness. More intensive studies including two of the first graduate projects on shorebirds focusing on both broad scale and fine scale characteristics of the inner gulf and its shorebird communities are on-going. One study is focusing on body condition and food availability in the Long-toed Stint. The other is working on the relationship between shorebird abundance and landscape characteristics, which is the speaker's area of research. Shorebirds were counted at 20 sites representing the whole inner gulf, and covering the southward migration, midwinter and northward migration seasons between October 2006 to April 2007. During this survey dependent double-observer approach was applied to counting techniques to estimate detection probability for more accurate abundance estimation. Preliminary data from these systematic and regular counts which covered more area of the inner gulf and consistency counting period showed much higher numbers of many species than all data available or ever published recently. Finally, richness and abundance of shorebirds in 20 sites will be analyzed with surrounding landscape metrics to reveal a keystone structure, as well as could be define a priority sites for conservation.

RESEARCH ON THE MIGRATION AND HABITAT SELECTION OF MIGRATORY SHOREBIRDS IN NORTHERN BOHAI BAY, CHINA

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Bohai Bay is in the western part of the Bo Sea in Northern China. Our main study site is located at Nanpu in Hebei Province (39 02'N and 118° 21'E), which is in the central northern part of Bohai Bay. The habitat includes wide intertidal mudflats and extensive salt works. Another part of the study site is an inland saltpan that is 8 km from the coast in Beipu (39° 08'N and 118° 15'E).

From January to December 2004, we visited the study area in Nanpu weekly during the migration periods, every two weeks in summer, and monthly in winter, and counted shorebirds on the mudflats and adjacent saltpans from a 6-km long seawall. We also conducted surveys during the low tide period during the northward migration peak in 2006.

Thirty nine species, most of them were migrants, were observed in study sites during the surveys, including nine species which were present in more than 1% of their estimated population in the East Asian Australasian Flyway (EAAF) - Curlew Sandpiper, Red Knot, Red-necked Stint, Marsh Sandpiper, Eurasian Curlew, Grey Plover, Pied Avocet, Black-winged Stilt and Broad-billed Sandpiper.

In 2004, the shorebird numbers peaked in spring and the maximum number observed during a single survey was 10,410 birds on 22 May 2004. The most common species are Red-necked stint, Red Knot, Curlew Sandpiper, Grey Plover and Eurasian Curlew. The secondary peak in shorebird abundance occurred in September and the third peak was in winter. The species richness of shorebirds varied seasonally in 2004: from 37 species in spring to 3 species in winter.

During the peak of the 2006 northward migration, 11 shorebird species were present in the study area at more than 0.25% of their estimated population in the EAA Flyway. Of these species four preferred foraging in the inland saltpans and seven species preferred the mudflats.

Shorebirds with leg flags occurred at our study sites. These were banded in Australia, New Zealand, and Chongming Island, China. Among them, were Red Knots from north-western Australia, south-eastern Australia and New Zealand.

The Capital Steel Group from Beijing is moving to our study region (to reduce pollution for the Beijing Olympics), and also the Cao Fei Dian coal port is being built and the big Nan Pu oil field has been recently discovered. All of these will make this region one of the biggest steel, energy and petrochemical hubs in China. As a result, lots of wetlands in inland and coastal areas are disappearing. So, how to keep balance between using wetlands and protecting biodiversity is a serious problem.

MANAGEMENT AT YALU JIANG WETLAND NATURE RESERVE, CHINA.

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In recent years considerable awareness and interest has been created in wetlands and their importance in China. Yalu Jiang was established as national reserve by the government in 1997. The main objective was to protect birds and their nature habitats. Yalu Jiang is located in the north-east of China, close to the border of North Korea. The total area of reserve is 101,000 hectares. More than 40 species shorebirds have been observed in reserve. Up to 500,000 shorebirds and other waterbirds use the Yalu Jiang reserve as habitat for breeding and feeding. Yalu Jiang reserve is one of the most important wetlands with special ecological value in Asia.

The main structure of reserve is the management station in Gushan, similar to the shorebird centre of Miranda in New Zealand. We spend many days conducting surveys of shorebirds. We also use the management station as and education centre. We have a lot of displays, brochures and other publications about shorebirds and their habitats. This year, we have established a multimedia system to show promotional pictures and films of shorebirds. Many students

and local people have been to the centre. All of these are free to the visitors.

The other feature of the reserve is the artificial roosting habitat used by shorebirds. In order to make a secure roosting habitat for shorebirds, we created an island surrounded by water. The artificial roosting habitat of shorebirds in ERdaogou is very successful. There was a large number of shorebirds roosting on it when the mudflats are covered by water. The other benefit is people can watch bird so close. It is very useful for them enhancing the interesting of the birds. More than 50,000 people, not only local people but also people from through the China, have been to here to watch bird in the last year.

EXPANDING THE ROLE OF THE AWSG AND OTHER NGO'S IN THE CONSERVATION OF MIGRATORY SHOREBIRDS IN THE FLYWAY

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In the past year there have been significant changes to the frameworks used by governments to plan and support actions for the conservation of migratory shorebirds and their habitats in Australia and the East Asian – Australasian Flyway. In Australia, the Commonwealth Government has finalised a "Wildlife Conservation Plan for Migratory Shorebirds" and at the Flyway level a new "Partnership for the Conservation of Migratory Waterbirds and the Sustainable Use of their Habitats in the East Asian – Australasian Flyway" has been launched.

The Wildlife Conservation Plan for Migratory Shorebirds details 31 actions while the Flyway Partnership identifies 13 outcome areas. This talk will briefly review these actions and outcome targets and discuss the interlinking elements of the two frameworks. The activities of AWSG will be matched against these frameworks to identify the contribution that is already being made and to identify where AWSG might target new or expanded work.

These two frameworks provide an important opportunity for AWSG and other environmental NGO's to work with Governments, and other stakeholders, for the conservation of shorebirds and their habitats. Lest make the most of these opportunities for migratory shorebirds.

VALUING COASTAL HABITATS: PREDICTING WADER HIGH TIDE ROOSTING HABITAT OCCUPANCY

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Human preference for coastal living and the resultant high density of urban development along the coasts of most countries have meant the loss of the much of the available wader roosting habitats in many parts of the world. Habitats left are also being degraded and birds are regularly disturbed each day. In Australia, the strong internal migration to Queensland as people seek a "sea change" in lifestyle is causing increased urbanisation of coastal lands as towns expand along the coast. In many parts of the coast, this is leading to the loss of large wader roosts to housing as well as dramatic increased disturbance of remaining roosts.

Effective conservation and management of these coastal environments requires a thorough understanding of factors affecting wader distribution. This understanding can be improved through the use of spatially explicit distribution models of wader habitat use. Waders depend on two critical habitats: foraging (intertidal flats) and roosting (safe and open supratidal sites). We used published information on high-tide roost use by shorebirds to develop spatially explicit roost selection (probability of occurrence) and usage (mean abundance) models for 12 species of shorebirds spending the non-breeding season in Moreton Bay, southeast Queensland. Roost selection was most strongly affected by the proximity to a large foraging area, field of view (i.e. perceived safety of the roost) and to a lesser extent by composition of the surrounding landscape. Abundance was associated with a different, although overlapping set of factors. Abundance of the locally most common large wader species such as bar-tailed godwit *Limosa lapponica*, eastern curlew *Numenius madagascariensis* and whimbrel *N. phaeopus* increased with the size of the nearest foraging area (the size of the nearest foraging population) and/or the size of the roost per se (its capacity to accommodate individuals). Our results suggest that the suite of wader species occurring in Moreton Bay can be accommodated by two generalised types of roosts: exposed ocean-front roosts typified by supratidal spits and sandbars and claypan/saltmarsh patches in the upper reaches of the tidal range surrounded by mangroves. The loss or regular disturbance of these types of roost habitats within close proximity of foraging habitats is likely to lead to changes in the regional distribution and abundance of birds as available roosts or foraging habitats reach their carrying capacity. Our models predict that roosting habitats are not yet limiting in Moreton Bay but declines in abundance of waders feeding on many intertidal flats suggest that availability of suitable foraging habitat may be limiting roost choices.

POSTER PAPERS

A DECREASE OF OVER 40%? CHANGES IN SHOREBIRD NUMBERS DURING 20 YEARS IN JAPAN.

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A comparison of monitoring data from 1973–1985 and 2000–2003 shows estimated decreases in total numbers of shorebirds of at least 40% in the northwards migration (NM) and at least 50% in the southwards migration (SM) during the past 20 years. The records of Kentish Plover in both the NM and SM; Great Knot, Ruddy Turnstone, Eurasian Curlew, Spotted Redshank in the NM; and Dunlin in the SM confirmed significant decreases over the same period. On the other hand, records of Eurasian Oystercatcher and Black-winged Stilt in the NM and SM, and those of Greater Sand Plover, Grey Plover, and Sanderling in the SM show significant increases. In Japan, 40% of the former area of tidal flats has been lost in the past 50 years. Habitat degradation and land reclamation in Japan are likely to be among the reasons for the observed decreasing trends of many shorebirds. The most recent survey, conducted in 2006 by the Ministry of Environment at 84–105 sites, recorded 53 species (89,812 birds) in the NM, 57species (35,044 birds) in the SM, and 40 species (50,148 birds) in the non-breeding season.

COASTAL BIRD INVENTORY ON KING ISLAND 2006/07

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An inventory of resident and migratory shorebirds and small terns on King Island, Bass Strait, was conducted in the summer of 2006/07. Approximately 140km of the island's 160km coastline was surveyed to determine the distribution and estimate the abundance of breeding Hooded Plovers, Red-capped Plovers, Sooty Oystercatchers, Pied Oystercatchers and Fairy Terns. Migratory species were also recorded during coastal surveys. This study will report the first estimates of resident breeding populations for King Island. Distribution and abundance data will be used to identify the beaches that are most valuable to coastal birds. These data will be integrated with contemporary data on human coastal uses on King Island to infer which beaches could be prioritised for conservation efforts. Preliminary analyses of the data suggest that the island supports internationally significant breeding populations of several species and internationally significant numbers of at least one migratory species.

PORT BOTANY EXPANSION PROJECT EXPANSION OF SHOREBIRD HABITAT AS MITIGATION FOR INDUSTRIAL DEVELOPMENT

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Sydney Ports Corporation (Sydney Ports) operates NSW's largest container port at Port Botany, serving the trade needs of Sydney and the state of NSW.

Port Botany is located adjacent to a small estuary (Penrhyn Estuary) that is currently a locally significant feeding and roosting area for seven species of migratory shorebirds: Bar-tailed Godwit (*Limosa lapponica baueri*), Red-necked Stint (*Calidris ruficollis*), Double-banded Plover (*Charadrius bicinctus*), Curlew Sandpiper (*Calidris ferruginea*), Red Knot (*Calidris canutus*), Pacific Golden Plover (*Pluvialis fulva*) and Sharp-tailed Sandpiper (*Calidris acuminata*).

Penrhyn Estuary contains the last remaining suitable shorebird habitat on the northern side of Botany Bay, as developments over recent years have resulted in habitat loss elsewhere. Penrhyn Estuary was formed in the 1970s as a result of the construction of the existing Port Botany. The estuarine ecosystem that has developed at Penrhyn Estuary includes saltmarsh, mangroves and intertidal flats.

Over recent years the suitability of Penrhyn Estuary as shorebird habitat has been under increasing pressure as a result of:

- ⇒ proliferation of mangroves onto intertidal flat habitats
- ⇒ contaminated surface and groundwater water inputs from urban and industrial activities in the upstream catchment
- ⇒ increased usage of the area by people and pets
- ⇒ disturbances from recreational vessels using the public boat ramp at the Estuary

⇒ erosion of the beach area which has made the beach slopes too steep for shorebird use.

These pressures are considered to be the cause of local declines of some species in the Estuary over the past five years.

- Bar-tailed Godwit – a gradual decline at Penrhyn Estuary in parallel with a general slow decline in the Bay
- Red-necked Stint – continued decline in Penrhyn Estuary whilst the numbers at Boat Harbour (just outside of the Bay) have remained relatively stable during this time.
- Curlew Sandpiper – this species has declined more than any other shorebird species in the Bay, including Penrhyn Estuary. This species has also declined throughout most of Australia as a result of a broad population level decline in the East Asian-Australasian Flyway.

Sydney Ports is committed to securing Penrhyn Estuary as shorebird habitat over the long term and providing public viewing, educational and research opportunities, whilst protecting the site from disturbance.

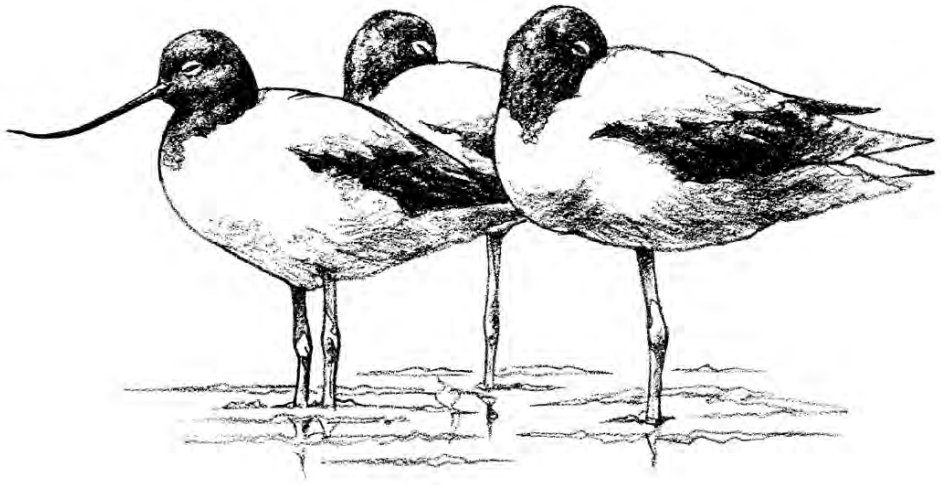
As part of Sydney Ports' project to expand Port Botany, Penrhyn Estuary will be enhanced to create a total of 27 hectares of secure estuarine habitat, with the following:

- prevention of access by recreational vessels, people, dogs and feral animals
- removal of mangroves which have reduced the area of feeding habitat
- creation of additional tidal flats will increase the area of feeding habitat more than four times
- construction of three islands to create secure roosting sites
- planting of additional saltmarsh vegetation
- provision of a boardwalk and viewing platform with bird hide and interpretative signage to enable viewing of the Estuary without disturbing shorebirds using the site and to prevent public access to tidal flats.

Sydney Ports is committed to the success of Penrhyn Estuary and is enthusiastic that the works will not only sustain the existing population of shorebirds but will increase the number of shorebirds and potentially shorebird species using the site.

Monitoring of shorebird usage of Penrhyn Estuary and reference sites in other parts of Botany Bay, and the Parramatta and Hunter River estuaries has commenced. Monitoring occurs on a weekly basis for seven months of the year when most migratory shorebirds are present and fortnightly at other times. Sydney Ports is committed to long term monitoring through to at least five years following commencement of operations on the expanded port land, which is likely to be until about 2017.

Details of the project can be found at www.sydneyports.com.au or by telephoning 1800 177 722 (toll free) or local call (02) 9206 4999.



OBSERVATION OF SHOREBIRDS DURING SOUTHWARD MIGRATION AT SCHASTIA BAY, SEA OF OKHOTSK, RUSSIA: JULY, 23 – AUGUST, 8 2006 AND JULY, 25 – AUGUST, 1 2007

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INTRODUCTION

Schastia Bay, Amur Estuary, Sea of Okhotsk, Russia (53^0 23'N, 141^0 17'E) is known for its high concentrations of migrating shorebirds during northern summer and fall. Our previous surveys (July 20 – August 5 2001; August 6 – September 21 2002 and July, 22–31 2003) provided data contributing to the international importance of the site for such species as Ruddy Turnstone *Arenaria interpres*, Red-necked Stint *Calidris ruficollis*, Black-tailed Godwit *Limosa limosa* and Whimbrel *Numenius phaeopus*. Smaller but still relatively high numbers for the Sea of Okhotsk of Dunlin *C. alpina*, Great Knot *C. tenuirstris* and Lesser Sand Plover *Charadrius mongolus* were also found. Further, the area had a high shorebird species diversity (totally 36 found for five seasons) and a considerable overall abundance (Antonov 2001; Antonov 2003; Antonov & Huettmann 2004). Region is an important part of the breeding range of Nordmann's Greenshank *Tringa guttifer*.

Other than shorebirds significant species are for instance Long-billed Murrelet *Brachyramphus perdix* and Steller's Sea Eagle *Halliaetus pelagicus* which regularly breed at the site and which carry an endangered status almost world-wide. In addition, the largest colony of Common Terns *Sterna hirundo* and Aleutian Terns *S. aleutica* in the Amur region exist, and as well plenty of waterfowl of different species occurs during migrations. The region has a high marine productivity, and is extremely important for valuable fish species such as Kaluga Sturgeon *Huso dauricus*.

Babenko (1990) surveyed the southward shorebirds migration in the region prior to our investigations, and the bird population of Chkalov Island, which is part of Schastia Bay, has generally been described by Babenko & Poyarkov (1998).

Relatively speaking, Schastia Bay is less remote than the other sites relevant for shorebirds of the Sea of Okhotsk. Thus, there are relatively good conditions for the implementation of shorebird migration monitoring projects here. It comes as no surprise that consistent long-term data sets have been developed for this site before it was done elsewhere in the region of the western Sea of Okhotsk.

We continued the shorebird studies further during July 23 to August 8 2006 and July 25–31 2007 at Chkalov Island. Moreover, two small islands inside the bay were visited during survey of 2006 (see Figure 1). The surveyed area consists of intertidal flats, inner lagoons and surrounding tundra plots, sand and pebble shores and small sludgy estuaries (Antonov & Huetmann 2004). Special emphasis was placed on shorebird catching and banding as well as on re-sighting of banded birds. This study is part of an ungoing investigation of Avian Influenza in the Pacific Rim.

METHODS

The majority of waders are caught by mist-netting at dusk and dawn (nets were open most of the day). Total length of

Figure 1. Our study plot in Schastia Bay, Sea of Okhotsk, Russia

nets fixed in the shorebirds habitats was about 450 m (150 m of nets big-mesh and 300 m of a small-mesh) in 2006 and 200 m (with big and small mesh equally) in 2007. In 2007, we used locations for mist-netting that were preferred by shorebirds as indicated in the 2006 season in inner part of the big lagoon (Figure 1).

Each captivated bird was fully processed for biometrics following the European-African Bird Migration Network banding protocol, samples for AI viruses prevalence were taken in 2006 (UAF protocol followed). Fat stores had been evaluated by the Kaiser score (Kaiser 1993), gender was defined casually by necropsy technique in the case of dead birds. Aging of birds was done by appearance whenever possible. Birds were weighed with electronic balances with an accuracy of $\pm$0.1 g. The standard error was evaluated for the means when appropriate. Mann-Whitney U Test was applied for relevant statistical comparisons.

We did not carry out large-scale surveys covering the entire island because of our special restriction at these seasons to the area of mist-netting. However, all birds we observed were recorded (2006: 8 standard transects, beach survey at Chkalov Island and two smaller islands inside the bay, 2007: seven standard transects, beach survey at Chkalov Island). Larger flock sizes of more than a dozen individuals was estimated in tens. The extensions of the daily permanent transects did not exceed 5 km (Figure 1). We tried to scan all feeding and roosting birds for bands. The ratio of marked birds was calculated for adults with clearly distinguished legs using a separate protocol.

Snails were identified by Mariana Zasypkina (Institute of Biology and Soil, Vladivostok). Weather conditions during the our work were generally favorable. Only few days with a strong southern wind occurred at 29th July to 2nd August 2006.

All bird banding data were submitted to the Russian Bird Banding Center in Moscow. Relevant bird banding details were documented and submitted to Environment Australia. Data from this project are available as FGDC NBII Metadata online and available from the authors by request.

RESULTS

A total of 7,897 shorebirds of 25 species was counted (both seen and caught) during observation in 2006 and 3,785 individuals of 17 species were identified in 2007. Fewer number were counted on standard transects at Chkalov Island - 2,870 and 2,445 waders correspondingly. Catching with mist-nets resulted into 170 individuals of 18 species in 2006 (nine individuals and two species per mistnet day), and 59 individuals of 10 species in 2007 (five individuals and two species per mist-net day). For details of these data see Table 1.

The most abundant species during the two years were Great Knot, Red-necked Stint, Dunlin, Whimbrel, Ruddy Turnstones and Bar-tailed Godwit. These species represented 94 % of all shorebirds observed. Largest numbers of Great Knots, Dunlins, Red-necked Stints, Bar-tailed Godwits were found at the two small islands in the centre of the Bay during roosting at the high-tide in 2006. Data obtained from standard counts at Chkalov Island for two runs are principally consistent for species and abundance, when considering survey effort (Table 2).

For most species we observed the migration of adults in late July and first waves of juveniles moving in the beginning of August. The migration of adults went relatively fast, with birds estimated visually (e.g. influx of number) to

Table 1. General results for years 2006 and 2007

	Number of waders seen				**Number of waders caught**			
Species	**2006**	**2007**	total	**%**	**2006**	**2007**	total	**%**
Actitis hypoleucos	5	0	5	0	9	0	9	4
Arenaria interpres	160	365	525	5	13	3	16	7
Calidris alba	0	4	4	0	2	0	2	1
Calidris alpina	1055	61	1116	10	6	1	7	3
Calidris canutus	15	12	27	0	0	0	0	0
Calidris ferruginea	1	0	1	0	0	0	0	0
Calidris ruficollis	1750	591	2341	20	67	29	96	42
Calidris subminuta	2	0	2	0	7	1	8	3
Calidris temminckii	1	0	1	0	3	0	3	1
Calidris tenuirostris	3100	2178	5278	46	16	3	19	8
Charadrius dubius	10	31	41	0	1	3	4	2
Charadrius mongolus	7	74	81	1	1	7	8	3
Haematopus ostralegus	1	0	1	0	0	0	0	0
Heteroscellus brevipes	15	39	54	0	3	1	4	2
Limicola falcinellus	0	1	1	0	0	0	0	0
Limosa lapponica	535	4	539	5	0	0	0	0
Limosa limosa	150	173	323	3	0	0	0	0
Numenius phaeopus	700	75	775	7	1	0	1	0
Phalaropus lobatus	1	0	1	0	0	0	0	0
Pluvialis fulva	5	0	5	0	1	0	1	0
Tringa erythropus	2	0	2	0	0	0	0	0
Tringa glareola	120	0	120	1	8	0	8	3
Tringa nebularia	18	10	28	0	2	0	2	1
Tringa ochropus	2	0	2	0	1	0	1	0
Tringa totanus	50	77	127	1	6	4	10	4
Xenus cinereus	22	31	53	0	23	7	30	13
Total	7727	3726	11453	100	170	59	229	100

Table 2. Results of the daily shorebirds census at the standard transect on Chkalov Island in 2006 (July 25, 27, 28, 29, 30, 31, August 2, 4) and 2007 (July 25-31)

	Species	July							August				Total	
		25	26	27	28	29	30	31	1	2	3	4		%
2006	*Arenaria interpres*	36		9	2		19	16		9			**91**	**3,2**
	Calidris alpina	1		1				20		5			**27**	**0,9**
	Calidris canutus	1											**1**	**0,0**
	Calidris ferruginea	1											**1**	**0,0**
	Calidris ruficollis	148				70	26	152		102		115	**613**	**21,4**
	Calidris temminckii						1						**1**	**0,0**
	Calidris tenuirostris	300		260	294	187		11		21		25	**1098**	**38,3**
	Charadrius dubius	4		6				4					**14**	**0,5**
	Charadrius mongolus	4								3			**7**	**0,2**
	Haematopus ostralegus							1					**1**	**0,0**
	Heteroscellus brevipes	3		2				2		1			**8**	**0,3**
	Limosa lapponica	36		10	34	21	1	3		2		3	**110**	**3,8**
	Limosa limosa	15					7	4					**26**	**0,9**
	Numenius phaeopus	8		69	83	22	1	60		8		127	**378**	**13,2**
	Phalaropus lobatus							1					**1**	**0,0**
	Pluvialis fulva	3											**3**	**0,1**
	Tringa glareola				2		1	4				120	**127**	**4,4**
	Tringa nebularia			5	3			2				4	**14**	**0,5**
	Tringa totanus			9			7	19					**35**	**1,2**
	Xenus cinereus						7	7					**14**	**0,5**
	Un-identified waders			300									**300**	**10,5**
	Total	**560**		**671**	**418**	**300**	**70**	**306**		**151**		**394**	**2870**	
2007	*Arenaria interpres*	30	37	34	90	92	38						**321**	**13,1**
	Calidris alba				3	1							**4**	**0,2**
	Calidris alpina		16	1	6	3							**26**	**1,1**
	Calidris canutus		1										**1**	**0,0**
	Calidris ruficollis	50	40	53	76	170	23	100					**512**	**20,9**
	Calidris tenuirostris	600	270	220	125	4	45	27					**1291**	**52,8**
	Charadrius dubius	6	4		7	4							**21**	**0,9**
	Charadrius mongolus	17	5		20	21							**63**	**2,6**
	Heteroscellus brevipes	2		3	13	3	2						**23**	**0,9**
	Limicola falcinellus				1								**1**	**0,0**
	Limosa lapponica				2	2							**4**	**0,2**
	Limosa limosa	30			4	1							**35**	**1,4**
	Numenius phaeopus			10	18	22	15						**65**	**2,7**
	Tringa nebularia	4			3								**7**	**0,3**
	Tringa totanus	30		4	13	4							**51**	**2,1**
	Xenus cinereus	5			14		1						**20**	**0,8**
	Total	**774**	**373**	**325**	**395**	**327**	**124**	**127**					**2445**	

turn-over with less than two or three days. Exceptions were Terek Sandpiper, some Stints and the local breeders such as Little Ringed Plover and Redshank.

The species with the highest fat index were adult Common Sandpiper, Ruddy Turnstone, Red-necked Stint. Most of the adults excluding some Red Knots still appeared to be in breeding plumage, and primaries did not show strong traces of wear. This indicates that these birds do not moult during this lag of migration.

Over the two years, eleven leg-flagged birds were seen among two thousands of waders that could be scanned accurately for flags (Table 3). The flag sightings included four Great Knots from NW Australia and seven Red-necked Stints (one from South Australia, four from Victoria and for the first time for this site two from Eastern China).

SPECIES ACCOUNTS

Great Knot. This species is one of the most noticeable bird at the study site. We observed an intense migration of adults in late July. The visible migration of adults ends when juvenile migration starts. Flock sizes comprised of adults reached 500+ individuals. Juveniles were found in smaller groups, and they did not exceed eight individuals. The first juveniles have been detected after 5th August 2006, and after 31st July 2007. Their body weight varied from 101.1 to 215.7 g. The average weight of juveniles (n=13) was 119.3±3.05 g, the average weight of adults (n=6) was 172.5±15.4 g. Young birds were slimmer (0.5±0.11 average fat score compared to 4±0.14 which adults had).

Two adult females were checked for stomach contents. Both birds had stomachs filled with gastopodes of two species: *Assiminea lutea* and *Ovassiminea sp.* (order *Littiriniformes*). Large flocks of adult Great Knots were seen actively feeding at intertidal muddy flats which are inhabited by these gastropode species.

Red Knot. Some individuals of the species were seen mixed with other waders (Great Knot and Bar-tailed Godwit). Most of them were still apparently in breeding plumage and some individuals were in the intermediate one.

Red-necked Stint. This is one of the most dominant species of shorebird migration in Schastia Bay. Bright-colored adults

Table 3. Results of specific observations for flagged shorebirds (two seasons combined)

Species	Number of scanned ind.	Number of flagged ind.	Ratio, flags / 100 birds
Arenaria interpres	263	0	0,00
Calidris alba	5	0	0,00
Calidris alpina	170	0	0,00
Calidris ruficollis	940	7	0,74
Calidris tenuirostris	550	4	0,73
Calidris canutus	5	0	0,00
Heteroscellus brevipes	28	0	0,00
Limosa lapponica	11	0	0,00
Xenus cinereus	45	0	0,00
Total	**2017**	**11**	**0,55**

of both sexes were found migrating. The observed sex ratio was eight males: six females. A few juveniles were seen on 30th July and 2nd & 8th August 2006 and 29th & 31st July 2007. Two re-trapped individuals were staying at the same place during three days. The weight of assessed specimens varied from 17.4 to 40.6 g, mean was 28.6±0.4 g (n=93). The average fat score for two years was 5.2±0.2 (n=94). Weight (p=0.318) and fat score (p=0.597) of Red-necked Stint do not differ significantly between two years.

Long-toed Stint. This species was mainly recorded by mist-netting but otherwise rarely seen. Likely, it just passes over the island and is rather secretive. One individual left the surveyed site after four days, according to our recapture information. Weights of trapped birds varied from 22 to 30.1 g. The average weight was 25.3±0.8, fat score 4.0±0.4 (n=11).

Temminck's Stint. Same as the previous species it was mainly detected through mist-netting. One recapture occurred three days after the bird was banded.

Dunlin. This species is distributed unevenly in the study area. The main concentration occurs at the small islands inside the Bay, and only loose groups and individuals visited our standard survey area. The average weight of trapped Dunlins was 43.6±2.8 g with a fat score of 3.7± 0.4 (n=7). We could not determine which subspecies they exactly belong (*C. alpina sakhalina* or *C. a. kistchinski*) but we exclude the occurrence of *C. a. actites*.

Whimbrel. This common species tends to feed on crowberry *Empetrum nigrum* that grows at the site during stop-over. Therefore, these birds utilize interior tundra plots of the islands. Local hunters disturb this bird more than others species because of the larger body-size.

Ruddy Turnstone. This species is well represented at both the counts and mist-netting. The flocks comprised of up to 21 individuals. It seems that adult females only migrated (the gender of five specimens was documented with gonads, some others were sexed distantly by head coloration). The average weight was 113.6±5.5 g, fat score 6.08±0.37 (n=16). We did not retrap a single individual indicating presumably fast turn-over rates.

Common Sandpiper. The first individual was caught 2nd August 2006 and then one to two birds were banded daily until the end of our stay at the site. Fat scores and body mass differ between adults (6.5±0.5 fat and 50.8±4.15 g weight, n=2) and juveniles (1.4±0.46 and 38.9±1.5 g, n=8). It is worth to state that no Common Sandpiper were recorded in the end of July both in 2006 and 2007.

Terek Sandpiper. This species is not very numerous at the study site, but we believe from our empirical data that Schastia Bay is nevertheless an important fattening site. Adults prevailed (73 % in catch) during the survey of 2006. The first juvenile was recorded at 6th August 2006, no juveniles were caught in 2007. The average body weight was 65.8±1.9 and average fat score 3.7±0.3, n=32. All available (four) dead individuals were females. Adult birds were staying at the site for some prolonged time (up to nine days, as confirmed by re-capture). The average daily weight growth of recaptured birds was 0.8 g (n=4). One of the retrapped individual gained the 20 % of the original body-weight during the nine days.

Terek Sandpipers tend to feed on the inner side of the bay with brackish water. One stomach contained young snails of *Assiminea lutea*.

Wood Sandpiper. Generally, this is known to be a fairly common species; however, none were recorded in 2007. Some isolated individuals were seen in the end of July 2006. The apparent influx appeared from the beginning of August onwards. Mist-netting shows that it were mainly young birds with a smaller fat score (average 2.4±0.4, n=8). Body weight was changing from 48,6 to 57,2 g (average 52.3±1.1, n=8).

Lesser Sand Plover. This species was rare. Some adults were recorded in 2006, more birds were seen in 2007. Sex ratio for two surveys combined was three males:five females as judge by mist-netting. The average weight was 69.1±1.5, fat score 4.9±0.4 (n=8).

Bar-tailed and Black-tailed Godwits. These species have fairly good but unstable numbers during fall migration at the study site. Abundances appear to vary from season to season. An adult female of *L. lapponica menzbieri* was shot by local hunter on July 29 2006. This specimen was heavily infected with fluke worms *Trematoda* and had no fat.

Other shorebird species. More species were found in minor number or in isolated cases. However, the whole list given in Table 1 shows that the study area hosts a relatively large diversity of species, which is an important feature of the staging site (see Gerasimov & Huettmann 2006 for the regional overview).

DISCUSSION

For Schastya Bay, it is thought (Babenko 1990) that the most intensive shorebirds migration (measured by largest numbers and species diversity) takes place annually at the end of July – beginning of August during fall migration. The composition of the dominant species vary significantly from season to season according to published data on this issue (Babenko 1990). The results from our standard counts for two runs show a resembling structure of the migration flow. The most distinct deviation of our observations from some previous ones (Babenko 1990; Babenko & Poyarkov 1998) concerns the smaller occurrence of Red Knot and Curlew Sandpiper in the migration. On the other hand, the proportion of Red-necked Stint numbers is substantially higher than in previous studies .

When comparing with other sites in the western Sea of Okhotsk region, the abundance of Terek Sandpiper was much greater in the second half of July and early August in Tugursky Bay (Pronkevich 1998). Contrary, Red-necked Stint, Lesser Sand Plover and Ruddy Turnstone were scarce there (part of each less then 1 % from total). The general percentage of Great Knot coincides at both sites.

Shorebird species with larger body-size are predominantly recorded by visual scanning and transects. Other species were easier detected by mist-netting. This shows that either method is incomplete, and that transect-based approaches fail detecting rare birds. In addition, some stints often get under-reported due to the difficulties in the prompt field identification. Hence, mist-netting for smaller *Calidrinae* represents a reliable and useful method to be carried out parallel to transects for a more complete investigation of the species composition. Unfortunately, there is a wider lack of mist-netting projects at the Sea of Okhotsk region, and only a small consistent base exists to draw from. We see such work as crucial, and would encourage more effort using such methods.

We were able to document noticeable influxes of the first waves of young Great Knot, Red-necked Stint, Terek Sandpiper and Wood Sandpiper that occurred at the end of July and early August.

Turn-over rate estimation remains a key problem for migration study and for studies that are non-invasive. Nevertheless, we had recaptured the following shorebird species during staging in Chkalov Island: Terek Sandpiper (up to nine days), Long-toed Stint (up to three days), Temmink's and Red-necked Stints (two days). We have not retrapped Ruddy Turnstones or juvenile Great Knots though they occurred in the catches. Weight loss instead of growth for one-two days recaptures had been noticed. This appears to be a usual event and was noted before (e. g. Schuckard et al. 2006).

For the species with inherent alloparental care such us Great Knot and Ruddy Turnstone separate migration of females are found at the end of July. The same situation was preliminary revealed for Terek Sandpiper, although its parental system is not well-known. Males and females of Red-necked Stint and Lesser Sand Plover are found on passage at the study site migrating together.

Our study identified two snail species in the stomach contents of Great Knots. We found that snails as a food supply for migrating waders are available in higher abundance at the study site but not fully used and browsed. A detailed benthos study is needed for further forage exploration and quantification. We propose to focus on these issues for the entire flyway and using consistent methods.

Compared to other sites, we found relatively high proportions of leg-flagged birds among adult Red-necked Stint and Great Knot at the study site. It is much greater than those being described at some stopover points of northward migration in the Yellow See region for instance (Barter et al. 2000, Guozhong et al. 2004). The differential accuracy of scanning and protocolling could contribute towards such inconsistencies particularly. This topic would require more investigations and standardisations.

The linkage of the Amur River Estuary region with China and Australia is basically confirmed by re-coveries and re-sightings of Great Knots and Red-necked Stints. The recoveries of Dunlin from Alaska (Ostapenko 1980) and Red Knots from Australia and New Zealand (Babenko 2000) are also known for western part of Sea of Okhotsk. This puts the study site and our findings into a wider international context.

THREATS AND CONSERVATION

Schastia Bay qualifies as an internationally important wetland according to Ramsar criteria two, for Long-billed Murrelet, Steller's Sea Eagle, Spoon-billed Sandpiper, Nordmann's Greenshank, three, four, five, six for Ruddy Turnstone, Red-necked Stint, Black-tailed Godwit, Whimbrel, seven for Kaluga Sturgeon and eight. In spite of this fact, the area is still not part of any national or regional protected zones, although there was a pending plan to attach the Wildlife Game Refuge status to the site.

It is believed that contemporary natural threats to the area are relatively low. However, specific research aimed at global warming or sea transgression effects to this region are scarce (Huettmann & Gerasimov 2006, Antonov 2006, Novorotsky 2006). The impact of environmental pollution is currently low, but could much increase due to oil industry advance in adjacent localities. Organic contamination of the Amur River and its tributaries is the obvious cause of the possible expansion of some invertebrates in the river estuary which could be beneficial for shorebirds, although the quality of water is getting worse. Detailed research on this topic for the site are absent (Huettmann & Gerasimov 2006). In addition, one needs to consider the globally critical situation for shorebirds (e.g. Huettmann 2008, Huettmann & Czech 2006), and particularly the flyway situation, e.g. Saemangeum affecting species such as Great Knot and many others.

Further, local people come to the Bay mainly for fishing (often illegal), mushrooms and berry harvesting and incidental hunting. They used to collect the Common and Aleutian Terns eggs at the colonies but no commercial trade exists to date. Fishery and whaling teams spend longer periods of time at the Bay, and might so bring more appreciable damage to migrating shorebirds by hunting them. However, we evaluate it as smaller impact due to the general paucity of people, and when compared with some southern parts of the flyway.

The first and foremost suggestions would be to include and encourage a detailed shorebird ecology research project here as well as benthos related studies. Unfortunately, the actual reality for this necessity is quite bleak because of the remoteness, lack of awareness and a regional shortage of scientific staff. International input could help to better understand relevant conservation priorities at this crucial site.

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SHOREBIRDS OF THE SOUTHERN GREAT BARRIER REEF ISLANDS: LADY ELLIOT AND LADY MUSGRAVE AND THE POTENTIAL EFFECT OF TOURISM ON THEIR POPULATIONS

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Surveys were undertaken of the shorebirds and terns on the Lady Elliot and Lady Musgrave Islands, two most southern islands on the Great Barrier Reef in Australia during December 2006 and January 2007. Low and high tide counts were made of the entire island and surrounding reef on Lady Elliot over three days and one day on Lady Musgrave Is. The highest count was 367 shorebirds on Lady Elliot Is, including 240 Ruddy Turnstone *Arenaria interpres*. This count represents approximately 1.2% of the national population and is the only site supporting substantial Ruddy Turnstone numbers in the region. Shorebird species composition on Lady Musgrave Is was similar to that seen on Lady Elliot Is. However, the diversity and total numbers were lower, with a maximum count of 80 birds. Both islands experience a large volume of tourists during the summer non-breeding season when shorebird numbers were highest. On Lady Elliot Is, both Ruddy Turnstone and Pacific Golden Plover *Pluvialis fulva* have habituated to humans and forage freely around the buildings in the tourist resort. In contrast, disturbance from tourists may be contributing to the lower shorebird numbers on Lady Musgrave Is. Here, the birds have fewer options to roost in areas free from regular tourist activity and the terrestrial habitats are more closed. This presumably makes terrestrial foraging less attractive for Ruddy Turnstone and Pacific Golden Plover and thus has reduced the degree of habituation by these species.

INTRODUCTION

The tropical coralline islands off north-eastern (Cornelius 1988), northern (Chatto 2003) and north-western Australia (Milton 2005) often support large populations of shorebird species that are less abundant on the adjacent mainland. The habitats on these islands are not well represented in coastal areas of the mainland. Species that prefer these coralline sandy island habitats, such as Grey-tailed Tattler *Tringa brevipes*, Ruddy Turnstone and Pacific Golden Plover are much less abundant on the adjacent coasts (Cornelius 1988; Chatto 2003; Milton 2005). Little information is available on the numbers of shorebirds on many of the offshore islands on the central and southern Great Barrier Reef. Many of these islands can have quite extensive intertidal feeding habitats that may support substantial populations of shorebirds. Two of these islands, Lady Elliot and Lady Musgrave Island, are the largest islands at the southern end of the Great Barrier Reef. Both have an extensive lagoons protected by a fringing reef. The intertidal area covers approximately 1.4 km^2 on Lady Elliot and 2 km^2 on Lady Musgrave Island, suggesting they may potentially support substantial shorebird populations.

Both islands are subject to heavy tourism pressure either from day-trip visits and campers (Lady Musgrave Is) to resident resort guests that stay multiple days (Lady Elliot Is). These high levels of visitor use on each island may potentially affect the numbers of shorebird using the islands. Regular human disturbance to feeding and roosting on the islands may be influencing the number of shorebirds present. The aims of the study were to (1) repeatedly survey the shorebirds on each island over multiple days and (2) make observations on the disturbance to shorebirds by people and assess their impact on the numbers present.

METHODS

Lady Elliot and Lady Musgrave Islands were surveyed for shorebirds and all roosts mapped during visits by QWSG members (Figs. 1 – 3). Lady Elliot Is was surveyed between 22 – 24 December 2006 and Lady Musgrave on 23 January 2007. On Lady Elliot Is, two counters surveyed the entire perimeter and open central sections of the island (including the resort) at both high and low tide each day between 22 – 24 December 2006. This provided a total of 6 separate surveys of the shorebirds and terns on the island. The same route was taken for all surveys, but the sequence and direction of movements varied among surveys. All flocks of roosting shorebirds were mapped at high tide. Birds were counted with 20 – 60x zoom telescope (70 mm objective) or 10x binoculars. The location of all roosting birds was measured with a GPS for later mapping of roost sites (Fig. 2).

RESULTS AND DISCUSSION

There were 11 species of shorebird counted on Lady Elliot Is and eight species on nearby Lady Musgrave Is (Table 1). Shorebird numbers were also much higher on Lady Elliot Is, although the species composition was similar. The most common species on both islands were Ruddy Turnstone, followed by Pacific Golden Plover. Both species were most abundant on Lady Elliot Is in the vicinity of the resort. Birds were highly habituated to the human traffic nearby. Disturbance distances at which birds would react to approach by humans were small (< 3 m). These distances were much less than seen for similar species in less disturbed areas on the adjacent mainland (> 100m, Milton unpubl. data). The same species on Lady Musgrave Is also allowed close approach, but the reaction distance was about 10 m (Geering unpubl. data). Both Ruddy Turnstone and Pacific Golden

Figure 1: Map of the central coast of Queensland showing the location of Lady Musgrave and Lady Elliot Is.

Plover fed on terrestrial insects and seeds around the resort buildings on Lady Elliot Is as well as in the adjacent intertidal areas. Other species did not use the resort area for roosting or feeding, preferring to roost in open areas such as the airstrip or the least disturbed south-western side of the island.

Both islands receive large numbers of visitors that are either day visitors, or camp (Lady Musgrave Is) or stay in a small resort (Lady Elliot Is). As a consequence, the shorebirds on these islands have had to adapted to a high levels of human interaction. The most confiding species was Ruddy Turnstone and these were common around the buildings, even during low tide when most other shorebirds are out feeding on the extensive intertidal reef flats around the island (Figure 1).

The substrate of the intertidal reef habitats are mostly coarse sand and so not utilised by shorebird species that probe in the substrate for their food. As a result, the island supported a different shorebird species composition to that found in adjacent coastal habitats (Milton & Harding 2007). Differences seen included the largest number of Ruddy Turnstones along the Burnett Coast (240) and five Wandering Tattlers *Tringa incana*. Lady Elliot and Lady Musgrave Is were the only roosts where this species was seen during extensive surveys of over 200 km of the adjacent coast (Milton & Harding 2007). The large count of Ruddy Turnstone represents about 1.2% of the estimated Australian population and almost 0.7% of the Flyway population (Geering et al. 2007). This would make Lady Elliot Is nationally-significant for this species. It is one of the few roosts in Queensland where substantial numbers of Ruddy Turnstone occur. All sites of national and international significance for Ruddy Turnstone occur in southern or western Australia (Geering et al. 2007).

Shorebirds do not appear to be excessively threatened by predators or human disturbance on Lady Elliot Is. Tourists

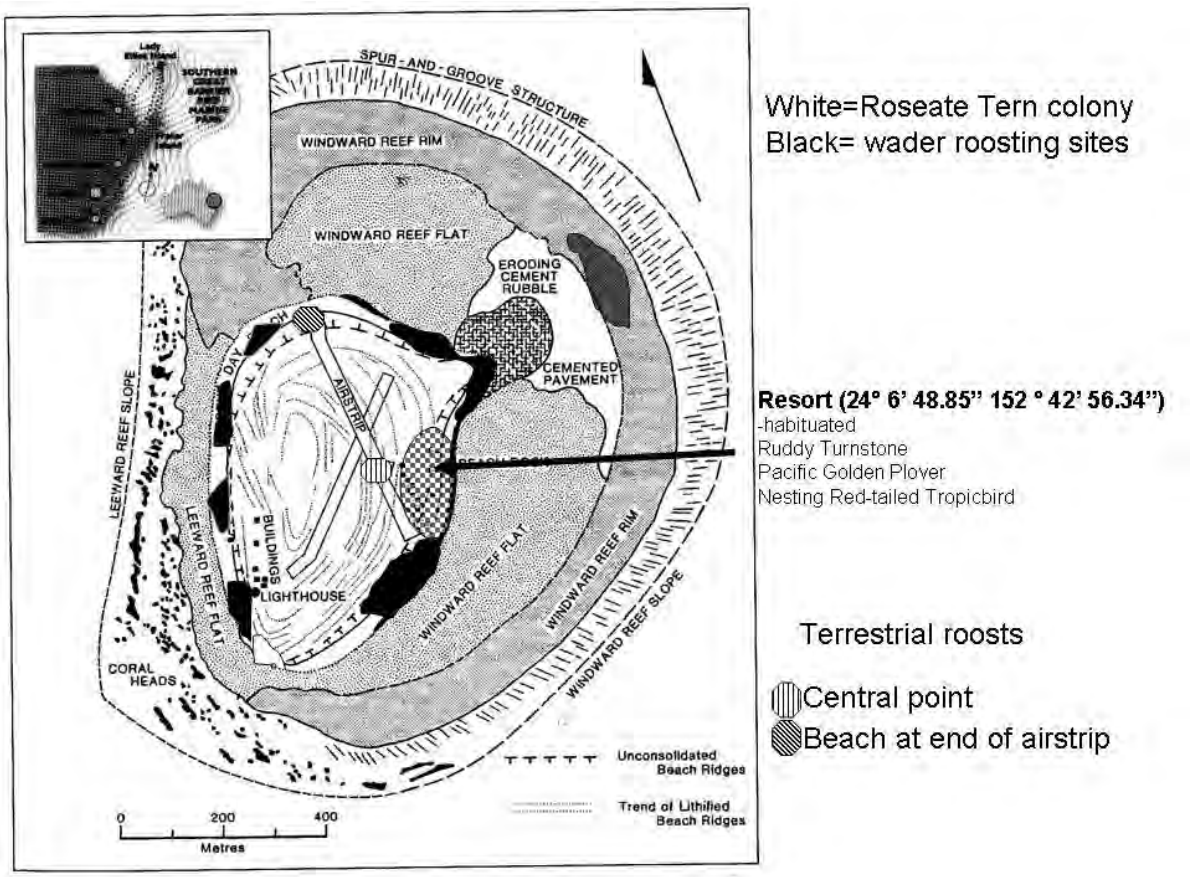

Figure 2: Sketch of Lady Elliot Is showing the location of shorebird beach roosts (in black), terrestrial roosts (hatched) and the Roseate Tern nesting colony on beach at the SW corner of island south of the lighthouse (white).

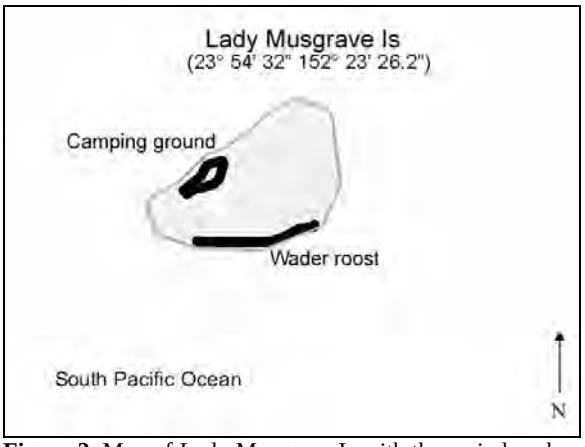

Figure 3. Map of Lady Musgrave Is with the main beach used by shorebirds for roosting at high tide shown in black along with the main camping ground.

do disturb some shorebirds throughout the tidal cycle each day, particularly at high tide when the birds roost on the upper beach. Typical examples of disturbance include Ruddy Turnstones roosting on the beach near the departure point for glass bottom boats. Other species, less adapted to disturbance roost in *Casuarina* forest on the south side of the island (around RP4: Figure 1) in an area off limits to the public.

Of greatest concern are the regular daily disturbances of the less tolerant, beach nesting terns such as Roseate *Sterna dougallii* and Black-naped Tern *Sterna sumatrana*. These species are known to abandon nests after even one or two disturbances at critical stages of their breeding cycle (Skerrett & Rocamora 2007). In order to ensure successful breeding by both Roseate and Black-naped Terns on Lady Elliot Is, the land managers (Queensland Environmental Protection Agency: EPA) needs to gain the cooperation of the resort owners to better inform their guests of the sensitive nature of these ground-nesting terns during the breeding season (November – January). Most guests will respect the

Table 1: The maximum number of each species of shorebird and other waterbird counted on Lady Elliot and Lady Musgrave Is during high tide surveys in December 2006 (Lady Elliot Is) and January 2007 (Lady Musgrave Is).

Species	Lady Elliot Is	Lady Musgrave Is
Bar-tailed Godwit *L. lapponica*	7	4
Black-naped Tern *S. sumatrana*	18	-
Crested Tern *T.. bergii*	136	-
Eastern Reef Heron *Egretta sacra*	1	9
Greater Sand Plover *Charadrius leschenaultii*	2	-
Grey-tailed Tattler *Tringa brevipes*	5	9
Lesser Sand Plover *Charadrius mongolus*	11	2
Pacific Golden Plover *Pluvialis fulva*	49	10
Pied Oystercatcher *Haematopus longirostris*	2	2
Red-necked Stint *Calidris ruficollis*	6	-
Roseate Tern *Sterna dougallii*	165	-
Ruddy Turnstone *Arenaria interpres*	240	52
Silver Gull *Chroicocephalus novaehollandiae*	14	-
Sooty Oystercatcher *Haematopus fuliginosus*	1	-
Wandering Tattler *Tringa incana*	5	1
Whimbrel *Numenius phaeopus*	2	-
White-faced Heron *Egretta novaehollandiae*	1	-
TOTAL shorebirds	367	80

nesting areas of the terns if they are better informed of the impacts that these kinds of disturbances will have on their breeding. Some signage is located on different sections of the beach informing tourists that there are seabirds nesting in the area. However, the signs have become obscured by vegetation over time and were not located in the vicinity of the current Roseate and Black-naped Tern nesting colonies (Figure 1).

Lady Musgrave Island is smaller than Lady Elliot Is and is mostly covered with native vegetation (Figure 2). The area of exposed intertidal reef flat may also be much smaller than on Lady Elliot Is. As a consequence, the island supports much fewer shorebirds (80 vs 367). The species composition of the shorebirds on Lady Musgrave Is was similar to that found on nearby Lady Elliot Is. The exceptions were the less common species on the larger island such as Greater Sand Plover *Charadrius leschenaultii* and Red-necked Stint *Calidris ruficollis* (Table 1).

The major issue for shorebirds on Lady Musgrave Island is the lack of roost sites that are free from disturbance by tourists. Unlike Lady Elliot Is, visitors can move freely over the entire island. This is most obvious during the summer non-breeding season when the numbers of shorebirds and tourists are highest. There are no rangers stationed on the island to monitor or manage human activities and the regular tourist boats that bring large numbers of people to the island daily. These visitors are not well-informed about the shorebirds as they are not seen as an important component of the reef ecology that is the focus of most visits. Our visit to the island for this survey was short (2 days) and thus may not be representative of the levels of disturbance regularly experienced by shorebirds on Lady Musgrave Is. However, the intensity of the disturbance suggests that it may be affecting the ability of these birds to build up body fat for migration in March–April. Evidence from recent studies in the UK have shown that disturbances of more than 1–2 times/hr during roosting can affect the survival of shorebirds in regions where food is scarce during their non-breeding season (Goss-Custard et al. 2006). These studies were undertaken in southern England where the temperatures are much harsher than at Lady Musgrave Is. However, we have no data on foraging rates and feeding success of shorebirds from Lady Musgrave Is to know if the shorebirds can sustain the levels of disturbance that will occur during daytime high tides in summer. As an interim measure until more quantitative data can be obtained on disturbance, we recommend that the EPA monitor the situation and provide information to the tourist boat operators and their guides on the adverse impacts of disturbance to roosting shorebirds. Campers can also be given material informing them about shorebirds and encourage them to minimise their use of the south-western beach during high tide. This information could be distributed with other materials when applying for permits.

The shorebird populations on Lady Elliot and Lady Musgrave Islands are small compared to populations on the adjacent mainland. The highest count on Lady Elliot Is was 367 birds and this was dominated by Ruddy Turnstone (65%). This population of Ruddy Turnstone on Lady Elliot Is is regionally and nationally-significant, representing over 1.2% of the estimated Australian population. Ruddy Turnstone and Pacific Golden Plover have habituated to high levels of human disturbance on Lady Elliot Is and many of these birds now forage in the grounds of the tourist resort. Other species, such as Bar-tailed Godwit *Limosa lapponica*, Red-necked Stint and Grey-tailed Tattler, are less tolerant of disturbance. They roost in *Casuarina* forest on the southwestern side of the island that is off limits to visitors (Figure 2). However, this habitat is extremely atypical of the roosting habitats normally chosen by these birds. In contrast, shorebirds on Lady Musgrave Is have fewer choices for roosting habitats because of the dense vegetation structure on the foredune and so are more heavily disturbed. The total population on Lady Musgrave Is was much lower than on Lady Elliot Is (80 birds), and may be affected by this higher level of disturbance.

Disturbance of beach-nesting terns such as the threatened Roseate Tern and the Black-naped Tern is also a major issue on Lady Elliot and probably also on Lady Musgrave Is (we have no direct evidence). These species are extremely vulnerable to nest abandonment during the early stages of nesting (Milton et al. 1996). Disturbance at this time could halt an entire breeding event on that island. Tourists have direct access to nesting habitats and the current signs on Lady Elliot Is are obscured by vegetation or not located in areas currently used by these species. The EPA and resort need to introduce a seasonal closure of the nesting beaches for these species during the critical six week period while the adult are nesting and rearing chicks.

We recommend that EPA take a more active role in promoting public awareness of shorebirds and beach nesting seabirds on these islands. Information on the adverse impacts of disturbance on these species needs to be provided to the tourist operators and their guides. They should be actively encouraged to include shorebirds on their public education program to both day and overnight visitors to these islands. Minimum approach distances could be calculated for each species group and the operators advised. We recommend tourists be advised to avoid using beaches beyond direct access points during the two hours either side of the daily daytime high tide. Any compliance will have a positive impact on the health of the shorebirds and will help maintain the viability of the ground nesting seabird colonies on these islands.

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CHANGES IN WADER NUMBERS IN THE GULF ST VINCENT, SOUTH AUSTRALIA, 1979–2008.

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This paper presents estimated average February numbers of waders in Gulf St Vincent, South Australia, in two periods, 1979–85 and 2000–08. Estimates were arrived at by sample counts of all roosting sites. Comparison of the results showed that numbers of 12 out of 14 species of palaearctic wader had decreased, the average decline for the 14 species being 50%. The numbers of six out of nine Australian-breeding species decreased greatly. Although, the average decline for the nine species was only 12%; this was because the most numerous of them, the Banded Stilt *Cladorhynchus leucocephalus*, increased. There was relatively little observable change in wader habitat between 1979–2008. It was therefore concluded that the decline in populations of waders was due mainly to factors outside Gulf St Vincent.

INTRODUCTION

Gulf St Vincent lies between the latitudes of 34º 14' and 35º 36' S, and 137º 45' and 138º 06' E. It is shaped like an inverted hairpin, being open at the southern end and closed at the northern end. The conurbation of Adelaide covers much of its eastern coast. Outside the conurbation, there are many residential settlements on both coasts. Adjacent to its shores lie two commercial salt-fields in active operation and on its shores lie extensive mudflats vegetated with samphire, and extensive areas of mangrove along the north-eastern and north-western parts. Large areas of shore (supra-tidal and inter-tidal) consist of sand or shellgrit, or mud or rocky shelf. There are two islands in the Gulf, both sandy: Troubridge Island on the west side is 10 km from land, and the artificial Section Bank (adjoining a rocky revetment at Outer Harbour) is one km offshore.

The Gulf waters are heavily fished with lines and trawling nets. On the eastern side, treated sewage and stormwater are discharged in large quantities, as well as some industrial effluent. These discharges contain abundant nutrients and much sediment, and have caused extensive dieback of underwater seagrass meadows (Bryars et al. 2008). As a result dead seagrass has accumulated in deep beds on large sections of the eastern shores. It is possible also that seafloor sediment has been released by the seagrass dieback. On the inter-tidal mudflats adjoining Price Saltfields in the north-west, soft sediment has accumulated. Whereas it was possible to walk on these mudflats in the early 1970s, it is no longer possible to do so because the mud is too deep. One significant site (regularly holding 1000+ waders) was created after the first period: the municipal wetlands known as Barker Inlet and Greenfields. These consist partly of brackish water, and mainly of freshwater. One marine site of comparable importance – Coobowie Inlet in the south-west – has recently (2007) lost much of its inter-tidal mudflats (formerly covering approximately 20 ha) owing to construction of new culverts before the second of two counts in the second period, causing tidal waters to be detained. An ephemeral freshwater lake of about 20 ha, Buckland Park, adjoining the Dry Creek salt-fields, has lost much of its value for birds since the early 1980s, owing to upstream interception of the Gawler River for agriculture and viticulture. This river used to fill the lake regularly each winter, but now does so much less frequently. Fork Creek, fed from Thompson's Creek, flows through the Dry Creek Saltfields and is saline at the seaward end. This used to hold several hundred waders most of the time in the early 1980s, but now never seems to hold more than a handful. The only imaginable reason is that the fresh water feeding it has become polluted with nutrients including ammonia by agriculturalists (Peri Coleman, personal communication).

Along the sea shores, there has – apart from the change to Coobowie Inlet - been little observable change of feeding and roosting habitat for waders between 1979 and 2008. Most of the habitat is protected either by natural inaccessibility, or by lying within, or adjacent to, commercial salt-fields, national parks, or a Australian Defence Department artillery range. However there have been no attempts to discover whether there have been long-term changes in nutritional value of inter-tidal mudflats.

COUNTING METHODS

All roosts were counted during an especially high tide in February in at least one year in each period. During anything less than a very high tide, waders were too dispersed over feeding areas or over lesser roosting sites to make counting possible. All the more important sites (with 1000+ waders) were counted in more than one year, except Troubridge Island which was counted only once in each period. The major sites (with 4000+ waders) were counted in at least three years in each period: these were Clinton Conservation Park, Price Saltfields and Dry Creek (formerly Penrice, formerly ICI) Saltfields. These three sites hold most of the waders in the Gulf. The results of these counts were used to estimate the average February population in each period, and are presented in Table 1. This month was chosen because it had been found (Close & McCrie 1986) that the largest numbers of palaearctic-breeding and Australian-breeding species were to be found in January and February; and because of school holidays it was difficult to find enough volunteer counters in January. Less common species are omitted from this paper because comparisons of their

numbers between periods is less likely to be significant. These species tend to be concentrated in particular sites, and several of the species are easy to overlook.

Counting methods were very similar or identical in the two periods. More volunteers were available in the first period. On the other hand, the counters in the second period were more familiar with important roosting sites on the east coast.

RESULTS

Results are shown in Table 1, which is confined to more common species, which were counted in numbers of 50+ in one or both periods. The total numbers of northern-hemisphere (or palaearctic) breeding species declined by 50%, from 59,851 to 29,929. The numbers of 10 out of 14 of the northern-hemisphere species in the table declined. Especially noteworthy was the decline in numbers of the three most numerous: Red-necked Stint *Calidris ruficollis*, Sharp-tailed Sandpiper *C. acuminata*, and Curlew Sandpiper *C. ferruginea*.

If we lump the two knot species, Red *C. canutus* and Great *C. tenuirostri*s, with unidentified knots, we find that the total knot numbers remained about the same. But there may have been a change in numbers of one or both knot species which could not be detected because of identification difficulties. The numbers of Ruddy Turnstone *Arenaria interpres* increased greatly, even though their preferred habitat (seashores and rocky banks of tracks in Price Saltfields) remained apparently unchanged. Numbers of Marsh Sandpipers *Tringa stagnatilis* also increased; a change which might be explained by the creation of the Greenfields Wetlands which they favour.

The total numbers of Australian-breeding species declined by 12%, from 18,759 to 16,530. However numbers of the most numerous of them, Banded Stilt, actually increased by 11%. Numbers of Australian Pied *Haematopus longirostris* and Sooty Oystercatcher *H. fuliginosus* also increased. But numbers of Red-necked Avocet *Recurvirostra novaehollandiae* – a species normally associated with Banded Stilt *Cladorhynchus leucocephalu*because it often favours the same habitat – slumped by 96%. Numbers of Black-winged Stilt *Himantopus himantopus*, Red-kneed Dotterel *Erythrogonys cinctus*, Red-capped Plover *Charadrius ruficapillus*, and Masked *Vanellus miles* and Banded Lapwing *V. tricolor* also declined greatly. None of the changes in numbers of Australian-breeding species which declined can be adequately accounted for by apparent changes in habitat in Gulf St Vincent. The loss of freshwater habitat in Buckland Park and Fork Creek (see above) seems to have been balanced by the creation of the new wetlands.

DISCUSSION

During the counts on which this article is based, numbers of all species of wader were found to vary at all times of year. Consequently, the method of estimating populations described above is subject to sampling error, in that numbers of some species may have been exceptionally high or low on the dates on which counts were held. In the case of Black-tailed Godwit *Limosa limosa*, for example, Figure 1 gives a somewhat misleading result. Many of this species were in fact still to be found in their favoured site (Dry Creek Saltfields) at several dates in the second period but in reduced numbers (Colin Rogers, personal communication). It appears that for some reason, they visited this site less regularly in February in the second period and so were absent during the counts used for this paper. This example illustrates the difficulty of using the method described in this paper to assess changes in populations of a comparatively uncommon and localised species.

Another possible source of error is that wader numbers vary from year to year. The first period may have included several years in which palaearctic waders were unusually

Table 1. Estimated February numbers of common waders in two periods, 1979-85 and 2000-08.

Species	1979-85	2000-08	Change	% Change
Black-tailed Godwit *Limosa limosa*	84	0	- 84	- 100
Bar-tailed Godwit *Limosa lapponica*	960	213	- 747	- 78
Eastern Curlew *Numenius madagascariensi*s	171	156	- 9	- 15
Marsh Sandpiper *Tringa stagnatilis*	55	77	+ 22	+ 40
Common Greenshank *Tringa nebularia*	1149	786	- 363	- 32
Grey-tailed Tattler *Tringa brevipes*	61	1	- 60	- 98
Ruddy Turnstone *Arenaria interpres*	289	513	+ 224	+ 77
Great Knot *Calidris tenuirostri*s	443	237	- 206	- 46
Red Knot *Calidris canutus*	1167	1036	- 131	- 11
Knot spp. *Calidris*	200	500	+ 300	+ 150
Red-necked Stint *Calidris ruficollis*	28912	18382	- 10530	- 36
Sharp-tailed Sandpiper *Calidris acuminata*	16469	4864	- 11605	- 70
Curlew Sandpiper *Calidris ferruginea*	8695	2541	- 6154	- 71
Australian Pied Oystercatcher *Haematopus longirostris*	21	130	+ 109	+ 400
Sooty Oystercatcher *Haematopus fuliginosus*	119	146	+ 27	+ 23
Black-winged Stilt *Himantopus himantopus*	590	306	- 284	- 48
Banded Stilt *Cladorhynchus leucocephalu*s	12592	13936	+ 1344	+ 11
Red-necked Avocet *Recurvirostra novaehollandiae*	1100	41	- 1059	- 96
Grey Plover *Pluvialis squatarola*	1167	564	- 603	- 52
Red-capped Plover *Charadrius ruficapillus*	3810	1731	- 2097	- 55
Red-kneed Dotterel *Erythrogonys cinctus*	103	38	- 65	- 63
Banded Lapwing *Vanellus tricolor*	155	0	- 155	- 100
Masked Lapwing *Vanellus miles*	269	191	- 78	- 29

abundant, and the second period may have included several years in which they were unusually scarce. Or the reverse may be true.

All one can say therefore is that this article provides a probable trend in numbers in Gulf St Vincent of the more abundant and widespread species. The results need replication in other regions.

We now arrive at the possible reasons for the changes in numbers. It is notorious that in recent years much of the overseas habitat in the East Asian-Australasian flyway used by all species of palaearctic-breeding waders has been destroyed. For this reason, one might expect a large-scale decline in numbers of these species in Australia in the southern summer. In a review of long-term counts in southern Australia in 1981–2006, Gosbell & Clemens (2006) do indeed conclude that numbers of Eastern Curlews *Numenius madagascariensi*s and Curlew Sandpipers have definitely declined, and that the numbers of Bar-tailed Godwits *L. lapponica* and Sharp-tailed Sandpipers have probably declined. They see it as possible that nine other species of palaearctic wader have also declined. They can however find no trend in numbers of Red-necked Stints, which in Gulf St Vincent appear to have declined greatly.

They note evidence of swinging variations in numbers of waders between regions: thus in any year, an abnormally high count in one region may be matched by an abnormally low count in another. In their review of numbers in Gulf St Vincent in 1979–85, Close & McCrie (1986) found evidence of large-scale movements of palaearctic waders from one region to another in Australia; and this evidence has been reinforced since (Greg Johnston, pers. comm.). For example, numbers of Red-necked Stints have on two occasions been known to spike in late February or March. It seems quite possible therefore that a long-term decline in the population of palaearctic waders may reveal itself earlier, or to a greater extent, in one region of Australia than in another. It was found for example that the decline of Eastern Curlews became apparent in South Australia and Tasmania (Close & Newman 1984) before it became apparent in Victoria and New South Wales.

Gosbell & Clemens (2006) also found that numbers of Ruddy Turnstone had increased in 1981–2008, a change which they tentatively attribute to more extensive counting of coasts in southern Australia. The results in Table 1 make it seem possible that there is an alternative explanation.

Within the two salt-fields, water levels have been raised in the pans in which palearctic waders were concentrated in the early 1980s. This change has drowned islands once used for roosting as well as mudflats once used for feeding. But this change seems unlikely to have affected wader numbers significantly, because the salt-fields have always been used chiefly for roosting by waders which feed on adjacent inter-tidal mudflats. There is still no shortage of roosting sites in the salt-fields.

The decline in numbers of Australian-breeding species is not readily explicable. It is tempting to see this as yet another manifestation of global warming. The Annual Climate Summaries of the Australian Bureau of Meteorology do indeed show that the years 2000–07 have been warmer than the long-term average in South Australia; and as a result, seasonal wetlands may have dried up sooner in summer but this source yields no clear conclusions concerning rainfall in the Gulf. In 2000–07, some years were wetter than the long-term average and some were drier. There has been no large-scale and deliberate drainage of wetlands near the Gulf in 1979–2008 which might account for a decline in the numbers of locally breeding waders. There has however occurred a long-term decline in the volume of water in the lower Murray River, which has presumably led to a reduction in the extent of riverine wetlands as well as wetlands in Lake Alexandrina, Lake Albert and the Coorong. These wetlands lie, at their nearest, approximately 80 km east and south-east of the Gulf. This reduction must have caused a decline in numbers of all species of wader dependent on these wetlands; and this decline may in turn be reflected in the numbers of these species found in Gulf St Vincent.

The increase in numbers of Banded Stilts in the Gulf may be due to the increasingly saline conditions in the Coorong, where numbers of this species have increased greatly in recent years. For example, the number counted there alone in February 2008 was greater than the estimated population in the whole of Australia up to that date (Wainwright 2008). On the other hand, the dramatic decline in numbers of Red-necked Avocet in the Gulf – a species often found feeding together with Banded Stilts –cannot easily be explained. Perhaps this species, also, has been adversely affected by a decline of freshwater wetlands.

One Australian-breeding species, Banded Lapwing, frequents dry land in areas of low rainfall, and appears in wader count sites during exceptionally hot weather. The dramatic decline shown in Table 1 may have been due to climatic conditions, and possibly to the accident that counts at sites which it favoured were not held in very hot conditions.

In the early months of 2008, water in Lake Alexandrina dropped to an exceptionally low level as a result of the lack of flow from the Murray River. Large numbers of palaearctic waders were seen feeding on the mud consequently exposed on the lake margins; and these may have included birds diverted from Gulf St Vincent. At this time, one major site (Clinton Conservation Park) was counted for the third time in the second period, and a significant site (Troubridge Island) was counted for the only time in the second period. The numbers recorded in these counts may consequently have been depressed.

The increase in numbers of Pied and Sooty Oystercatchers raises the possibility that the small molluscs favoured by this species have also increased. This factor might also account for the increase in numbers of Ruddy Turnstones. All these are conspicuous species not likely to have been overlooked in the first period; so that we can assume that the increase shown in Figure 1 was not due to counting error.

It is likely that comparison of the results of counting in the Gulf with counts in other regions in Australia will do much to explain the trends discussed in this article.

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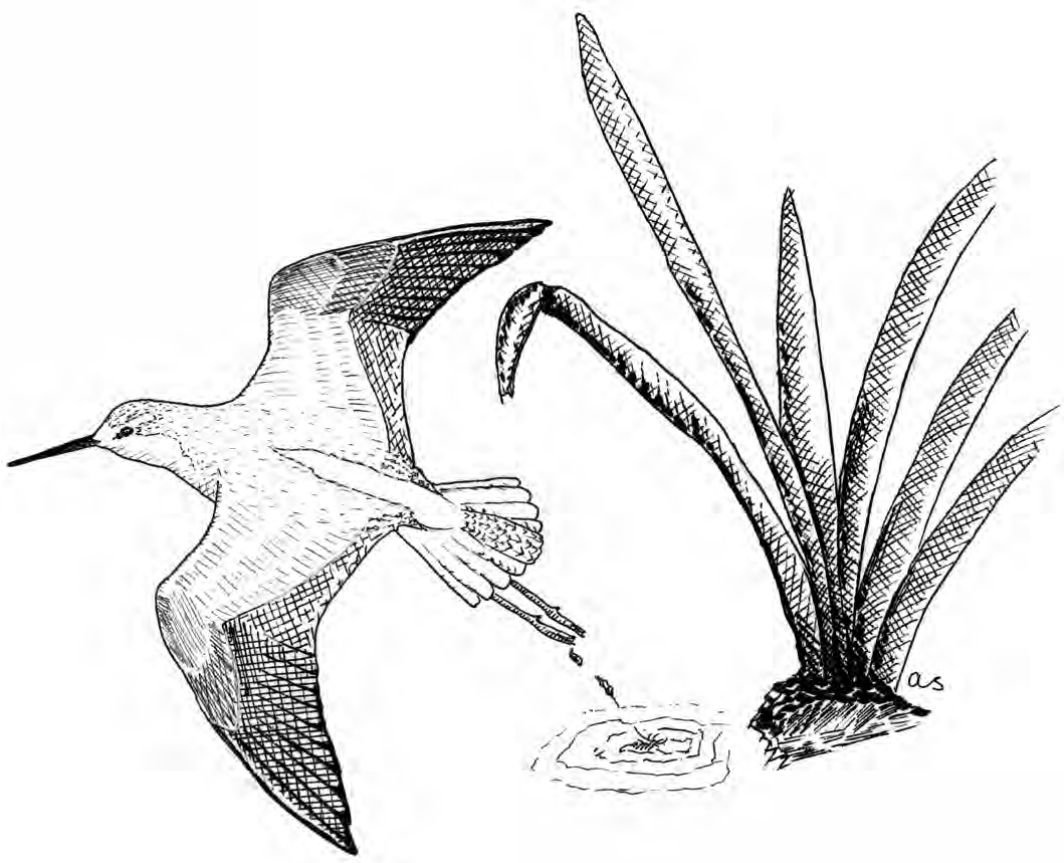

THE BEHAVIOUR OF BLACK-WINGED STILTS *HIMANTOPUS HIMANTOPUS* ROOSTING AT THOMSON'S LAKE, PERTH, WESTERN AUSTRALIA

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INTRODUCTION

Black-winged Stilts *Himantopus himantopus* (Figure 1) are widespread in Australia especially in southern and coastal zones and although they are resident waders they disperse seasonally to take advantage of unseasonal rainfall events.

Thomson's Lake is an internationally important wetland listed under the Ramsar Convention with Forrestdale Lake on 7th June 1990 (32º09'S 115º52'E). These two fresh to brackish, seasonal lakes are located in Perth's metropolitan area approximately 23 km from the city. They are fringed by emergent vegetation which gives way to trees such as *Melaleuca* which are tolerant to water-logging. Higher ground supports woodland dominated by *Eucalyptus* and *Banksia*. More than 10,000 waterbirds are regularly supported.

From late September until December 2007 many evening and day waterbird surveys were conducted at the Thomson's Lake to determine if Australasian Bittern *Botaurus poiciloptilus* were present. These surveys revealed that Thomson's Lake is used regularly at night during these months as a roosting site for Black-winged Stilts. Stilts have been recorded as roosting in shallow water or on banks or islets in sheltered wetlands and on sandflats in estuaries (Marchant & Higgins 1993, Powlesland & Robertson 1987).

The literature review did not show any movements of Black-winged Stilts from one non-tidal wetland to another for roosting as appears to have occurred here. Bamford (1999) noted Black-winged Stilts flying approximately 4.5km from Alfred Cove to Pelican Point on the Swan River, Perth, in response to rising tides. Pierce (1986) noted in the Cass River Valley of South Island, New Zealand Black-winged Stilts flew up to 1.5km to find better foraging areas as light conditions made feeding more difficult.

METHOD

From the middle of September until late December 2007 Thomson's Lake was surveyed for waterbirds at least weekly during the day. On these surveys waterbird species lists were made and on many occasions waterbird counts were documented with the results input into the Bird's Australia Atlas database. On six evenings from 23rd September 2007 until 4th December 2007 evening surveys were conducted by volunteers for the Swan Coastal Plain Australasian Bittern Survey. During the evening twilight volunteers recorded all waterbird species using both visual and audible methods. In the darkness after evening twilight only audible methods were used.

Figure 1. Black-winged Stilt at Alfred Cove near Perth.

RESULTS

From the middle of September until 4th November, Black-winged Stilt were only recorded during the evening surveys. They were not recorded on Thomson's Lake during any of the six daytime surveys conducted during this period.

From the 4th November 2007 until the lake was dry, in late December, Black-winged Stilts were recorded regularly at dawn, during the day and evening. Table 1 documents the Black-winged Stilt flocks during surveys from 4th November until 17th December 2007 together with time of

Table 1. Black-winged Stilts at Thomson's Lake from 4th November 2007 to 17th December 2007.

Survey time	High tide of 0.8m	High tide of 0.9m	High tide of 1.0m	High tide of 1.1m
Evening	R=2 flocks n=1	R=3 flocks to 250 birds n=2	-	-
Dawn	-	-	R= 49 to 1150 Ave=600 n=2	-
Day	R=0 to 1080 Ave= 251 n=5	R=5 to 150 Ave=60 n=5	R=0 to 23 Ave=11 n=3	R=970 n=1

R = Range Ave=Average and n=Number of surveys

day and high tide level.

Dawn survey at Thomson's Lake 9th December 2007

At dawn on 9th December 2007 the Stilts were mainly resting in large flocks with a few individuals feeding away from the flocks. A few Stilts were heard calling during this period, however, as soon as the first part of the sun was visible over the horizon the Stilts commenced calling more frequently and started to spread out across the lake to forage. At 0740 hours the first flock of 32 Stilts flew north out of the lake. By 0810 hours a total of 422 Black-winged Stilts had flown north out of Thomson's Lake in flocks of 32 to 140 individuals. At 0855 hours no further Stilts had flown out of the lake and 730 Black-winged Stilts remained spread out foraging.

Data from additional lakes

During December on several occasions Black-winged Stilts were recorded flying north between Yangebup Lake and Little Rush Lake during mornings flying south between these lakes during the evening (Figure 2).

Dusk survey at North Lake - 17th December 2007

On 17 December 2007 counts of Black-winged Stilts were made at several lakes in the late afternoon and evening. The results were as follows:

1900–1930 hours	Thomson's Lake	170 Black-winged Stilts
1940–1945 hours	Yangebup Lake	0 Black-winged Stilts
1950–1955 hours	Bibra Lake	59 Black-winged Stilts
2000 hours	North Lake	510 Black-winged Stilts

North Lake was monitored from 2000 hours until 2100 hours to record any movement of Black-winged Stilts either from the lake or over the lake. The observer was located approximately mid way from north to south to view all Stilts on the lake but to also note any Stilts flying over the lake from other locations (Figure 2).

Initially the Stilts mostly remained stationary in flocks of 70 to 230 individuals, however, some Stilts were observed wading and slowly foraging away from the flocks. During this period it was noticed that a small number of Stilts were heard calling, however, at 2030 hours a small rain shower passed through and simultaneously the number of Stilts heard calling increased significantly. At this time between 5 to 10 percent of the Stilts in the large stationary flocks commenced flapping and rising up to 40 cm off the lake surface prior to landing back on roughly the same spot. This behaviour was not exhibited previously but it was unknown if it was a response to the shower or a response to the latter twilight and additional darkness provided by the denser cloud cover.

A few minutes later the larger Stilt flocks at both ends of the lake took off and flew rapidly in a small area before landing again. It appeared that the flocks had been spooked but for no apparent reason. After this several whole flocks were noticed calling with a much quicker and sharper calls than noticed previously and this rapid calling continued for several minutes.

After a second heavier rain shower the Stilts once more exhibited the flapping and short rising behaviour noted at 2030 hours. At 2048 this behaviour was noted once more without a preceding rain shower. At 2050 the Stilts began to fly out of the lake in groups of 9 to 70 individuals towards the south. By 2100 hours approximately 290 Black-winged Stilts had flown out of North Lake to the south in small to medium sized flocks. No Stilts were observed flying over the lake or flying out of the lake in any other direction except south.

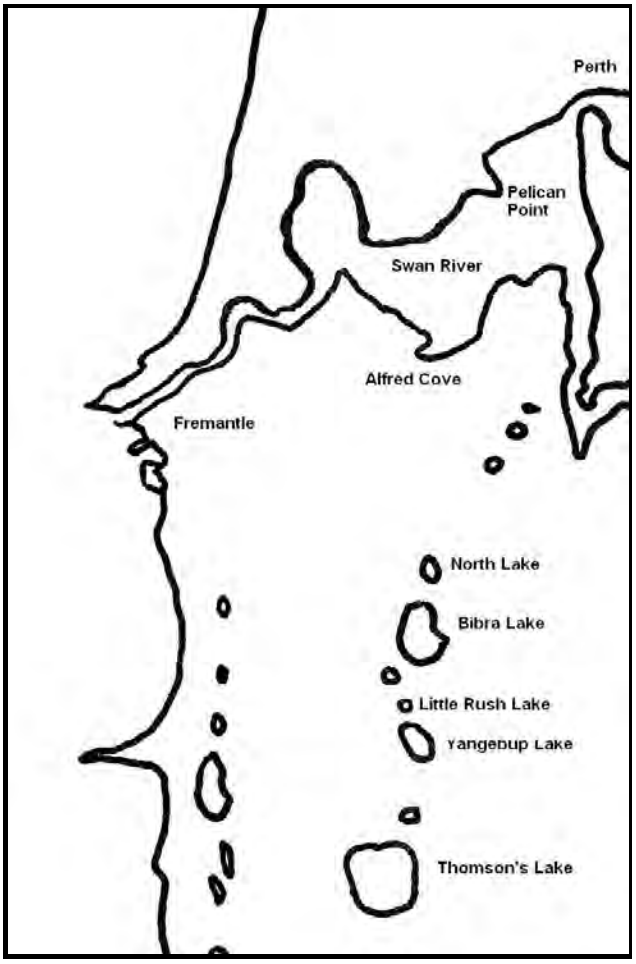

Figure 2. The relationship of Thompson's Lake to other lakes mentioned in the text. Thompson's Lake is approximately 23 km south of Perth.

At 0550 hours on the following day (18th December 2007) a count of Black-winged Stilts was made at North Lake to determine how many Stilts roosted at North Lake out of the 510 counted the previous late afternoon. A total of 74 Black-winged Stilts were recorded at the lake indicating that approximately 436 Black-winged Stilts had roosted elsewhere. Unfortunately time was not available to survey Thomson's Lake that morning.

DISCUSSION

Black-winged Stilts fly into Thomson's Lake from the north at dusk and for a short time after during most evening surveys. They also appear to use the lake more regularly at night than during the day. However, this may be a seasonal change in the Stilts behaviour as fewer birds were noted

during the day on Thomson's Lake in spring 2007 as in several other recent years. Pierce (1986) notes that Black-winged Stilts are opportunistic feeders which frequently move to other feeding areas to take advantage of better conditions.

There are several possible reasons for the use of Thomson's Lake by Black-winged Stilts for roosting. These include:

1. The site is used as a safe roosting zone as it is free of estuarine tides and has reduced predators due to the predator exclusion fence surrounding the Thomson's Lake Nature Reserve.
2. The site is used as a roosting zone during periods of high tides in the Swan River Estuary.
3. At night Thomson's Lake has a higher availability of invertebrates while in the daylight these are unavailable for foraging.
4. The site is used for roosting stop overs during seasonal movements.

Much of the data collected during the evening showed that Stilts fly in from the north to Thomson's Lake to roost and return to the north in the early morning. This suggests that Thomson's Lake is used primarily as a safe roosting zone by birds foraging north of Thomson's Lake or the lake provides higher quantities of night-time prey. Pierce (1986) noted that Black-winged Stilts use visual methods of feeding in over 95% of their feeding attempts and during darkness or in areas of low visible prey this species is forced to feed at lower rates or move to other foraging areas.

The information gathered from Thomson's Lake and North Lake suggest strongly that Black-winged Stilts foraging at North Lake during the day fly 7 km south to Thomson's Lake to roost the night. This distance is slightly further than the 4.5 km travelled in the Swan River Estuary to roost on a rising tide (Bamford 1999).

The data does not show that additional Stilts roost at Thomson's Lake during higher tides (1.0 to 1.1 m tides), however, further data would need to be collected to rule out this hypothesis. The Swan River Estuary is some 13.5 km north of Thomson's Lake. Similarly moon phase did not appear to affect Stilt movement.

It was noted that Stilts flocks flying along the chain of lakes between Thomson's Lake and North Lake fly comparatively low and appear to use the lakes as a flight guide.

CONCLUSIONS

In spring and summer 2007 Black-winged Stilts used Thomson's Lake as a night roost. There is a high probability that these Stilts foraged during the day at North Lake some 7km north of Thomson's Lake prior to returning to roost at Thomson's Lake. The literature does not appear to show other reports of Black-winged Stilts moving from one lake to another to roost.

ACKNOWLEDGEMENTS

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WADER SURVEYS AT THE COORONG AND S.E. COASTAL LAKES, SOUTH AUSTRALIA, FEBRUARY 2008

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The Coorong 35^0 50'S 139^0 20'E and adjacent lakes Alexandrina and Albert in South Australia are listed as Wetlands of International Importance under the Ramsar Convention because they contain many aquatic habitats which support a diverse suite of flora and fauna. Shorebirds are an important component of this diversity with almost a quarter of a million shorebirds being recorded in the early 1980's. Sadly the number of migratory shorebirds has shown dramatic declines over the last 20 years. In February 2008, ignoring the ephemeral species of Banded Stilt *Cladorhynchus leucocephalus* and Red-necked Avocet *Recurvirostra novaehollandiae*, the number counted was 25,889; the lowest on record since 1982. This represents an 85% reduction in migratory shorebirds since the early 1980's. The decline this year was notable for the absence of Red-necked Stint *Calidris ruficollis*, nominally the most abundant migratory wader species at the site. In contrast, Sharp-tailed Sandpiper *C. acuminata* and Curlew Sandpiper *C. ferruginea* were present in higher numbers when compared with the 2007 data. Banded Stilt were highly abundant in the Coorong's Southern Lagoon, where a flock exceeding 250,000 was observed. This is possibly the largest recorded Banded Stilt flock in Australia.

Curlew Sandpiper numbers remain concerning, however the 2008 population of 3,988 birds indicated some form of recovery compared with the 2007 count (and record low abundance) of 2,171 birds. When compared with historical data, 1981 for example, Curlew Sandpiper abundance has declined more than 90%. While this needs to be put in the context of the flyway population declines, it does highlight the critical deterioration of the Coorong as a non-breeding site.

The distribution of birds along the length of the Coorong in 2008 confirmed a general movement to the northern lagoons for most species as a result of the hyper-salinity south of Parnka Point. Ignoring Banded Stilt, the southern lagoon supported few waders. The ecology of the Coorong has deteriorated significantly over the last eight years largely as a result of the lack of fresh water flows from the River Murray through the barrages.

Prior to the 2008 count, observational work showed that waders were moving between the Coorong and the lakes following tidal and wind patterns. Local drought conditions and record low-flows across the Murray-Darling Basin during 2007 caused the lake water levels to draw-down severely. Newly created lake edge habitat was hypothesized as an alternative for Coorong waders however aerial observations of the lake edges shortly after the survey suggested that recently uncovered sediments (in the main) were not particularly attractive to waders.

A survey of the Southeast Coastal Lakes between the Coorong and Lake George found variable use by waders. All of these lakes have been substantially altered over time by drainage and farming practices. The drought has affected the ephemeral habitats associated with many of these lakes, and therefore the abundance of waders. Lake George appears to be slowly recovering from a period of deteriorating water quality, and invertebrate abundance, caused principally by algal toxicity.

It is essential that water quantity and quality are closely monitored throughout the Coorong because both are pivotal to the ecological recovery of the wetland. The communication of information should help land and water mangers to improve this critical situation.

INTRODUCTION

The Coorong 35^0 50'S 139^0 20'E is a body of marine to hypersaline water confined by the coastal dunes of the Younghusband and Sir Richard Peninsulas in South Australia. It is comprised of two linear lagoons and a number of ephemeral lakes which span a distance of 140 kilometres. Historically, the Coorong waters ranged from seasonally fresh water near the barrages during periods of high flow, to brackish in the Murray Mouth area, to hypersaline in the southern lagoon. These days, the water regime is dictated principally by tidal movements of marine water through the Murray Mouth. Freshwater in-flows have reduced to the extent that the Coorong is now a dysfunctional estuary. The water regime has been altered over a long period by reduced river flows, water diversion and extraction, drainage and habitat modification. Drought conditions in the Murray-Darling Basin since 2002 have reduced River Murray flows further such that there has been no environmental allocation for the Coorong.

Since 2000 water has been released at the rate of 5-15GL/year from Morella Basin into the Southern lagoon via Salt Creek. The Upper South East drainage scheme collects surface and ground water via a system of drains which converge at Morella. The drain water is fresher (15–20,000 mg/L) than the Southern Lagoon, however its effect on the ecology (or absolute salinity other than the immediate discharge area) has been negligible.

During summer water levels in the southern lagoon are low. This exposes mud flats and shallow sandbars which are habitat for a number of species of wader.

The Coorong (including Lakes Alexandrina and Albert) was listed as a Wetland of International Importance under

the Ramsar Convention in 1985. A Management Plan was prepared in 2000 by the South Australian Department for Environment and Heritage (DEH) in consultation with community groups (Department for Environment & Heritage, 2000). In 2006 DEH (SA) published a document describing the Ecological Character of the Coorong, Lakes Alexandrina and Albert Wetland of International Importance (Phillips & Muller 2006) aimed at establishing a benchmark for planning and management. This document clearly shows that the ecological character of this site has been altered significantly particularly over the last 20–30 years. The underlying cause of this change 'would appear to have been accelerated and exacerbated by water extractions that are too high for the system to be able to sustain itself through the recent drought conditions, as it would have under natural conditions'. One of the objectives of the 2007 wader survey was to contribute robust data that can be used in the ongoing assessment of this important area.

The waders in the Coorong have previously been counted in 1981, 1982, 1987 and 2000 to 2008 (Jaensch & Barter 1988; Wilson 2000, 2001; Gosbell et al 2002, 2003; Gosbell & Christie 2004, 2005, 2006, 2007). In the 1980s the Coorong was the third most important wader site in Australia, after Eighty Mile Beach and Roebuck Bay in N.W. Australia (Watkins 1993). This is no longer the case (Bamford et al. 2008). The counts showed a reduction in the total number of waders from 141,614 in 1981 and 234,543 in 1982 to 130,483 in 1987, 68,599 in 2000 to a low of 48,425 in 2001. The magnitude of these declines are a cause for concern, and for that reason the Australasian Wader Studies Group (AWSG) has been contracted by DEH(SA) to co-ordinate counts at the Coorong since 2001. This report gives the results of the 2008 count, compares the results with previous counts for each species and documents the wader distribution within the Coorong.

The survey this year was particularly important because there have been no fresh-water inputs from the River Murray and the Southeast of South Australia has suffered another year of below average rainfall. Both lagoons were almost solely dependent on marine water which rapidly became more saline in the southern lagoon as tidal effects ameliorated. Water deficiencies across the broader Murray-Darling Basin continued, resulting in record low flows, and variable habitat at Lakes Alexandrina and Albert. Collectively these factors further compromised the ecology at the Coorong because the change-in-state is becoming further removed from natural. The species richness and abundance of waders are a visible and measurable bio-indicator of ecosystem function.

In order to assess the use by waders of the extensive lake system southeast of the Coorong, a survey was conducted over a variety of wetland habitats between the Coorong and Lake George. Figure 1 shows the general area.

METHODS

Methods used in the 2008 count and factors influencing the result are discussed in detail in Wainwright & Christie

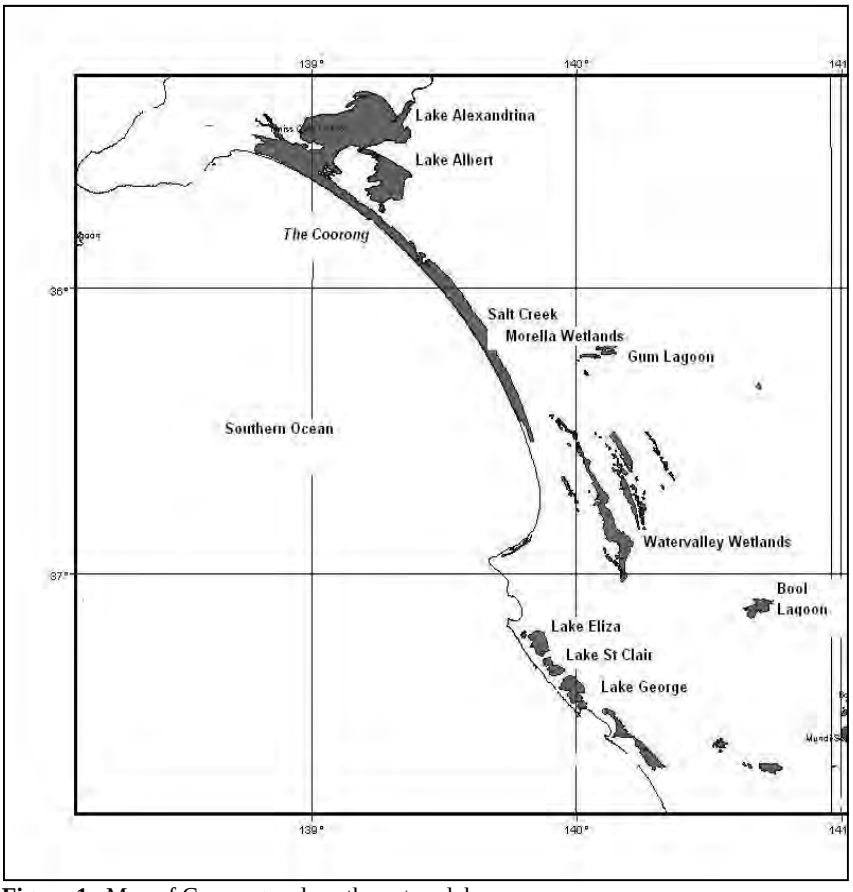

Figure 1. Map of Coorong and south-eastern lakes.

(2008).

The count period and coverage

The Coorong was counted by the AWSG over a two day period, 2nd and 3rd February 2008. The count Sections (Figure 2) were the same as used previously. All sections were counted comprehensively due to the availability of excellent resources (counters and boats) and favourable weather conditions (Wainwright & Christie 2008).

The ocean beach between Tea Tree Crossing and the Murray Mouth was covered on 4th February 2008. The main purpose of the count was to note the numbers and locations of Australian Pied Oystercatchers and Hooded Plovers as well as establish the number and distribution of Sanderling.

On the 5th and 6th February 2008 two separate teams surveyed Lake George and the other south east Lakes including Lake Eliza, Lake St Clair and Lake Robe. In general, movements of birds within and between areas were noted in order to minimise the possibility for double counting.

Conditions at the time of the count

The first day of the count was mild and sunny (24^0 – 30^0 C) with light winds (5–10 knts) in the morning followed by much stronger southerly winds in the afternoon (20–30 knts). Day two was overcast with some short sunny spells. Temperature is likely to have been within the range of 20–24^0 C with a similar wind pattern, again strengthening throughout the afternoon. The low water levels created difficulties for boats to move close inshore particularly in the southern lagoon. It is again a credit to the boatmen and team members that such an extensive survey was carried out under these adverse conditions.

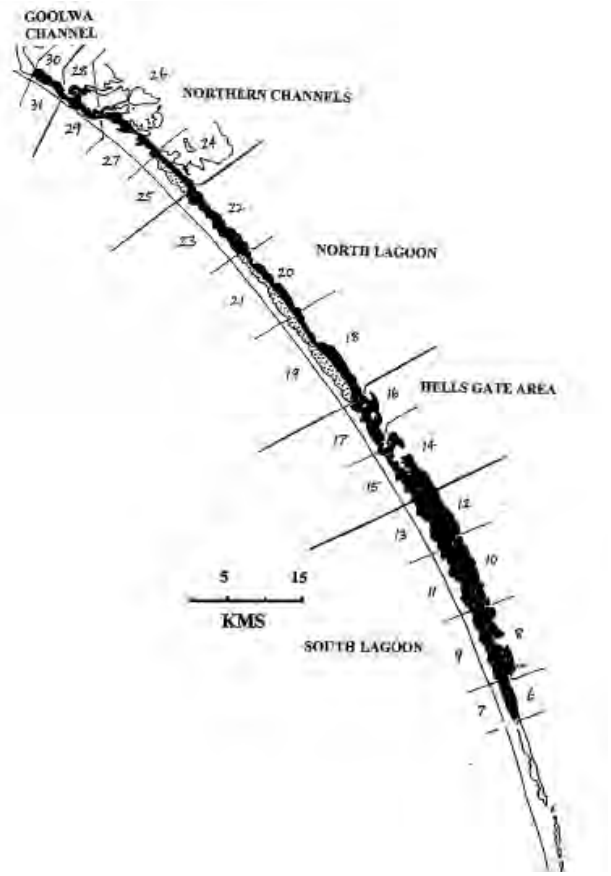

Figure 2. Count sections of the Coorong.

The water level on 3rd February 2008 read from the Parnka Point gauge was minus 0.09, this compares with 0.00 in 2007. This is the lowest water level recorded since recent counting commenced in 2000. In the absence of fresh-water inputs, water levels are dictated by tide heights and wind direction. The 2008 survey coincided with a period of low tides and strong southerly winds. Under these conditions, water is pushed northwards out of the Coorong and total volume decreases. Shallow water hampers progress and wader observations have to be made at greater distances. The boats, despite their shallow drafts, make little progress in the numerous, large shallow embayments within the Coorong. Sandbars to the north and south of the mouth prevented easy boat access to the Goolwa channel with the result that this section was counted from a boat launched from the 19th Beacon. Similarly, shallow conditions prevented Boundary Creek from being surveyed further than the first aggregation of shacks on the southern side.

The overriding general impression by the survey team was the poor condition and paucity of grey waders using the southern lagoon. Water levels were low, exposing wide, lifeless salt flats with few birds of any species. While we were not equipped to sample the water quality it was evident that salinities were probably of the same order (four times sea water) as last year with brine shrimp *Parartemia sp*., the only obvious form of life in the southern areas. Water in the southern lagoon appeared uniformly less turbid when compared with February 2007. A new channel is being 'cut' along the Younghusband Peninsula shore and the old channel near Hacks is beginning to become shallow; this could possibly be a result of the dredging at the Mouth.

Water levels in Lakes Alexandrina and Albert were at an all time low. When water is available the lake levels are normally surcharged to 0.75 AHD during the spring. This year the elevations of both lakes were below sea-level (0 AHD) during February. Exposed shorelines of mudflat spanned the circumference of both lakes. While this was considered as a potential site for waders from the Coorong to feed, our aerial observations did not confirm any large numbers present. This is also confirmed by D. Dadd and J. Eckert point count program (pers com).

RESULTS

Total counts for 2008 and previous years in the Coorong and on the Ocean Beach are shown in Tables 1 and 2, together with population estimates from Watkins (1993). The distribution and abundance of the waders in each section of the Coorong in 2008 are shown in Table 3. Counts in the Morella Basin made in 2001 to 2008 are shown in Table 4.

Total numbers in the Coorong.

The total number of waders recorded in the Coorong in 2008 was 287,313. This is the highest number ever recorded by an AWSG survey (Table 1); however the figure is heavily

Table 1. Total counts in Coorong in 1981, 1982, 1987, 2000-08

		1993 (Watkins)	1981	1982	1987	2000	2001	2002	2003	2004	2005	2006	2007	2008
Black-tailed Godwit	*Limosa limosa*	150	133	185	105	210	115		21	98		5	99	2
Bar-tailed Godwit	*Limosa lapponica*	25	15		3	8			20	5	58	116	21	150
Eastern Curlew	*Numenius Madagascarienis*	24	17	24	8	15	16	2	2	13	15	23	29	10
Marsh Sandpiper	*Tringa stagnatis*	30		2	30			68	1	2	1	9	3	4
Greenshank	*Tringa nebularia*	720	600	717	596	557	305	323	312	355	616	520	416	436
Terek Sandpiper	*Tringa terek*							1						1
Common Sandpiper	*Actitis hypoleucos*	5	13	1	1		1		2			8	2	
Ruddy Turnstone	*Arenaria interpres*			1		1						3		
Great Knot	*Calidris tenuirostris*	5	3	4		1						1		1
Red Knot	*Calidris canutus*	100	57	67		80		30		12		1		
Sanderling	*Calidris alba*	930	113	929	308	512	53	10	120	165	235	173	16	131
Sharp-tailed Sandpiper	*Calidris acuminata*	55700	24871	55739	22898	10697	5718	17067	6992	6535	10447	32214	3848	6222
Pectoral Sandpiper	*Calidris melanotos*			1										
Red-necked Stint	*Calidris ruficollis*	63800	54743	63794	54710	30145	18368	44544	46067	28772	29265	33599	20298	12288
Curlew Sandpiper	*Calidris ferruginea*	40000	39882	22614	22512	13124	4309	9177	13430	3304	7052	2382	2171	3988
Cox's Sandpiper	*Calidris paramelanotus*				1									
Australian Pied Oystercatcher	*Haematopus longirostris*	630	108	297	84	92	9	208	149	255	58	258	200	77
Sooty Oystercatcher	*Haematopus fuliginosus*	18			3	3	3	24			12	19	5	4
Black-winged Stilt	*Himantopus himantopus*	600	238	991	291	340	183	712	282	238	180	399	132	700
Banded Stilt	*Cladorhynchus leucocephalus*	77000	13782	77149	18692	11299	15611	24552	8602	12055	29195	91609	9106	261229
Red-necked Avocet	*Recurvirostra novaehollandiae*	5400	1449	5401	3589	93	260	3856	4122	5687	3331	2411	165	195
Pacific Golden Plover	*Pluvialis fulva*	290	289	230	144	84	103	43	43	30	91	256	50	34
Grey Plover	*Pluvialis squatarola*		1			12		2	3	1	11	5		1
Red-capped Plover	*Charadrius ruficapillus*	5700	4677	5152	2533	1089	1288	968	2897	817	803	1231	737	1065
Double-banded Plover	*Charadrius bicinctus*	150			1				1					
Black-fronted Plover	*Charadrius melanops*	15		2					1					
Lesser Sand Plover	*Charadius mongolus*							2						1
Hooded Plover	*Charadrius rubricollis*				12	3	4	12	7	8	15	23	6	21
Red-kneed Dotterel	*Erythrogonys cinctus*	10	14	17				1	3	18	9	4		2
Oriental Plover	*Charadrius veredus*		18											
Banded Lapwing	*Vanellus tricolor*	150		248	130								18	
Ruff	*Philonachus pugnax*					1								
Masked Lapwing	*Vanellus miles*	800	591	978	765	233	355	337	423	284	328	540	512	348
Red-necked Phalarope	*Phalaropus lobatus*				3								2	
Unidentified medium													20	20
Unidentified small					3064		1724	1912	539	103	55	1103	200	20
TOTAL		**252252**	**141614**	**234543**	**130483**	**68599**	**48425**	**103851**	**84039**	**58757**	**81777**	**166912**	**38056**	**286950**
Total number of Red-necked Avocet & Banded Stilt		82400	15231	82550	22281	11392	15871	28408	12724	17742	32526	94020	9271	261424
TOTAL less Red-necked Avocet and Banded Stilt		169852	126383	151993	108202	57207	32554	75443	71315	41015	49251	72892	28785	25889

Table 2. Counts of the Ocean Beach in 1981, 1982 and 2000 to 2008.

	Kingston to Middleton**	Kingston to Waitpinga***	Tea Tree to Murray Mouth	Tea Tree to Murray Mouth	Tea Tree to Murray Mouth	Tea Tree to Murray Mouth	Tea Tree to 60km North	Tea Tree to Murray Mouth	Tea Tree to Murray Mouth	Tea Tree to Murray Mouth	Tea Tree to Murray Mouth
	1981	**1982**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Bar-tailed Godwit				1							
Common Sandpiper		2									
Sanderling	311	**	15	161	24	110		543	187	2	
Red-necked Stint	68	10	23			17	16	20	159		374
Australian Pied Oystercatcher	568	334	526	432	331	502	398	486	348	368	473
Sooty Oystercatcher	18	5	13	2	1	2	1		1		
Banded Stilt				5							
Grey Plover	5										
Red-capped Plover	902	529	48	52	6	168	22	61	9	29	31
Hooded Plover	102	130	25	49	18	5	10	18	13	20	16
Oriental Plover		6									
Masked Lapwing	159	337			n/c	11					
Total	**2133**	**1353**	**650**	**702**	**380**	**815**	**447**	**1128**	**717**	**419**	**894**

*** 865 Sanderling were recorded inside the Murray River mouth in 1982.

*** Note that a much longer section was counted in 1981 and 1982 compared with 2000-2008

Table 3. Wader count by sections at the Coorong, February 2008.

Count Area	South Lagoon									Total	North Lagoon						Goolwa	Total	TOTAL
Date:	2/02	2/02	2/02	2/02	2/02	2/02	2/02	2/02	2/02	Sth	3/02	3/02	3/02	3/02	3/02	3/02	3/02	Nth	
Section(s)	8	10	12	7	9,11	6	13,15	14	16,17		19,21	18,20	22,24	23,25	26,27	28,29	30,31		
Black-tailed Godwit										0						2		2	**2**
Bar-tailed Godwit										0					62		88	150	**150**
Eastern Curlew										0					8	2		10	**10**
Marsh Sandpiper										0					2		2	4	**4**
Common Greenshank			4		3					7	25	4	22	29	155	15	179	429	**436**
Terek Sandpiper										0							1	1	**1**
Common Sandpiper										0								0	**0**
Ruddy Turnstone										0								0	**0**
Great Knot										0							1	1	**1**
Red Knot										0								0	**0**
Sanderling										0		11		50			70	131	**131**
Red-Necked Stint	1	19	82		17	2	1613	1050	4065	6849	1732	642	1	139	574	785	1566	5439	**12288**
Sharp-tailed Sandpiper		287	85				144	10	836	1362	1205	692	421	78	650	386	1428	4860	**6222**
Curlew Sandpiper	1								1828	1829	10	9	3	2	1025	836	274	2159	**3988**
Australian Pied Oystercatcher									2	2		2	2		6	1	64	75	**77**
Sooty Oystercatcher										0							4	4	**4**
Black-winged Stilt							28		490	518	2	9	3	19	82	6	61	182	**700**
Banded Stilt		11	1	10			250000		11205	261227	2							2	**261229**
Red-necked Avocet										0	133	16	11	27			8	195	**195**
Pacific Golden Plover	4									4			2				28	30	**34**
Grey Plover										0							1	1	**1**
Red-capped Plover		237	109			39	210	135	223	953	53	32	2	3	11	8	3	112	**1065**
Double-Banded Plover										0								0	**0**
Lesser Sand Plover										0							1	1	**1**
Greater Sand Plover										0								0	**0**
Black-Fronted Dotterel										0								0	**0**
Hooded Plover		2		2						4	17							17	**21**
Red-Kneed Dotterel					2					2								0	**2**
Masked Lapwing	12	28	40	2	8	2	34	5	8	139	40	6	16		38	13	96	209	**348**
Unidentified Meduim										0							20	20	**20**
Unidentified Small		6								6	22							22	**28**
Unidentified WaderSpp.										0		355						355	**355**
TOTAL	**18**	**590**	**321**	**14**	**30**	**43**	**252029**	**1200**	**18657**	**272902**	**3241**	**1778**	**483**	**347**	**2613**	**2054**	**3895**	**14411**	**287313**

Table 4. Counts of waders in the Morella Basin 2001-2007.

Year	2-Feb-01	2-Feb-02	10-Feb-03	2-Feb-04	24-Jan-05	6-Feb-06	7-Feb-07	5-Nov-07
Marsh Sandpiper			8		2			
Common Greenshank	28	n/c	10	7	23	37	12	9
Ruddy Turnstone		n/c						
Red Knot								
Red-Necked Stint	151		546		1351	60	184	3
Sharp-tailed Sandpiper	565	600	185	41	1240	3345	1	10
Curlew Sandpiper	2		16					
Black-winged Stilt	190	60	2			1		46
Banded Stilt	337	8000	110	150	10	28		
Red-necked Avocet	3						8	
Red-capped Plover	29		41	5	85	2	100	3
Blackfronted Dotterel			2					
Red-Kneed Dotterel	3	2	10	12	3			19
Banded Lapwing	9							
Masked Lapwing	50	30	29		7	14	10	34
Unidentified Small	182	2000						
TOTAL	**1549**	**10692**	**959**	**215**	**2721**	**3487**	**315**	**124**

skewed by the presence of large numbers of Banded Stilt. The total count this year excluding Banded Stilt and Red-necked Avocet was 25,889, the lowest ever recorded (Table 1). When compared with the peak recorded counts of 1982, migratory species have reduced 85%.

Total numbers on the Ocean Beach.

Conditions for observing and counting this coast were good with fine, warm weather and excellent visibility. The number of Australian Pied Oystercatcher 473 was higher than the eight year average of 433 birds. Sixteen Hooded Plover including several juveniles and a nest were observed, this compares with the longer term average of 20 birds (Table 2). Unusually, no Sanderling were sighted on the ocean-beach and few were observed in the broader Coorong. The trend was similar last year when only two birds were observed on the beach. Historically, Sanderling flocks in the tens and hundreds have been observed foraging in the active zone along the Ocean Beach.

Comparison of the counts on the Ocean Beach between 1981, 1982 and 2000 to 2008 is not possible because the current transect between Tea Tree Crossing and the Murray Mouth (100 kms) is considerably shorter. In 2004 there was an incomplete count which has been excluded from long term averages.

The distribution in the Coorong.

Table 3 shows the distribution in the Coorong according to count section in 2008. The Channel north of the Murray Mouth to Goolwa barrage is included in the Northern Channels sector.

The 2008 count revealed a higher proportion of birds using the Hells Gate area and fewer birds using the southern lagoon than in previous years (Wainwright & Christie 2008). This was due to the large number of Banded Stilt (c. 250,000) present in the area.. Proportionally, fewer birds were observed in the Northern Channels. However, when Banded Stilt and Red-necked Avocet are excluded the proportion of birds using the Northern Channels has been relatively constant over the last six years while the Hells Gate and Northern Lagoon show a more variable pattern of use (Wainwright & Christie 2008).

The Morella Basin.

The Morella Basin is a recently modified wetland basin of approximately 250ha situated approximately three kilometres inland of the Coorong and to the south of Salt Creek. The wetland receives drain water from the south and acts as a storage basin as part of the Upper South East Dryland Salinity Drainage Scheme. When sufficient water is available controlled flows via Salt Creek are released into the South Lagoon. The releases are considerably fresher (brackish) than the hyper-saline Coorong lagoon water. The water level is governed by the controlled flow into Salt Creek as determined by the SE Drainage Authority. At the time of the count the basin had low water levels and there had been no water released into the Coorong this summer (pers. com. Mark de Jong). 2007/08 represented a year of very low rainfall and reduced drain flow across the upper south east of SA. Morella Basin provides suitable habitat for many species of waders and waterbirds due to its extensive mudflats and sheltered location. Higher abundances are observed when water levels are low because foraging habitat increases. There was no count in February 2008; however there was a count in November 2007 which is summarized along with previous surveys in Table 4.

Selected Species Accounts

The following outlines the changes in numbers and distribution for the most commonly found species.

Common Greenshank
Numbers have varied between a maximum of 717 in 1982 and a minimum of 277 in 2001. There were 436 counted in 2008 mainly roosting in the Northern Channels.

Sanderling
Sanderling are normally found on the sandbanks in the vicinity of the Murray Mouth both on the ocean beach and on the lagoon side. In 2008, 131 birds were recorded on the lagoon side while none were seen on the Ocean Beach. This

compares with the 16 birds observed during the 2007 count. Sanderling are known to roam along the South Australian beaches and flocks of 500–1000 are regularly observed at Danger Point in the Lower SE (Christie pers. com.). In February 2007 there was approximately 600 Sanderling at Green Point (Jeff Campbell pers. com.).

Sharp-tailed Sandpiper

Sharp-tailed Sandpiper numbers ranged from approximately 20,000 to 55,000 in the 1980's. From 2000 to 2007 numbers varied from 33,600 (2006) to 3,848 (2007). This year the number counted was 6,222 showed some recovery from the lowest recorded figure recorded in 2007. Prior to the 2007 count heavy rains fell and birds may have moved away from the Coorong to exploit alternative habitat

The distribution of Sharp-tailed Sandpiper in the Coorong was skewed strongly to the Northern Channels in 2007 however this year 990 birds were counted at Hells Gate, a figure more indicative of their historical distribution. 372 birds were found in the southern lagoon.

Red-necked Stint

There were about 50,000–60,000 Red-necked Stint in the Coorong in the 1980's. This year 12,288 were recorded which is the lowest figure on record, and 40% less than the number counted in 2007 (20,298).

Minton et al 2005, indicated that the breeding success of Red-necked Stint based on percentage of first year birds in cannon-net catches in SE Australia was 'Very good' in 2001/02, 'Moderate' in 2002/03 and 'Good' in 2003/04 and 'Poor' in 2004 and 2005 (Minton et al 2006). The 2006 and 2007 breeding seasons was 'average' for Red-necked Stint (Clive Minton, pers com). These indicators are reflected to some degree in the population trends observed in the Coorong from 2002 to 2008.

Red-necked Stint were rarely seen in the Southern lagoon (121 birds), a confounding statistic because this species has always been observed in healthy numbers along these shorelines in the past. From 2000 to 2007, numbers varied from 8,447 (2005) to 2,595 (2002).

Curlew Sandpiper

The number of Curlew Sandpiper counted in 2008 (3,988) was 45% higher than the 2007 (lowest recorded) figure of 2,171 birds but drastically lower than historical records. There were 22,000 to 40,000 Curlew Sandpiper in the Coorong in the 1980's and the average population based on observations from 2000–2008 is 6,549.

Curlew Sandpiper has shown a very widespread and large population decline in southern Australia since the 1980s. Gosbell & Clemens 2006 show that there has been a significantly declining trend in this species at a number of sites in Victoria and South Australia. The changes in the populations in the Coorong followed a similar trend to that observed in Victoria up to 2003 (Gosbell & Grear, 2003). The upturn recorded in the Coorong in 2002 was also noted in Victoria where the percentage of first year birds in wader catches in 2001/2002 indicated a 'Very good' breeding year in 2001 (Minton 2002). Minton et al (2005), indicated that the breeding success of Curlew Sandpiper based on percentage of first year birds in cannon-net catches in SE Australia was 'Moderate' in 2002/03 and 'Good' in 2003/04. They were also 'Good' in 2004/05 and 2005/06 (Minton *et al* 2006) and 'poor' in the 2006 breeding season (Clive Minton, pers com). These indicators are not reflected in the numbers observed in the Coorong to the same extent as for the other *Calidris* species. The large fall (up to 95% reduction) in this species in the Coorong is of particular significance and concern. While Gosbell and Clemens 2006 suggest this is due to lower survival rates, in part arising from influences at stopover sites, the impact of local factors in the non breeding areas need further research.

2008 data shows a redistribution of birds from the Northern Channels (where most of the population were observed in 2007) to Hells Gate. 55% of the 2008 population were observed in the Northern Channels and 45% at Hells Gate. This species, unlike the Red-necked Stint has been mostly absent from the southern lagoon since 2005.

Australian Pied Oystercatcher

473 Australian Pied Oystercatcher were counted on the Ocean Beach from Tea Tree crossing to the Murray Mouth in 2008; when the 77 recorded in the Coorong lagoons are also accounted for there is a total of 550 which is similar to the numbers recorded in the last three years.

Black-winged Stilt

The number recorded in 2008 was 700. The maximum number recorded was 891 in 1982 and minimum number was 182 in 2001. The numbers have remained within this general range since 2000.

Banded Stilt

The number of Banded Stilt counted in 2008 was a record high 261,229 birds. This species was single-handedly exploiting the hyper-saline conditions in the southern lagoon (opposite Woods Well and immediately south of the Needles). No breeding was observed during February 2008. Further details of the Banded Stilt count can be found in Wainwright & Christie (2008).

Red-necked Avocet

The number of Red-necked Avocet (195) was similar to 2007 but less than the 2000–2008 average of 2,235. There was no indication of breeding in 2008. Low counts in the Coorong in 2000 and 2001 (93 and 260) support the possibility (Wilson 2001a) that Red-necked Avocet had relocated to ephemeral wetlands in northern South Australia, New South Wales and southern Queensland which were in prime condition for waders during those years. Similarly, rainfall in southern Queensland at the time of the 2008 count may have provided attractive alternative habitat. Red-necked Avocet was distributed over all sectors of the Coorong but with showed a preference for the northern lagoon.

Red-capped Plover

The population in 2008 was 1,065 compared with 737 last year. Red-capped Plover numbers have remained relatively consistent since 2000. The figure recorded is considered to be conservative due to the likelihood of missing birds roosting on out-cropping limestone. This species has historically showed a preference for the areas south of Parnka Point where there are usually extensive areas of dry

mud-salt being exposed. In 2008 53% of the population were observed at Hells Gate.

Masked Lapwing
The number recorded in 2008 was 348. The maximum number recorded was 863 in 1982 and minimum numbers were 233 in 2000. The numbers remain within this general band.

Hooded Plover
Sixteen Hooded Plover including two juveniles were observed on the Ocean Beach between Tea Tree crossing and the Murray Mouth. A further 21 birds were recorded in the Coorong lagoons. A specific Hooded Plover survey monitoring a longer stretch of coastline is carried out in November each year. This work provides a more accurate estimate of population trends for this species (Iain Stewart pers. comm.)

DISCUSSION

Potential influences on wader numbers

The Coorong is an important area for some 85 species of waterbirds (Carpenter 1995) including waders. Wader numbers at the Coorong have been counted on twelve occasions between 1981 and 2008. The survey in 2008 recorded 22 species of waders.

Significant numbers (internationally or nationally) of six wader species regularly use the Coorong lagoon system. These comprise four long-distance migrants that breed in Siberia - Red-necked Stint, Curlew Sandpiper, Sharp-tailed Sandpiper and Common Greenshank - and two species that breed in Australia - Banded Stilt, and Australian Pied Oystercatcher. Although several other wader species use the Coorong they occur in small numbers only and are of little significance in an Australian context. Using the 1% criteria for sites of International and National Importance (Watkins 1993), the 2008 survey resulted in four species being present in numbers of International Importance. These are indicated in Table 1. Sanderling and Common Greenshank have more or less consistently been present in 'Internationally Important' numbers in previous years, however the 2008 data indicates that both species satisfy the lower 'Nationally important' threshold.

The historical Coorong wader dataset, beginning in 1981, shows great variability in total abundance and species abundance. One of the reasons for counting the Coorong is to assess how well it is being managed for birds, a matter of considerable interest given the large human influence on the hydrology of the region and the importance of the habitat for waders in Australia. This is not entirely straightforward because changes in the numbers of waders do not necessarily reflect changes in the condition of the Coorong. The main factors affecting numbers are discussed below:

Changes in habitat quality at the Coorong.

Birds are likely to show a numerical response to the suitability of the Coorong, in particular the availability of feeding grounds and the density of invertebrate populations. One of the primary factors affecting the aquatic food supply is the salinity level. It has been recorded (Australian Water Environments 2005) that the salinity levels in the Coorong as measured by electrical conductivity were trending upward from 1981 to 2000. Since 2000 the levels have been much (over 20%) higher, particularly in the south lagoon. This is attributed to reduced River Murray flows and the silting of the Murray Mouth. Paton (Paton, 2005) recorded salinities of 100 ppt TDS in January 2004, 2005 and 2006 (cf sea water of 35 ppt TDS). Paton states that 'Aquatic food sources have declined throughout the Coorong. In the South Lagoon the abundance of *Ruppia tuberose* and turions and hardyhead fish have declined considerably, particularly for the two southernmost sections. The abundances of chironomid larvae did not follow this trend and were higher in January 2005 than in some previous years in several sections. The higher abundances of chironomid larvae recorded in 2005 might be a consequence of low numbers of hardyhead fish, which would typically feed on chironomid larvae.' These influences have been magnified by the prolonged drought in south eastern Australia resulting in virtually no flow from the Murray River and no run off from the Upper Southeast Drainage region coupled with high levels of evaporation.

Changes in habitat quality at alternative sites

A feature of the ecology of most waders is their mobility. To a lesser or greater extent all the nine wader species examined here also use alternative sites, in particular ephemeral wetlands in central Australia. Therefore, a change in number in the Coorong may reflect changes in habitat availability elsewhere. It is unfortunate that neither the availability of alternative sites nor the numbers of waders using them has been monitored regularly. Because species differ in their habitat requirements and extent of mobility they are likely to respond differently to the changes occurring at alternative sites. For the Siberian migrants, the Coorong is located at the far southern-end of the flyway. The extent to which birds choose to fly this far is likely to depend on the quality of other sites encountered en route and the extent of non-breeding site fidelity.

In the case of the 2008 survey it is important to note that approximately two weeks prior to the count there was a significant rain event over a wide area of South Australia causing temporary flooding of low lying areas in the north of the State. In a count conducted immediately prior to the rain, Paton (pers com), observed very high numbers of Banded Stilt and almost three times the number of Sharp-tailed Sandpiper than is reported in the current survey. This was supported by general comments by fishers and other locals. However, while the low levels of the adjacent lakes Alexandrina and Albert exposed areas of mudflat, personal observations and those of David Dadd and John Eckert who undertake regular point counts, do not support any large increase of use by waders.

Wader Numbers

The total number of waders counted in February 2008 was the highest of any count over the last 26 years. However, when the ephemeral species of Banded Stilt and Red-necked Avocet are subtracted from the total, the numbers of predominantly migrant waders reduce to 25,889; well below the previous low of 29,000 in 2007. The number of small

and medium waders continues to be well below those present in 1982 and 1987. Red-necked Stint were at their lowest recorded abundance since counts commenced in the 1980's. Sadly, Curlew Sandpipers despite a small increase in abundance this year opposed to 2007 are thinly spread across the site. This continuing and increasing trend is evident in other parts of southern Australia although high numbers are still observed in North-west Australia (Gosbell and Clemens 2006).

During the 2007 Coorong count it was noted that Sanderling were almost non existent on the Ocean Beach or in the vicinity of the Murray Mouth. The 2008 data supports this observation, as Sanderling were again scarce in both localities. It is likely that the dredging operations, including the movement of sand are affecting the habitat quality in and around the Murray Mouth. Empirical data indicates that the area receiving dredged sand now appears to support few waders, whereas previously several hundred of several species were present. The Ocean beach to the south of the Mouth has also been altered as a result of dredging. This highlights a need to monitor the impact of dredging on species that utilize the habitat near the Mouth to assess any degrading impacts.

There is anecdotal evidence that in times of previous droughts (pre 2000 at least) waders and waterbirds utilized the Coorong as a refuge. Reports by Lane 1983 and Jaensch & Barter 1988 both refer to this feature. Jaensch & Barter (1988) say that 'the Coorong is important as a drought refuge: this is shown by the large number of waders present in 1982 (a drought year) compared with the lower numbers in 1987 (a wetter year)'. The low utilisation in 2008 indicates there are fewer birds or that they have located more favourable feeding grounds as a refuge. It is possible that the carrying capacity of the Coorong is being exploited in a year of average climatic conditions, such that larger shorebird populations (as expected during a drought year) cannot be supported due to the paucity of benthic matter in the substrate. A likely scenario is that the Coorong no longer has the ecological character to act as an effective drought refuge in its current state; while it has water (hypersaline for the southern lagoon); the essential biotic ingredients of the system are largely dysfunctional.

Distribution

Over the nine previous years of records the number of migratory waders using the area to the north of the Needles has been in the range of 45% to 73%. In 2008, 96% of birds were observed in these zones. This observation suggests that habitat quality (driven principally by the availability of food resources) in the southern lagoon is continuing to deteriorate. The 2008 count showed a sharp increase in the percentage of birds using the Hells Gate zones, 42% compared with 7% in 2007 and 17% in 2006.

With the relatively poor conditions in the southern lagoon, (Geddes 2003), birds will seek alternative feeding sites where available in the northern areas of the Coorong or along the coasts of SA and Victoria. The species mix utilizing the northern areas has also changed with Red-necked Stint and Sharp-tailed Sandpiper tending to move towards the northern areas. In contrast, one of the few species to maintain its abundance in the southern lagoon is the Red-capped Plover. Data indicates that the population for this species has been stable since 2000.

Water Levels

The water level at the Parnka Point gauge was below the 0.00 mark. This is the lowest the southern lagoon has been in any survey since 2000. Water levels are currently dictated by the tidal flow through the Murray Mouth, the complete lack of flow over the barrages and the high evaporation rates this summer. Some of the potential implications for the Coorong as a result of closure or restricted flow at the Murray Mouth are discussed in Murray-Darling Basin Commission Report - The Murray Mouth, 2002 and in Ecological Character Description, Phillips and Muller 2006.

SURVEY OF THE SOUTHEAST COASTAL WETLANDS

This year was the seventh consecutive year that the lakes south of the Coorong to Lake George have been counted in conjunction with the AWSG summer count of the Coorong. This year the count area was extended southwards to include Mullins Swamp. These southeast coastal lakes are part of a system of lakes situated in the interdunal swales between a series of present day and relic coastal dunes. The lakes extend from Paranki Lagoon, adjacent to the southern Coorong, to Lake Bonney, northwest of Port MacDonnell (Lands SA, 1991). These lakes have been nominated in the Directory of Important Wetlands of Australia as Nationally Important Wetlands (Environment Australia 2001). The study area remains in the grip of the worst drought for almost 100 years.

RESULTS

The following text describes the surveys that were carried out including brief site descriptions and observations of habitat and wader counts. With the exception of 2005, when the count was conducted two weeks earlier, all counts have been completed at the same time of the year. Results are shown in Table 5.

***Blackford Drain* (1st February, 2008)**

This drain crosses the Princess Highway some 5 kms north of Kingston SE.

There was no drain flow this year, rather, a succession of shallow stagnant pools hard up against the northern bank. Compared with 2007, pools were smaller, and suitable habitat was more concentrated. The drain outlet at the sea was completely dry.

See Table 5 for a summary.

Lake Hawdon

Lake Hawdon lies on the eastern side of the Woakwine Range. It is a shallow, semi-permanent, brackish lake that is divided into a northern and southern basin. The basins are separated by higher land which carries the old Robe to Naracoorte road. The northern basin is, at its maximum, 6 km long and 6 km wide; and the southern basin is 9kms long and 4.5 km wide at its maximum. When full, both lakes have

Table 5. Wader counts of South East Lakes February 2008.

	Tolderol Game.Res		Blackford Drain		Fox/Pub Lake		Hawson South (i)		Lake Eliza		Lake St Clair		Lake George		Mullins Swamp	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Lathams Snipe					**3**	6								2		
Marsh Sandpiper																5
Common Greenshank	4	10			**3**	2								71		12
Red-necked Stint	37	832			**15**				488	175	38	6	5289	3645		12
Sharp-tailed Sandpiper	11	160			**10**	11			2				22	266		1275
Common Sandpiper					**1**											
Curlew Sandpiper													300	8		
Black-winged Stilt	26	1														5
Red-necked Avocet													22	59		
Red-capped Plover		8		4					36	47	12	38	14	174		
Red-kneed Dotterel						6										
Black-fronted Dotterel																2
Masked Lapwing		61		10	**6**			200	2		23	6	10	29		42
Unidentified Small								200						200		
TOTAL	**78**	**1072**	**0**	**14**	**38**	**25**		**400**	**528**	**222**	**73**	**50**	**5657**	**4454**		**1353**

a maximum water depth of less than a metre. Lake Hawdon South will often retain water until late December whereas Lake Hawdon North generally dries about 6 weeks earlier. (Lands SA 1991, Jones W. 1978). The current series of surveys has found water in Lake Hawdon South during late January/early February in four years out of seven.

Lake Hawdon South

An AWSG team did not survey Lake Hawdon South this year. It was visited on 14th January 2008, by a group from the Department for Environment and Heritage. Their visit covered two areas relevant to this report.

i) The southern basin which is the area traditionally covered by AWSG counts. It was wet in the extreme SW corner of the basin with water lying amongst rushes and reeds in habitat regarded as unsuitable for waders. The main body of the southern basin, including the thrombolite and clay pan areas, was completely dry. No waders were observed (R. Anderson, pers.com.).

ii) In the northern wetland water normally persists here until the end of February (G. Bowyer, pers.com.). This wetland is surrounded by *Gahnia* spp. and is difficult to reach on foot. The only time it has been included as part of the annual AWSG survey was when it was surveyed on 17th January, 2005 when there was 25–30 ha water extending out into surrounding vegetation. There were no waders present, although it was observed that it would be interesting to re-visit the area when the water had begun to dry back. On 14th January, 2008, when surveyed by the DEH group, only a small amount of water remained in the basin, and a flock of approx 200 small grey waders were feeding on the muddy shores. There were also a small number of Australian Shelduck present, along with approx. 200 Masked Lapwing (R. Anderson, pers.com.).

Once again, this year emphasizes the point made in earlier reports - that the importance of the wetland varies with the level of water within the lakebed. In 2003, 2007 and 2008 there was no water present in the Southern Basin but in 2000, 2002 and 2005 Sharp-tailed Sandpiper were present in numbers of International Importance, and in 2004 Marsh Sandpiper were in numbers of National Importance. In 2004 few waders were counted but the drying mud was covered with small wader prints, indicating that there had been larger numbers of waders there earlier in the season. In 2006 there was very little water present, and very few waders, but a few weeks earlier there had been 8 species of waders present including Sharp-tailed Sandpiper in numbers of International Importance (pers. obs.).

Variability in both the total number of waders present, and species richness, is a reflection of the water level at the time of the count.

Table 5 provides a summary of the count data.

Lake Robe

In view of the low counts over the preceding three years, Lake Robe was not visited this year.

Lake Fox and The Pub Lake **(5th February, 2008)**

Drain L becomes a series of small lakes in its last two to three kilometres before discharging into Guichen Bay. The main road into Robe crosses the Drain between the last two of these lakes – Lake Fox on the seaward side, and The Pub Lake on the inland side. This site is within the township of Robe, with the main road passing between the two lakes. The Pub Lake viewing point near the road looks out over a silt bar. Both the size of this bar, and the depth of water surrounding it, varies. In most summers dry sections of the bar provide roosting sites, and the combination of shallow water and wet mud provide suitable feeding areas. This year the silt bar has expanded and become very dry.

The marsh areas surrounding Lake Fox were also drier than in previous years. Continuing low numbers of Latham's Snipe is a concern considering other known sites within the area were dry (Table 5).

Lake Eliza **(5th February, 2008)**

Lake Eliza is situated 7km's south-east of Robe, and is a saline, coastal lake situated below sea level. The lake is a hydrologically closed system; where in-flow is a combination of precipitation, ground-water and drain flow and loss is solely evaporation and direct recharge. It has a maximum depth of 1.4 metres and is hyper-saline. Calcarenite dunes form several small islands in the lake. (South East Coastal Strategy). In the centre of the northern

half of the lake there are fossil shell beds pushed up into banks that lie NW to SE and are exposed when water levels are low (Don Mount, pers. com.).

Watkins (1993) had Lake Eliza listed as a site of International Importance for Banded Stilt based on the 1985 Summer Count of 5,000. The 1% threshold indicating 'international importance', 2,060, was exceeded in 2002, 2004 and 2005. The 2006 count indicated that Golden Plover were present in numbers of National Significance.

Access was gained through private property on the eastern side, and the survey began in the NE corner (Site 2). Much of the northern shore was driven along by 4X4 ATV; the eastern shore was also driven along (Site 1), then across the southern end of the lake, past Euro Point and into the dry south/west arm of the lake (Sites 7 & 8). Much of the western shoreline is deep, soft mud or decayed rock and so unsuitable for vehicles. The fresh water soak of the SW corner (Site 6A) was surveyed on foot. Little Dip Conservation Park (Sites 5 & 6) was accessed via a DEH service road by an observer who walked the lake's edge from there north to exit the lake at the Public Access Point (Site 3). For count summary see Table 5, count details Table 6.

Site 1. Eastern shore of the Lake, opposite The Springs Road.

The water level in the lake was very low. Despite the long, dry, season, the fresh water springs and drains along this side of the lake were flowing, with fresh water spreading out across the rock flats to reach the lake water. The few Red-necked Stint observed were feeding at one of the fresh water soaks. Another soak had a flock of 37 Australian Shelduck.

Site 2. The Northern end of the Lake

There are never many birds in this area (Don Mount, pers.com.). Normally the survey of this section is limited to a scan by telescope from the NE fenceline. Last year the water's edge was sufficiently far out to enable the ATV to be driven around the end of the fence. This year the water level was similar, but access was gained through a break in the fence. It was noted that new treated posts were laid out in readiness to replace the fence. The water's edge was well out from the shore. The exposed saline lake bed was dry. The fresh water spring in the NE corner of the lake was dry. There were no water birds or waders in this section.

Site 3. Public Access

In 2002, 2003, 2006 and 2007 no waders were observed in the saltmarsh between the water's edge, and the road. In 2004 there was a large flock of Red-capped Plover. In 2005 Red-capped Plover, Sharp-tailed Sandpiper and Pacific Golden Plover were in the dry salt-marsh. This year, no waders or water birds were observed. See Table 5 for count summary.

Site 4. Stockdale

Early in the season it has large numbers of small waders (Malcolm McCourt pers. comm.). This year the lake bed was dry. With a strengthening SW wind, heat haze and mirage, it was difficult to tell how far towards the east the water's edge had retreated. It was dry at least as far as the shell banks. There were no waders observed during this count.

Sites 5 & 6. Little Dip Conservation Park

The area of shoreline in front of Little Dip Conservation Park is typical wader feeding habitat, and waders are often seen there if the wind is in the NE. (D. Mount pers. com). This year the waterline was barely visible from the shore, disappearing amongst a shimmer of haze. Along this shore there are several small freshwater soaks. A small number of waders were feeding at these soaks. This section was walked well out into the lake bed – midway between the shore and the treed island offshore.

Site 6A Fresh Water Soak, South Western Corner

This area is very difficult to survey because of deep, soft mud associated with the fresh water soak, thickly vegetated shores and the decayed rock of the lakebed. It was not covered during the 2002 count and only a distant overview was obtained in 2003. In 2005 the count was abandoned when it was deemed unsafe to proceed and is therefore incomplete. In 2004, 2006/07/08 a count was successfully completed (Table 6). Fresh water lies in a shallow film over deep mud between clumps of reeds. Deeper pools of fresh water lie close to the shore. Small flocks of Red-necked Stint were feeding around the fresh water pools and on the wet silt. One was flagged with the Victorian flyway code of orange on the tibia. Moving from the influence of the fresh water, the silt gives way to the decayed rock typical of the western shore of the lake. About 1 kilometre to the north lies a small treed island. Last year it was possible to walk to this island, taking care not to break the crust of the decayed rock. This year insufficient time was available to negotiate the treacherous terrain. A flock of 200 Australian Shelduck were roosting amongst short, dry, vegetation between the springs area and the island.

Sites 7 & 8. Balance of Eastern shore and Southern end of lake.

Much of this section was covered well away from the vegetated shore and so any Masked Lapwing and Red-capped Plover in the samphire margins would have been missed. Visibility was extremely bad, with overcast conditions and misty rain.

Once away from the influence of the fresh water soaks, the lake bed was a crust of crystalline salt with a thin veneer

Table 6. Wader count Lake Eliza 5th February 2008

Species	Site 1	Site 2	Site 3	Site 5/5A	Total
Red-necked Stint	2			4	**6**
Red-capped Plover	20	6	4	8	**38**
Masked Lapwing	4	2			**6**
Total	**26**	**8**	**4**	**12**	**50**

of water. Last year the atmosphere had been full of dry salt whipped up by the gusting wind. This year light rain meant that there was no wind-borne salt. With the wind freshening from the South, blowing water to the North, it was possible to drive along the entire southern end of the lake, to the nearest shell banks and the closest treed islands.

Across the lake to the west is the soft mud of the Fresh Water Soak (Site 6A). Between is a dry arm of the lake the head of which is vegetated with samphire and salt tolerant herbs.

In 2006 a flock of Pacific Golden Plover were observed amongst the samphire. They were not present this year. A small number of Red-necked Stint and Red-capped Plover were foraging amongst the dry vegetation. An adult Red-capped Plover making an energetic 'broken-wing' display was a sign that a pair was breeding there.

***Lake St. Clair* (8th February, 2008)**

Lake St. Clair is located between Lake Eliza to the north and Lake George to the south. It 'is a saline, coastal lake situated below sea level' which has a hydrologically closed system, water coming in from rain, springs and drains, but only being removed by evaporation. It has a maximum depth of 1.4metres. Calcarenite dunes form two peninsulas on the western side of the lake and it is the most saline of the three lakes (Lands SA 1991).

The eastern and southern shores were driven along on the lakebed below the shoreline by 4x4 ATV. The western and northern sides (with the exception of Cabarita Point) were driven along by 4WD above the shoreline. Areas not directly covered could be observed from vantage points.

Lake St Clair often has very few birds of any kind, although 'large numbers of ducks congregate on the lake around drain outlets and springs during dry seasons' (South East Coastal Strategy). Results are shown in Tables 5 and 7.

Site 1 The Euro (formerly Woakwine Group land)
Access to the northern end of the lake was off Bog Lane through private property, now owned by the Pegler family. Counting was commenced at the boundary fence, continuing along the western side of the lake, and across the northern end of the lake until their eastern boundary was reached (approx. 5kms). With care it is possible to drive along the vegetated shore, making detours for clumps of trees. The waters of the lake were calm, and, with assistance from a gusting south-easterly wind, the water was approx. 20 metres from the northern shore. Very few waders were observed, except for one flock of 20 Red-capped Plover roosting amongst sparse vegetation on the shore.

Site 2 The western peninsulas.
Calcarenite dunes form two peninsulas on the western side of the lake. Bays each side of the southern most peninsula have small islands of vegetation that are surrounded by soft mud created by fresh water soaks. Each of these soaks had a small number of feeding waders.

Site 3 Eastern side (southern).
The eastern bed of the lake is rock and the entire eastern side was traversed. It was very difficult to judge between water and mirage, but it appeared that the southern half of the lake was dry. The only waders observed were Red-capped Plover, including one adult displaying whilst protecting a nest containing one egg and one chick.

Site 4 Southern end.
The entire width of the lake was driven along. The southern half of the lake appeared dry, with no water visible between the southern shore and the southern most western peninsula. No waders were seen.

Site 5 & 5A Extended Conservation Area.
For surveys done in 2002 and 2003, the 'Conservation Area' was defined as the area in the north east corner of the lake which has fresh water soaks at the margin of the lake and scrub running down to the lake's edge. The western limit was defined by a large spit of saltmarsh vegetation which extends out into the bed of the lake in front of land owned by the Pegler family (formerly owned by the Woakwine Group). The scrub on 'The Euro' land has been fenced to exclude stock and this adjoins the Lake St. Clair Conservation Park. The boundaries of the Conservation Park have been extended, and now include the Pacific Golden Plover roost site that was counted as part of Section 4 in the first two surveys. In the 2004 survey figures for this section of rocky coast through to the fence that runs out into the bed of the lake opposite the ruined stone buildings, were kept separately as Site 5A. Since 2005 these sites have been treated as one.

Once again, it was dry between the fresh water soaks of the eastern shore, and the water of the lake. Very few waders were seen in this section, most of those were at an almost dry fresh water soak. Yet again, no Pacific Golden Plover were seen.

Legoes Swamp.

This area was counted as part of this survey for the first time in 2005. It is an ephemeral swamp in farmland 3kms inland of the southern end of Lake St. Clair. Legoes Road traverses the swamp. Leaving the highway, the road crosses a ridge of high ground and from this vantage point a good overview of the swamp is obtained. Closest to the ridge is the deepest section of the swamp. In 2005 Sharp-tailed Sandpiper were in Internationally Significant numbers. In 2006 the entire swamp was dry except for a stream snaking through it. In

Table 7. Wader count Lake St Clair 8th February 2008.

Species	Site 1	Site 5/6	Site 6A	Site 7/8	Total
Red-necked Stint	21		96	58	**117**
Red-capped Plover	14	18	11	4	**47**
Total	**35**	**18**	**107**	**62**	**164**

Note: There were no waders counted at Sites, 2, 3 and 4

2007 and 2008 the entire swamp was dry, with pasture grasses carpeting the swamp bed.

Aerial overview **(27th January, 2008)**

This year a dedicated aerial survey of the Lower Lakes was not conducted, however an aerial survey of Lake Bonney was extended to include a quick assessment of the area between Lake Bonney and Lake George. The results of this overview are summarised under the relevant sections. The survey of Lake Bonney is the subject of a separate report (Christie 2008).

Lake Frome/Mullins Swamp **(27th January and 5th February, 2008)**

The forward to the Lake Frome Conservation Park Management Plan points out that Lake Frome and Mullins Swamp were included on the Register of the National Estate in 1993 because of their outstanding wetland conservation values. The wetland is also listed as a Wetland of National Importance in *A Directory of Important Wetlands in Australia* (Environment Australia, 2001*).*

Mullins Swamp receives in-flow from the Mount Hope drain. From Mullins Swamp it passes into Lake Frome, and ultimately into the sea at Southend. Wader numbers vary widely at this site, depending on the level of water retained in the swamp (J. Mullins pers. com.) When water levels are kept high, water spreads out amongst the reedy vegetation, leaving no-where suitable for waders to feed. Current dry conditions have meant that water levels are low, with shallow, muddy areas available to waders.

This is the first year of the current series of counts that has included this wetland.

The aerial overview on 27th January 2008, found that Lake Frome was dry. Mullins Swamp had some water with the falling water level exposing a strip of drying silt. A flock of approximately 1000 grey waders was disturbed from the southern section of the swamp by the passing of our aircraft. A flock of 200 Black-winged Stilts was observed at the northern end.

A survey was conducted on foot on 5th February 2008. Conditions were overcast with heavy low cloud and a strong to gale force SW wind. Water depth at the southern end was 6 cms to dry mud and at the northern end 30 cms to dry mud. Most waders were counted in the southern section of the swamp (Table 5). Count of the northern end was not comprehensive due to time constraints.

Table 8 shows historical count data from Mullins Swamp. Abundance varies from 66 birds in 1981 to 2,337 in 1983.

Lake George **(27th January and 5th February 2008)**

Lake George is the largest of the South East Coastal Lakes surveyed. It lies between Lake St Clair and the town of Beachport. The lake is approximately 13 km long and 8 km wide at its extremities and comprises three basins. At the northern end the basin, referred to as 'Big Lake', the water is approximately 3.5m deep but trends shallower towards the southern basin, referred to as 'Little Lake' where several low islands occur. Water levels can vary by 1 to 1.5m from winter/ spring peaks to autumn lows (DEHAA 1997). The Management Plan points out that Lake George would have been hypersaline similar to Lake St Clair and Lake Eliza had it not been for engineering changes to water flows. Fresh water entering by Drain M and an outlet to the sea have created what is normally an estuarine environment.

The aerial overview on 27th January 2008, found that Drain M had ceased flowing, and that Little Lake was dry. Middle Lake had small numbers of grey waders along with Australian Shelduck, Musk Duck, Swans and Whiskered Tern. A flock of 200 waders was noted on the western shore. Fairy Terns were observed around Foster Point. Big Lake had small waders at the fresh water springs. Chestnut Teal, Australian Shelduck and Pelicans were also present as well as a flock of 100 Red-necked Avocet.

At the time of the land survey on 5th February, 2008, conditions were similar. Low water levels enabled the survey team to drive around all of Middle Lake and all but a small section of Big Lake. The survey commenced at Red Spider

Table 8. Wader counts, Mullins Swamp

	1981	**1982**	**1983**	**1984**	**1985**	**2008**
Marsh Sandpiper		1				5
Common Greenshank	8	56	9	115	44	12
Wood Sandpiper	1	4	1	2	2	
Ruddy Turnstone						
Red-necked Stint	40	395	1200			12
Pectoral Sandpiper	1		12	1		
Sharp-tailed Sandpiper	15	995	110	7	32	1275
Curlew Sandpiper	1	35	680			
Black-winged Stilt					350	5
Banded Stilt		144				
Red-necked Avocet		8			401	
Red-capped Plover			1			
Black-fronted Dotterel						2
Red-kneed Dotterel		1			98	
Masked Lapwing		6	324	207	107	42
Unidentified Small				50		
Unidentified Medium				50		
TOTAL	**66**	**1645**	**2337**	**432**	**1034**	**1353**

Note: Counts 1981-1985 from AWSG data base.

Soak on the western shore of Big Lake, and it continued in an anti-clockwise direction around Foster Point into Middle Lake and past Five Mile Drift. The bed of the lake was crossed at Wooley Point which is the junction of Middle Lake and Little Lake. Finally, the eastern shore including Cocky's Point and the northern end of the lake was surveyed (Table 9)

Last year the very poor condition, especially of Big Lake, was noted. This year conditions were found to be improved, with a range of water birds present. Spoonbill sp (predominately Royal) 65; White-faced Heron 26; Little Egret 14, Great Egret 1; Whiskered Tern 460; Fairy Tern 4; Caspian Tern 25; Swan; Duck sp (predominately Shelduck); Pelican.

Lake George is listed as Internationally Important for Banded Stilt (50,000 1985), Curlew Sandpiper (3,582 1982) and Red-necked Stint (5,977 1986) (Watkins 1993). Sharp-tailed Sandpiper have been in numbers of International Importance in two years of the current series of counts (2002 – 2008).

DISCUSSION

The Coorong is only part of an extensive network of wetland environments in the South East of South Australia. What commenced as a survey of the Coorong proper in 2000 has been progressively added to so that now counts are undertaken of Tolderol on the northern shores of Lake Alexandrina, the lakes and wetlands south of the Coorong to Mullins Swamp and The Bool to the east. In 2003 and this year parts of the Watervalley wetlands were also counted. It should be noted that the total area counted does not represent the full extent of the wetlands. Lake Bonney lies further to the south. Areas similar to Legoes swamp are scattered throughout the region.

Lakes Eliza and George are important for Banded Stilt, with numbers regularly exceeding the International Importance figure of 2060. In 1985 and 2002 flocks in excess of 50,000 were counted on Lake George and in 2005 there were 30,000 on Lake Eliza. This year there were no Banded Stilt and only 59 Red-necked Avocet counted in the SE Coastal Lakes. Red-necked Stint also failed to trigger the National Importance figure at Lake George this year. This has occurred only twice in 10 counts at Lake George between 1981 and 2006. (International Significance thresholds have been exceeded during 6 counts and National thresholds during two counts).

Sharp-tailed Sandpiper were at Lake George in numbers of International Significance during the 1980's, and in recent years they have utilised ephemeral wetlands. In 2005 and 2006 they were present in numbers of International Importance at Lake George, as well as Legoes Swamp, Lake Hawdon South, The Bool and Tolderol. This year the ephemeral wetlands of this system were dry by the time of the count.

The area is also important for waders that make up a much smaller proportion of our wader population. Pacific Golden Plover are regularly in numbers of National Significance on Lake St. Clair/Lake Eliza, although none were seen this year. The Pub/Fox Lake complex within the township of Robe, is an important site for Latham's Snipe. Marsh Sandpiper were in numbers of National Significance on Lake Hawdon South in 2004.

In 2005 the total number of grey waders counted in these wetlands was approximately 20,000 and in the Coorong approximately 50,000. This year, along with last year, the numbers in the SE Lakes are well down. This reflects the ephemeral nature of parts of this wetland, with numbers of waders greater earlier in the season.

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Table 9. Wader counts, Lake George, Februrary 2008.

	Red Spider Soak	Foster Point	Five Mile Drift	Cocky's Point	Total
Lathams Snipe			2		**2**
Common Greenshank	3	10		58	**71**
Red-necked Stint	2161	330	515	639	**3645**
Sharp-tailed Sandpiper	89	150	5	22	**266**
Curlew Sandpiper	8				**8**
Red-necked Avocet		19		40	**59**
Red-capped Plover	1	7	1	165	**174**
Masked Lapwing	6	13		10	**29**
Unidentified Small			200		**200**
TOTAL	**2268**	**529**	**723**	**934**	**4454**

Natt, Richard Owen, Sarah Pearson, Rob Tanner, Cheryl Taylor-Hurling, Wendy and David Trudgen, Inka Veltheim and Paul Wainwright. John Eckert surveyed the shore from Long Point to Pelican Point and Tolderol Reserve independently. Jack and Pat Bourne counted at Bool Lagoon and wetlands in the Naracoorte area. Ross Anderson, DEH, provided data on Lake Hawdon South. John Mullins independently surveyed Mullins Swamp. Mark de Jong provided waterbird and hydrological data from Morella Basin.

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SURVEY OF SHOREBIRDS IN THE MOONEE CREEK ESTUARY ON THE NORTH COAST OF NEW SOUTH WALES, AUSTRALIA

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Twenty seven low-tide surveys in the small (20 ha) lower estuary of Moonee Creek, New South Wales, Australia over a 12 month period in 1996–1997 recorded small numbers of three migratory shorebirds, Bar-tailed Godwit *Limosa lapponica*, Whimbrel *Numenius phaeopus* and Eastern Curlew *Numenius madagascariensis*, three resident shorebirds of conservation concern in New South Wales, Beach Stone-curlew *Esacus magnirostris*, Australian Pied Oystercatcher *Haematopus longirostris* and Sooty Oystercatcher *H. fuliginosus* and one common resident shorebird Masked Lapwing *Vanellus miles*. This study demonstrates that minor estuaries can make a small but nevertheless valuable contribution to supporting shorebird communities.

INTRODUCTION

The New South Wales (NSW) coastline includes over 130 estuaries ranging from major rivers to small creeks and coastal lagoons (NSW Department of Natural Resources 2008), supporting significant populations of migratory and resident shorebirds. The large areas of estuarine habitat occurring in the Hunter River, Richmond River, Clarence River, Port Stephens, Botany Bay and Shoalhaven River have been identified as the major shorebird sites in coastal NSW (Smith 1991). Shorebird populations in Australia are currently in serious decline (Nebel et al. 2008), and identification and protection of complementary areas of shorebird habitat is important. Rohweder (2004) documented the contribution of the moderate-sized Bellinger River estuary on the NSW north coast in helping support shorebird populations. The present study examined the extent and patterns of use of a minor estuary by migratory and resident shorebirds.

STUDY AREA AND METHODS

The Moonee Creek estuary (30°12’ S 153°9’ E) is located approximately 570 km north of Sydney in Gumbaynggirr Aboriginal Country in the NSW north coast bioregion of eastern Australia. Moonee Creek is a small coastal stream with a catchment area of about 40 km^2 (NSW Department of Natural Resources 2008). The entrance to the estuary is open and unmodified (untrained). The village of Moonee Beach is situated on the southern side of the estuary and includes a rapidly growing urban area as well as a popular tourist camping reserve. The northern side of the estuary is bordered by Moonee Beach Nature Reserve. Moonee Creek estuary is now covered by a habitat protection zone as part of the Solitary Islands Marine Park (declared in 1998).

This study was restricted to the lower 1500 m of the estuary, an area of about 20 ha dominated by tidal sand flats. Additional intertidal and supra-tidal habitats present in the study area include sandy beach and berm on the northern side of the estuary opening, rocky shoreline on the southern side of the estuary opening and small areas of mangrove forest, saltmarsh and seagrass beds. Surveys of the birds present in the study area were done at low tide during daylight hours on 27 separate days between March 1996 and March 1997. Eight surveys were in autumn (March–May), seven in winter (June–August), six in spring (September–November) and six in summer (December–February). Survey dates are listed in Appendix 1. On each survey a set walking route was followed over a period of about 90 minutes and all birds observed were recorded. Notes were also made on human activity in the study area.

RESULTS

A total of seven species of shorebird were recorded during the study: three migratory species and four resident species (Table 1). Overall shorebird numbers were low, with a sum of the maximum counts for each species totalling only 22 birds. The Whimbrel was the most common migratory shorebird, with up to five birds seen feeding on tidal sand flats and occasionally in mangrove forest between September and March. Single Bar-tailed Godwits were seen feeding on tidal sand flats in September and November and a single Eastern Curlew was seen feeding on tidal sand flats in January.

Masked Lapwings were the most common resident shorebird, with up to nine birds seen on one occasion and nesting recorded. A pair of Australian Pied Oystercatchers and two to three Sooty Oystercatchers were seen feeding or loafing in the study area throughout the year, more often in autumn-winter than in spring-summer. A single adult Beach Stone-curlew was recorded on three occasions over a six week period between late May and early July, feeding on soldier crabs *Myctyris* sp. on tidal sand flats in the early morning and late evening and sheltering amongst mangroves on a small sandy island during the middle of the day.

An additional 27 non-passerines were also recorded utilising estuarine habitats in the study area (Table 2). The most abundant and frequently recorded species were the Silver Gull and Crested Tern, with additional common species including the White-faced Heron, Australian White Ibis, Brahminy Kite and Sacred Kingfisher.

Human activities in the study area included fishing, collecting bait (marine yabby *Callianassa* sp.), boating, exercising dogs off-leash, walking, swimming and horse-riding. The level of human activity varied with weather conditions, time of day and between weekdays and weekends. The highest activity level was approximately 100 people and more than 10 dogs counted at one time in the

Table 1. Summary of records of migratory and resident shorebirds derived from 27 low tide surveys of Moonee Creek estuary March 1996-March 1997. (Habitats used: mf = mangrove forest, rs = rocky shore, sbb = sandy beach and berm, sm = saltmarsh, tsf = tidal sand flats.)

Species	Number of surveys when species observed				Maximum count	Habitats used
	Autumn 8 surveys	Winter 7 surveys	Spring 6 surveys	Summer 6 surveys		
Migratory shorebirds						
Bar-tailed Godwit *Limosa lapponica*			2		1	tsf
Whimbrel *Numenius phaeopus*	1		4	1	5	mf, tsf
Eastern Curlew *Numenius madagascariensis*				1	1	tsf
Resident shorebirds						
Beach Stone-curlew *Esacus magnirostris*	1	2			1	mf, tsf
Australian Pied Oystercatcher *Haematopus longirostris*	3	4	1	1	2	tsf
Sooty Oystercatcher *Haemotopus fuliginosus*	2	2	1	1	3	rs, sbb, tsf
Masked Lapwing *Vanellus miles*	7	7	3	6	9	sm, tsf

Table 2. Additional non-passerine species recorded during the shorebird monitoring surveys in the Moonee Creek estuary.

Species	Number of surveys when species observed (total 27 surveys)	Maximum count
Australian Wood Duck *Chenonetta jubata*	1	2
Pacific Black Duck *Anas superciliosa*	4	3
Wedge-tailed Shearwater *Ardenna pacifica*	1	1
Little Pied Cormorant *Phalacrocorax melanoleucos*	5	4
Little Black Cormorant *Phalacrocorax sulcirostris*	6	7
Great Cormorant *Phalacrocorax carbo*	4	2
Australian Pelican *Pelecanus conspicillatus*	10	3
White-faced Heron *Egretta novaehollandiae*	20	26
Little Egret *Egretta garzetta*	1	1
Eastern Reef Egret *Egretta sacra*	9	3
Eastern Great Egret *Ardea modesta*	5	1
Striated Heron *Butorides striatus*	9	3
Australian White Ibis *Threskiornis molucca*	18	13
Eastern Osprey *Pandion cristatus*	5	3
Whistling Kite *Haliastur sphenurus*	2	1
Brahminy Kite *Haliastur indus*	19	3
White-bellied Sea-Eagle *Haliaeetus leucogaster*	7	1
Jaeger sp, *Stercorarius* sp.	1	2
Silver Gull *Larus novaehollandiae*	27	383
Crested Tern *Thalasseus bergii*	24	209
Common Tern *Sterna hirundo*	1	3
Little Tern *Sternula albifrons*	2	6
Crested Pigeon *Ocyphaps lophotes*	3	3
Bar-shouldered Dove *Geopelia humeralis*	1	2
Galah *Cacatua roseicappilla*	1	1
Azure Kingfisher *Ceyx azureus*	1	1
Sacred Kingfisher *Todiramphus sanctus*	11	6

intertidal zone, with more present on the margins of the study area.

DISCUSSION

The Moonee Creek estuary was found to support only small numbers and low diversity of shorebird species. One species of shorebird and another eight species of non-passerine were represented by only single records, suggesting that further survey effort may have detected additional species. It should also be noted that the estuary extends upstream beyond the boundaries of the study area and may support additional numbers or species.

The survey did identify several species of conservation significance. The migratory Bar-tailed Godwit, Whimbrel and Eastern Curlew are protected under the JAMBA, CAMBA and ROKAMBA international agreements. Three resident shorebird species recorded are listed as endangered or vulnerable under the NSW *Threatened Species Conservation Act* 1995 (TSC Act). The occurrence of the endangered (higher risk) Beach Stone-curlew is particularly noteworthy. The total NSW population of this species is estimated at only eight pairs (Rohweder 2003). Breeding pairs are known from the Corindi River estuary 33 km north and Nambucca River estuary 57 km south (Clancy 1986;

Rohweder 2003). The vulnerable (lower risk) Sooty Oystercatcher is moderately common along the 50 km section of coastline between Arrawarra (23km north) and Sawtell (27km south) while the vulnerable Australian Pied Oystercatcher is uncommon there (Murphy unpublished data).

The range of additional non-passerine species recorded in the Moonee Creek estuary further demonstrates the area's habitat values. This included another seven species listed under CAMBA, JAMBA or ROKAMBA (Wedge-tailed Shearwater, Eastern Reef Egret, Eastern Great Egret, White-bellied Sea-Eagle, Crested Tern, Common Tern and Little Tern) and two species listed under the TSC Act (Eastern Osprey and Little Tern). Eastern Ospreys hunted over the estuary and adjacent coastal waters and used large trees on the edge of the estuary as feeding perches. Little Terns were observed in February and March: adults were diving for small fish in estuarine waters and feeding them to dependent fledged young.

Whilst individually providing only limited areas of estuarine habitat and supporting low numbers of shorebirds, smaller estuaries such as that at Moonee Creek provide potential stop-overs for birds moving between major shorebird sites such as the Clarence River estuary 110 km north (Martindale 1984; Smith 1991) and Port Stephens 370 km south (Smith 1991; Stuart 2005). The combined habitat area provided by smaller estuaries collectively can also be significant in its own right. For example, the 14 minor estuaries (including Moonee Creek) in the 150 km between the Clarence River and Bellinger River contain a combined area of 935 ha of estuarine waterway, 258 ha of mangrove forest and 223 ha of saltmarsh (NSW Department of Natural Resources 2008).

In common with many estuaries, Moonee Creek is a popular location for a range of recreational activities. High levels of human activity can have a detrimental effect on shorebirds including reduced feeding opportunities, decreased availability of invertebrate prey, disruption of roosts and abandonment or destruction of eggs or young (Burger 1986; Shepherd and Boates 1999; Lafferty 2001; Blumstein et al. 2003; Ruhlen et al. 2003). The protection of the estuary as part of the Solitary Islands Marine Park since 1998 is a positive move; however, the expanding human population locally at Moonee Beach and in the wider NSW north coast region is likely to result in increasing pressure on shorebirds in the area.

This study demonstrates that even minor estuaries can be utilised by migratory and resident shorebirds and make a small but nevertheless valuable contribution to supporting shorebird communities. Recognition and protection of these areas is particularly important given the recent significant declines in shorebird populations.

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Appendix 1. Survey dates for Moonee Creek estuary shorebird survey.

Autumn	Winter	Spring	Summer
Friday 29-Mar-1996	Saturday 8-Jun-1996	Saturday 14-Sept-1996	Monday 9-Dec-1996
Sunday 21-Apr-1996	Saturday 22-Jun-1996	Sunday 29-Sept-1996	Saturday 21-Dec-1996
Sunday 5-May-1996	Saturday 6-Jul-1996	Saturday 12-Oct-1996	Saturday 4-Jan-1997
Sunday 12-May-1996	Thursday 18-Jul-1996	Saturday 26-Oct-1996	Sunday 19-Jan-1997
Thursday 16-May-1996	Saturday 3- Aug-1996	Friday 8-Nov-1996	Tuesday 4-Feb-1997
Friday 24-May-1996	Friday 16-Aug-1996	Saturday 23-Nov-1996	Saturday 15-Feb-1997
Saturday 1-Mar-1997	Saturday 31-Aug-1996		
Sunday 16-Mar-1997			

AUSTRALIAN PIED OYSTERCATCHERS BREEDING AT MORTIMER BAY , TASMANIA, AUSTRALIA 1977–2000

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INTRODUCTION

A previous paper (Newman 1992) reported the results of a long term study of the breeding of Australian Pied Oystercatchers *Haematopus longirostris* at Gorringes Beach, Mortimer Bay in south-east Tasmania, Australia (42^0 58'S.147^0 28'E). These surveys, which commenced in 1977/78, were continued through to the end of the 1999/2000 breeding season, providing data over 23 consecutive years.

This paper is concerned with the survival of adults breeding in the study area and with their fidelity to pair bond and territory during ten years after the previous publication (Newman 1992).

STUDY AREA AND METHODS

Newman (1992) which describes the study area and methods should be referred to for additional detail.

Gorringes Beach is approximately 3 km in length, stretching south from Rifle Range Road, which provides access to the northern end of the beach. The territories of pairs 1 to 8 referred to in Table 1 occur in sequence from north to south, with pair 8 nesting on a rocky headland at the southern extremity of the beach. This paper provides information on an additional pair 9, which nested in a small bay immediately north of Gorringes beach, and used the intervening headland when feeding dependent young.

Development and recreational disturbance of the area increased during the ten year period and impacted adversely on the breeding oystercatchers. For instance vehicular access to parking areas at each end of the beach improved, and two residential dwellings were constructed on the southern headland. Paddocks on this headland, occasionally used as nest sites by oystercatchers are no longer suitable.

I relocated to NSW during 1992, but continued to make regular visits to Tasmania. Monitoring has been continued throughout each breeding season, mainly by Priscilla Park to determine adult survival, territory occupancy and the breeding success rate in terms of young raised to the flying stage. However, it was not possible to sustain the banding activity, and replacement breeding birds have not been trapped for individual identification with colour bands.

RESULTS

Adult mortality and fidelity to pair bond and breeding territory

Of the 16 individually marked birds breeding in 1989/90 (Newman 1992) 12 were still present as members of a territorial pair in the 1999/2000 season. This represents a remarkable 75% survival rate for territorial adults over a 10 year period.

Of these 12 birds one, the male of pair 2, has been present each season with an unbanded female, but no nests were found. Hence the survival statistics are quoted in terms of territorial as opposed to breeding pairs. Another, the female of pair 7 disappeared during the 1999/2000 season after extensive territorial disputes with a third bird which was un-banded, and is presumed to have replaced the banded female. For the purpose of this analysis the pair 7 banded female present initially in 1999/2000 is deemed to have survived the 10 year period.

Members of pair 9 were banded at the northern headland in the 1991/92 and 1992/93 seasons and by 1999/2000 had survived 7 and 8 years respectively.

These results also demonstrate the fidelity of the breeding adults to their pair bond and territories.

Age structure

Birds banded as breeding adults were conservatively aged at 4+ years based on studies in south-east Tasmania where it has been found that oystercatchers banded as runners do not breed until they are at least 4 years and many are considerably older before they breed. On this basis the average age of the 15 birds detailed in Table 1 exceeds 17.2 years. These birds represent 83 percent of the Gorringes beach breeding population at the start of the 1999/2000 season. The remaining 3 un-banded birds, 17% of the population, are replacements, which are expected to be younger birds.

The average age of males and females exceeded 16.8 and 17.7 years based on samples of 8 and 7 birds, representing 89 and 78 percent of the population respectively.

The oldest known ages of males and females in the population are 26+ and 22+ years respectively.

Fidelity to territory and pair

Throughout the ten year period 1989/90 to 1999/2000 all the surviving adult birds reported in the previous paper (Newman 1992) remained faithful to their territory and pair. When a member of a pair, either male or female, went missing it was rapidly replaced by another partner as reported previously (Newman 1992).

Pair 9 breeding on the headland to the north of the beach use nest sites in a small adjacent bay. This bay was not monitored until 1991/92 and is probably a traditional rather than a new territory.

DISCUSSION

When this study commenced in 1977 it was totally unexpected that two of the three adult birds trapped on their nests during that year would survive 23 years later or that this study would still be in progress.

Table 1. Histories of Adult Australian Pied Oystercatchers breeding at Gorringes Beach 1999/2000.

Pair	First Banded		Age (1)	Sex (2)	Number of Years breeding		
	Date	Method(3)	Years		Study Area	Territory	Present Pair (4)
1	18/07/82	C	21+	M	18+	18+	18+
1	01/08/82	C	21+	F	18+	18+	18+
2	22/10/77	T	26+	M	23+	23+	-
3	07/11/86	T	17+	M	14+	14+	14+
3	09/11/81	T	22+	F	19+	19+	14+
4	02/08/87	C	16+	M	12	12	12
4	01/08/82	C	21+	F	17+	17+	12
5	29/10/77	T	26+	M	23+	23+	11
5	06/11/84	T	19+	F	16+	11	11
6	27/12/86	T	19+	F	16+	11	11
7	22/11/86	T	17+	M	14+	14+	14+
7	02/11/84	T	16+	F	16+	16+	14+
8	06/11/87	T	16+	M	13+	13+	-
9	22/11/91	T	12+	M	9	9	8
9	29/12/92	T	12+	F	8	8	8

(1) Age based on first year of life = 1 and unpublished results for the study area. These indicate that Australian Pied Oystercatchers do not breed until at least their fourth year of life in the study area.
(2) Sex determined by comparing bill and total head lengths within pairs knowing that on average females have longer bills than males.
(3) Capture method codes; T = trapped on nest; R = banded as runner; C = cannon-netted.
(4) Number of consecutive breeding seasons the pair bond is known to have been maintained.

In the previous paper (Newman 1992) the average age of 16 breeding adults was shown to be at least 9.1 years. Ten years later the results in Table 1 demonstrate an average age of greater than 17.2 years for 15 individually marked breeding birds, with the two males at least 26 years of age. The greatly increased estimate of the average age of the breeding birds stems from the remarkably high survival rate of the individually marked birds over the ten year period. Only 4 members of the original 9 pairs were lost, indicating an annual survival rate of almost 98% (171 annual survivals out of 175 bird years, assuming that the unmarked replacement birds survived). This survival rate exceeds the 90% cited by Johnsgard (1981) and equals the highest rate reported in a number of studies cited by Cramp & Simmons (1983). The oldest known age for a Pied Oystercatcher is 35 years and 11 months (Cramp & Simmons 1983).

Of the four banded birds that were lost over the ten year period, 3 were female and one male. However, while this result may suggest the possibility that female mortality rates are higher than males, the sample size is very small and the surviving females demonstrate similar longevity to males. Indeed the average age of the 7 females in Table 1 exceeded the 8 males by almost 1 year.

The extreme fidelity of the breeding birds to their breeding location, territory and pair bond was confirmed. Over the ten year period no exceptions were observed. Pair 1 in Table 1 has now remained faithful to their pair bond and territory for at least 18 consecutive seasons. However, it is interesting to note that while prior to 1990 they invariably nested on the beach near the high tide line, they have in recent years extended their territory and now nest in adjacent paddocks behind the beach. This change is attributed to a number of factors including natural changes in the fore dune structure caused by tidal erosion and increased disturbance by recreational use of the beach. Formerly, an additional pair nested in these paddocks for several years during the 1980's. One member of this displaced pair was subsequently found breeding at Prices Bay on the Tasman Peninsula, a straight line movement of 25 km. In our extensive studies this is the only instance we have recorded of a breeding bird shifting to another beach. It is possible that aggression from the more established Pair 1, as their beach front breeding sites became unsuitable, contributed to the displacement of this bird from the Mortimer Bay area.

The Pair 5 female which had previously changed partners and territories following the loss of a foot (Newman 1992) remained as a member of pair 5 throughout the presently reported ten year period. However this pair did not successfully raise any young to the flying stage. Indeed breeding failure is now a feature of pairs nesting along the beach, but pairs nesting in the vicinity of the two headlands are intermittently successful.

In summary adult Australian Pied Oystercatchers nesting at Mortimer Bay show extreme faithfulness to their breeding area despite an increase in recreational disturbance and in the case of some pairs continuous breeding failure. In view of the extreme longevity of the species caution must exercised in drawing conclusions on the long term viability of the species based on population monitoring studies of breeding pairs and non breeding flocks. Only long term trends in breeding success will provide early warning of a population collapse.

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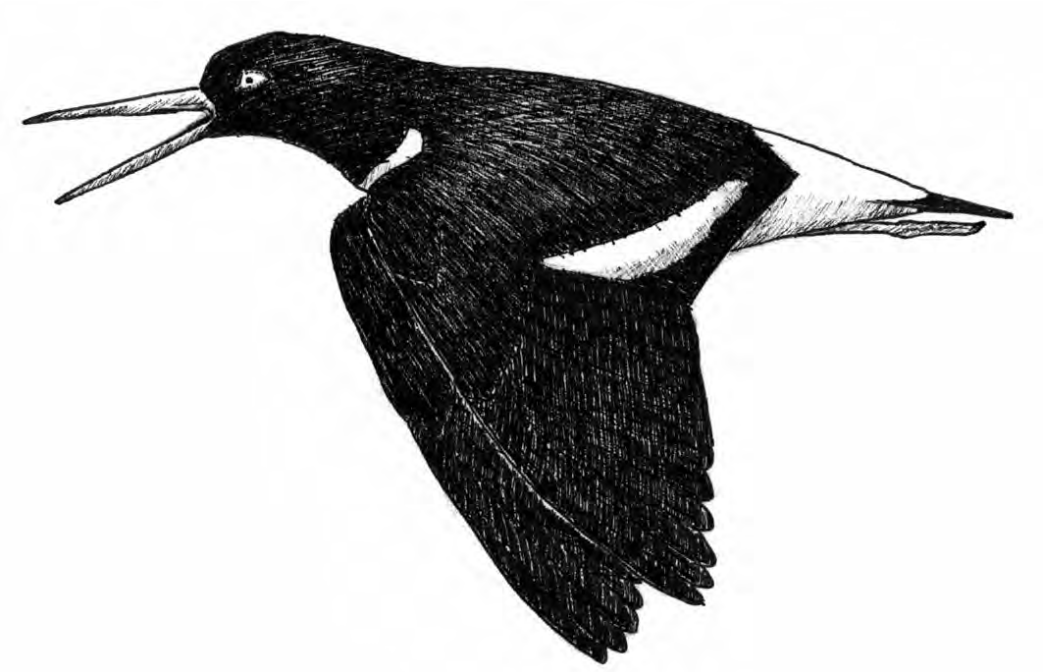

REPORT ON POPULATION MONITORING COUNTS 2007 AND SUMMER 2008

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Many shorebird areas across Australia have been surveyed for the last 28 years. These data are invaluable for understanding how shorebird populations in Australia have changed over time, and how important areas are for shorebirds. Therefore, it is vital that data continue to be made available for effective conservation management.

In 2007 Birds Australia, in collaboration with AWSG, NHT and WWF, launched Shorebirds 2020 with the aim of reinvigorating shorebird monitoring in Australia. As a result, there has been a large increase in the number of people undertaking shorebird counts across Australia. Further, shorebird data is available for a greater number of shorebird areas: many are areas that have not been surveyed in recent years, others are new areas that have not been regularly surveyed in the past. We are still waiting for some data, from a few areas but most of it is reported here for summer 2007, winter 2007, and summer 2008 counts.

In response to the increased quantity of data being collected, there are a few slight changes to way that this shorebird data is reported in the summaries published in Stilt. First, we've revised the boundaries of what a "shorebird area" includes. In some cases this has meant smaller areas within a region are reported. For example, previous Stilt summaries reported figures for NE Tasmania: these data were collected at three individual shorebird areas (Cape Portland, Great Musselroe Bay, GeorgeTown/Tamar Estuary). Similarly, data collected in the SE coast of South Australia has also been presented as a single region, but are reported as two areas here. We still have much to learn on how to define a shorebird area, but each shorebird area is meant to include the entire area used by each shorebird population over the peak summer months. We have no doubt that as we learn more from shorebird experts throughout the country, these boundaries will continue to be refined, but analysis of the data in some areas suggest that these revised boundaries will reduce annual count variation.

Second, Stilt summaries have reported data collected in a core group of shorebird areas in which counts have been undertaken consistently over the last 20+ years. The number of shorebird areas for which data are reported in Stilt will increase as Shorebirds 2020 progresses. It is important to emphasise that future Stilt summaries should not be interpreted as indicating that shorebird numbers are increasing in Australia. Rather they will reflect an increased survey effort across the country, thus providing a better understanding of the importance of a greater number of areas to different shorebird species, and an increased ability to detect population changes.

Last, Stilt summaries have traditionally reported the count figures collected during the biannual Population Monitoring Count (summer/winter) undertaken at each shorebird area. Often, this will be the only count conducted in shorebird areas, however, in some areas shorebird counts are undertaken on a monthly basis, and this year there were several new areas that conducted repeated summer counts. When more than one count is undertaken in summer or winter, the maximum number of individuals for each species recorded over all counts undertaken in these seasons will be reported. Thus, the figures reported for one shorebird area may relate to counts undertaken on different days. For the purposes of calculating the maximum count of each species, 'summer' includes the months of November to February, inclusive, and winter includes the months of May to August, inclusive.

Shorebird's 2020 staff and volunteers have been working with the historic National Shorebird Database, to learn how best to determine population trends for shorebirds at a national level, and to determine site-based population trends. Power analyses done on the existing data showed that statistically significant national population trends would require visits to from 30 to 35 areas for each species. We've identified 149 shorebird areas throughout Australia that would meet those requirements for 28 migratory shorebird species, and over the next year we will be attempting to get counts happening in each of those areas.

For site-based population trends we have found during power analyses that the best way to determine population trends for more species in more areas is to reduce the annual count variation at each site. We are still learning how best to do this. Fortunately, the repeat counts done this summer, and in previous years give us some data to investigate. A quick look at the repeated counts done over the summer of 2008 suggests that repeated counts would reduce annual count variation if we take a maximum count over multiple counts. The degree to which a maximum over multiple counts reduces variation appears to be dependent on local site characteristics, and the way shorebirds in the area use the area. It is likely that areas with high count variation would benefit most from more surveys, as well as potentially some changes to the area covered or counting methods.

Again we will continue to look into this, but this year showed some clear cases where repeated summer counts were valuable. In Shallow Inlet, for example, three counts were conducted, and yet Sanderling (a species usually there in the hundreds) was only recorded on one of the counts. Likely this was related to very windy conditions during two of the counts. Similarly, counts of Pacific Golden Plover during the surveys in Shallow Inlet varied from zero to 88 to 167. Over the last two years repeat counts have been conducted in a season at 31 shorebird areas, with as many as four counts done in a season at some areas. Counts for some species in some areas were nearly identical, but on average the within season variation suggests that the annual variation would be too high to detect site specific population trends. We will look to quantify the benefits of repeated counts in the coming years. We will also be continuing to explore some analytical methods to reduce variation with the help of some new data on possible co-variates (on the new data sheets), but finding ways to reduce the actual variation in counts for more species in more areas will increase our ability to report on population trends.

In the short term due to the obvious benefit observed this year from taking the maximum of repeated counts we will be recommending that at least two summer counts be planned if possible, with the understanding that as many as four (possibly more) summer counts may be ultimately needed in some areas.

For more detailed information on the work we've been doing, for maps of the areas we need counted, data sheets, and ID or counting training information please visit "The Toolkit" section of the revised website www.shorebirds.org.au

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SUMMER 2007	**NSW**									**NT**	**Qld**					**New Areas**	
Species	Botany Bay	Hunter Estuary	Lake Illawarra	Port Stephens	Shoalhaven Estuary	Tweeds Estuary	Richmond River Estuary	Clarence River	Parramatta River	North Darwin	Bowen	Mackay	Moreton Bay	Cairns	Townsville	Maroochy River	Great Sandy Straight
Asian Dowitcher																	
Banded Lapwing				2													
Banded Stilt							**N**	**N**	**N**					**N**	**N**		
Bar-tailed Godwit	578	1077	13	809	330		**O**	**O**	**O**	323	45	44	10810	**O**	**O**		1300
Beach Stone-curlew							**T**	**T**	**T**	2	3		5	**T**	**T**		
Black-fronted Dotterel		2															
Black-tailed Godwit		170		1			**C**	**C**	**C**	776			245	**C**	**C**		
Black-winged Stilt	4	423				29	**O**	**O**	**O**	4	8		448	**O**	**O**		
Broad-billed Sandpiper							**U**	**U**	**U**					**U**	**U**		
Bush Stone-curlew							**N**	**N**	**N**			2	2	**N**	**N**		
Common Greenshank	4	151		13			**T**	**T**	**T**	4	3		113	**T**	**T**		
Common Sandpiper	1						**E**	**E**	**E**	21	1			**E**	**E**		
Curlew Sandpiper	8	276					**D**	**D**	**D**	32		40	2002	**D**	**D**		
Double-banded Plover	5				5												
Eastern Curlew	240	555		350	28					23	11	148	1348			3	300
Great Knot		1								4928	14	370	1105				
Greater Sandplover										1800		110	487				15
Grey Plover										27			46				
Grey-tailed Tattler	70	20		100						22		124	940				
Hooded Plover																	
Latham's Snipe						3											
Lesser Sandplover		3		4						40		2800	747			1	60
Little Curlew																	
Long-toed Stint																	
Marsh Sandpiper		143			3					2			23				
Masked Lapwing	4	90		50	5	6				8	17	4	55				
Oriental Plover																	
Pacific Golden Plover	37	293			310					45	6	186	1184			50	22
Pectoral Sandpiper																	
Pied Oystercatcher	46	2		108	6					2	7	6	472			2	4
Red Knot					6					498			1				
Red-capped Plover	12	18	43	41	17					35	13	40	125			27	35
Red-kneed Dotterel													2				
Red-necked Avocet		2151		6									43				
Red-necked Stint	224	23	41	59	179					432	5	340	2896			39	14
Ruddy Turnstone	21			5						63		48	63				
Ruff																	
Sanderling					1					100							
Sharp-tailed Sandpiper	58	683	3	8	365					88	10	42	1521				
Sooty Oystercatcher	11	11		11							2	3					
Terek Sandpiper		7		6						117		22	94				
Wandering Tattler																	
Whimbrel	77	76	1	215						26	21	59	511			6	70
Wood Sandpiper																	
Unidentified small wader													30				
Unidentified medium wader																	
Unidentified large wader																	
TOTAL	1400	6175	101	1788	1255	38	-	-	-	9418	166	4388	25318	-	-	128	1820
No. of species	17	21	5	17	12	3	-	-	-	25	15	18	27	-	-	7	9

SUMMER 2007	**SA**									**Tas**								
	SE coast		**SE lakes**					**Coorong**		**SE**		**NE**		**NW**	**New Areas**		
Species	Carpenter Rocks	Port MacDonnell	Fox and Pub Lakes	Lake Eliza	Lake George	Lake Robe	Lake St Clair	Coorong	Tolderol	Derwent	Marion Bay & Blackmans Bay	Cape Portland	George Town Reserve	Robbins Passage/Boullanger Bay	Georges Bay	Maurouard Beach	Moorland Point
Asian Dowitcher																	
Banded Lapwing								18		1		13					
Banded Stilt								9106									
Bar-tailed Godwit		2						21		60	18			191	38		
Beach Stone-curlew																	
Black-fronted Dotterel										2							
Black-tailed Godwit								99									
Black-winged Stilt								132	26								
Broad-billed Sandpiper																	
Bush Stone-curlew																	
Common Greenshank	19	1	3					416	4	38				105	3	1	
Common Sandpiper			1					2									
Curlew Sandpiper	8	118			300			2171		30		2		876			
Double-banded Plover	1	8								3	7			55	1		4
Eastern Curlew	1							29		43			31	120			
Great Knot														3			
Greater Sandplover																	
Grey Plover														2			
Grey-tailed Tattler	3																
Hooded Plover		5						26			12	4		21	5	18	
Latham's Snipe			3														
Lesser Sandplover																	
Little Curlew																	
Long-toed Stint																	
Marsh Sandpiper								3									
Masked Lapwing	5	36	6	2			23	512		415		4	18	102	37		45
Oriental Plover																	
Pacific Golden Plover	45	21						50		43		100		196			5
Pectoral Sandpiper										1							
Pied Oystercatcher	5	7						568		760	185		13	479	135	9	2
Red Knot														963			
Red-capped Plover	6	75		36	14	2	12	766		78	14	6		66	4	1	
Red-kneed Dotterel																	
Red-necked Avocet								165									
Red-necked Stint	1286	1985	15	488	5289		38	20298	37	1830	1115	269		7828	230		
Ruddy Turnstone	128	255										49		846		30	114
Ruff																	
Sanderling	57	615						18		1				1			
Sharp-tailed Sandpiper	20	53	10	2	22			3848	11			6		4	1		
Sooty Oystercatcher	1	4						5		6	2			300		4	2
Terek Sandpiper														1			
Wandering Tattler																	
Whimbrel																	
Wood Sandpiper																	
Unidentified small wader								200									
Unidentified medium wader																	
Unidentified large wader																	
TOTAL	1585	3185	38	528	5625	2	73	38453	78	3311	1353	453	62	12159	454	63	172
No. of species	14	14	6	4	4	1	3	21	4	15	7	9	3	19	9	6	6

SUMMER 2007	**Tas**			**Vic**																
	New Areas			**Bellarine Peninsula**													**Port Phillip Bay**			
Species	Narantapu National Park	Policemans Point	Scamander	Begola	Belmont Common	Black Rocks / Breamlea	Lake Lorne	St. Leonards Salt Lake	Point Richards	Moolap Saltworks	Swan Bay & Mud Islands	Lake Connewarre area	Corner Inlet	Anderson Inlet	Shallow Inlet	East Port Phillip	Werribee / Avalon	Laverton/Altona	Western Port
Asian Dowitcher																			
Banded Lapwing																			
Banded Stilt										5200							500		
Bar-tailed Godwit	2									21	15	3	10791		52			4	230
Beach Stone-curlew																			
Black-fronted Dotterel					2		11			6						25	12		
Black-tailed Godwit																	14		
Black-winged Stilt					3		32	2		387		3				50	406	29	
Broad-billed Sandpiper																			
Bush Stone-curlew																			
Common Greenshank						2				65	186	40	110	188	33	4	56	15	230
Common Sandpiper												1				1	3		
Curlew Sandpiper										543	334	2514	607	1	1140		2049	372	446
Double-banded Plover											6			25					21
Eastern Curlew	21										65	7	804	149	108		2		583
Great Knot											3		66		1				
Greater Sandplover													6						
Grey Plover											4		331						
Grey-tailed Tattler													2		2		1		
Hooded Plover	2	4	1			2					5		2		5				
Latham's Snipe				2	23					25						18			
Lesser Sandplover											1								1
Little Curlew																			
Long-toed Stint																			
Marsh Sandpiper										126						1	267	18	
Masked Lapwing	70	10	10	2	4	1	44	3	3	193	88	8	35	73		119	200	38	271
Oriental Plover																			
Pacific Golden Plover											26			94	233		47		1
Pectoral Sandpiper											1					2	3		
Pied Oystercatcher	155	40	3							14	40	6	917	24			45		323
Red Knot											125		955		11				
Red-capped Plover	1						10	2		30	83	52	18	14	31	18	41	16	77
Red-kneed Dotterel																			
Red-necked Avocet										3						11	1170		
Red-necked Stint	60	240				246				1717	3536	4037	13358	3040	2568	70	11586	1973	6710
Ruddy Turnstone	14	22									15		4				7		19
Ruff																			
Sanderling		6											41		533				
Sharp-tailed Sandpiper										1757	458	2024	23	51	102	350	2258	186	247
Sooty Oystercatcher											1		295		4		1		6
Terek Sandpiper																			3
Wandering Tattler																			
Whimbrel	1												2		3				1
Wood Sandpiper																			
Unidentified small wader																			
Unidentified medium wader																			
Unidentified large wader																			
TOTAL	326	322	14	4	32	251	97	7	3	10087	4992	8695	28367	3659	4826	669	18668	2651	9169
No. of species	9	6	3	2	4	4	4	3	1	14	19	11	19	10	15	12	20	9	16

SUMMER 2007	**WA**							**TOTAL**
	North West							
Species	80 Mile Beach*	Bush Point (Roebuck Bay sth)	Dampier Saltworks	Roebuck Bay	Swan River & Rottnest Island	Wilson Inlet	Albany	**ALL shorebird areas**
Asian Dowitcher		1		1				2
Banded Lapwing			13		12			59
Banded Stilt			11		154	159	**N**	15130
Bar-tailed Godwit	52035	24275	160	12216	4		**O**	115467
Beach Stone-curlew							**T**	10
Black-fronted Dotterel								60
Black-tailed Godwit	5			435			**C**	1745
Black-winged Stilt			40	66	4	476	**O**	2572
Broad-billed Sandpiper	314	62		53			**U**	429
Bush Stone-curlew							**N**	4
Common Greenshank	3880	35	8	362		267	**T**	6359
Common Sandpiper				23	1		**E**	55
Curlew Sandpiper	3102	250	590	1403	13		**D**	19227
Double-banded Plover								141
Eastern Curlew	837	409	2	638				6855
Great Knot	66018	7160	51	11228				90948
Greater Sandplover	27315	15656	20	5562	1			50972
Grey Plover	652	477	20	458	4			2021
Grey-tailed Tattler	8929	1070	7	1558	4			12852
Hooded Plover								112
Latham's Snipe								74
Lesser Sandplover	114	1		21				3793
Little Curlew	900			500				1400
Long-toed Stint								
Marsh Sandpiper	326		107					1019
Masked Lapwing								2616
Oriental Plover	8891	384		28				9303
Pacific Golden Plover	264	45	1	39	1			3344
Pectoral Sandpiper								7
Pied Oystercatcher	50	931	6	36	9	4		5421
Red Knot	11275	325		1071				15230
Red-capped Plover	4894	2330	1206	1682	71	261		12323
Red-kneed Dotterel								2
Red-necked Avocet			18	30	11	44		3652
Red-necked Stint	21891	4370	1911	4384	1207	3678		131542
Ruddy Turnstone	172	1081	15	334	129			3434
Ruff								
Sanderling	882	1754			62			4071
Sharp-tailed Sandpiper	233	5	469	2		28		14948
Sooty Oystercatcher	1			32				702
Terek Sandpiper	8999	535		588				10372
Wandering Tattler								
Whimbrel	479	665	1	353				2567
Wood Sandpiper								
Unidentified small wader								230
Unidentified medium wader								
Unidentified large wader								
TOTAL	222458	61821	4656	43103	1687	4917	-	551070
No. of species	25	22	20	27	16	8	-	41

* = 80 Mile Beach counts included estimates

WINTER 2007	NSW									NT	Qld					SA	
Species	Botany Bay	Hunter Estuary	Lake Illawarra	Port Stephens	Shoalhaven Estuary	Richmond River Estuary	Tweeds Estuary	Clarence River	Parramatta River	North Darwin	Bowen	Mackay	Moreton Bay	Cairns	Townsville	Carpenter Rocks	Port MacDonnell
Asian Dowitcher																	
Banded Lapwing																	
Banded Stilt						N	N	N	N					N	N		
Bar-tailed Godwit	277	310	21	10	232	O	O	O	O	45			1424	O	O		
Beach Stone-curlew						T	T	T	T	1				T	T		
Black-fronted Dotterel		36									2		21				
Black-tailed Godwit		7				C	C	C	C				16	C	C		
Black-winged Stilt	9	193	8			O	O	O	O		9		1552	O	O		
Broad-billed Sandpiper						U	U	U	U					U	U		
Bush Stone-curlew						N	N	N	N			2		N	N		
Common Greenshank		21				T	T	T	T		2		8	T	T		
Common Sandpiper		1				E	E	E	E	1				E	E		
Curlew Sandpiper		3				D	D	D	D				25	D	D		
Double-banded Plover	11		36		122								116				152
Eastern Curlew	101	176		150	20						1	2	234				
Great Knot										186			5				
Greater Sandplover										761			11				
Grey Plover																	
Grey-tailed Tattler	4	5								14			252				
Hooded Plover																11	14
Latham's Snipe																	
Lesser Sandplover										20			54				
Little Curlew																	
Long-toed Stint																	
Marsh Sandpiper		2															
Masked Lapwing		54		2	5						31		55			4	4
Oriental Plover																	
Pacific Golden Plover	1	1											20				
Pectoral Sandpiper																	
Pied Oystercatcher	47	2	4	5	19					2	7		315			6	6
Red Knot										6							
Red-capped Plover	2	61	35		40					26	16	2	206			3	51
Red-kneed Dotterel																	
Red-necked Avocet		370											5				
Red-necked Stint	22	35	4							73	3		992			120	101
Ruddy Turnstone	1									2			23				
Ruff																	
Sanderling										15							
Sharp-tailed Sandpiper										4							
Sooty Oystercatcher	12	4		1							2		3			5	5
Terek Sandpiper		1								3			1				
Wandering Tattler																	
Whimbrel	2	3									5		299				
Wood Sandpiper																	
Unidentified small wader													12				
Unidentified medium wader																	
Unidentified large wader																	
TOTAL	489	1285	108	168	438	-	-	-	-	1159	78	6	5649	-	-	149	333
No. of species	12	19	6	5	6	-	-	-	-	15	10	3	23	-	-	6	7

WINTER 2007	Tas									Vic								
	SE		NE	NW	New Areas					Bellarine Peninsula								
Species	Derwent	Marion Bay & Blackmans Bay	Cape Portland	Robbins Passage/Boullanger Bay	Georges Bay	Maurouard Beach	Moorland Point	Narantapu National Park	Scamander	Begola	Belmont Common	Black Rocks / Breamlea	Lake Lorne	St. Leonards Salt Lake	Point Richards	Moolap Saltworks	Swan Bay & Mud Islands	Lake Connewarre area
Asian Dowitcher																		
Banded Lapwing							4	4										2
Banded Stilt			**N**													18		
Bar-tailed Godwit	33		**O**		22												65	6
Beach Stone-curlew			**T**															
Black-fronted Dotterel	12							5				2				8		
Black-tailed Godwit			**C**															
Black-winged Stilt			**O**													243	53	2
Broad-billed Sandpiper			**U**															
Bush Stone-curlew			**N**															
Common Greenshank			**T**														10	
Common Sandpiper			**E**															
Curlew Sandpiper		4	**D**														1	
Double-banded Plover	117			532	6	17	95	152	3								660	5
Eastern Curlew	2			1				4										
Great Knot																	3	
Greater Sandplover																		
Grey Plover																	2	
Grey-tailed Tattler				1														
Hooded Plover		16		80		33		14				7					15	
Latham's Snipe																		
Lesser Sandplover																		
Little Curlew																		
Long-toed Stint																		
Marsh Sandpiper																6	2	
Masked Lapwing	340			5	21		7	17		2	2	3	12	2	4	88	100	25
Oriental Plover																		
Pacific Golden Plover																		
Pectoral Sandpiper																		
Pied Oystercatcher	632	77		573	92	6	2	52	6							32	29	3
Red Knot				27													78	
Red-capped Plover	48	19		536	27	45	2	34	10			15				31	68	50
Red-kneed Dotterel																		
Red-necked Avocet																		
Red-necked Stint	224	10		628	41	35			3							17	375	2
Ruddy Turnstone				3		3											5	
Ruff																		
Sanderling																		
Sharp-tailed Sandpiper																	5	
Sooty Oystercatcher	61	12		297	18	4	3		2								1	
Terek Sandpiper																		
Wandering Tattler																		
Whimbrel	1																	
Wood Sandpiper																		
Unidentified small wader																		
Unidentified medium wader																		
Unidentified large wader																		
TOTAL	1470	138	-	2683	227	143	113	282	24	2	2	27	12	2	4	443	1472	95
No. of species	10	6	-	11	7	7	6	8	5	1	1	4	1	1	1	8	17	8

WINTER 2007	Vic					WA						TOTAL
	Port Phillip Bay					North West						
Species	East Port Phillip	Laverton/Altona	Werribee / Avalon	Corner Inlet	Wesern Port	80 Mile Beach	Bush Point (Roebuck Bay sth)	Roebuck Bay	Swan Coastal Plain Lakes	Swan River & Rottnest Island	Albany	ALL shorebird areas
Asian Dowitcher							1	20				21
Banded Lapwing										40		50
Banded Stilt		45								601	N	664
Bar-tailed Godwit				390	73	5848	4260	878			O	13894
Beach Stone-curlew											T	1
Black-fronted Dotterel	50		86									222
Black-tailed Godwit			2				1	528			C	554
Black-winged Stilt	110	86	419				292	390	112	5	O	3483
Broad-billed Sandpiper							8	1			U	9
Bush Stone-curlew											N	2
Common Greenshank		4	3			424	290	51			T	813
Common Sandpiper								2			E	4
Curlew Sandpiper		2	7			31	5	174			D	252
Double-banded Plover		171	291	125	142							2753
Eastern Curlew				42	37	118	584	48				1520
Great Knot						2222	1920	4639				8975
Greater Sandplover						1850	1544	34				4200
Grey Plover				2		58	52					114
Grey-tailed Tattler				1	1	1431	590	719				3018
Hooded Plover				2								192
Latham's Snipe												
Lesser Sandplover						5	1	12				92
Little Curlew												
Long-toed Stint												
Marsh Sandpiper												10
Masked Lapwing	40	13	133	6	140		4					1119
Oriental Plover												
Pacific Golden Plover		1				3	2					28
Pectoral Sandpiper												
Pied Oystercatcher			44	974	274	13	182	48		27		3479
Red Knot				80		492	45	295				1023
Red-capped Plover	9	24	192	31	79	5361	895	104		78		8100
Red-kneed Dotterel												
Red-necked Avocet		11					1	46	83	4		520
Red-necked Stint		182	619	372	444	2351	760	414		143		7970
Ruddy Turnstone						13	4	9		4		67
Ruff												
Sanderling						36	23					74
Sharp-tailed Sandpiper												9
Sooty Oystercatcher			6	308	1			20				765
Terek Sandpiper						160	340	263				768
Wandering Tattler												
Whimbrel				3	14	57	196	477				1057
Wood Sandpiper												
Unidentified small wader												12
Unidentified medium wader												
Unidentified large wader												
TOTAL	209	539	1802	2336	1205	20473	12000	9172	195	902	-	65834
No. of species	4	10	11	13	10	18	24	22	2	8	-	36

SUMMER 2008	NSW									New areas				NT	Qld		
Species	Botany Bay	Hunter Estuary	Lake Illawarra	Port Stephens	Richmond River estuary	Shoalhaven Estuary	Tweeds Estuary	Clarence River	Parramatta River	Manning River Estuary	Tuggerah Lakes	Hastings River	Ulladulla	North Darwin	Cairns area	Mackay	Moreton Bay
Asian Dowitcher																	
Banded Lapwing											1						
Banded Stilt								N	N								
Bar-tailed Godwit	527	1226	60	886	114	499	46	O	O	180	111	110	2	264	164	106	7385
Beach Stone-curlew								T	T	2				1	2	2	2
Black-fronted Dotterel		4															1
Black-tailed Godwit		212						C	C					657	22		424
Black-winged Stilt	2	167				2		O	O		6			5			245
Broad-billed Sandpiper								U	U								2
Bush Stone-curlew								N	N							4	1
Common Greenshank	6	127		5	7			T	T	1	26			5	5		142
Common Sandpiper	1	1		1		5		E	E	1				60			
Curlew Sandpiper	2	260			19	1		D	D		6			5	46		1197
Double-banded Plover	4		2			27					1	1					
Eastern Curlew	241	424	5	320	41	149	22			34	1	40		10	16	273	1090
Great Knot					13									3315	139	40	911
Greater Sandplover					19					2				544	43		54
Grey Plover						1								23			21
Grey-tailed Tattler	79	52		37	38	1	1				2	10		69	22	7	1349
Hooded Plover																	
Latham's Snipe		1															
Lesser Sandplover				2	3					1				21	17		187
Little Curlew																	
Long-toed Stint																	
Marsh Sandpiper		80														21	123
Masked Lapwing	3	116		46	4	52	7			12	52	1	8	24	8	6	59
Oriental Plover																	
Pacific Golden Plover	23	161			22	214				94	29			53	1		185
Pectoral Sandpiper																	
Pied Oystercatcher	75	7	16	107	4	14	1			17	4	2	2	9	2	20	407
Red Knot	3	79				1								368	7		2
Red-capped Plover	7	21	21	11		49				80	13	22		7	3		360
Red-kneed Dotterel		16															
Red-necked Avocet		1722															
Red-necked Stint	192	20	28	38	88	192				350	181	6		27	472		2653
Ruddy Turnstone	16	1		5	26	2				8	25			84			35
Ruff																	
Sanderling	1				7	1				39				5			
Sharp-tailed Sandpiper	1	37		1	2	10					78				13		1144
Sooty Oystercatcher	18	19		10		2					15	2				3	2
Terek Sandpiper		19		5	38									18	13	2	7
Wandering Tattler																	
Whimbrel	92	71		261	3		25			10	1	31		13	17	63	484
Wood Sandpiper														1			
Unidentified small wader																	16
Unidentified medium wader						8											
Unidentified large wader																	
TOTAL	1293	4843	132	1735	448	1230	102	-	-	831	552	225	12	5588	1012	547	18488
No. of species	19	24	6	15	17	19	6	-	-	15	17	10	3	24	19	12	28

SUMMER 2008	**Qld**					**SA**										
			New areas			**SE coast**		**SE lakes**						**Coorong**		
Species	Bowen	Townsville	Kinka Beach	Maroochy River	Great Sandy Straight	Carpenter Rocks	Port MacDonnell	Fox and Pub Lakes	Lake Eliza	Lake George	Lake Hawdon	Lake St Clair	Mullins Swamp	Coorong	Tolderol
Asian Dowitcher															
Banded Lapwing															
Banded Stilt	**N**	**N**												261229	
Bar-tailed Godwit	**O**	**O**			3115									150	
Beach Stone-curlew	**T**	**T**	1		1										
Black-fronted Dotterel			2										2		
Black-tailed Godwit	**C**	**C**												2	
Black-winged Stilt	**O**	**O**	16		19								5	700	1
Broad-billed Sandpiper	**U**	**U**													
Bush Stone-curlew	**N**	**N**													
Common Greenshank	**T**	**T**		2	138	8		2		71			12	436	10
Common Sandpiper	**E**	**E**													
Curlew Sandpiper	**D**	**D**			31	34	172			8				3988	
Double-banded Plover															
Eastern Curlew			3		734	1								10	
Great Knot					1001									30	
Greater Sandplover			91		25										
Grey Plover					4									1	
Grey-tailed Tattler			72		1806										
Hooded Plover						3	3							37	
Latham's Snipe					2			6		2				4	
Lesser Sandplover			40		458									1	
Little Curlew															
Long-toed Stint															
Marsh Sandpiper					103								5	4	
Masked Lapwing			2		55	20	97			29	200	6	42	348	61
Oriental Plover															
Pacific Golden Plover					25	9	36							50	
Pectoral Sandpiper															
Pied Oystercatcher			2	6	108	7	14							550	
Red Knot														30	
Red-capped Plover			16	7	28	6	55		47	174		38		1096	8
Red-kneed Dotterel					2			6						26	
Red-necked Avocet										59				195	
Red-necked Stint				30	801	920	1600		175	3645		6	12	12662	832
Ruddy Turnstone					12	269	210								
Ruff															
Sanderling							445							131	
Sharp-tailed Sandpiper			28		119	80	212	11		266			1275	6222	160
Sooty Oystercatcher					3	8	3							4	
Terek Sandpiper					123									1	
Wandering Tattler															
Whimbrel			9		182										
Wood Sandpiper															
Unidentified small wader										200	200			28	
Unidentified medium wader														20	
Unidentified large wader					150										
TOTAL	-	-	282	45	9045	1365	2847	25	222	4454	400	50	1353	287955	1072
No. of species	-	-	12	4	25	12	11	4	2	9	2	3	7	27	6

SUMMER 2008	**SA**								**Tas**											
	Yorke Peninsula								**SE**		**NE**			**NW**	**New areas**					
Species	Port Victoria	Coobowie Inlet	Black Point	Goldsmith Beach to Wattle Pt	Stansbury / Oyster Point	Pine Point (Yorke)	Troubridge Island / Shoal	Gulf of St Vincent	Derwent	Marion Bay & Blackmans Bay	Cape Portland	George Town Reserve	Great Musselroe Bay	Robbins Passage/Boullanger Bay	Georges Bay	Maurouard Beach	Moorland Point	Narantapu National Park	Policemans Point	Scamander
Asian Dowitcher																				
Banded Lapwing											45									
Banded Stilt		6						10000												
Bar-tailed Godwit								6150	30	30	2		3	466	47			6		
Beach Stone-curlew																				
Black-fronted Dotterel																				
Black-tailed Godwit																				
Black-winged Stilt								120												
Broad-billed Sandpiper																				
Bush Stone-curlew																				
Common Greenshank	6	4	22	6	30	4		500	39				16	35	5					
Common Sandpiper								1												
Curlew Sandpiper	15	5	15		34		150	650			43	1	14	912						
Double-banded Plover			4											1	5					
Eastern Curlew								57	42			27		113	5			18		
Great Knot								370						1						
Greater Sandplover			2					20												
Grey Plover		4	4	10			20	53						54						
Grey-tailed Tattler														2			1			
Hooded Plover	14									3	5		1	30	3	25			7	6
Latham's Snipe														2						
Lesser Sandplover														1						
Little Curlew																				
Long-toed Stint																				
Marsh Sandpiper								7												
Masked Lapwing	26	35	3		2	2		15	124	4	124	28	5	55	107	3	45	58		7
Oriental Plover																				
Pacific Golden Plover			5	8							19			246			5			
Pectoral Sandpiper																				
Pied Oystercatcher	4						6	25	804	218	72	19	70	738	242	9	2	120	38	7
Red Knot				10			15	2000					16	1734						
Red-capped Plover	36	20	40	50			20	405	74	19	49		12	96		2	5	21	57	5
Red-kneed Dotterel								120												
Red-necked Avocet								150												
Red-necked Stint	60	20	400	200	250		800	5300	791	52	1176	51	450	10382	87			200	65	16
Ruddy Turnstone	10	6	22	6	14		40	60			51	57	55	1201	5		142	14	18	
Ruff																				
Sanderling							3							4					34	
Sharp-tailed Sandpiper	55	5			30		20	2800			30		4	124						
Sooty Oystercatcher	12				12		6	79	48		68	9	2	205	7	12			13	
Terek Sandpiper								1												
Wandering Tattler																				
Whimbrel								20	1				1							
Wood Sandpiper																				
Unidentified small wader		300			200															
Unidentified medium wader																				
Unidentified large wader																				
TOTAL	238	405	517	290	572	6	1080	28903	1953	326	1684	192	649	16402	513	51	200	437	232	41
No. of species	10	10	10	7	8	2	10	23	9	6	12	7	13	21	10	5	6	7	7	5

SUMMER 2008	Vic														
	Bellarine Peninsula												**Port Phillip Bay**		
Species	Begola	Belmont Common	Black Rocks / Breamlea	Lake Lorne	St. Leonards Salt Lake	Point Richards	Moolap Saltworks	Swan Bay & Mud Islands	Lake Connewarre area	Corner Inlet	Anderson Inlet	Shallow Inlet	East Port Phillip	Laverton/Altona	Werribee / Avalon
Asian Dowitcher															
Banded Lapwing															
Banded Stilt							370	8	20					5	2000
Bar-tailed Godwit								178		10150	20				18
Beach Stone-curlew															
Black-fronted Dotterel	2	6					7		5				26		19
Black-tailed Godwit														1	9
Black-winged Stilt		3		8			25	31	259				110	77	538
Broad-billed Sandpiper								1							
Bush Stone-curlew															
Common Greenshank			5				32	108	226	64	23	47	1	18	61
Common Sandpiper													2	1	2
Curlew Sandpiper							217	115	3184	1070		800		527	3051
Double-banded Plover								2	13	17		2			3
Eastern Curlew									6	695	130	157			1
Great Knot								12		50					
Greater Sandplover										6					
Grey Plover								14		247		1			
Grey-tailed Tattler								1	2						
Hooded Plover										14		1			
Latham's Snipe	17	46					2		6				20		
Lesser Sandplover							1	4		15					
Little Curlew															
Long-toed Stint															
Marsh Sandpiper							34	12	80			5		24	67
Masked Lapwing	4	3	4	25	2	30	185	88	122	8	90	26	96	27	186
Oriental Plover															
Pacific Golden Plover			26									167		58	21
Pectoral Sandpiper															3
Pied Oystercatcher							23	40	3	1148	3	26		11	63
Red Knot								66	4	612					
Red-capped Plover			5				84	182	132	40		25	5	28	98
Red-kneed Dotterel							7		3				1		1
Red-necked Avocet							1								182
Red-necked Stint			11				1416	4109	3753	15266		3517	2	1320	7144
Ruddy Turnstone								38		24					
Ruff															3
Sanderling										140		302			
Sharp-tailed Sandpiper							984	1409	3166	31	150	153	265	455	3342
Sooty Oystercatcher								2		318	10	44			4
Terek Sandpiper															
Wandering Tattler															
Whimbrel										45		1			
Wood Sandpiper													2		1
Unidentified small wader							3	12		35				350	
Unidentified medium wader								40		60					
Unidentified large wader															
TOTAL	23	58	51	33	2	30	3391	6472	10984	30055	426	5274	530	2902	16817
No. of species	3	4	5	2	1	1	16	22	17	22	7	16	11	14	23

SUMMER 2008	Vic										WA							
	Gippsland			**West coast**							**North West**			**South West**				
Species	Jack Smith Lake	Lake Reeve	Loch Sport	Discovery Bay to Glenelg River	Fitzroy River Mouth	Port Fairy	Port Fairy West	Hamilton	Lake Corangamite area	Western Port	80 Mile Beach	Bush Point (Roebuck Bay sth)	Roebuck Bay	Swan Coastal Plain Lakes	Swan River & Rottnest Island	Peel & Yalgorup Lakes	Broadwater (Busselton)	Vasse-Wonnerup Estuary
Asian Dowitcher												11						
Banded Lapwing															21			
Banded Stilt								16						96	11866	11538	25	4000
Bar-tailed Godwit										348	51981	11783	8696		4	46		
Beach Stone-curlew													1					
Black-fronted Dotterel																		6
Black-tailed Godwit											12		944			1		
Black-winged Stilt						200			157				141	1185	13	807	389	2903
Broad-billed Sandpiper											43	27	199					
Bush Stone-curlew																		
Common Greenshank		4		16		37	6			9	2787	15	371	16		36	1	103
Common Sandpiper											1	1	19			2		1
Curlew Sandpiper				1		40			143	783	3547	344	1207	8	77	3	67	10
Double-banded Plover						2				10								
Eastern Curlew										748	403	288	261			7		
Great Knot											59448	6104	16278			12		
Greater Sandplover											26424	7299	6026		1			
Grey Plover											750	322	133	3	13	39		2
Grey-tailed Tattler											10532	37	1500		6			
Hooded Plover				30	35	23	48									58		
Latham's Snipe						45	1		3									
Lesser Sandplover											26	3	32					
Little Curlew											519							
Long-toed Stint														2			3	
Marsh Sandpiper				6							62							8
Masked Lapwing		51		6	6	152	41	72	155	109							2	
Oriental Plover											6028	99						
Pacific Golden Plover							6			7	57	35	37			35		
Pectoral Sandpiper																2		
Pied Oystercatcher				118	17	20	26			226	22	457	28		7	2		
Red Knot										50	13482	808	1222					
Red-capped Plover		6		9	18	95	30	26	131	62	7057	1900	1752	1300	281	428	30	417
Red-kneed Dotterel																		
Red-necked Avocet						1			17					278	9	772	615	1915
Red-necked Stint				106	6	1697	546		8799	6778	27655	4906	3967	100	852	1875		1365
Ruddy Turnstone						48	26			40	150	385	345		260			
Ruff									1									
Sanderling				500		67					511	1955	3		28	4		
Sharp-tailed Sandpiper						1238	318	5000	2162	791	209	16	7	20	1	469	242	88
Sooty Oystercatcher				1		3	7						23					
Terek Sandpiper											4853	682	570					
Wandering Tattler																		
Whimbrel										4	157	582	200		2	1		
Wood Sandpiper							9		2							1	43	4
Unidentified small wader							4							20				
Unidentified medium wader																	80	
Unidentified large wader																		
TOTAL	0	61	0	793	82	3668	1068	5114	11570	9965	216716	38059	43962	3028	13441	16138	1497	10822
No. of species	0	3	0	10	5	15	13	4	10	14	25	23	25	11	16	21	11	13

SUMMER 2008	WA			TOTAL
	South			
Species	Albany	Wilson Inlet	Shark Bay	ALL shorebird areas
Asian Dowitcher				11
Banded Lapwing				67
Banded Stilt	372			301551
Bar-tailed Godwit	20		248	105171
Beach Stone-curlew				12
Black-fronted Dotterel			3	83
Black-tailed Godwit				2284
Black-winged Stilt		55	7	8196
Broad-billed Sandpiper				272
Bush Stone-curlew				5
Common Greenshank	31	5	48	5740
Common Sandpiper	5		5	109
Curlew Sandpiper				22802
Double-banded Plover	1			95
Eastern Curlew	2		10	6384
Great Knot	139		68	87931
Greater Sandplover	8		96	40660
Grey Plover	74		11	1804
Grey-tailed Tattler	1		91	15718
Hooded Plover	22			368
Latham's Snipe				157
Lesser Sandplover	1			813
Little Curlew				519
Long-toed Stint				5
Marsh Sandpiper				641
Masked Lapwing	2			3393
Oriental Plover				6127
Pacific Golden Plover	7			1641
Pectoral Sandpiper				5
Pied Oystercatcher	157		27	6172
Red Knot	3		29	20541
Red-capped Plover	18		25	17164
Red-kneed Dotterel				182
Red-necked Avocet		12	9	5937
Red-necked Stint	253	12	454	141139
Ruddy Turnstone	2		18	3730
Ruff				4
Sanderling	1			4181
Sharp-tailed Sandpiper	44			33287
Sooty Oystercatcher	6		1	981
Terek Sandpiper				6332
Wandering Tattler				
Whimbrel			26	2302
Wood Sandpiper			1	64
Unidentified small wader				1368
Unidentified medium wader	90			298
Unidentified large wader				150
TOTAL	1259	84	1177	856396
No. of species	23	4	19	46

Please note:

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Vignettes:
Rob Mancini, p12
Debbie Sullivan, p23
Andrew Silcocks, p27, p53

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The closing dates for submission of material are **1 March** and **1 September** for the April and October editions respectively. **Extensions to these dates must be discussed with the Editor.** Contributors of research papers and notes are encouraged to submit well in advance of these dates to allow time for refereeing. Other contributors are reminded that they will probably have some comments to consider, and possibly incorporate, at some time after submission. It would be appreciated if this could be done promptly.

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