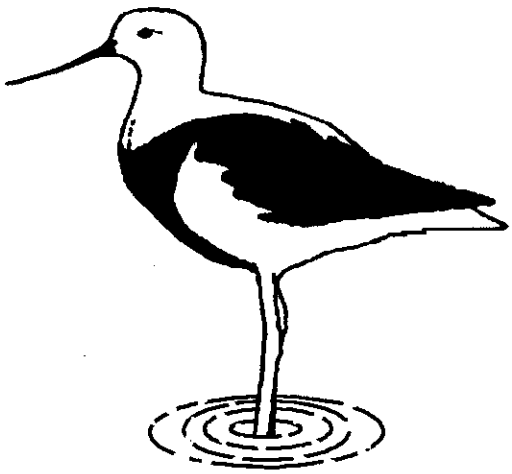
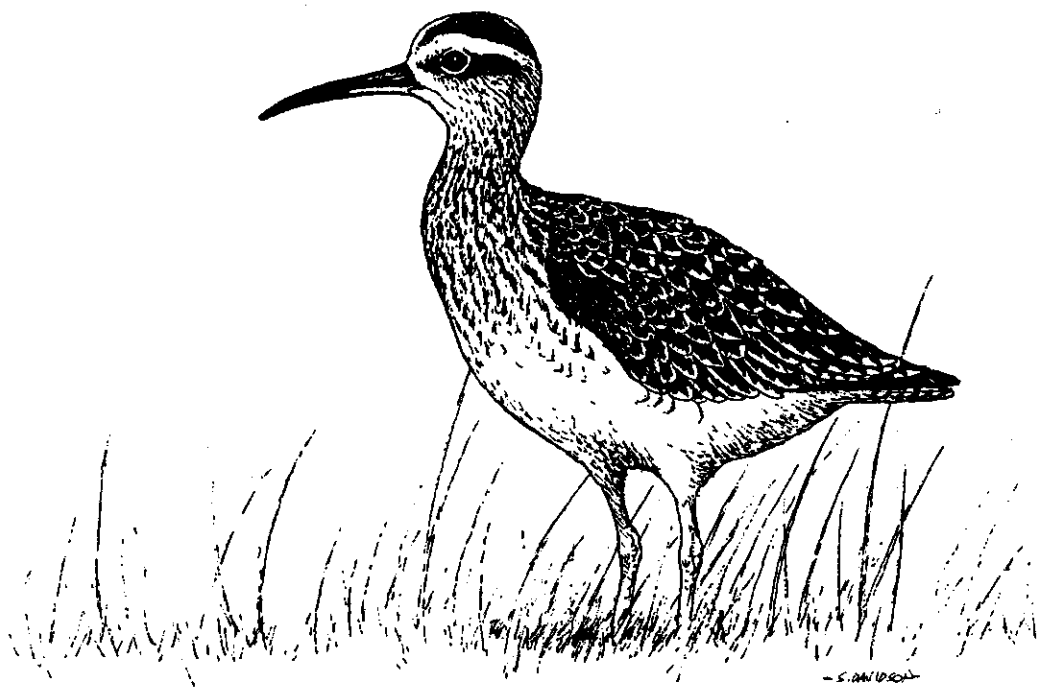
The Stilt



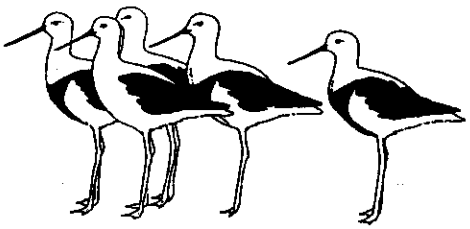
The Bulletin of the East Asian-Australasian Flyway



Australasian Wader Studies Group

A special interest group of Birds Australia

Number 37
October 2000



The Stilt

ISSN 0726-1888

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 the *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 *The Stilt*, and the quarterly newsletter *The Tattler*. Please direct all membership enquiries to the Membership Manager at Birds Australia (RAOU) National Office, 415 Riversdale Rd, East Hawthorn, 3122. Vic., AUSTRALIA.
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Cover Illustration: Stephen Davidson

EDITORIAL

This issue marks the completion of my third year as editor of *The Stilt*. I have enjoyed this time and learnt a lot about waders. In this issue, we have articles and abstracts from the successful Second AWSG Conference that was held in conjunction with the Southern Hemisphere Ornithological Congress (SHOC) in Brisbane on 1-2 July 2000. Mark Barter has two articles on his surveys in China and he continues to show how critical northeastern China is for waders enroute to their breeding grounds. Reducing the effect of high human population pressure in the region will be one of the major challenges if waders are going to continue to use this area as their last major staging point before they fly to the breeding ground.

Adrian Riegan broadens the perspective of the issue by providing a summary of the banding recoveries from the extensive banding programme in New Zealand. He also co-authors a thought provoking article with Pavel Tomkovich on the population structure of Red Knot that winter in Australia and New Zealand.

Jim Wilson provides a summary of an extremely successful survey of waders along the South Australian coast. It highlights the worrying trends of declining wader numbers in regions that were previously extremely important. The survey found new sites of international significance and effectively combined both aerial and ground surveys to maximize the coverage of the coast. Lets hope this provides impetus for more regular, comprehensive surveys of the South Australian coast in the future. This will be crucial if Australia is to meet its international obligations under RAMSAR to regularly re-estimate the wader populations here.

The AWSG committee has decided to revamp the regional coordination of wader studies by replacing the State Representatives with new State Conservation Officers. The role of the State Conservation Officers will be to coordinate nomination of sites in their state for inclusion in the East Asian-Australian Shorebird Network. Wetlands International ha identified and prioritised a list of sites that are high priority for inclusion. The committee hopes that the State Conservation Officers can help with that nomination process. We hope that this will provide a new and greater focus on state wader issues and give AWSG members in each state a regional conservation contact.

As usual, we need more articles to be submitted to *The Stilt*. The standard is improving and I thank the authors and encourage others to write articles on any subject relating to waders. I hope you enjoy reading the second issue for the new millenium and contact me with any suggestions.

David Milton

NORTHWARD MIGRATION OF SHOREBIRDS IN THE SHUANGTAIZIHEKOU NATIONAL NATURE RESERVE, LIAONING PROVINCE, CHINA IN 1998 AND 1999

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ABSTRACT

Comprehensive counts of shorebirds were conducted in the Shuangtaizihekou National Nature Reserve during both the 1998 and 1999 northward migrations. The 1998 survey took place in mid-May, whilst in 1999 the count occurred in late-April some three weeks earlier in the migration period. A total of 27,501 shorebirds of 29 species were counted in the late-April period compared to 63,641 of 36 species in mid-May. Shorebirds were distributed similarly throughout the Reserve in both years. The greater number present in mid-May is explained by the large populations of the later-arriving arctic-breeding species, such as Whimbrel, Great Knot, Red Knot, Dunlin and Grey Plover. Of these, most of the increase was due to greater numbers of Great Knot and Dunlin. Conversely, species that can migrate earlier, because they have more southerly breeding grounds, were present in greater numbers in the late-April count: Eurasian Curlew, Eastern Curlew and Kentish Plover. Bar-tailed Godwit and Grey Plover numbers were very similar in both years. Eleven species were present in internationally significant numbers in at least one of the two years. These were: Bar-tailed Godwit, Whimbrel, Eurasian Curlew, Eastern Curlew, Spotted Redshank, Great Knot, Dunlin, Black-winged Stilt, Grey Plover, Kentish Plover and Lesser Sand Plover.

INTRODUCTION

Comprehensive counts of shorebirds were conducted in the Shuangtaizihekou National Nature Reserve (Figure 1) during both the 1998 and 1999 northward migrations. These counts formed part of the continuing China-Australia cooperative programme of shorebird study activities and involved personnel from the Reserve, Wetlands International - China Programme and the Australasian Wader Studies Group.

The 80,000 ha Shuangtaizihekou National Nature Reserve was established in 1985 and is located in northern Liaodong Wan, Liaoning Province, at the mouth of the Shuangtaizi River [40° 52' - 41° 3'N 121° 35' - 121° 55'E] (Figure 1).

The Shuangtaizi River carries a large annual silt load arising from the Longgang and Yiwulyu mountains and the intensively farmed region between these ranges and the sea (Melville 1991, Brazil 1992). Melville (1991) quotes an accretion rate of 2,668 $t.ha^{-1}.yr^{-1}$, with the river mouth moving seawards at a rate of $250m.yr^{-1}$, but Brazil (1992) suggests that growth rates are less than this.

The Reserve is flat and low-lying (0-4 m asl), has a coastline length of approximately 55km and contains extensive mudflats which are backed by salt marsh and phragmites. There are two large sandbanks in the river mouth. The landward portion of the Reserve contains 24,000 ha of reed beds, most of which are located on the western side of the river. There are extensive areas of rice paddies in the east and salt extraction ponds and a large, currently unfilled, fresh water reservoir in the southeast.

The Reserve is situated above the Liaohe oilfield, the third largest in China, and there are many wells located within the Reserve, both on land and in the adjacent intertidal areas and waters. There is an active drilling programme, which also involves building access roads across the extensive mudflats (pers. obs.).

Winters are cold with a January mean of -12°C and a minimum of -29.3°C. In mid-winter, the ground freezes to a depth of 1 m and the sea freezes for several km offshore. The average July temperature is 24°C, with a maximum of 35.2°C. There are, on average 172 frost-free days each year. Mean annual rainfall is 610 mm, mostly falling in June to August, and average total annual evaporation is 1,700mm (Melville 1991, Melville & Li 1998, Scott 1989).

None of the ornithological studies carried out so far at the Reserve has concentrated specifically on shorebirds. Work to date has focused on the Saunders' Gull *Larus saundersi* and Red-crowned Crane *Grus japonensis*. The Saunders' Gull has an estimated world population of 3,000 (Rose & Scott 1997) of which, one-half to two-thirds breed in the Reserve (Brazil 1992, Anon. 1997). The Reserve is the most southerly breeding location in China for the Red-crowned Crane (Melville 1991). Jin (1991) lists 236 species of bird in the Reserve including important shorebird records: 100+ Eurasian Oystercatcher, 200+ Black-winged Stilt, 400 Kentish Plover, 500+ Common Redshank, 1140 Great Knot, 225

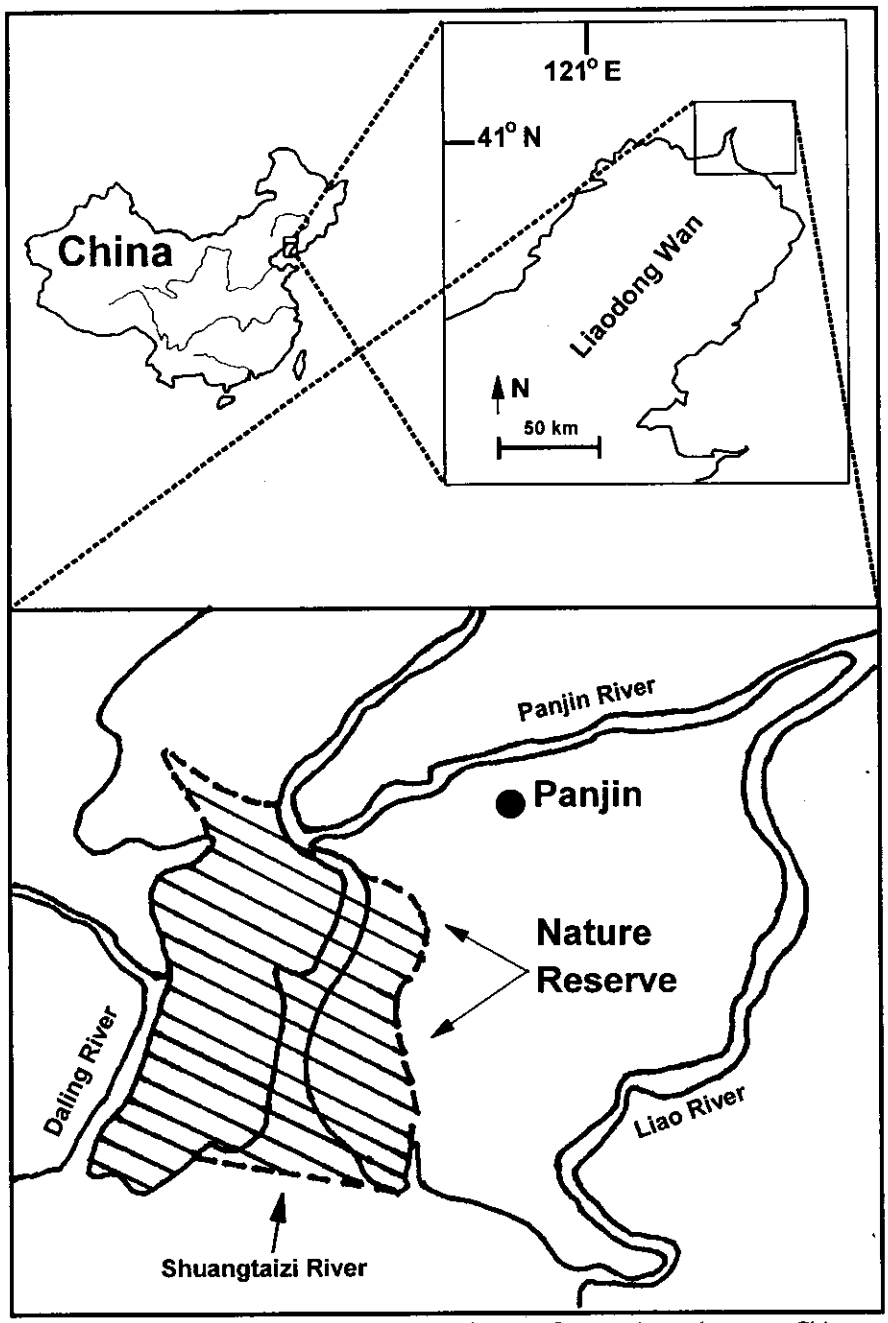

Figure 1. Location of Shuangtaizihekou National Nature Reserve in north-eastern China.

Red Knot and 50 Broad-billed Sandpiper. Jin *et al.* (1989) previously recorded 750 Eastern Curlew, whilst Wang *et al.* (1994) list a record of 1,000 Black-tailed Godwit and Melville (1991) recorded 270 Sharp-tailed Sandpiper.

Eurasian Oystercatcher, Black-winged Stilt, Pied Avocet, Kentish Plover, Grey-headed Lapwing, Northern Lapwing and Common Redshank have been recorded breeding in the Reserve (Table 1).

METHODS

The counting programme in both years focused mainly on the coastal mudflats of both the eastern and western parts of the reserve and the northernmost sand bank (Figure 2). A limited amount of counting was done within the rice paddies, reed beds and the currently empty freshwater reservoir on the eastern side. The length of coastline along which shorebirds were counted was approximately 55 km, of which 18 km was in the east. The sandbank is about 5 km long and has a shoreline length of about 12 km. The only difference in coverage between the two periods was that in 1999 (late-April) the harbour area in the most eastern part of the

Table 1. Shorebird species recorded both previously and during the 1998 and 1999 surveys

Species	Scientific names	1998	1999
Eurasian Woodcock	*Scolopax rusticola*		x
Common Snipe	*Gallinago gallinago*	x	x
Black-tailed Godwit	*Limosa limosa*	x	x
Bar-tailed Godwit	*Limosa lapponica*	x	x
Little Curlew	*Numenius minutus*		x
Whimbrel	*Numenius phaeopus*	x	x
Eurasian Curlew	*Numenius arquata*	x	x
Eastern Curlew	*Numenius madagascariensis*	x	x
Spotted Redshank	*Totanus erythropus*	x	x
Common Redshank	*Totanus totanus*	x	x
Marsh Sandpiper	*Tringa stagnatilis*	x	x
Common Greenshank	*Tringa nebularia*	x	x
Green Sandpiper	*Tringa ochropus*	x	
Wood Sandpiper	*Tringa glareola*	x	x
Terek Sandpiper	*Xenus cinereus*	x	x
Common Sandpiper	*Actitis hypoleucos*	x	x
Ruddy Turnstone	*Arenaria interpres*	x	x
Asian Dowitcher	*Limnodromus semipalmatus*	x	
Great Knot	*Calidris tenuirostris*	x	x
Red Knot	*Calidris canutus*	x	x
Sanderling	*Calidris alba*	x	
Red-necked Stint	*Calidris ruficollis*	x	x
Long-toed Stint	*Calidris subminuta*	x	
Sharp-tailed Sandpiper	*Calidris acuminata*	x	
Dunlin	*Calidris alpina*	x	x
Curlew Sandpiper	*Calidris ferruginea*	x	
Broad-billed Sandpiper	*Limicola falcinellus*	x	
Eurasian Oystercatcher	*Haematopus ostralegus*	x	x
Black-winged Stilt	*Himantopus himantopus*	x	x
Pied Avocet	*Recurvirostra avosetta*	x	x
Pacific Golden Plover	*Pluvialis fulva*	x	
Grey Plover	*Pluvialis squatarola*	x	x
Kentish Plover	*Charadrius alexandrinus*	x	x
Lesser Sand Plover	*Charadrius mongolus*	x	x
Greater Sand Plover	*Charadrius leschenaultii*	x	
Grey-headed Lapwing	*Vanellus cinereus*	x	x
Northern Lapwing	*Vanellus vanellus*	x	x
Oriental Pratincole	*Glareola maldivar*		

reserve was counted. Weather was fine during both survey periods, ensuring good conditions for counting birds.

There were eight counters each day, broken into three teams. The group was based at Panjin and two four-wheel drive vehicles were used to transport the teams as close as possible to the count sites. In 1998, counting was conducted over an eight-day period from 12 to 19 May, and in 1999 from 20 to 25 April. The coastline was covered in six sections (Figure 2). The land-based counts were conducted in an east to west direction. In 1998, a boat was used to count birds along the shoreline of the southeast coast, whilst in 1999 this part of the coastline was successfully counted from the adjacent sea wall. Boats were used in both years to reach the northern sandbank.

Counting conditions varied between the two years. In 1998, tides were more favourable for counting with high water changing from about 06:00 to 14:00 during the survey. Most counting started in the late morning and extended to mid-afternoon. In 1999, counting was carried out during a neap tide period, with high water changing from about 09:00 to 14:30 during the period of the survey. However, even at high tide, much of the intertidal flats were uncovered and the counting technique in both years involved walking just inland of the tide edge and counting roosting and feeding birds as they were passed. This meant that counters walked quite

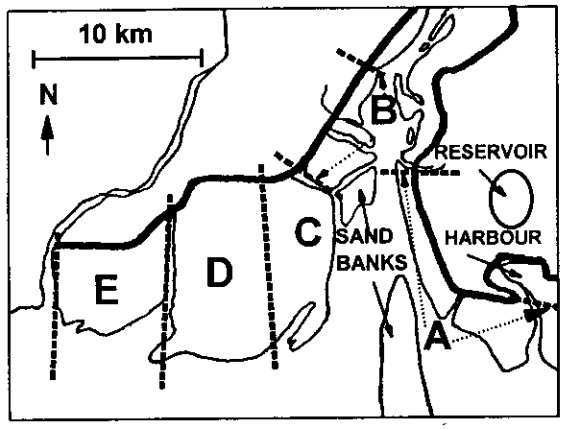

Figure 2. Locations of count sections within the Shuangtaizihekou National Nature Reserve.

long distances. Fortunately, few problems were encountered because the mud flats were quite firm and had shallow channels. The higher flats were also counted when birds were found there. The 1% criterion from WIO (2000) (based mainly on Rose and Scott 1997) was used to determine whether a species was present in internationally significant numbers. Counts in adjacent sections were adjusted when birds moved between areas.

RESULTS

A summary of the count of each species in both years is given in Table 2. More detailed information, by section, can be found in Barter *et al.* (1999, 2000a).

Comparison of numbers and general distribution

A total of 63,641 shorebirds of 36 species were recorded in mid-May 1998, whereas 27,501 shorebirds of 29 species was counted in late-April 1999. These totals included 9,441 in 1998 and 4,018 unidentified shorebirds in 1999 (about 15% of the count in each year). A large proportion of the between-year difference can be explained by the presence of greater numbers of Great Knot (24,915 vs. 719) and Dunlin (16,411 vs. 7,699) in mid-May compared to late-April. The distribution of birds throughout the reserve was generally similar in both years (Figure 3), except that few birds were present on the northern sandbank in the late-April period. Less than 4% of the birds counted in 1999 occurred in the harbour area which was surveyed for the first time that year.

Comparison of individual species numbers and distribution

The most common species with the greatest increases in numbers between late-April and mid-May were Great Knot (+24,196), Dunlin (+8,712), Whimbrel (+1,129), Red Knot (+927), Lesser Sand Plover (+581), Wood Sandpiper (+423) and Red-necked Stint (+222) (Table 2). Whereas, only Eastern Curlew (+1,793), Eurasian Curlew and Kentish Plover (both +1,273) were present in greater numbers in late April.

Table 2. Comparison of shorebird numbers in Shuangtaizihekou National Nature Reserve between mid-May 1998 and late-April1999.

Species	1998	1999	Difference
Eurasian Woodcock	0	1	1
Common Snipe	2	1	-1
Snipe spp	10	2	-8
Black-tailed Godwit	2	12	10
Bar-tailed Godwit	3493	3738	245
Little Curlew	0	1	1
Whimbrel	1306	177	-1129
Eurasian Curlew	262	1535	1273
Eastern Curlew	10	1803	1793
Curlew spp	292	1495	1203
Spotted Redshank	90	115	25
Common Redshank	90	79	-11
Marsh Sandpiper	16	37	21
Common Greenshank	63	62	-1
Green Sandpiper	1	0	-1
Wood Sandpiper	454	31	-423
Terek Sandpiper	71	5	-66
Common Sandpiper	5	1	-4
Ruddy Turnstone	7	1	-6
Asian Dowitcher	6	0	-6
Great Knot	24915	719	-24196
Red Knot	949	22	-927
Sanderling	4	0	-4
Red-necked Stint	270	48	-222
Long-toed Stint	3	0	-3
Sharp-tailed Sandpiper	190	0	-190
Dunlin	16411	7699	-8712
Curlew Sandpiper	33	0	-33
Broad-billed Sandpiper	115	0	-115
Eurasian Oystercatcher	36	38	2
Black-winged Stilt	58	109	51
Northern Lapwing	2	1	-1
Grey-headed Lapwing	2	2	0
Pied Avocet	10	27	17
Pacific Golden Plover	1	0	-1
Grey Plover	4227	4248	21
Kentish Plover	94	1367	1273
Lesser Sand Plover	682	101	-581
Greater Sand Plover	2	0	-2
Oriental Pratincole	16	6	-10
Unidentified waders	9441	4018	-5423
TOTALS	63641	27501	-36140

Distributions of the six most common species in each of the periods are shown graphically in Figures 4 and 5. The only species for which reasonable between-year comparisons can be made are Dunlin and Grey Plover. In 1999, a higher proportion of Dunlin was present in the westernmost part of the reserve. Grey Plover had a similar distribution in both years.

Almost half of the Kentish Plover were found on the large inter-tidal flats in the harbour (first counted in

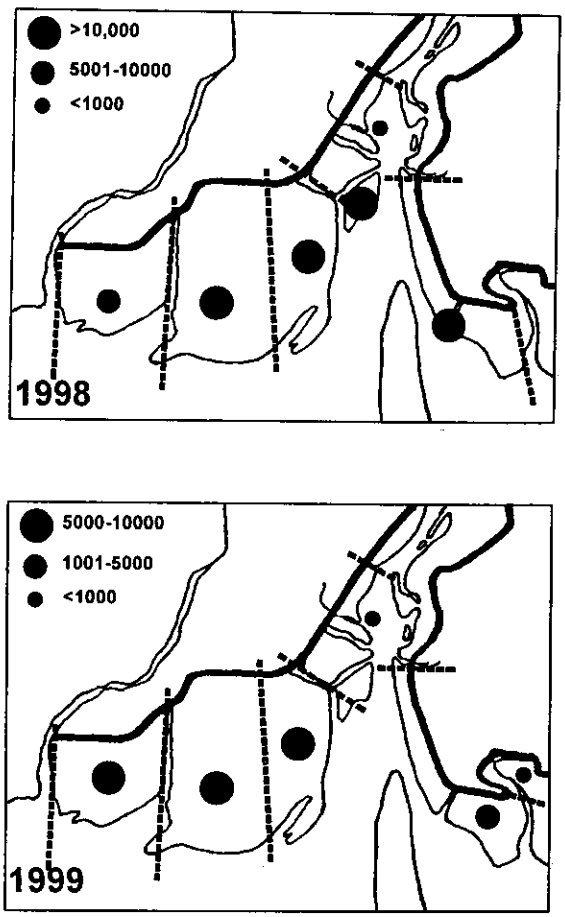

Figure 3. The distribution of shorebirds within the Shuangtaizihekou National Nature Reserve in 1998 and 1999.

1999). Few individuals of this species were present in the reserve in mid-May 1998 and it is unlikely that significant numbers were missed through non-counting of the harbour in that year. Those present in the reserve in 1998 were probably mostly breeders.

Eleven species were present in internationally important numbers during either survey period: Bar-tailed Godwit, Whimbrel, Eurasian Curlew, Eastern Curlew, Spotted Redshank, Great Knot, Dunlin, Black-winged Stilt, Grey Plover, Kentish Plover and Lesser Sand Plover.

Eight Australian leg-flagged birds were seen during the surveys. In 1998, three Great Knot, one Red Knot and one Bar-tailed Godwit from north-western Australia, and a Bar-tailed Godwit from south-eastern Australia were observed. In 1999, two Bar-tailed Godwit from north-western Australia were seen (Table 3).

DISCUSSION

It is important to note that the count totals are minimum estimates of the numbers present as they only represent those birds actually seen. The very extensive intertidal mud flats made complete coverage of all shorebird habitats impossible. Birds in those areas well inland from the tide edge could not be adequately counted. Thus, it is likely that the numbers of birds of species favouring the high tidal flats (Whimbrel, Grey Plover, Kentish Plover and, to a lesser extent, Bar-tailed Godwit) were significantly underestimated. The numbers of those species favouring fresh and brackish wetlands (Wood Sandpiper and Sharp-tailed Sandpiper) were also likely to have been significantly under counted.

The difference between numbers of shorebirds present in the two periods can be explained by variations in the timing of migration by different species. Individuals of those species that have relatively southern breeding ranges, which can be occupied early, were present in good numbers during the late-April count. Species such as Eurasian Curlew, Eastern Curlew and Kentish Plover had mostly departed by mid-May. Arctic-breeding species, such as Whimbrel, Wood Sandpiper, Great Knot, Red Knot, Red-necked Stint, Dunlin and Lesser Sand Plover cannot use their breeding grounds until late May, at the earliest, and so were present in much larger numbers in mid-May.

We estimate that at least 10% of the Flyway breeding populations of Eurasian Curlew, Eastern Curlew, Great Knot, Dunlin and Grey Plover (WIO 2000) use the reserve during northward migration. Estimating the total numbers of shorebirds using the reserve during northward migration is complicated by the fact that many shorebird species probably use the northern Yellow Sea region as the final staging post before flying to the breeding grounds (Wilson & Barter 1998). Thus, the site does not function in the same way as a wetland further south in the Flyway where birds are continuously passing through to staging sites further north. Turnover at Shuangtaizihekou may be low and the maximum count for a species may be a reasonably accurate estimate of the total number of that species using the site. Taking the maximums of the two counts of each species results in a total of around 60,000 birds using the reserve in the end-April/mid-May period. When allowance is made for the 15% unidentified birds, incomplete coverage, the likelihood that the maxima recorded for each species were probably underestimates of actual peak numbers and the fact that some species would pass through in early- to mid-April, it seems that the reserve could be supporting closer to 100,000 birds during northward migration.

The reserve accounts for less than 40% of the mudflat area in northern Liaodong Wan, implying that possibly 250,000 shorebirds could be using the region during northward migration. Confirmation of the importance of another part of the region was obtained during a survey of the proposed Linghekou Provincial Nature Reserve

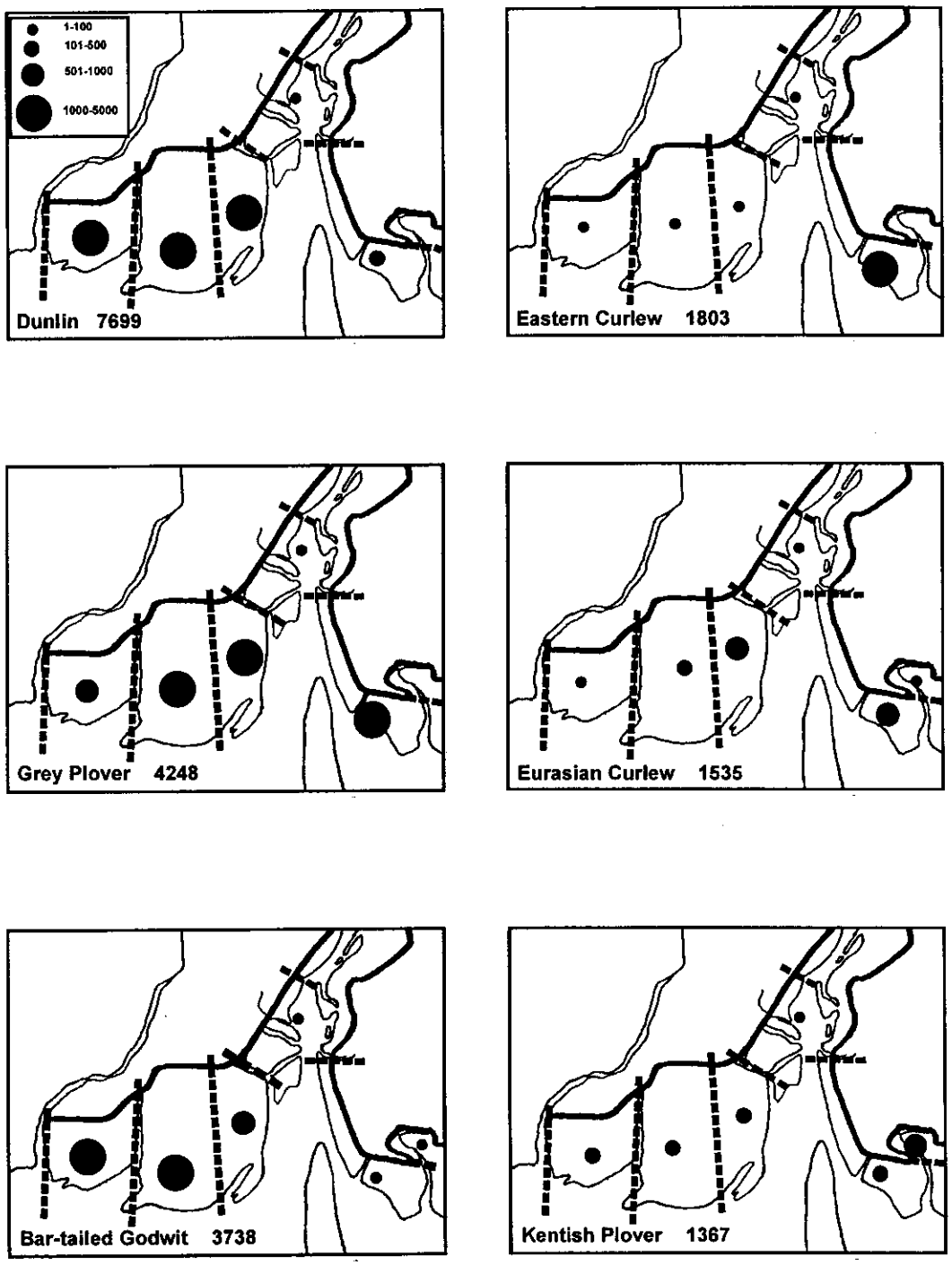

Figure 4. Distribution and numbers of the six most common species of shorebird counted in the Shuangtaizihekou National Nature Reserve in late-April (1999).

(immediately to the west of Shuangtaizihekou) from 26 to 29 April 1999. During this survey, we counted 34,445 shorebirds of 24 species (Barter *et al.* 2000b).

It is important that more information on shorebird numbers, distribution and turn over rates, in both the Shuangtaizihekou National Nature Reserve and the remainder of northern Liaodong Wan, be obtained. This will improve estimates of total and individual species numbers passing through the region. To achieve this will require surveys during both northward migration and the whole of the southward migration period. Such

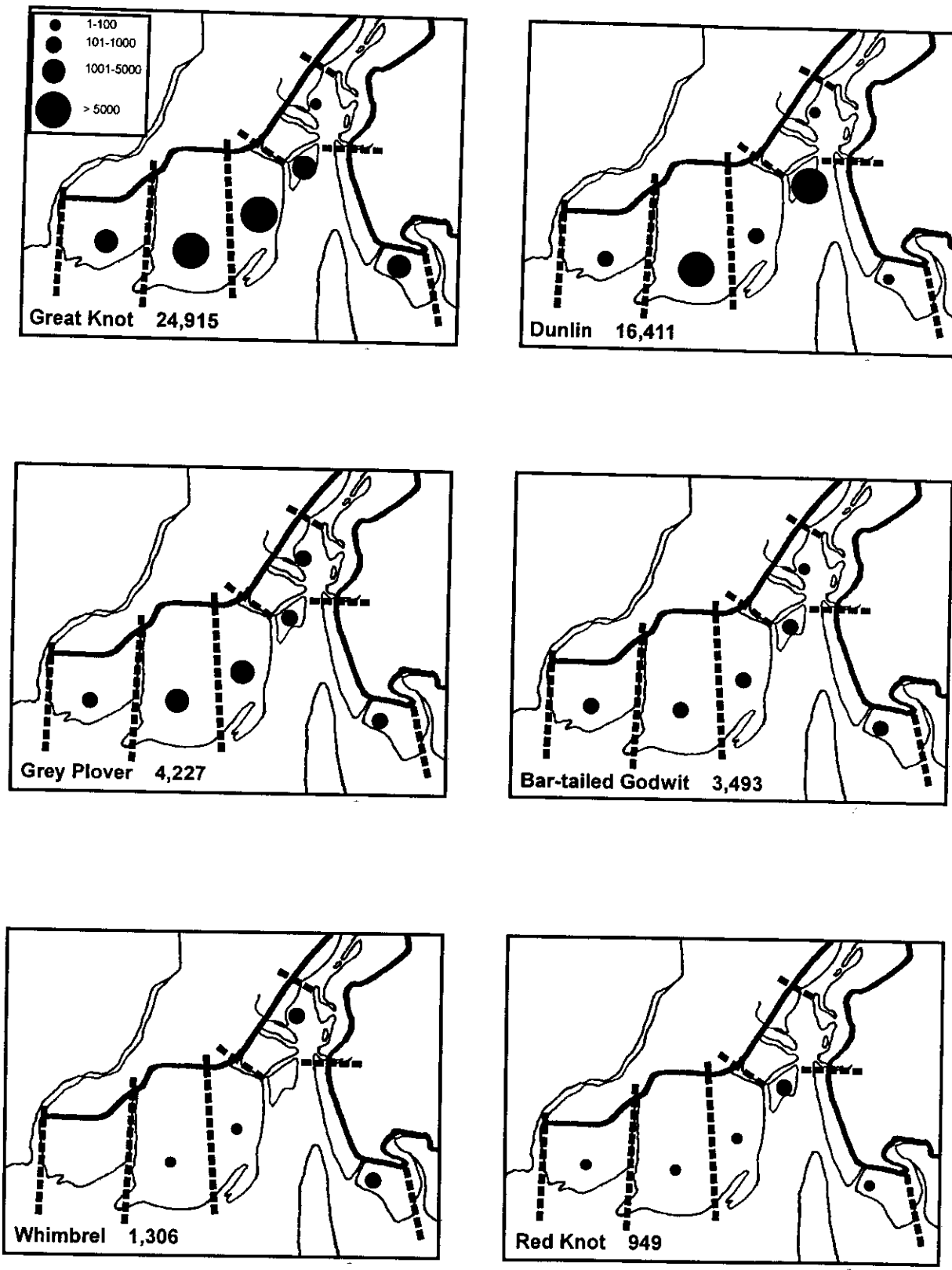

Figure 5. Distribution and numbers of the six most common species of shorebird counted in the Shuangtaizihekou National Nature Reserve during mid-May (1998).

additional information would almost certainly lead to the identification of additional sites of international importance within Liaodong Wan and an increase in the

Table 3. Leg-flagged shorebirds seen in Shuangtaizihekou National Nature Reserve during surveys in 1998 and 1999 (NWA = north-western Australia; SEA= south-eastern Australia).

Species	Sex	Flagging location	Date
Bar-tailed Godwit	Male	NWA	19, 20, 22 April 1999
	Male	NWA	24 April 1999
		NWA	19 May 1998
		SEA	19 May 1998
Great Knot (3)		NWA	19 May 1998
Red Knot		NWA	19 May 1998

number of species found to be present in internationally important numbers.

ACKNOWLEDGEMENTS

The counts were made possible through the generous assistance of the management and staff of the Shuangtaizihekou National Nature Reserve who planned the programme and arranged accommodation and transport. In particular, we acknowledge the help and hospitality of Yang Fu Lin (Director of the Nature Reserve), and Cao Xi Ren (Vice Director). We thank Environment Australia for providing the funding to cover participants' travel and accommodation costs through its International Conservation Program. Doug Watkins, Wetlands International - Oceania, carried out the initial planning and organising of the project.

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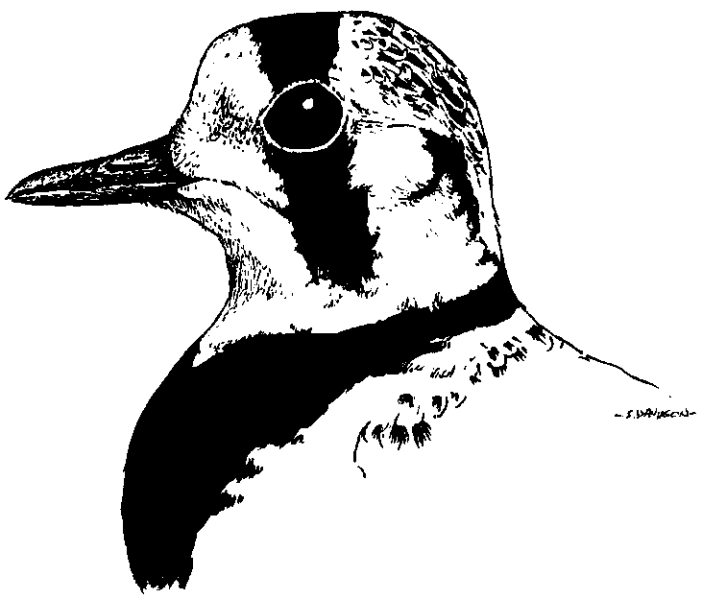

A HIGH COUNT OF ASIAN DOWITCHERS IN ROEBUCK BAY, NORTH-WESTERN AUSTRALIA

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ABSTRACT

A count of 414 Asian Dowitchers was made in Roebuck Bay, north-western Australia, on 30 March 2000. This is the highest count of Asian Dowitchers made at a single site in Australia. Most of the birds were in a single loose flock (of 410 birds), feeding in soft mud at the sea-edge during a neap low tide. The flock was in a remote area of Roebuck Bay seldom visited by birdwatchers. Accordingly, we do not know whether these high numbers are typical of Roebuck Bay. However, we suggest that the numbers of Asian Dowitchers in Roebuck Bay have traditionally been underestimated.

INTRODUCTION

Asian Dowitcher (*Limnodromus semipalmatus*) was once considered an extremely rare species, both in Australia and world-wide. Surveys in south-east Asia during the 1980s changed this perception; the non-breeding strongholds of the species were discovered in east and south-east coastal Sumatra (Silvius 1987, van Marle & Voous 1988). As a result, the world population was estimated to be about 20,000 (Parish 1989; Garnett 1993). Asian Dowitcher was not recorded in Australia until 1971 (Crawford 1972) and in most parts of their Australian range, they are still considered sporadic and rare visitors (Higgins & Davies 1996). However, they have been seen reasonably regularly in north-western Australia since wader studies were initiated in this region in the early 1980s, albeit in small numbers.

Roebuck Bay, near Broome, is one of the two areas in north-western Australia where Asian Dowitcher has been seen regularly. Since the establishment of Broome Bird Observatory in 1989, much wader watching has been undertaken at the high-tide roosts along the northern shore that are easily reached by road. There always seem to be a few dowitchers along there (Collins 1995), but usually only small numbers are found (1 – 6 birds) mixed in with large flocks of Bar-tailed Godwits (*Limosa lapponica*). However, larger numbers of Asian Dowitcher have sometimes been detected; the bird log at Broome Bird Observatory includes counts from the northern shore of Roebuck Bay of 35 in June 1992, 54 in June 1993, 45 in August 1993, 103 during a count on 9th March 1995, and 75 in February and March 1998 (Collins 1995 and unpubl. data). There is also a record of 57 birds roosting at Bush Point in the south-east corner of Roebuck Bay (Jaensch 1983). Bush Point is only visited once or twice a year for high-tide counts; on spring high tides it appears to be the only suitable beach-roost in the southern half of Roebuck Bay and holds large numbers of waders at these times (maximum count 100,000). Jaensch (1983) suggested that Asian Dowitcher may be easily overlooked in the huge godwit flocks at Bush Point.

Very few wader counts have been made along the eastern side of Roebuck Bay, in part because access is difficult. There are no nearby roads and it cannot be reached on foot at low tide because Crab Creek and the very soft mudflats make an approach from the north impossible. Consequently, a boat or hovercraft is needed to get there. In addition, the eastern side is lined with mangroves and has no beaches. Thus, it has not been considered a likely site for roosting waders. At low tide however, very large areas of intertidal flat are exposed along the eastern shore, and long distance observations suggest that many waders feed there.

METHODS

On 30 March 2000 a radio-telemetry expedition gave us an opportunity to get into this corner of Roebuck Bay. Our objective was to locate radio-tagged Red and Great Knots with handheld radio-receivers. The search was conducted by hovercraft along most of the eastern coast on a neap low tide. At this time, the intertidal flats were about half a kilometre wide. We started observations 12 km south of the mouth of Crab Creek. We then headed north, travelling either on the mudflats halfway between the tide-line and the mangroves, or on the sea about 100 m from the tide-line to avoid disturbing the waders feeding at the sea-edge. Once every two km we stopped to do a radio-scan (Fig. 1) and as we approached Crab Creek we stopped more frequently (once every km). During each radio-scan, at least one observer was free to scan the feeding waders with a telescope. In the excellent

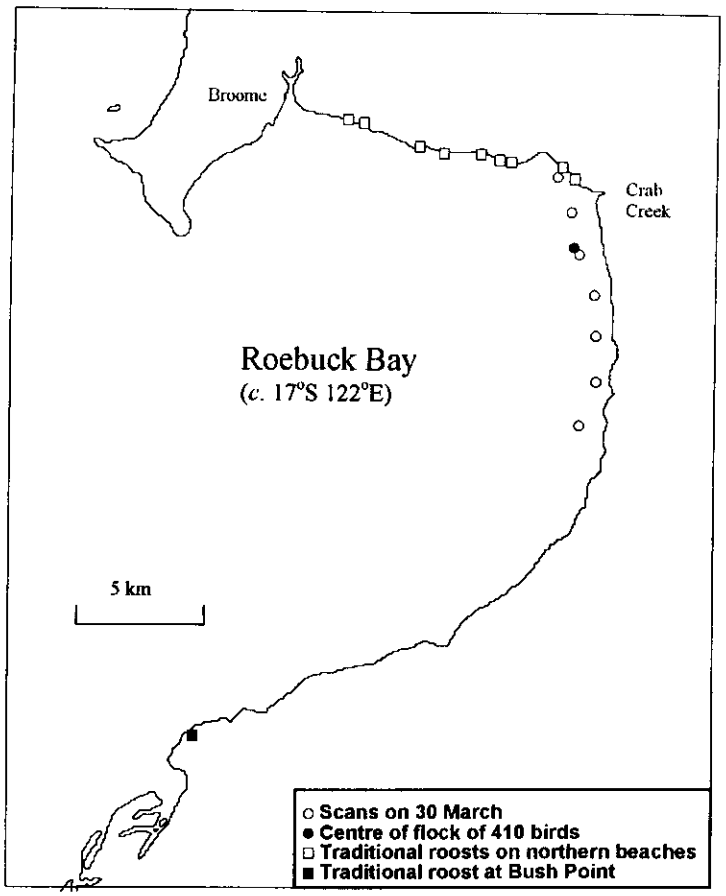

Figure 1. Map of Roebuck Bay, showing the site where our observations were made, and sites where reasonable numbers of Asian Dowitchers have been found roosting in the past.

light conditions at the time, it was possible to see and identify most waders within *c.* 500 m of the hovercraft.

RESULTS

For most of the 12 km of sea-edge that we passed, loose flocks of waders were feeding on wet mud within 20 m of the sea-edge. Smaller numbers of birds fed in the water itself. Most of the birds were Bar-tailed Godwits, Black-tailed Godwits (*Limosa limosa*), Great Knots and Red Knots. Rogers (1999) also found that these species fed near the sea-edge rather than on areas of open mudflats that have been exposed for some time. During the radio-scan made just south of Crab Creek at 18° 00.84' S, 122°21.846' E, one of us (PB) noticed that there were many Asian Dowitchers feeding there. He and DR counted them independently, and then repeated the count as it was hard to be believe what we were seeing. All counts were consistent – there were 410 Asian Dowitchers feeding in a loose flock, spread along about 500 m of the water edge. We had earlier seen four Asian Dowitchers two km south of this point, bringing the total count to 414 birds.

The Asian Dowitchers seen were very close to the water edge; many were feeding in the sea, in water no deeper than the tibio-tarsal joint. The remainder were mostly feeding on exposed mud within 10m of the edge. On average, the dowitchers were feeding closer to the water edge than the Bar-tailed Godwits, Black-tailed Godwits and Great Knots that were feeding in the same area. The substrate at this site was soft and muddy. We did not have time to try to work out what the dowitchers were eating. Some were feeding with the 'sewing machine' action characteristic of the species (e.g. Higgins & Davies 1996). Others were evidently hunting deeply buried prey, as they occasionally probed to almost a full bill-length. The dowitcher flock consisted mostly of apparent adults, in varying stages of pre-breeding moult. Also some birds lacked any breeding plumage and were probably immature.

DISCUSSION

The previous highest count of Asian Dowitchers in Australia was of 130 at Port Hedland Saltworks (Jaensch 1983). Our Roebuck Bay count, of 414 Asian Dowitchers, is the highest reported in Australia, and it constitutes about 2% of the estimated world population.

Following the approach of Watkins (1993), it would appear that Roebuck Bay holds more than 1% of the world population of Asian Dowitchers and therefore qualifies as a site of international importance to the species.

We do not know whether the dowitchers we saw were a flock making a brief migratory stopover, or a population that is present throughout the non-breeding period. The presence of a variety of plumage conditions and apparent immatures in the flock is arguably more consistent with the idea that they were not staging birds.

It is noteworthy that around the period that our observations were made, there were few Asian Dowitchers using high tide roosts on the northern beaches of Roebuck Bay. Numbers seen on these beaches in March and April 2000 ranged from zero to 56. Much of the wader watching done along these beaches in this period was opportunistic rather than systematic, and Asian Dowitchers can be overlooked in large flocks of godwits. Nevertheless, we do not think that 400 Asian Dowitchers would have been overlooked, and conclude that the dowitchers we saw must have been using a different high tide roost. One possibility was that they were roosting at Bush Point, a seldom-visited site that holds vast numbers of roosting waders on spring high tides. However, Bush Point is considerably further from the site where we saw the dowitchers than the northern beaches of Roebuck Bay (Fig.1), and it seems illogical that the dowitchers would have preferred to roost down there. We think it quite possible that there is a major undiscovered roost (or roosts) somewhere along the east coast of Roebuck Bay. One possibility is on the salt-flats and very sparse saltmarsh to the east of the mangroves. These areas would have been wet at this time (as it was at the end of a very rainy wet season) and would have probably offered better roosting habitat than they do in drier weather.

Most of the birds we saw were concentrated along a small (0.5 km) stretch of the 12 km of tide edge that we looked at. It is possible that on spring low tides, feeding flocks of dowitchers would not be so localised. Radio-telemetry of Great and Red Knots in Roebuck Bay during Feb.- Apr. 2000 showed that many individuals moved into the muddy eastern part of the bay on neap tides when little mudflat was exposed further west (unpubl. data). However, no large concentrations of Asian Dowitchers have been seen along the 9 km of intertidal flats on the northern shores of Roebuck Bay. This is despite the area being more thoroughly surveyed for feeding shorebirds in the last three years, including the period from Feb. to April 2000 (Rogers 1999 and unpubl. data).

Although the northern mudflats of Roebuck Bay are fairly well known, the 35 km or so shoreline to the south of these northern flats are virtually unexplored. We suspect that the 15 km or so of intertidal flats close to Bush Point would not hold large numbers of feeding dowitchers as they are relatively sandy (Pepping 1999; E. Oldmeadow pers. comm.). Asian Dowitchers seem to prefer muddy substrates (Rogers 1999, pers. obs.). Nevertheless, that leaves some 20 km of intertidal flats along the eastern edge of Roebuck Bay that may offer potential feeding habitat for dowitchers. Thus, the actual number of Asian Dowitchers in Roebuck Bay may be considerably higher than we found.

ACKNOWLEDGEMENTS

This fieldwork was undertaken as part of the "Tracking 2000" expedition based at Roebuck Bay from February-May 2000. Funds for this project were received from the National Geographic Society, Ian Potter Foundation, George Alexander Foundation, Australian Bird Environmental Foundation, Stuart Leslie Award (Birds Australia), a PIONIER grant to Theunis Piersma from the Netherlands Organisation for Scientific Research, the Australian School of Environmental Studies (Griffith University) and Charles Sturt University. We thank Jamie Wallis from Wallis Drilling for the use of his hovercraft and piloting expertise.

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YALU JIANG NATIONAL NATURE RESERVE, NORTH-EASTERN CHINA – A NEWLY DISCOVERED INTERNATIONALLY IMPORTANT YELLOW SEA SITE FOR NORTHWARD MIGRATING SHOREBIRDS

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ABSTRACT

A total of 151,708 shorebirds of 25 species of shorebirds were counted in the Yalu Jiang National Nature Reserve from 2 to 9 May 1999. The ten most common species were Bar-tailed Godwit, Eastern Curlew, Common Greenshank, Wood Sandpiper, Great Knot, Red Knot, Dunlin, Broad-billed Sandpiper, Grey Plover and Lesser Sand Plover. Nine species were present in internationally significantly numbers: Bar-tailed Godwit, Eurasian Curlew, Eastern Curlew, Spotted Redshank, Great Knot, Dunlin, Broad-billed Sandpiper, Grey Plover and Lesser Sand Plover. Seven New Zealand and Australian leg-flagged birds were seen. We believed that the reserve could support more than 200,000 shorebirds during the northward migration period. The site is highly significant as it is almost certainly the final staging area before the breeding grounds for many species and it supports a very high proportion of the breeding populations of Bar-tailed Godwit, Eastern Curlew and Great Knot.

INTRODUCTION

The 108,057 ha Yalu Jiang National Nature Reserve was established in 1997 and is located in far eastern coastal Liaoning Province of China, adjacent to the North Korean border (Figure 1). The Reserve is flat and low lying with a coastline length of 92 km. It has extensive intertidal mud flats that are backed by fishponds for most of their length and by reed beds near the Da Yang He. Mean monthly temperatures vary from -8° C in January to 23° C in July. Annual rainfall averages 930 mm (range 670-1472 mm).

Little ornithological work has been carried out in the Reserve. Studies from May 1982 to January 1984 showed that the region is a very important breeding, non-breeding and staging area for waterfowl. More than 70 species have been recorded including Chinese Egret *Egretta eulophotes*, Whooper Swan *Cygnus cygnus*, Baer's Pochard *Aythya baeri*, five species of cranes (Gruidae), and Band-bellied Crake *Porzana paykullii* (Scott 1989). Twenty to thirty thousand geese were present at the mouth of Da Yang He in November 1991 (Xiao *et al.* 1996). No published information on shorebird abundance has been found.

A list of the common English and scientific names of all shorebird species recorded during the 1999 survey is given in Table 1.

METHODS

The shorebird count at Yalu Jiang NNR was conducted as part of a China - Australia cooperative programme of shorebird studies and involved personnel from the China Environment Protection Agency, Wetlands International - China Programme and the Australasian Wader Studies Group. The programme focused on the coastal mud flats and adjacent fishponds. Opportunistic counts were made within fishponds and reed beds as we travelled through the reserve to and from count locations. The straight-line length of coastline along which shorebirds were counted was approximately 60 km.

Counting was conducted over an eight day period from 2 to 9 May. The coastline was split into five sections (Figure 2). The six counters were divided into two teams. Vehicles were used to transport the teams as close as possible to the count sites. Both vehicle access and surveying conditions were generally good and we were able to achieve a reasonably complete coverage of the coastal mud flats and nearby fishponds.

Tides were particularly favourable with high water changing from about 09:30 to 14:40 over the count period (Figure 3). Most counting started in mid-morning and extended to mid-afternoon. The tidal range in the reserve is quite large and during the survey varied from 4.6 m on spring tides to 3.2 m on neap tides. High tides reached the sea wall on all days except the last two.

Birds formed pre-high tide roosts at preferred locations (generally in bays or at river/channel mouths) as the tide front approached the sea wall. They then moved into the adjacent fishponds as the mud flats were covered. When the tide fell they returned to the pre-high tide roosting areas and quickly commenced feeding, often moving considerable distances.

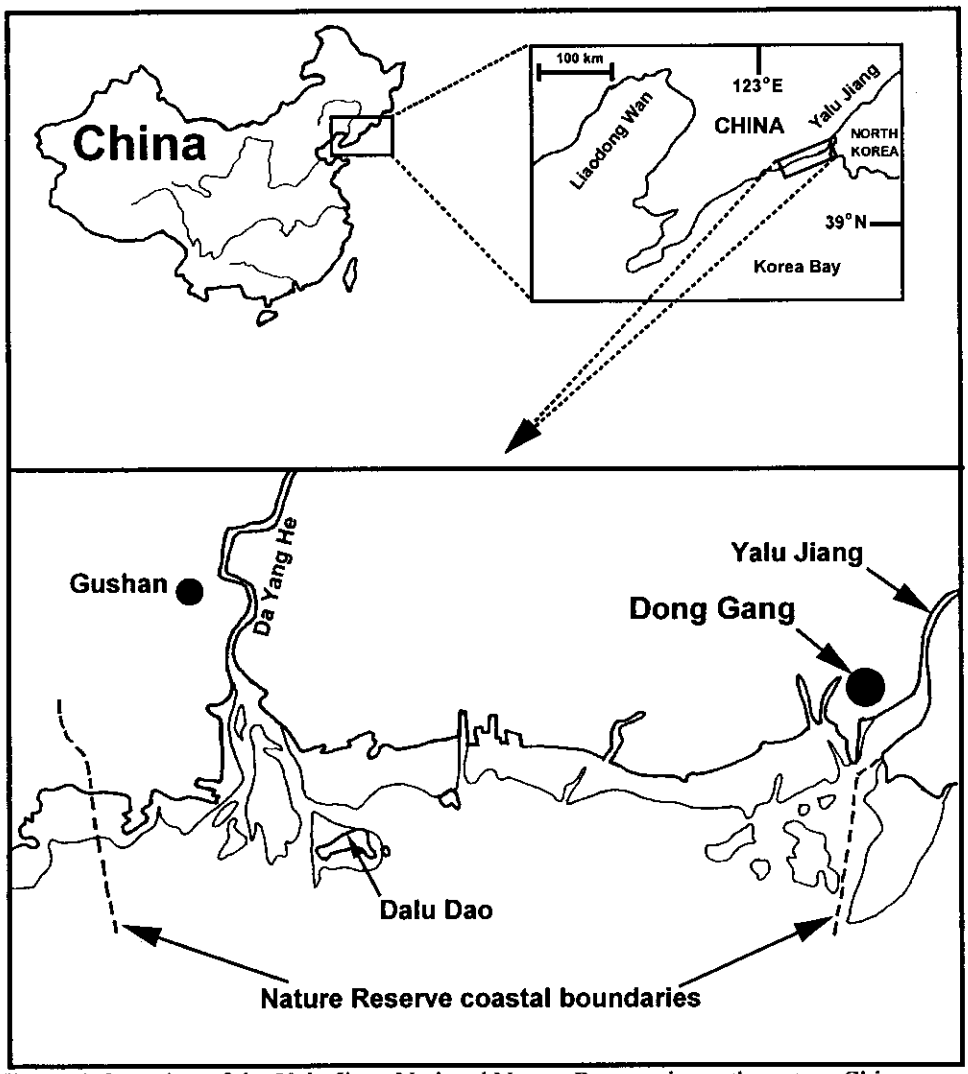

Figure 1. Location of the Yalu Jiang National Nature Reserve in north-eastern China.

The large tidal range and the very flat intertidal areas meant that the tide moved in and out very quickly and it was very important to be in position early at the pre-high tide roosts. Thus, the counting technique adopted involved taking up positions on the sea wall some two to three hours before high tide and counting birds as they came into the pre-roost areas. Check counts were often carried out on roosts in the fishponds at the peak of the high tide. During the rising tide, nearby pre-roosting sites were identified for counting on the falling tide when birds returned to the mud flats from the fishponds.

The method of counting on the rising and falling tide appeared to cover most species satisfactorily. However, plovers were often missed as they moved inland individually or in small flocks well before high tide. These birds were more accurately counted as they returned to the flats in larger flocks and roosted for a while before feeding on the higher flats. On the last two days, when the high tide failed to reach the sea wall, counts were confined to large roosting flocks on the uncovered part of the mud flats.

The general accuracy of counts is believed to be reasonable, although no check counts were carried out, except for a limited amount of supplementary counting in Sections C (fog-affected count on first occasion) and E (incomplete count initially). It is probable that some thousands of birds were uncounted in Section A, as the inland roosting site could not be found. In this case, an estimation of numbers and species composition of the flocks flying inland was made. Elsewhere, we managed to find the fish pond roosts and large counting errors due to missed birds is unlikely to have occurred. Any errors would tend to lead to under-estimation of shorebird numbers. We adjusted counts when birds moved between adjacent sections.

Weather conditions throughout the count period were generally favourable although fog significantly affected

Table 1. Shorebird species recorded during the 1999 survey

Species	Scientific name
Bar-tailed Godwit	*Limosa lapponica*
Whimbrel	*Numenius phaeopus*
Eurasian Curlew	*Numenius arquata*
Eastern Curlew	*Numenius madagascariensis*
Spotted Redshank	*Tringa erythropus*
Common Redshank	*Tringa totanus*
Common Greenshank	*Tringa nebularia*
Wood Sandpiper	*Tringa glareola*
Terek Sandpiper	*Xenus cinereus*
Common Sandpiper	*Actitis hypoleucos*
Grey-tailed Tattler	*Heteroscelus brevipes*
Ruddy Turnstone	*Arenaria interpres*
Great Knot	*Calidris tenuirostris*
Red Knot	*Calidris canutus*
Red-necked Stint	*Calidris ruficollis*
Long-toed Stint	*Calidris subminuta*
Sharp-tailed Sandpiper	*Calidris acuminata*
Dunlin	*Calidris alpina*
Broad-billed Sandpiper	*Limicola falcinellus*
Eurasian Oystercatcher	*Haematopus ostralegus*
Black-winged Stilt	*Himantopus himantopus*
Pacific Golden Plover	*Pluvialis fulva*
Grey Plover	*Pluvialis squatarola*
Kentish Plover	*Charadrius alexandrinus*
Lesser Sand Plover	*Charadrius mongolus*

counting on one day in Section C, as mentioned above. A subsequent visit was made to supplement the first count.

The 1% criterion from WIO (2000) (based mainly on Rose and Scott 1997) was used to determine whether a species was present in internationally significant numbers.

RESULTS

Numbers and general distribution

A total of 151,708 shorebirds of 25 species was counted including 7,702 unidentified shorebirds (5.1% of the total count). Count data for individual species are listed by section in Table 2.

Although large numbers of birds occurred in all sections, more than 50% were found in Section E, which is the closest to the Yalu Jiang mouth (Figure 4). A high-tide check for roosting birds on Dalu Dao only found a small number of Bar-tailed Godwit. No roosting birds could be seen on Xiaolu Dao, the small island south of Section C. It seems that birds are maximising their feeding time by using the mud flats closest to the sea wall rather than roosting on offshore islands. They then move to nearby roosting areas in the fish ponds during the high tide period.

Less than 1% of the total count were found in fish ponds and reed beds (other than high tide roosts). The total of 1,390 birds found in these habitats is probably a gross under-estimate of numbers present due to the lack of systematic coverage of inland areas.

Individual species numbers and distribution

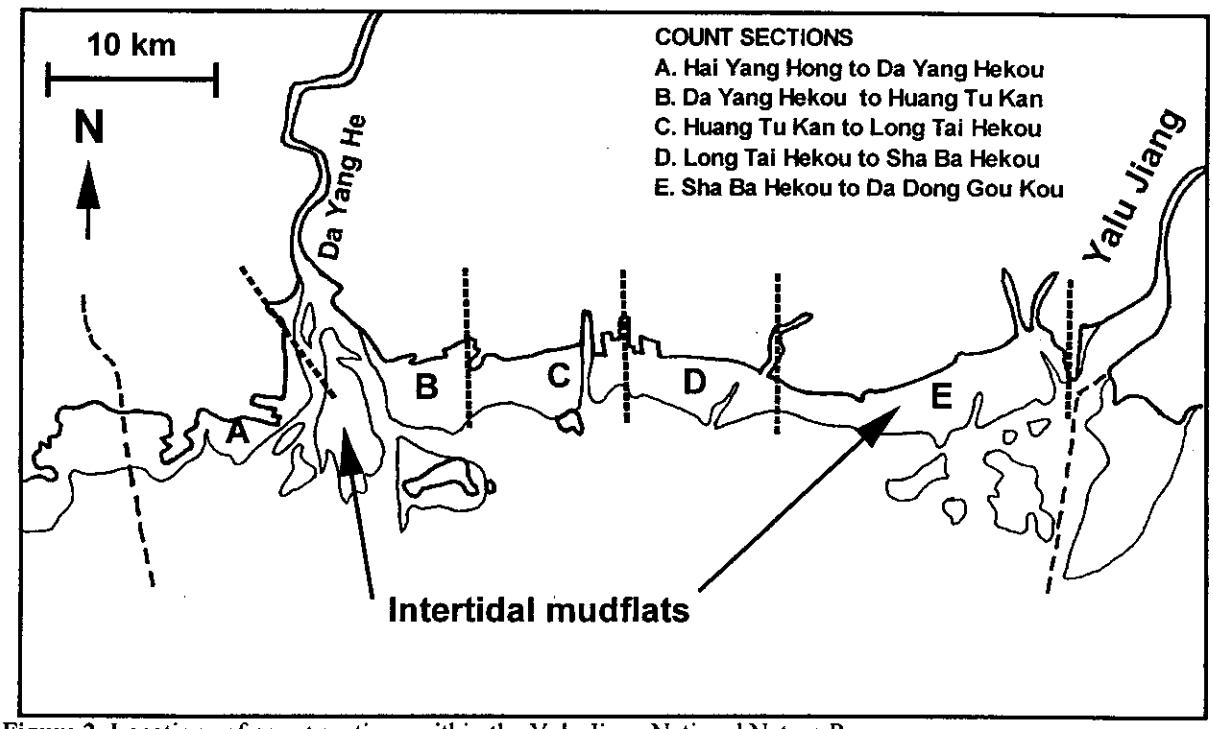

Figure 2. Locations of count sections within the Yalu Jiang National Nature Reserve.

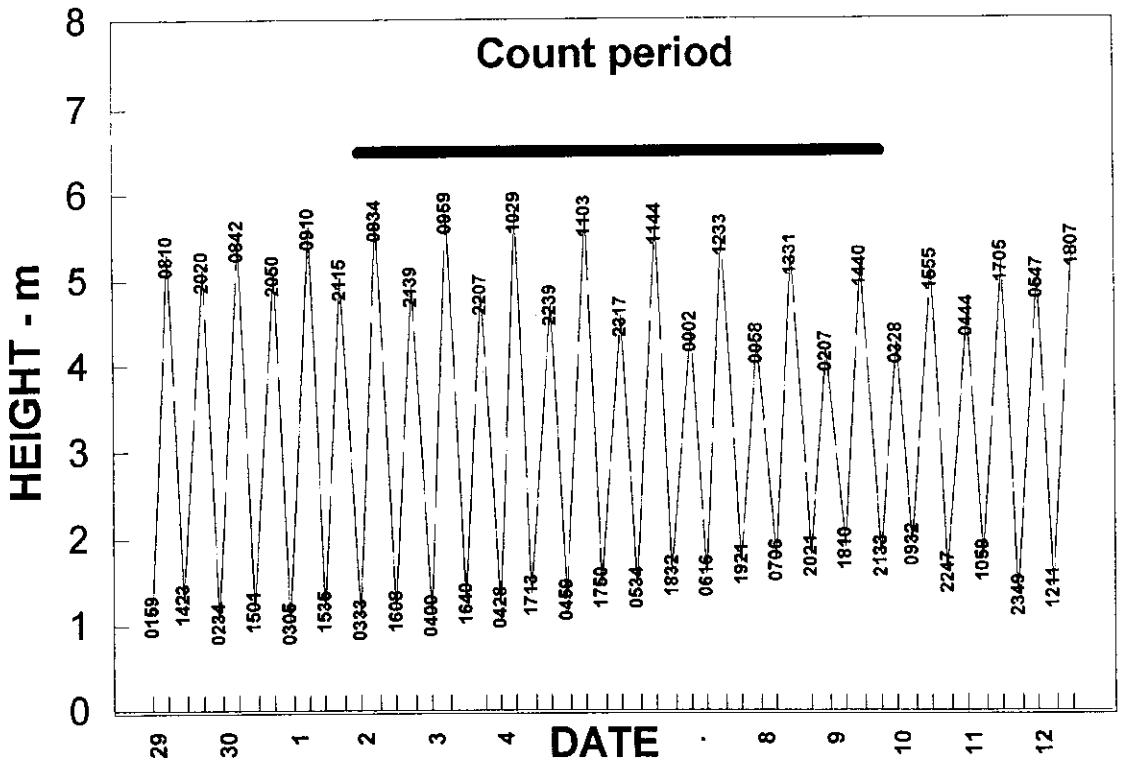

Figure 3. Heights and times of high and low tides at Dalu Dao (39° 45' N, 123° 45' E) from 29 April to 12 May.

The ten most common species counted (in decreasing abundance) were Great Knot (54,178 individuals - 37.6% of identified birds), Bar-tailed Godwit (51,918 - 36.1%), Dunlin (25,181 - 17.5%), Grey Plover (3,995 - 2.8%), Eastern Curlew (3,744 - 2.6%), Red Knot (1,499 - 1.0%), Broad-billed Sandpiper (729 - 0.5%), Wood Sandpiper (490 - 0.3%), Common Greenshank (351 - 0.2%) and Lesser Sand Plover (306 - 0.2%). These ten species represented 98.8% of the identified shorebirds.

The poor coverage of inland sites within the Reserve will have caused significant underestimates in the numbers of those species preferring brackish/fresh water habitats, such as Whimbrel, Spotted Redshank, Common Greenshank, Wood Sandpiper, Long-toed Stint and Pacific Golden Plover.

Nine species of shorebird were present in internationally significant numbers. These were: Bar-tailed Godwit, Eurasian Curlew, Eastern Curlew, Spotted Redshank, Great Knot, Dunlin, Broad-billed Sandpiper, Grey Plover and Lesser Sand Plover.

The distributions of the six most common species (>1,000 individuals counted) are shown graphically in Figure 5. It can be seen that Dunlin, Grey Plover and Eastern Curlew were fairly evenly distributed throughout the reserve, whilst Great Knot, Red Knot and Bar-tailed Godwit were concentrated in the most easterly section.

Seven leg-flagged birds were seen amongst many thousands of shorebirds scanned for flags. They comprised four Bar-tailed Godwit (two from New Zealand, one each from north-western and south-eastern Australia), two Red Knot (both from New Zealand) and one Great Knot from north-western Australia (Table 3). The sightings of New Zealand-marked Bar-tailed Godwit and Red Knot are the first for China.

DISCUSSION

Estimation of the total number of shorebirds using the Yalu Jiang National Nature Reserve during northward migration is complicated by the fact the site is probably the final wetland used by many birds before departure to the breeding grounds. As such, we expect that numbers will build up as birds collect before the final flight. At the time of our count (2-9 May), it is very likely that some birds still have to arrive from areas further south. Numbers would be expected to increase through to the second-half of May, as arctic-breeding birds will not be able to depart before then because the breeding grounds are still frozen and unable to support arriving birds. Some of the more southerly breeding shorebirds, such as Eurasian Curlew, Spotted and Common Redshank and Kentish Plover may have already passed through. Thus, the total number of shorebirds supported during northward migration could well be more than 200,000.

Table 2. The number of shorebirds counted in each section (see Figure 2) of the Yalu Jiang National Nature Reserve from 2 to 9 May 1999. Percentage identified refers to the fraction of the total number of birds identified. (Int. Imp. = Internationally important; Criterion is the count estimate for the threshold 1% of the world population that triggers international importance).

Species	Section						TOTAL	Percentage identified	Int. Imp.	Criterion (1%)
	A	B	C	D	E	Misc.				
Snipe sp.						5		<0.01		
Bar-tailed Godwit	7925	6693	10746	6750	19804		51918	36.1	X	2700
Whimbrel	4	17	27	28	22	188	286	0.2		400
Eurasian Curlew	155	20	22	37			234	0.2	X	100
Eastern Curlew	1335	292	869	138	1110		3744	2.6	X	210
Curlew sp.					20		20	0.0		
Spotted Redshank		32			14	116	162	0.1	X	100
Common Redshank	2		10	4	2	31	49	<0.01		
Common Greenshank	1	48	73	84	66	79	351	0.2		400
Wood Sandpiper						490	490	0.3		1000
Terek Sandpiper	2	9	28	14	38	62	153	0.1		360
Common Sandpiper						5	5	<0.01		
Grey-tailed Tattler			2	1		3	6	<0.01		
Ruddy Turnstone		3	4	3	14	20	44	<0.01		
Great Knot	6526	750	2685	3217	41000		54178	37.6	X	3200
Red Knot		1	12	1	1485		1499	1.0		2000
Red-necked Stint		1		2	175	121	299	0.2		
Long-toed Stint						24	24	<0.01		
Sharp-tailed Sandpiper					45	16	61	<0.01		
Dunlin	3700	5182	4250	3157	8890	2	25181	17.5	X	1300
Broad-billed Sandpiper					729		729	0.5	X	160
Eurasian Oystercatcher		1	64	3		2	70	<0.01		4000
Black-winged Stilt						38	38	<0.01		
Pacific Golden Plover			15			132	147	0.1		
Grey Plover	610	550	858	559	1388	30	3995	2.8	X	250
Kentish Plover				6		6	12	<0.01		
Lesser Sand Plover	40		23	92	151		306	0.2	X	250
Unidentified waders	2000	1500	2170	500	1512	20	7702			
TOTAL	22300	15099	21858	14596	76465	1390	151708			

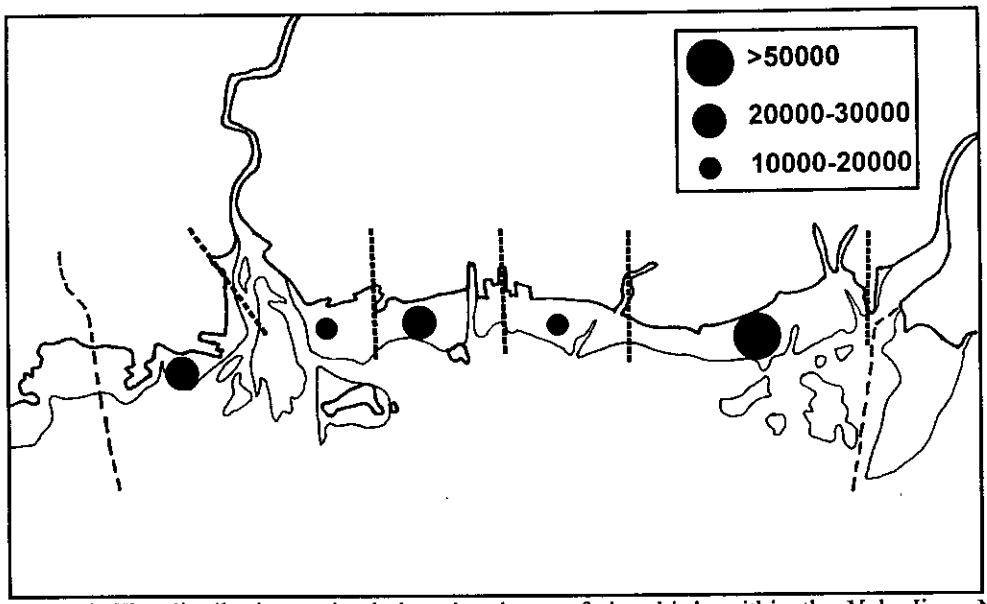

Figure 4. The distribution and relative abundance of shorebirds within the Yalu Jiang National Nature Reserve.

The most noteworthy feature of the count is the very large numbers of Great Knot and Bar-tailed Godwit seen. Together they represented almost 75% of the birds counted. The great importance of Yalu Jiang for these two species is demonstrated by the fact that the reserve

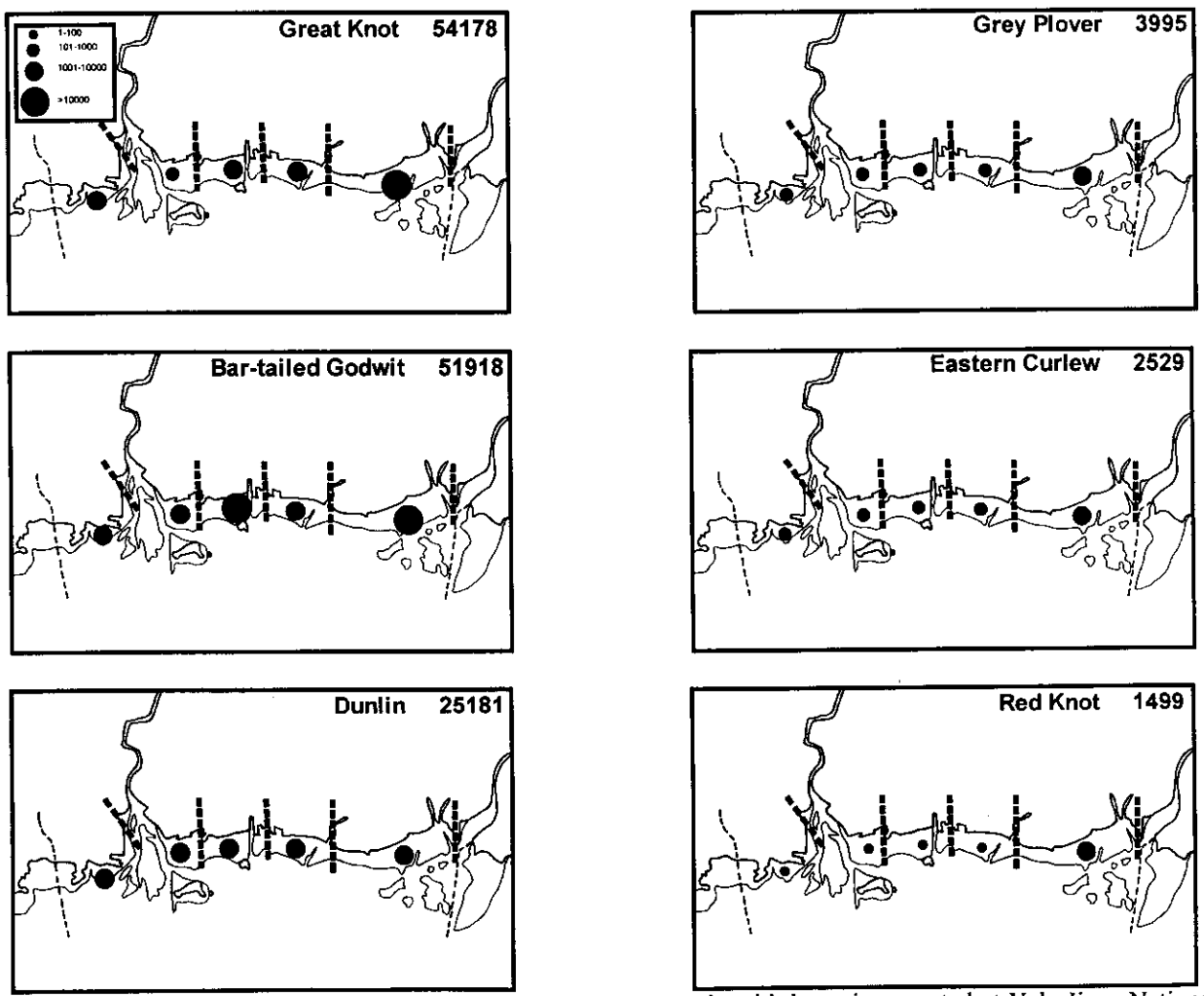

Figure 5. The distribution and numbers of the six most common shorebird species counted at Yalu Jiang National Nature Reserve from 2 – 9 May 2000.

Table 3. List of sightings of leg-flagged birds seen at Yalu Jiang National Nature Reserve during 2 – 9 May 1999. (NZ = New Zealand; NWA = north-western Australia; south-eastern Australia).

Species	Sex	Flagging site	Date
Bar-tailed Godwit	Male	SEA	2 May
Bar-tailed Godwit	Male	NZ	3 May
Great Knot		NWA	6 & 7 May
Bar-tailed Godwit	Female	NZ	9 May
Bar-tailed Godwit	Female	NWA	9 May
Red Knot		NZ	9 May
Red Knot		NZ	9 May

was supporting 20-25% of the estimated breeding populations during the count period (including both *menzbieri* and *baueri* races of Bar-tailed Godwit).

Yalu Jiang was also very important for Eastern Curlew that also had an estimated 20-25% of the breeding population present during the survey. Significant proportions of the breeding populations of Dunlin, Broad-billed Sandpiper and Grey Plover were also using the reserve during the count period.

The large numbers of shorebirds counted at this reserve, the Shuangtaizihekou and Huang He National Nature Reserves (Barter *et al.* 1998a, 1998b, 1999a, 1999b, 2000a) and the proposed Linghekou Provincial Nature Reserve (Barter *et al.* 2000b), provide strong support for the suggestion that the intertidal mud flats of the northern Yellow Sea are the final staging region for many shorebird species on northward migration in the East Asian-Australasian Flyway (Wilson & Barter 1998).

It is highly desirable that more information on shorebird numbers and distribution be obtained so that a more precise estimate can be made of total and individual species numbers passing through the reserve. This will involve surveys being conducted earlier during northward migration and during the whole of the southward migration period. Improved coverage of inland areas is also necessary.

Past reclamation of mudflats appears to have been extensive, although there seems to have been little reclamation carried out in recent years (pers. obs.). The major attraction of the reserve to shorebirds is the extensive and productive mudflat feeding areas. Therefore, it is very important that these be fully conserved. Human disturbance pressures on the mud flats seem to be relatively minor, apart from major shell fishing activities in the central parts of the reserve (pers. obs.). The harvesting of large quantities of shellfish could affect the availability of food for shorebirds either by the direct removal of food or by the severe disturbance of sediments affecting productivity. Disturbance of shorebirds by shell fishermen could also affect food intake rates. A study of the shell fishing industry and its effects on shorebirds is desirable.

The major impact of humans at Yalu Jiang is probably on roosting birds in the fish ponds. The number of birds at some roosts exceeded 10,000 birds. At this stage of their migration, birds are not only putting on fuel reserves (fat) for their long flight to the breeding grounds, but also additional reserves to sustain them during the period immediately after arrival, when feeding conditions may be poor. Serious disturbance of roosting birds will cause them to consume these valuable fat reserves whilst they are flying around and, perhaps, affect their ability to reach the breeding grounds in good enough condition to breed successfully. Thus, it is very important that roost disturbance be minimised at this critical time in the annual life cycle.

ACKNOWLEDGEMENTS

The surveys and counts would not have been possible without assistance from the management and staff of the Dandong and Dong Gang Branches of the China Environment Protection Agency (CEPA), who helped with the planning of the programme, provided advice on and arranged access to count sites, and organised accommodation. In particular, we wish to acknowledge the help and hospitality of Yu Lian Sheng (Director) and Xu Chuan Zhen (Vice Director) of the Dandong Branch of CEPA. We thank Environment Australia for providing the funding to cover participants' travel and accommodation costs through its International Conservation Program. Doug Watkins, Wetlands International - Oceania, carried out the initial planning and organising of the project.

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BIVALVE COMES TO GRIPS WITH A TEREK SANDPIPER IN CHINA

or '*Yu Bang Xiang Zheng, Yu Wong Deli*'

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While undertaking a shorebird survey at Yalu Jiang National Nature Reserve in northern China on 19 May 2000, one of the local staff, Jiang Lin Sheng, and I noticed a Terek Sandpiper *Xenus cinereus*, take off from the side of a prawn pond as we approached. It was trailing a large bivalve of some sort from its left foot. The bird had trouble flying with the extra weight and fell in the water about 1m from the bank from where it managed to struggle ashore. We were able to pick up the bird and found the bivalve had a strong grip on its centre toe. The bivalve had to be prized off with a knife. Half the toe was almost severed and would undoubtedly have fallen off fairly quickly. On closer inspection, we saw that half the left toe on the same foot was also missing, presumably from a similar incident.

The following day at another prawn pond, I saw a Greenshank *Tringa nebularia* fly across the water with a bivalve locked onto a toe. Being a heavier and stronger bird, it had less trouble flying and landed safely on the other side of the pond. It was impossible for us to catch this bird and examine the bivalve.

We (NZWSG) have noticed when banding Red Knot *Calidris canutus* and Bar-tailed Godwit *Limosa lapponica* in New Zealand, that quite a few birds have toes missing, but have been unsure of the cause. Many South Island Pied Oystercatchers *Haematopus finschi* in New Zealand also have toes or whole feet missing. This problem seems to be caused by strands of wool tightly wrapped round toes or legs (a legacy of sheep breeding in the South Island) to the extent that the circulation is cut off and the affected part is lost.

Mike Carter observed a Pied Oystercatcher *Haematopus longirostris* being caught on a toe by a bivalve at Ballina, NSW, on 19 January 1999 (Australian Birding, Autumn 1999). In his article he expressed concern that banding may be contributing to oystercatcher injuries. However, observations of injured Pied Oystercatchers in New Zealand would suggest that the attachment of bivalves or wrapping with sheep wool are more likely causes.

Interestingly, in China they have a saying, *'Yu Bang Xiang Zheng, Yu Wong Deli'*, which translates as, "When a sandpiper fights with a shellfish, the fisherman is the winner". A saying that translates readily to the human situation. In the Yalu Jiang case, the Terek Sandpiper was released and limped away, but the bivalve provided a quick snack for Jiang! For the Chinese to have a specific saying like this, we can assume bivalve attachment to shorebirds is a fairly common occurrence.

Acknowledgments

My thanks to Mark Barter for making helpful comments on this note.

Bivalve clinging to toe of Terek Sandpiper.

CURLEW SANDPIPERS *CALIDRIS FERRUGINEA* SWIMMING WHEN FEEDING

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Most waders swim, but only a few (eg. the Phalaropes *Phalaropus sp.*, Banded Stilt *Cladorhynchus leucocephalus* and Red-necked Avocet *Recurvirostra novaehollandiae*) regularly feed while swimming. In addition, some species form high tide roosts swimming on sheltered freshwater areas (eg. Spotted Redshank *Tringa erythropus* and Common Greenshank *Tringa nebularia*) if no suitable dry resting area is available.

In most species of wader, swimming during feeding is usually confined to a short periods. This often occurs when a bird that is wading, finds itself temporarily out of its depth, or when there is just a short distance to traverse between one shallow wading area and another.

The regular feeding of Curlew Sandpipers *Calidris ferruginea* by swimming on one of the large saline concentrating ponds (Pond 5) at the Cargill Saltworks, 30 km northeast of Port Hedland, Western Australia, is thus an unusual behaviour. This behaviour has been observed in most years since these saltworks were first regularly visited for wader studies in 1982. The lagoon is about

2.5 km^2 (approximately 642 ha) and has a typical water depth of about 0.65m.

Curlew Sandpipers, sometimes numbering up to 200 individuals, are often seen feeding all over this lagoon, especially in relatively calm weather. Their behaviour is similar to feeding Phalaropes except that pirouetting has not been observed and the tail is cocked up rather higher. They show considerable buoyancy and this is presumably aided by the salinity of the water. It is interesting that when Red-necked Phalaropes *Phalaropus lobatus* are also present at the saltworks (5-15 birds quite regularly) they also tend to feed on the same lagoon. It is tempting to think that the Curlew Sandpipers learned this habit from the Phalaropes! Banded Stilts and Red-necked Avocets also regularly feed on the same lagoon, but they also feed on other lagoons immediately adjacent to this one in the salt treatment process.

The Curlew Sandpipers appear to have no difficulty in rising from the water and flying whenever they choose. This behaviour in Curlew Sandpipers has not been noted anywhere else, nor do other small waders common at the saltworks (Red-necked Stints *Calidris ruficollis* and Sharp-tailed Sandpipers *Calidris acuminata*) adopt this feeding method.

It may be significant that the concentration lagoon selected by the birds is towards the latter part of the primary concentration process. The salt concentration in the water in Pond 5 is usually around 15% (specific gravity 1.11), which is approximately four and a half times the concentration of the seawater pumped into the first lagoon of the evaporation area (3.4% salt, specific gravity 1.03). Adjacent ponds in the system (Ponds 4 & 6) have salt concentrations approximately 2-3% lower/higher respectively than Pond 5 and as the Curlew Sandpipers do not regularly feed on these they presumably have less suitable feeding conditions. Furthermore this is the only lagoon (out of 7) in the primary concentration area which has an algal mat on the floor - a feature which is critical to the efficient operation of the saltworks - and this may be also related to the apparent good food availability.

Clearly the conditions in Pond 5 lagoon are those which most favour the food (unknown, but possibly brine shrimps) taken by the Curlew Sandpipers. It appears to be a rich food resource because this behaviour has been most frequently noted in March and early April when birds are in breeding plumage and fattening for northward migration.

Acknowledgments

We thank Cargill Salt for permission to visit their saltworks and for providing the technical information relating to salt concentrations.

WADERS ROOSTING ON MANGROVES

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Waders have regularly been observed roosting on mangroves during high tide periods, especially in the tropics where such mangroves tend to be taller and to have more suitable branches for the birds to perch on. Whimbrel *Numenius phaepus* and Grey-tailed Tattlers *Heteroscelus brevipes* are perhaps the most widespread species using mangroves for roosting in Australia. But Pacific Golden Plover *Pluvialis fulva* have been observed roosting on mangroves in Westernport, Victoria (R. Loyn, pers. comm.). Eastern Curlew *Numenius madagascariensis* on very short mangroves at Corner Inlet, Victoria, (pers. obs.) and Terek Sandpipers *Xenus cinereus* at Roebuck Bay, Broome, north-western Australia (per Broome Bird Observatory and Australasian Wader Studies Group).

In most cases, birds roost on mangroves alone or as small loose flocks. However, at Anderson Inlet, Inverloch, Victoria in early December 1999, virtually the whole wader population of the estuary was located roosting at high tide in densely packed groups on small well foliaged mangroves in a sheltered bay on the south side of the estuary. An estimated 3000 Red-necked Stints *Calidris ruficollis*, 500 Curlew Sandpipers *Calidris ferruginea*, 70 Common Greenshank *Tringa nebularia*, and 50 Pacific Golden Plovers were present. As the tide covered the last of the mudflats the birds lifted in small groups and settled in an area of mangroves some 50 meters square. The mangroves in this area were only about 2 m tall and were spaced out with one to three meters between each plant. They had relatively rounded, or flat, tops and on some plants the "platform" was enhanced by tide wrack which had been lodged in the tops of the mangroves by earlier storm tides. Sometimes as many as 50 birds were present on one small mangrove top. The birds looked surprisingly comfortable and returned even when disturbed.

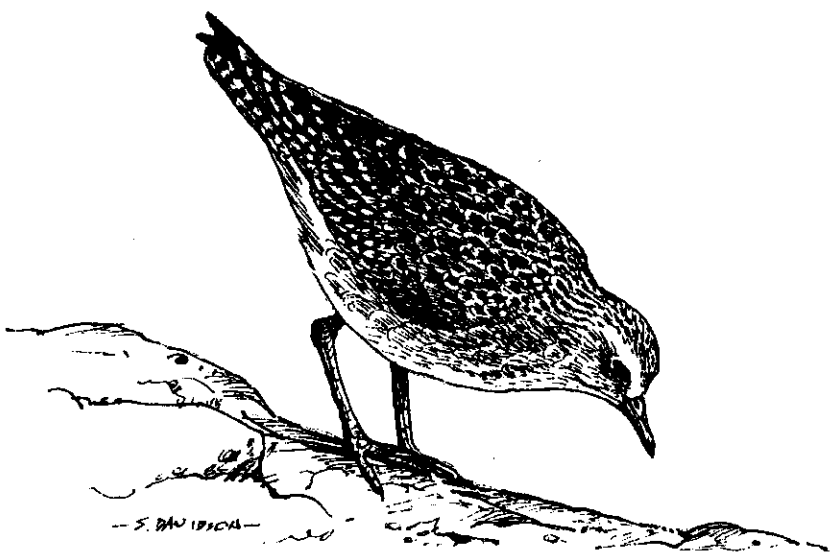
This unusual roosting habit had apparently previously been observed by Thierry Rolland (pers. comm.) over the previous two years. This mangrove roost has subsequently regularly been observed by JW and others. Sharp-tailed Sandpipers *Calidris acuminata* were also seen roosting in the mangroves in March 2000. In contrast, after the initial visit, Greenshank were more usually found roosting in *Spartina* rather than on top of the mangroves.

In March, both Red-necked Stints and Pacific Golden Plovers were also observed roosting on the northern side of the Inlet on similar small stands of mangroves at the mouth of Pound Creek. The number of birds at this location was significantly less than at the southern site (Red-necked Stints 175, Pacific Golden Plover 28) but it is interesting to note that their roosting behaviour is not confined to one site.

It is probable that the waders have resorted to such a novel high tide roost because of the gradual loss of most of their traditional roosting areas in the estuary because of extensive growth of *Spartina* over the last 15 years. Regular counts at these roosts had led to the conclusion that many of the waders had abandoned the estuary due to the spread of *Spartina* but most have clearly remained there and were missed during counting because of the inaccessible (without a boat) and unusual roosting location. It will be interesting to see if the waders gradually return to their more conventional roosts in the future, should the current *Spartina* eradication programme be successful in clearing these areas.

Acknowledgments

We are grateful to Brian Martin and Parks Victoria for providing boat transport to the roost sites.



MIXING OF RED KNOT POPULATIONS IN AUSTRALASIA: SOME THOUGHTS

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It has been suggested that Red Knots, *Calidris canutus*, originating from two Siberian breeding populations may spend the non-breeding season in the Australasian region (Tomkovich 1992, Higgins & Davies 1996, Lindström *et al.* 1999). We have made several observations in New Zealand and Australia which suggest that two groups of Red Knots co-occur in the region. These groups possibly correspond to the two breeding populations of Red Knot. This note is to attract the attention of observers and researchers to the necessity to collect more information about the possible complicated population structure and migrations of this species in Australasia and on the East Asian-Australasian Flyway.

New Zealand birds

Red Knots start to attain breeding plumage in mid-January (Battley 1999). Many Red Knots had already moulted into bright coloured plumage during our wader counts on 6-16 April 1999 in the Gulf of Carpentaria, Queensland, Australia, as well as during observations on 11-12 and 26 March 2000 near Miranda, Firth of Thames, and on 18-19 March 2000 at Farewell Spit, Nelson area, New Zealand. Birds of two colour patterns could be recognized among them. Almost all the birds were of bright rufous colour on the underparts as a result of advanced moult, although the colour was slightly deeper red in some birds and lighter in others. Those birds that were brighter underneath, often also had rufous feathers on the undertail and vent areas and their bright rufous breeding plumage was also developed on the upper parts. In many cases, this gave them a general "red" appearance (see photos of such birds in Chudleigh & Chandler 1990, plate 240, Moon 1996, p. 133). Contrary to these bright "red" birds, Red Knots with the paler rufous colour of the underparts rarely had rufous feathers at the undertail, vent and the upper parts of their body. Their upper parts were of grey colour mottled with black, giving the birds a grey look from above (photo in Pringle 1987, p. 315, Chambers 1989, p. 280).

We did not make separate counts of Red Knots of the two colour patterns in flocks on 11-12 March 2000 at Miranda, however it was certain that bright "red" birds were less common than pale or "grey" ones. Scanning the body profile of birds in flocks gave an impression that lightly coloured Red Knots were fatter than bright birds.

On 11 March 2000, we were able to handle several Red Knots captured near Miranda by cannon-net. Among adult birds, three had the bright type of plumage colouration and five birds had pale or indefinite plumage type. All bright "red" birds were relatively light (136, 144 and 154 g) and well under the mean departure weight of 185-193 g (Battley 1999). Of the paler birds, two were heavier (182 and 188 g, about the departure weight) and others were light (128, 142 and 160 g).

A large number of Red Knots migrated from the Firth of Thames in the early 20s of March 2000 (K. Woodley, pers. comm.). On the 26 March, we found that brightly coloured "red" birds were about 3 times more abundant in the Red Knot flock at the high tide roost near Miranda (mean ratio of "red" and "grey" adults was 3:1 in three random samples). Small numbers of birds (under 10%) continued their feeding on the mudflat at one edge of the roosting flock. Pale-coloured Red Knots predominated among these feeding birds (ratio 1:10). Thus, the latter birds were obviously more hungry or were actively building up their energy reserves for migration. Similar unusual high-tide feeding is described by Battley (1997) in a pre-departure flock at Farewell Spit in March 1994.

A catch of 25 adult Red Knots mist-netted on 1 April 2000 at Karaka, Manukau Harbour, New Zealand, still had not completed moulting into breeding plumage. Numbers of bright (n=10) and pale (n=14) birds in the sample were rather similar. Almost without exception birds were heavy (188.6 ± 16.94 SD) and there was no significant difference between the mean weight of the two colour cohorts.

Birds in northern Australia

In 1999, Red Knots arrived in the Gulf of Carpentaria in large numbers between 5-16 April. At least some New Zealand birds with white leg flags were found among them (Riegen 1999*a*). Birds of two colour patterns, bright and pale ones, were clearly distinguished and were mixed in approximately equal proportion (Riegen pers. obs). One of us (Tomkovich) made notes in his diary during the 1996 NW Australia AWSG expedition that those Red Knots in advanced breeding plumage in Roebuck Bay on 20 March had deep 'red' colour both on

the underneath and above. They also had many rufous feathers on the undertail area and were of similar appearance to birds of the nominate *canutus* subspecies. In the second week of April 1996, most Red Knots left Roebuck Bay. However, a large influx of new arrivals to Eighty Mile Beach took place between 5-14 April (Minton *et al.* 1997). Birds in well developed breeding plumage predominated in cannon-net catches on 15-19 April, and many of them were of bright 'red' plumage.

Migration patterns

Based on observations at Farewell Spit during March 1994, Red Knots start their northward migration from New Zealand after 8 March, with median departure date of 19 March (Battley 1997; 1999). However, observations and counts in recent years at Miranda (1996-1999) have shown that Red Knots depart in two main waves: some birds go in mid March, and the rest in late March/early April.

Our observations near Miranda in March 2000 indicate that pale-coloured "grey" Red Knots most possibly depart in the first wave. The "grey" birds were heavier and became much less abundant within two weeks of the first large flocks migrating. If these preliminary observations are correct, then it suggests that pale birds get their final breeding plumage (rufous colour in the body upper parts) somewhere further north at a staging site. Brightly coloured "red" birds attain their complete or almost complete breeding plumage in places they spend the austral summer. At least some Red Knots do undertake active moult of back feathers into breeding plumage while staging in China (Tomkovich unpubl. obs. on museum skins). These results explain why those Red Knots which undergo moult into breeding plumage at their non-breeding range start their migration later than some lightly coloured birds which moult further north.

In most waders, males migrate northward slightly ahead of females. Females are more pale-coloured in Red Knots (Tomkovich 1992, Higgins & Davies 1996). The pale-coloured birds in the first wave of migration are unlikely to be female and more likely reflect population, not sexual difference in migration schedule.

Australasian Red Knots are classsified as the subspecies *C. canutus rogersi* that breed in Chukotka, NE Siberia (Barter 1992, Higgins & Davies 1996, Riegen 1999*b*). However, it was learnt recently that Red Knots breeding further west, on the New Siberian Islands (Novosibirskie), also migrate and spend the non-breeding season in NW Australia and New Zealand (Lindström *et al.* 1999, Riegen in prep.). Birds of this population have deep rufous colour in breeding plumage similar to the nominate subspecies *C. c. canutus* from Taimyr. However, these birds are smaller than the birds from Taimyr like *C. c. rogersi* (Tomkovich 1992). Bright rufous colour on the upper side of birds from the New Siberian Islands seems to match the bright "red" colour of birds that depart from New Zealand during the second wave of migration. This suggests that the pale Red Knots departing in the first wave presumably belong to the subspecies *C. c. rogersi*.

Several of the Red Knot breeding plumage descriptions in the Australasian region are probably based on the most colourful birds (Lane 1987, Chudleigh & Chandler 1990, Heather & Robertson 1996, Higgins & Davies 1996). These birds are presumably *C. c. canutus* type of plumage. Full breeding plumage of pale-coloured birds (presumably *rogersi*) is supposedly attained further north (possibly in China). If this is the case, it would escape the attention of most Australasian researchers (but see Mathews 1913). This possibly was a reason why Australian Red Knots were often assigned to the subspecies *C. c. canutus* (eg. Condon 1975, Blakers *et al.* 1984).

These preliminary results need further checking and quantitative evaluation. Birds of the two colour pattern we were able to distinguish in New Zealand and in the Gulf of Carpentaria possibly have a wider distribution in Australasia. Unfortunately, they can only be recognised mainly in March and April, when birds are in or nearly in breeding plumage. This creates difficulties when trying to understand differences in moult and migration schedule of these birds when they probably belong to different breeding populations. Further study is required to confirm that these birds do belong to separate breeding populations (subspecies). Closer observation in eastern Asia during migration will help determine whether the two groups also use partly different migration routes.

ACKNOWLEDGMENTS

The senior author is very grateful to the Miranda Naturalists' Trust for funding his visit to New Zealand in March 2000 and giving him the opportunity to observe and catch waders. He also thanks many people (first of all Keith Woodley, David Melville, Rob Shuckard) for help, hospitality and cooperation. Checking of bird skins in the Museum of New Zealand Te Papa Tongarewa was possible thanks to Sandy Bartle and Alan Tennyson.

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SIGHTINGS OF LEG-FLAGGED SHOREBIRDS FROM NEW ZEALAND REPORT NUMBER 1: JULY 2000

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INTRODUCTION

A single white Darvic leg flag have been placed on the right tibia of migrant shorebirds in the Auckland region of New Zealand by the New Zealand Wader Study Group (NZWSG) since December 1992. Annual updates of flag sightings are published in the New Zealand Wader Study Group Newsletter but this is the first report for *The Stilt*.

Since 1992, white flags have been placed on 1245 Red Knot *Calidris canutus*, 746 Bar-tailed Godwit *Limosa lapponica* and 71 Ruddy Turnstones *Arenaria interpres* at three sites in the Auckland region, Miranda - Firth of Thames (37°10'S 175° 20'E), Jordan's - Kaipara Harbour (36°34'S 174°21'E) and Karaka - Manukau Harbour (37° 05'S 174°50'E). No other arctic species are being flagged in New Zealand.

Many sightings have been made at the flagging sites but these are not covered in this report. However, a selection of other sightings from the Auckland region is included. This report is set out on a regional basis and covers the period December 1992 - June 2000.

In the last three years, there hve been some very notable overseas sightings of birds on northward migration, particularly from China, Japan and South Korea.

RED KNOT

DATE SEEN	QTY	LOCATION	OBSERVER
NEW ZEALAND			
MANUKAU HARBOUR			
02.08.92	1	Gordon's Rd	T Habraken
29.05.93	1	Puhinui	T Habraken
01.03.94	1	Pollok Spit	T Habraken
17.10.96	1	Clark's Beach	T Habraken
24.10.96	1	Mangere SP	R Clough
21.01.97	1	Conifer Grove	E Ward
05.03.98	1	Conifer Grove	E Ward
FIRTH OF THAMES			
17.11.96	1	Waihuo R.	T Habraken/D Veitch
KAIPARA HARBOUR			
01.02.99	1	Papakanui Spit	G Pulham et al
REST OF NORTH ISLAND			
29.12.92	1	Paua (34°32'S 172°50'E)	P Agnew
21.10.93	1	Waipu Est (36°00'S 174°28'E)	R Pierce
12.01.97	1	Manawatu Est (40°29'S 175°13'E)	R & P Slack
00.01.98	2	Waipu Est	K Hansen
09.01.98	1	Waipu Est	G Pulham
19.09.98	1	Manawatu Est	I Saville
SOUTH ISLAND			
25.02.94 - 14.03.94	1	Farewell Spit (40°33'S 173°00'E)	P Battley

18.03.00	2	Farewell Spit	R Shuckard/P Tomkovich
AUSTRALIA			
30.09.93	1	Altona Beach, VIC (38°10'S 144°40'E)	Rohan Clarke
16.04.99	4	Karumba, QLD (17°20'S 140°50'E)	A Riegen
05.09.99	1	Manly Harbour, QLD (27°22'S 153°10'E)	QWSG
SOUTH KOREA			
09.05.98	1	Kanghwa Island (37°34'N 126°23'E)	Jin-Young Park
CHINA			
09.05.99	2	Yalu Estuary (39°50'N 123°44'E)	J Wilson

There are not many sightings of Red Knot outside New Zealand. Only one record from Victoria is quite surprising compared to the 100 or so Victorian flagged (orange) Red Knot sightings in New Zealand. Many of the banded birds from Victoria recovered in New Zealand, were banded as first or second year birds, so it is possible that once they reach New Zealand they do not return in subsequent years to Victoria but instead return directly to New Zealand.

BAR-TAILED GODWIT

DATE SEEN	QTY	LOCATION	OBSERVER
NEW ZEALAND			
MANUKAU HARBOUR			
19.05.95	1	Seagrove	T Habraken
24.11.96	2	Pollok Spit	T Habraken
13.11.96	1	Airport	T Habraken
14.02.94 - 02.03.98	1/3	Conifer Grove	E Ward
many sighting between these dates by Eilane Ward who visited this site on a regular basis.			
24.06.97 - 03.03.98	1	Mangere	R Clough
Four sightings between these dates			
KAIPARA HARBOUR			
05.06.93	1	Papakanui spit	G Pulham
19.06.93	1	Mairetahi	S Davies
26.06.93	1	Haranui Rd	T Habraken
26.11.95	1	Tapora South	D Watkins
29.09.96	1	Tapora South	Gavin Grant
05.01.97	2	Tapora South	A Riegen
12.03.97	5	Papakanui Spit	G Pulham
16.11.97	1	Haranui Rd	T Habraken
06.12.97	1	Papakanui Spit	G Pulham
06.03.98	1	Waikiri Ck	G Pulham
14.04.98	1	Waikiri Ck	J Dowding
22.11.98	1	Papakanui Spit	T Habraken

FIRTH OF THAMES			
17.11.96	3	Waihuo R.	T Habraken/CR Veitch
14.03.97	1	Mataitai	T Habraken
REST OF NORTH ISLAND			
24.10.93	1	Manawatu Est	P & R Slack
19.09.97	1	Manawatu Est	P & R Slack
06.02.98	1	Manawatu Est	R & D Batcheler
09.03.00	1	Matakana Is - BOP (37°28'S 175°59'E)	B Woolley
SOUTH ISLAND			
01.02.94	1	Farewell Spit	A Crossland
25.02.94 - 14.03.94	1	Farewell Spit	P Battley
15.01.95	1	Farewell Spit	P Battley
JAPAN			
01.04.92	1	Ariaka Sea (32°50'S 130°50'E)	J Thompson
17.04.95	1	Sone Tidal Flat (33°49'N 130°58'E)	Shin Ichi Hanawa
01.05.95	1	Sone Tidal Flat	?
06.04.96	1	Gannosa, Hakata Bay (33°40'S 130°25'E)	via Nial Moores
29.04.98	1	Nakatsu, Kyushu (33°36'N 131°13'E)	?
07.05.98	1	Sone Tidal Flat	?
REPUBLIC OF SOUTH KOREA			
18.04.98	1	Kanghwa Island (37°34'N 126°23'E)	Jeong-Yeon Yi
23.04.98	1	Kanghwa Is	Jin-Young Park
25.04.98	1	Namyang Bay (37°05'S 126°45'E)	Jeong-Yeon Yi
04.05.98	1	Aphaedo Mokpo (34°50'S 126°30'E)	Nial Moores
09.05.98	1	Kanghwa Is	Jin-Young Park
14.04.99	1	Kanghwa Is	Jin-Young Park
19.04.99	1	Mankyung Est (35°52'N 126°43'E)	Jin-Young Park
14.04.00	1	Kanghwa Is	Mark Barter
AUSTRALIA			
17.04.99	1	Moreton Bay - QLD (27°20'S 144°40'E)	M Waugh
13.10.99	1	Kooragang Is - NSW (32°56'S 151°47'E)	K Brandwood
CHINA			
03.05.99	1	(M) Yalu Est (39°50'N 123°44'E)	J Wilson
09.05.99	1	(F) Yalu Jiang	J Wilson
ALASKA			
04.09.99	8	Kushokwim R (60°00'N 163°00'W)	R Gill/B McCaffery

A much better crop of sighting of the Bar-tailed Godwit, mainly from southern Japan and South Korea. The two in early May from Yalu Jiang are interesting as this is the northern most part of the Yellow Sea and the point where birds depart for the breeding grounds. In spite of more Bar-tailed Godwits being banded since May 1999, none were seen at Yalu Jiang in the second half of May 2000. It is likely that birds from New Zealand had already passed through the area by then. As well, all the sightings from Japan and South Korea are in April or the first half of May and only on northward migration.

The birds in Alaska were seen with orange (Victoria) and green (Queensland) flagged birds but none from NW Australia. This provides more evidence that the Bar-tailed Godwits found in SE Australia and New Zealand are mostly *L. l. baueri.*

RUDDY TURNSTONE

REPUBLIC OF SOUTH KOREA			
05.09.97	1	Dongjin Est (35°49'N 126°42'E)	Jin-Young Park

Just a single record from anywhere other that the flagging sites.

ACKNOWLEDGMENTS

The NZWSG are very grateful to all those observers who take the trouble to scan the forest of shorebird legs on the mudflats and at roost sites. These sightings are very important and further our understanding of shorebird movements along the East Asian-Australasian Flyway. Please send all sightings of white-flagged birds to Adrian Riegen at the above address.

OCCASIONAL COUNTS NO 4

WADER COUNTS AT YANTABULLA SWAMP (CUTTABURRA BASIN), NEW SOUTH WALES, AUSTRALIA

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The Yantabulla Swamp, otherwise known as the Cuttaburra Basin, lies on the Warrego River, in northern inland New South Wales (29°15'S 144°51'E), about 150 kms N.W. of Bourke. It is well known as an important wetland and can support at least 40,000 waterbirds including very large numbers of ducks. It is also an important breeding site for many waterbird species. The swamp is covered in vast areas of lignum, but the southern end is an open lake when flooded. Waders have been recorded there during aerial surveys (Black-winged Stilt 3,576 and small waders 3,241) (Kingsford & Porter 1999).

In 1997, I was asked by the BBC to locate large flocks, and breeding concentrations, of Pink-eared Ducks, for their film "Extreme Ducks". I hired a plane in mid-September and flew down the Warrego and Paroo river systems in northern New South Wales, and over the Bullo Lakes in southern Queensland, at a height of about 300 feet. Especially large concentrations of ducks (about 25,000) were found on the Yantabulla Swamp near the Thoura station. I stayed at the station for two days. At that time the water level was quite high and flowed back into the lignum surrounding the lake, and there were few waders.

I went back to the lake in mid-October 1997 with the BBC to film the ducks. By then, the water levels had dropped, and the lake was nowhere more than knee deep. There were large numbers of waders on the wet mud. The lake was then about 4 kms^2 in size. Table 1 shows the count made on 14 October, while we were filming the ducks. Also shown are numbers estimated from the air and given in Kingsford & Porter (1999) at sites along the Paroo and Warrego rivers, and numbers recorded as of national and international importance in Watkins (1993). The former authors also state that migratory waders are common at lakes Numalla and Whyara at the Currawinya National Park (a Ramsar site) in southern inland Queensland and can occur in numbers exceeding 10,000.

The numbers of Sharp-tailed Sandpipers at the Yantabulla Swamp recorded in October 1997 represent 4.2% of the estimated Flyway population and the Marsh Sandpipers 2.2% of the estimated Australian population. The earlier count of Black-winged Stilts represents 1.2% of the estimated Australian population (Watkins 1993).

DISCUSSION

It was surprising to find such large concentrations of waders occurred on such a small area. The Paroo and Warrego rivers are of special interest in that they are the only river systems in the Murray Darling Basin catchment that have not been developed. Also they flood comparatively frequently — approximately every four years.

There is little detailed knowledge about the waders in these catchments. Yantabulla Swamp has not previously been recognised as being of international importance for waders. A scientific workshop was held at Hungerford from 7-9 July 1997 where all interested parties, including landholders, were invited to attend. Landholders and the scientists both made five recommendations. In summary, the meeting recommended that the water in these rivers should not be developed (Kingsford 1999). From conversation with the landholder at Thoura in October 1997, it was obvious that the pastoralists were dependent on the water flows for their stock and grazing land, and were therefore interested in some form of legal protection for the rivers.

The wader concentrations throughout much of inland Australia are not well documented, although it is known that large numbers often occur there. Following the good rains in early 2000, the AWSG would encourage people to do detailed counts in the 2000/2001 season as the drying wetlands are likely to provide optimal conditions for many species. We request any further information on the waders of the Paroo/Warrego river systems be passed on to the count coordinator.

The Cuttaburra Basin is easily accessible, and in good weather can be reached from the Thoura station by two-wheel drive vehicle. The landholders in 1997, Chris and Kate Eagles, have since left the station and there are now new landholders, who should of course be contacted before visiting the site.

ACKOWLEDGEMENTS

Many thanks to Chris and Kate Eagles of the Thoura station for introducing me to the wonderful hospitality of outback Australia. My apologies for bringing flowers when I should have brought beer (I was new to Australia) and for scaring the wits out of you (and myself) when we flew low over the lake. I also thanks Mary Colwell and the BBC for financing my first trip into the Australian outback.

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Table 1. Wader counts at the Yantabulla Swamp in 1997 and other sites on the Paroo and Warrego River systems.

Species	1997	Kingsford & Porter 1999								Watkins 1993				
	Yantabulla Swamp	Blue Lake	Mullawoolka Basin	Nichebulka Lake	Peery Lake	Poloko Lake	Lake Wyara	Yantabangee Lake	**Yantabulla Swamp**	Lake Numalla	Nichebulka Lake	Paroo Floodplain	Wilcannia Wetlands	Wongalarroo Lake
Marsh Sandpiper	200									500				
Common Greenshank	10													
Red-necked Stint	1													
Sharp-tailed Sandpiper	7000									2000				
Curlew Sandpiper	3													
Black-winged Stilt	400								3272			5127		
Banded Stilt				10047			4680							
Red-necked Avocet	142	1301	4571		2123	3722	11965	12680			7800	14540	2000	6320
Red-capped Plover	50											2380		
Red-kneed Dotterel	5													
Masked Lapwing	50													
Australian Pratincole	7													
Unidentified small waders							2530		3241					
Total waders	7868	1301	4571	10047	2123	3722	19175	12680	6513	2500	7800	22047	2000	6320

A SURVEY OF SOUTH AUSTRALIAN WADERS IN EARLY 2000

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INTRODUCTION

In January and February 2000, the AWSG and the South Australian Ornithologists Association counted waders over extensive areas of coastal South Australia. Four main zones were covered on the ground, Gulf St Vincent, Spencer Gulf, western Eyre Peninsula westwards to the Ceduna area, and the Coorong. The Spencer Gulf and western Eyre Peninsula were also counted from the air by Peter Driscoll in his microlight aeroplane. The results have been published in a 94 page report (Wilson 2000a). This paper summarizes the counts and the main findings of the survey. Anybody wishing for more details of the methods, or the results should refer to the report. This has been deposited in the Birds Australia library in Melbourne and the CSIRO library in Canberra. It can also be bought for $20 from Jim Wilson or Ken Gosbell (for addresses see the inside front cover of this issue of *The Stilt*).

RESULTS

Gulf St Vincent

The total number of waders counted in the Gulf of St Vincent was 45,764 compared with a population estimate of 177,010 in Watkins (1993) and represented a 74% decline in numbers (Table 1). The 1993 estimates were based on counts modified by local experience of what the populations were believed to be. The best indication of any major changes is made by either comparing the comprehensive 1981 survey or the counts of the two saltfields, Penrice and Price, and Clinton Conservation Park (Close & McCrie 1986) with the 2000 survey. Some of the 1981 counts are included in Close & McCrie, so the two old data sets partly overlap. The 1981 counts gave 66,730 waders compared with 45,764 (37.4% decrease) and the 1986 publication 59,663 waders compared with 26,877 (55% decrease). The changes in populations of individual species in South Australia are discussed below.

Watkins (1993) listed seven sites of international or national significance in the northern Gulf St Vincent. These sites were still important in 2000, but in the report it was decided to list the northern shores of the Gulf St.Vincent, which have 100 kms of continuous intertidal mudflats and two large saltfields, as one unit. This is because there must be considerable movement between sites for some species. Also Watkins (1993) did not recognise that waders roosting in the saltfields at high tide fed on the adjacent mudflats. The report recommends that the whole northern shore of the Gulf St Vincent is designated a Ramsar Site. In 2000, these areas and adjacent saltfields held 39,170 waders with seven species of international significance and three more species of national significance.

Spencer Gulf

The total count of waders in Spencer Gulf, based on ground counts and aerial surveys was 38,199 (Table 2). This figure is an increase of 49% compared with the 25,610 in Watkins (1993). A few areas of minor importance were not counted in 2000, but the previous counts from these were included in the overall population estimates. The increase is undoubtedly due to better coverage from the air and the ground. In particular, an unknown roost site was found south of Port Davis, and many Common Greenshanks were counted from the air on long stretches of coast that had never been visited on the ground.

Watkins (1993) listed the Spencer Gulf as internationally important for ten species and nationally important for a further two species. The number of species of international and national importance was reduced by two as Curlew Sandpipers and Sanderlings no longer reached significant levels. As found along the whole of the South Australia coast, the number of Curlew Sandpipers have crashed (see below). Also the national significance of Sanderlings seems to have been based on one sighting of a flock of Sanderlings at Tumby Bay and none were seen in 2000.

The coastline of Spencer Gulf is 600 kms long, measured between headlands, and 140 kms across at the mouth. There are long stretches of coast with few or no waders. It is misleading to list huge chunks of coastline with discontinuous wader populations, and this has no practical meaning in terms of protection of wader sites. In the report, there is only one coastline complex which is considered to be worthy of consideration for Ramsar nomination. This includes the mudflats and mangroves south of Port Pirie, and the associated roost sites at Ward Spit and south of Port Davis.

Table 1. The counts of waders in Gulf St Vincent during the 2000 survey and counts made during previous surveys in 1981 and published counts from Penrice and Price Salfields and Clifton Conservation Park (Close & McCrie 1986). The population estimate for Gulf St Vincent in Watkins (1993) are shown along with the species in nationally (N) and internationally (I) significant numbers in 2000.

Species	West		North Gulf		Total Gulf		Change	Saltfield and Clifton			Total Gulf		Significance
	1981	2000	1981	2000	1981	2000	(%)	1986	2000	Change (%)	2000	Watkins 1993	
Black-tailed Godwit			149	1	149	1	-99	94			1	200	
Bar-tailed Godwit		1	1661	742	1661	743	-55	1066	400	-62	743	1250	
Whimbrel			90	20	90	20	-78	5	20	300	20	90	
Eastern Curlew	9		145	120	154	120	-22	178	102	-43	120	300	
Marsh Sandpiper			48	156	48	156	225	67	111	66	156	350	N
Common Greenshank	233	191	963	614	1196	805	-33	615	318	-48	805	1250	I
Wood Sandpiper				38		38					38	*	
Terek Sandpiper			2	1	2	1	-50				1	5	
Common Sandpiper	1		15	6	16	6	-63		2		6	80	
Grey-tailed Tattler	10		56	3	66	3	-95				3	100	
Ruddy Turnstone	49	130	162	212	211	342	62	95	190	100	342	600	N
Great Knot	3		630	702	633	702	11	500	500	0	702	2000	
Red Knot			770	2019	770	2019	162	864	2000	131	2019	4000	N
Unidentified Knot								400					
Red-necked Stint	2947	1460	21772	13582	24719	15042	-39	19200	7000	-64	15042	60000	I
Long-toed Stint				4		4					4		
Pectoral Sandpiper				4		4					4		
Sharp-tailed Sandpiper	798	209	16864	6801	17662	7010	-60	12500	3874	-69	7010	17000	I
Curlew Sandpiper	812	316	6105	1480	6917	1796	-74	6300	1237	-80	1796	30000	
Pied Oystercatcher		21	27	86	27	107	296	9	3	-67	107	450	
Sooty Oystercatcher	19	7	102	140	121	147	21				147	120	I
Black-winged Stilt			338	458	338	458	36	590	306	-48	458	3000	
Banded Stilt	2	21	5288	9985	5290	10006	89	13100	9512	-27	9016	50000	I
Red-necked Avocet		3	1267	38	1267	41	-97	1100	38	-97	41	740	
Pacific Golden Plover	11		47		58		-100				0	60	
Grey Plover	56	51	930	451	986	502	-49	424	255	-40	502	1500	I
Red-capped Plover	355	123	3525	1228	3880	1351	-65	2305	851	-63	1351	3600	I
Double-banded Plover			1		1		-100				**	300	
Lesser Sand Plover			5	3	5	3	-40				3		
Greater Sand Plover			26		26		-100						
Black-fronted Dotterel				9		9					9	5	
Hooded Plover		2				2					2		
Red-kneed Dotterel			2	64	2	64	3100	103	29	-72	64	10	
Masked Lapwing	25	54	410	198	435	252	-42	148	129	-13	252	*	
Unidentified wader***											5000		
TOTAL	5330	2589	61400	39165	66730	41754	-37	59663	26877	-55	45764	177010	
								Resident waders			11447	57925	
								Migrant waders			34317	119085	

* no estimate given

** none seen in 2000 - this is a winter visitor

*** estimate of wader numbers on areas not counted

Table 2. The counts of waders in Spencer Gulf during the 2000 survey. The population estimates for the Spencer Gulf (Lane 1987, Watkins 1993) are shown along with the species in internationally (I) and nationally (N) significant numbers in Watkins (1993) and during the 2000 survey.

Species	This study			Port Victoria-	Banks Grp	Grand	Lane	Watkins	Importance	
	East Gulf	West Gulf	Total	Hardwicke Bay	Port Lincoln	Total	1987	1993	1993	2000
Black-tailed Godwit						0	1			
Bar-tailed Godwit	462	50	512			512	600	600		
Whimbrel						0	1	5		
Eastern Curlew	44		44	1		45	46	50		
Marsh Sandpiper	2	1	3			3	25	25		
Common Greenshank	542	501	1043	19	16	1078	320	320	N	I
Terek Sandpiper						0	2			
Grey-tailed Tattler	6		6			6	16			
Ruddy Turnstone	154	1	155	31	102	288	470	470	I	N
Great Knot	14		14			14	1300	1300		
Red Knot	6937		6937			6937	4750	4750	I	I
Sanderling					4	4	100	100	N	
Red-necked Stint	8296	5159	13455	821	329	14605	7600	7600	I	I
Sharp-tailed Sandpiper	1487	1429	2916	8	30	2954	2730	2730	I	I
Curlew Sandpiper	362	372	734	82		816	2500	2500	I	
Pied Oystercatcher	143	200	343	18	80	441	200	400	I	I
Sooty Oystercatcher	21	44	65	56	87	208	100	100	I	I
Black-winged Stilt	30	29	59			59	23	25		
Banded Stilt	5890	1450	7340			7340	1900	1900	I	I
Red-necked Avocet		1	1			1	28	30		
Pacific Golden Plover	18		18	2		20	21	20		
Grey Plover	358	94	452			452	740	750	I	I
Red-capped Plover	722	493	1214	192	215	1621	1910	1900	I	I
Lesser Sand Plover	4		4			4	7			
Greater Sand Plover						0	8			
Oriental Plover						0	10			
Black-fronted Dotterel						0	11	10		
Hooded Plover		2	2	13		15	17	25		
Red-kneed Dotterel	1		1			1	2			
Banded Lapwing	4		4	487		491				
Masked Lapwing	24	9	33	154	97	284				
TOTAL	25519	9836	35355	1884	960	38199	25438	25610		
				Total resident waders		10461	4191	4390		
				Total migrant waders		27738	21247	21220		

Western Eyre Peninsula

The total count of waders on the western Eyre Peninsula, which is based on ground and aerial counts, was 42,421 birds compared with 19,375 in Watkins (1993) and is an increase of 120% (Table 3). This increase is undoubtedly due to better coverage. All the sites listed by Watkins (1993) as internationally or nationally important were found to be still important except for Lake Newman where there were only 25 Banded Stilts. This was probably because birds had gone inland to breed in 2000, rather than the result of any real change (see below).

Several new sites of significance were also found (Table 4) Two hundred Sanderlings were seen from the air at Lake Newland Beach. Aerial counts also showed that Venus Bay was internationally important for Pied and Sooty Oystercatchers. These two sites have still never been counted on the ground. Two of the most important sites were at Eyre and St Peter Islands and both had never previously been counted. A full report of the results from these sites has been given elsewhere (Wilson 2000b). Murat Bay and Tourville Bay near Ceduna have only been counted once before. The bays around Ceduna and these two islands, all lying within a 50 km stretch of coastline, are recommended in the report for consideration of Ramsar nomination. The complex has over 20,000 waders and 9 species of international importance.

One of the most surprising findings of the South Australian surveys was that the western Eyre Peninsula had more waders than Spencer Gulf, and that the importance of the Ceduna area had not been appreciated.

The Coorong

The total number of waders counted in the Coorong was 60,249, much lower than the 141,614 counted in 1981, 234,543 in 1982, or 127,419 in 1987. The 1981 and 1987 counts did not include the ocean beach which is mainly important for Pied Oystercatchers, Hooded Plovers and Sanderlings (Table 5).

Although there were very large declines in counts of many species in 2000 (see below), there were eight species recorded as internationally significant. The Coorong was still amongst the top ten wader sites in Australia and is a Ramsar site. There are concerns about the low volumes of fresh water now entering the Coorong due to extraction further upstream in the Murray. Apart from monitoring wader populations, the possible environmental problems facing the Coorong were not studied in this survey.

Population changes of selected species

Bar-tailed Godwit

Compared to older counts, the numbers of Bar-tailed Godwits were down in the Gulf St Vincent (-55% to -63%). Estimates were similar in Spencer Gulf and there was a large increase on the western Eyre Peninsula (1,415 vs 150) due to new sites being found. Given these differences, it is not possible to say whether there has been a real change in the population.

Eastern Curlew

Historically there have been large declines in populations of Eastern Curlews in South Australia (Close & Newman, 1984). Compared to old counts, the numbers in Gulf St Vincent and the Coorong were slightly lower in 2000. More were recorded on the western Eyre Peninsula than in earlier surveys due to new sites being found. From the limited data it is not possible to say whether there has been a real population change.

Common Greenshank

The number of Common Greenshanks was down in the Gulf St Vincent (-33% to -48%) compared to older count numbers. Estimates trebled from 320 to 1,078 in Spencer Gulf and almost doubled on the western Eyre Peninsula from 580 to 965. This is probably due to better coverage. Numbers in the Coorong showed a small decline from1982 and 1987, which may not be significant (1981: 600, 1982: 797, 1987: 596, 2000: 557). Overall, there is a suggestion of a decline, but this may not be real. The total estimated population in the survey areas was 3,405 or 22% of the estimated Flyway population. It would seem that the Flyway estimates are too low.

Red Knot

More Red Knot were recorded in Gulf St Vincent than in the earlier counts, although the higher numbers have been recorded in other years than shown here. They gave an earlier estimate of 4000 birds. Estimates increased in Spencer Gulf (6,937 vs 4,750) and the western Eyre Peninsula (3,007 vs 710) due to new sites being found. There is no real evidence to suggest any population changes.

Sanderling

Sanderlings are known to move large distances along the southern Australian coastline (VWSG data). In this study, 17 leg flagged birds were seen. At Coffin Bay on the western Eyre Peninsula, three Victorian leg flags were seen. In the Coorong, there were two birds from north-western Australia (caught on migration through there), four from Victoria and eight from S.E. South Australia. The total population estimate of Sanderling increased by 23% (1,897 vs 1,540), but this includes one new site with 200 birds near Lake Newland. One off counts from individual sites in such a mobile species cannot be used to give reliable measures of population changes.

Table 3. The counts of waders on the western Eyre Peninsula during the 2000 survey from both the ground and air and the conversion factor for the aerial counts. The previous count of the region between Tourville Bay and Point Adieu in 1984 and the 2000 count for the same region are shown along with the population estimates for the western Eyre Peninsula in Watkins (1993) and the percentage change in the estimated populations.

	Ground	Air counts	G-A factor	Total	1984	2000	Watkins 1993	Change (%)
Bar-tailed Godwit	1415			1415		1415	150	843
Whimbrel	32			32		32	5	540
Eastern Curlew	73			73		73	25	192
Marsh Sandpiper	2			2		2	60	
Common Greenshank	857	65	1.4	948	17	965	580	66
Common Sandpiper	3			3	1	4		
Grey-tailed Tattler	7			7		7	50	
Ruddy Turnstone	885			885	12	897	780	15
Great Knot	519			519		519	230	126
Red Knot	3007			3007		3007	710	324
Unidentified Knot	100			100		100		
Sanderling	741	330	1.8	1335	35	1370	510	169
Red-necked Stint	14077			14077	618	14695	8500	73
Sharp-tailed Sandpiper	2142			2142	41	2183	1740	25
Curlew Sandpiper	1333			1333	146	1479	920	61
Pied Oystercatcher	1168	449	1.4	1797	11	1808	450	302
Sooty Oystercatcher	549	206	1.3	817	33	850	450	89
Black-winged Stilt	0			0		0	50	
Banded Stilt	56			56	1495	1551	1340	16
Red-necked Avocet	0			0	3	3	310	-99
Pacific Golden Plover	31			31	2	33	20	65
Grey Plover	2070			2070	3	2073	1300	59
Red-capped Plover	1633			1633	264	1897	1050	81
Lesser Sand Plover	72			72		72		
Greater Sand Plover	18			18		18		
Oriental Plover	600			600		600		
Black-fronted Dotterel	0			0		0	140	
Hooded Plover	19			19	11	30		
Red-kneed Dotterel	0			0		0	5	
Banded Lapwing	360			360		360		
Masked Lapwing	84	184	1	268		268		
Unidentified medium wader		474	1.4	664		664		
Unidentified small wader		3026	1.8	5447		5447		
Total	31853	4734		39729	2692	42421	19375	119
			Resident waders			6766	3795	78
			Migratory waders			35654	15580	129

Table 4. Sites of international (I) and national (N) importance on the western Eyre Peninsula recorded in the 2000 survey and in Watkins (1993).

		Watkins 1993		This study	
Site	Species	Number	Imp	Number	Imp
Sleford Bay	Sanderling	200	I	100	N
Gunyah Beach	Sanderling	350	I	199	I
Avoid Bay	Sanderling	88	N	108	N
Coffin Bay wetlands	Sanderling	350	I	263	I
	Pied Oystercatcher	110	I	241	I
	Sooty Oystercacher	82	I	82	I
	Grey Plover	400	I	269	I
Lake Newman	Banded Stilt	2400	I	25	?
Lake Newman beach	Sanderling			200	I
Venus Bay	Pied Oystercatcher			255	I
	Sooty Oystercatcher			119	I
Baird Bay	Sooty Oystercatcher			94	I
	Grey Plover	444	I	157	N
Sceale Bay	Ruddy Turnstone	231	N	180	N
	Sanderling	135	I	201	I
Streaky Bay	Ruddy Turnstone	179	N	60	
	Grey Plover	325	I	170	I
Eyre Island	Common Greenshank			263	N
	Pied Oystercatcher			251	I
	Sooty Oystercatcher			93	I
	Grey Plover			657	I
	Oriental Plover			600	I
St Peter Island	Ruddy Turnstone			161	N
	Pied Oystercatcher			180	I
	Sooty Oystercatcher			93	I
	Grey Plover			295	I
Murat Bay	Ruddy Turnstone	171	N	56	
	Sooty Oystercatcher	163	I	107	I
	Grey Plover	123	N	81	
Tourville Bay	Common Greenshank	260	N	301	N
	Pied Oystercatcher	136	I	389	I
	Sooty Oystercatcher	122	I	84	I
	Grey Plover	310	I	290	I
Ceduna Bays and Islands	Common Greenshank			720	I
(Inc Eyre & St Peter Island,	Ruddy Turnstone			385	I
Murat & Tourville Bay)	Red Knot			2788	I
	Red-necked Stint			6157	I
	Pied Oystercatcher			897	I
	Sooty Oystercatcher			399	I
	Grey Plover			1440	I
	Oriental Plover			600	I
	Banded Lapwing			360	I

Table 5. The counts of waders in the Coorong during the 2000 survey. Also shown are counts in 1981 (excluding beach), 1982 (included beach) and 1987 (excluded beach), population estimates in Watkins (1993) and species in nationally (N) and internationally (I) significant numbers in Watkins (1993) and in the 2000 survey.

Species	Total ex beach 1981	Total inc beach 1982	Total ex beach 1987	Total Coorong 2000	Total inc beach 2000	Watkins 1993	Importance 2000	Importance 1993
Black-tailed Godwit	133	185	105	210	210	150		
Bar-tailed Godwit	15	0	3	8	8	25		
Eastern Curlew	17	24	8	15	15	24		
Marsh Sandpiper	0	2	30	0	0	30		
Common Greenshank	600	717	596	557	557	650	I	I
Common Sandpiper	13	1	1	0	0	5		
Ruddy Turnstone	0	1	0	1	1			
Great Knot	3	4	0	1	1	5		
Red Knot	57	67	0	80	80	100		
Sanderling	113	929	308	512	527	930	I	I
Red-necked Stint	54743	63794	54710	30145	30168	60000	I	I
Pectoral Sandpiper	0	1	0	0	0			
Sharp-tailed Sandpiper	24871	55739	22898	10697	10697	35000	I	I
Curlew Sandpiper	39882	22614	22512	13124	13124	22000	I	I
Pied Oystercatcher	108	297	84	92	618	630	I	I
Sooty Oystercatcher	0	0	3	3	16	18		
Banded Lapwing	0	248	130	0	0	150		
Black-winged Stilt	238	991	291	340	340	600		
Banded Stilt	13782	77149	18692	11299	11299	30000	I	I
Red-necked Avocet	1449	5401	3589	93	93	4500		I
Pacific Golden Plover	289	230	144	84	84	290		N
Grey Plover	1	0	0	12	12			
Red-capped Plover	4677	5152	2533	1089	1137	4000	I	I
Double-banded Plover	0	0	1	0	0	150		
Oriental Plover	18	0	0	0	0			
Black-fronted Dotterel	0	2	0	0	0	15		
Hooded Plover	0	0	12	3	28			
Red-kneed Dotterel	14	17	0	0	0	10		
Masked Lapwing	591	978	765	233	233	800		
Cox's Sandpiper	0	0	1	0	0			
Ruff	0	0	0	1	1			
Red-necked Phalarope	0	0	3	0	0			
TOTAL	141614	234543	127419	68599	69249	160082		
			Resident waders		13764	40723		
			Migrant waders		55485	119359		

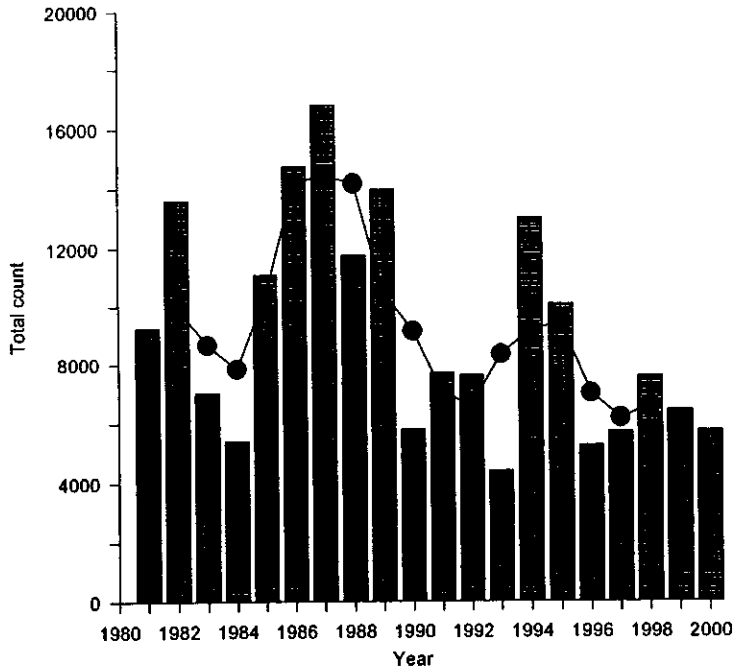

Figure 1. The combined summer counts of Red-necked Stint at six sites in Victoria (Altona, Bellarine Peninsula/Mud Is, Corner Inlet, eastern Port Phillip Bay, Werribee, Westernport Bay) since 1981 and the 3-year moving average. Data are from the AWSG population monitoring project.

Red-necked Stint

In Gulf St Vincent, numbers were down 39% and 64% compared with the earlier counts. Estimates increased for Spencer Gulf by 92% (14,605 vs 7,600) and on the western Eyre Peninsula by 73% (14,695 vs 8,500). These increases are at least partly due to better coverage. Numbers of Red-necked Stint in the Coorong were down by 53% (30,168 vs 63,794) for the 1982 count and down 45% (30,168 vs 54,710) on the 1987 count. Overall, the data suggests that there had been a decline in the number of Stints. This decline is not matched by the population monitoring data from Victoria, where numbers seem to have been fairly stable over the last 20 years (Fig. 1). As with Sharp-tailed Sandpipers, birds may have been using inland wetlands more in 2000 than previously.

Sharp-tailed Sandpiper

In Gulf St Vincent, there was a decline of 60% and 69% compared with earlier counts. Numbers in Spencer Gulf and western Eyre Peninsula were similar to the 1993 estimates (2,954 vs 2,730 and 2,183 vs 1,740 respectively). These counts were in spite of better coverage and suggest there may have been a decline. In the Coorong, numbers were down 81% from 1982 and 53% from 1987. The data from all areas surveyed in 2000 suggests that there were very large declines. Counts from all sites in the population monitoring project in Victoria shows that 1982 and 1987 may have been good years for Sharp-tailed Sandpipers (Fig. 2), thus inflating the earlier Coorong counts. It is not known if the cause of the low numbers in South Australia in 2000 was because birds were using inland wetlands, or if there has been a real decline in the total population.

Curlew Sandpiper

In Gulf St Vincent, the numbers of Curlew Sandpiper were down 74% and 80% compared with earlier counts. In Spencer Gulf, the new estimate was down by 67% (816 vs 2,500), in spite of better coverage. On the western Eyre Peninsula, estimates increased by 61% (1,479 vs 920), probably due to better coverage. In the Coorong numbers were down 67% from 1981 (13,124 vs 39,882), down 42% from 1982 (22,614) and down 42% from 1987 (22,512). In Victoria, there have been similar large declines in Curlew Sandpiper numbers (Fig. 3). Large declines from the 1980s have also occurred in S.W. Australia (Mike Bamford pers comm) and in S.E. Tasmania (AWSG Population Monitoring Project).

Pied Oystercatcher

Although Pied Oystercatcher population estimates in the Gulf St Vincent were down from those in 1993 (107 vs 450), the counts were up from 27 in 1981. Counts for Spencer Gulf (441) were up on the previous estimate of 400. The estimate for western Eyre Peninsula (1,808) was a considerable increase from the previous estimate (450), probably due to better coverage. In the Coorong, the estimated numbers remained the similar (618 vs 630). The total population estimate in the four survey areas increased by 54% suggesting that numbers are either stable or increasing. Based on the Watkins (1993) estimates of total Flyway numbers, the survey area held

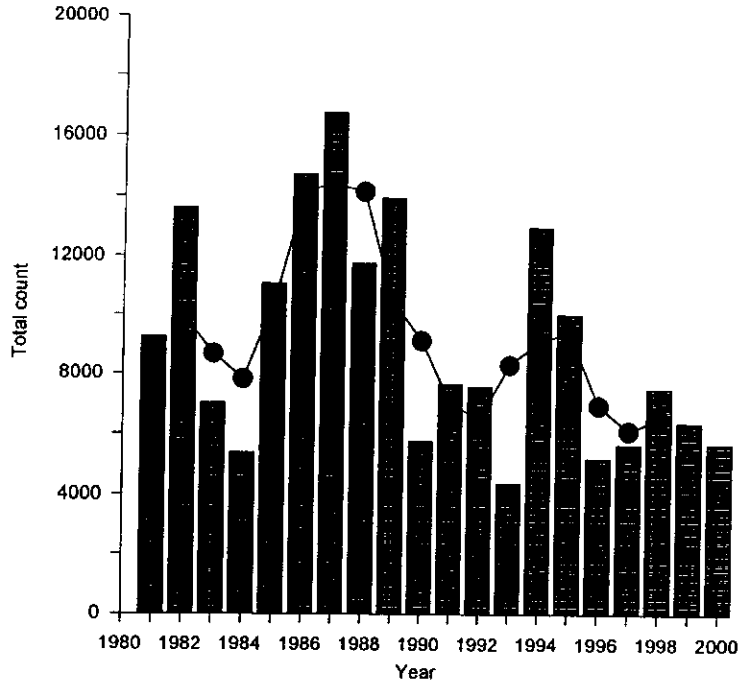

Figure 2. The combined summer counts of Sharp-tailed Sandpiper at six sites in Victoria (Altona, Bellarine Peninsula/Mud Is, Corner Inlet, eastern Port Phillip Bay, Werribee, Westernport Bay) since 1981 and the 3-year moving average. Data are from the AWSG population monitoring project.

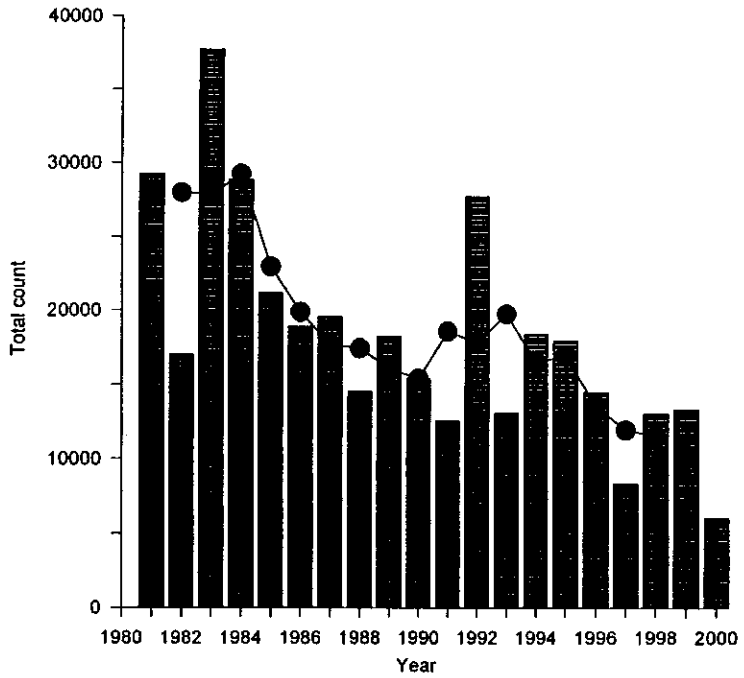

Figure 3. The combined summer counts of Curlew Sandpiper at six sites in Victoria (Altona, Bellarine Peninsula/Mud Is, Corner Inlet, eastern Port Phillip Bay, Werribee, Westernport Bay) since 1981 and the 3-year moving average. Data are from the AWSG population monitoring project.

27% of Pied Oystercatchers in the Flyway. However, the Flyway population size is probably underestimated.

Sooty Oystercatcher

In Gulf St Vincent the population at the internationally important site at Port River (147) had increased from the 1993 estimate (120). The estimate for Spencer Gulf increased from 100 to 208, and that on the western Eyre Peninsula from 450 to 850. The combined Sooty Oystercatcher population estimate increased by 77%. This increase is probably mostly due to better coverage during the 2000 survey. Based on Watkins' (1993)

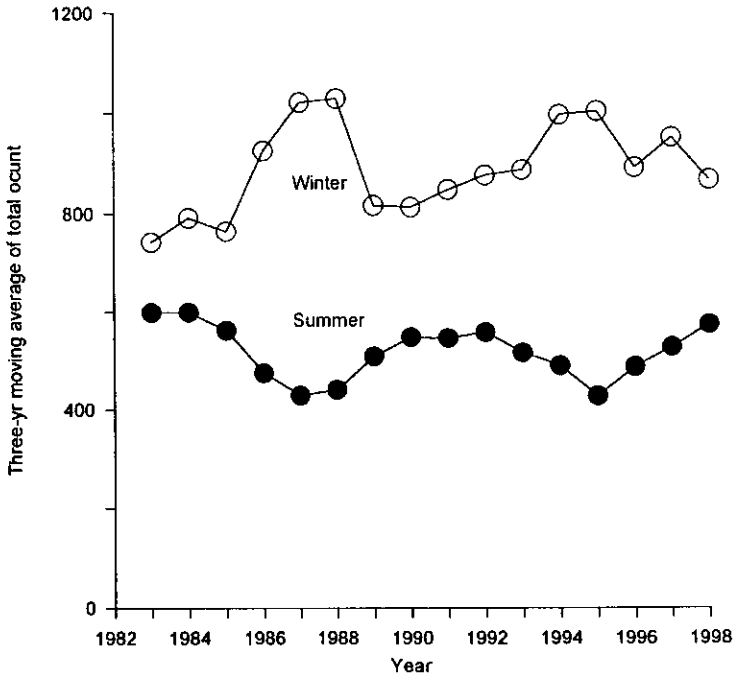

Figure 4. The 3-year moving average of the combined summer and winter counts of Red-capped Plover at six sites in Victoria (Altona, Bellarine Peninsula/Mud Is, Corner Inlet, eastern Port Phillip Bay, Werribee, Westernport Bay) since 1981. Data are from the AWSG population monitoring project.

estimates of the total Flyway population, the survey area held 30% of the Sooty Oystercatchers in the Flyway and suggests that the Flyway population size is probably underestimated.

Banded Stilt

Numbers of Banded Stilt were generally down throughout the survey area. It seems unlikely that the breeding event at Lake Eyre in 2000 was the direct cause of the decline, as the lake flooded towards the end of the 2000 survey. However, there may have been enough water in other inland areas in 2000 to draw the Banded Stilts away from the coast, and these birds may have later bred in Lake Eyre.

Red-necked Avocet

Only 135 Red-necked Avocets were recorded throughout the survey area compared with the previous population estimate of 5,580. Comparing individual counts, numbers were well down at all sites where Avocets normally occur. The inference must be that birds had gone inland to breed in 2000.

Pacific Golden Plover

No Pacific Golden Plover were recorded in Gulf St Vincent compared to the 1993 estimate of 60. Elsewhere, the numbers in Spencer Gulf were the same as previous estimates (20); the count on the western Eyre Peninsula was higher (33 vs 20), but half of previous counts on the Coorong (84 against 144 to 289). Some birds may have been missed in the Coorong in 2000 as a known Golden Plover site west of the Murray Mouth was not visited. Overall, the figures suggest that there may have been a decline in the species. There was a national decline in the number of Pacific Golden Plover in the 1980s and early 1990s (Harris 1994).

Red-capped Plover

In Gulf St Vincent, there was a 63-65% decline in the count of Red-capped Plover compared with earlier counts. In Spencer Gulf, estimates were down by 14%, in spite of better coverage and the decline can be traced at several sites (see report). Increases on the western Eyre Peninsula (1,897 vs 1,050) were probably due to better coverage. In the Coorong, numbers showed a decline between 1982 (5,152) and 1987 (2,533) and then again in 2000 (1,137). Overall, there seemed to have been a very large decline in numbers of Red-capped Plovers. The new estimate for the Coorong (1,137) is about a third of the previous estimate (4,000). Data from Victoria for the AWSG Population Monitoring Project show large fluctuations in summer counts. Low numbers in summer tend to coincide with peaks in the winter (Fig. 4). The inference is that when the summer numbers are low it indicates that birds are breeding inland. The winter counts appear to be inflated by juveniles; when summer numbers are high the inland wetlands are dry and little breeding takes place, resulting in low winter counts. The inland near the coast of South Australia was very dry in 2000, so one would have expected high numbers of Red-capped Plovers on the coasts. However, birds could have moved to other parts of Australia where there was a good

wet season. From the 2000 counts alone, it is not possible to show whether the decline is an artefact of good inland breeding conditions, or if it is a real decline.

ARE THE POPULATION CHANGES SEEN IN 2000 REAL AND DO THEY REFLECT CHANGES IN THE FLYWAY POPULATIONS ?

It must be recognised that the 2000 count is from only one point in time. Comparing this count with similar one-off counts or estimates from up to 20 years ago, is subject to unquantifiable errors. Small changes would not be detectable. However, some changes in populations are unexpectedly large and deserve further comment.

Most of those species with the largest declines are resident species that use inland wetlands to breed (Red-capped Plover, Banded Stilt, and Red-necked Avocet), or migrants that use inland wetlands extensively (Sharp-tailed Sandpiper, Red-necked Stint). Wetlands near the South Australia coast were very dry in 2000. Many had dried up, and others, such as Lake George, were at the lowest levels for many years. However, there were floods in the inland of southern Queensland and northern New South Wales before the survey, and Lake Eyre began to flood at the end of the survey. Resident species had probably moved inland. Sharp-tailed Sandpipers and Red-necked Stints may have moved inland, or stopped off further north on their southward migration. Thus, from the 2000 survey, we cannot make any definitive statement as to whether or not there have been real changes in the populations of these species.

Common Greenshanks also use inland wetlands, although once they have started using a site on the coast they may then remain faithful to that site. From the present data it is uncertain if there have been changes in the population.

The numbers of Curlew Sandpipers, which use inland wetlands to a lesser extent, do seem to have crashed throughout southern Australia. The crash must be caused by factors occurring on migration or poor breeding success, rather than local factors in Australia. It is not known whether this crash represents a return to pre-1980 populations, (although there are a few old data sets that may show whether this is true) or a long-term decline in the size of the population.

Species that are strictly coastal do not generally seem to show the same dramatic decline as species that also use the inland. The data suggests that populations of both Oystercatchers might be stable, or even increasing. For coastal migrant species, some populations seem to be stable and others to show some decreases. But, given the way the data has been collected, one cannot be confident about any changes. However, large increases, or the dramatic decreases recorded for other species that also use the inland, were not apparent in the strictly coastal waders.

The very large decreases of many species in the Coorong are a cause of concern, because there is evidence that the Coorong may be under "stress". However, this one survey could not identify whether the declines in the Coorong were wholly or partly a reflection of a wider pattern, or were also due to environmental factors within the Coorong. More frequent surveys in the Coorong would help to resolve this question.

DISCUSSION

Waders were counted throughout Australia from 1981 to 1985 as part of the RAOU wader project (Lane 1987, Watkins 1993). This original survey was followed by the regular counts project from 1986 to 1990. During this project, certain sites were counted every month (Alcorn *et al.* 1994). Wader counting has continued at 23-30 sites in February and June each year as the AWSG Population Monitoring Project. There has also been many other wader counts, some quite comprehensive, in other parts of Australia since the end of the initial RAOU project. However, the South Australia survey highlighted the fact that there are sites which have never been counted (even sites of international importance), or only counted once at one time of year. This is particularly true at inland sites. It is important to have population estimates as accurate as possible, as conservation decisions are being based on these estimates. Populations will change over time, but this survey has shown that, even over 20 years, the importance of most sites has not changed. The survey shows that it is important to continue the 1981 to 1985 count programme in some form or other.

The previous importance of some sites were based on counts from roost sites and not from their associated feeding areas. An example of this is the saltfields of Price and Penrice. Apart from being feeding areas themselves, these saltfields are also roost sites for other birds feeding on the adjacent mudflats. These mudflats are not listed as being of international importance. In the future, more attention must be focussed on recording feeding, as well as roosting areas.

The Ramsar Convention calls for monitoring of Ramsar sites. However, in order to interpret changes at a site, monitoring is of limited value for waders unless one also knows what is happening to the overall population. This was illustrated by the work in the Coorong. Although there have been very dramatic declines in many species there, we cannot show whether this is due to external factors or internal pressures within the Coorong. This is because the counts are made so many years apart. Annual monitoring would partly address this, but there is obviously a need for a wider monitoring of the

populations in order to interpret changes at individual sites.

ACKOWLEDGEMENTS

Many people were involved in the counts and these have been acknowledged by name in the report. The survey would not have taken place without the assistance of John Hatch, president of the South Australian Ornithologists Association. Counts in the Gulf St. Vincent were organised by David Close who also helped with other logistics. The project was assisted by the Department of Environment, Heritage and Aboriginal Affairs in Adelaide, Mt. Gambier and Ceduna. The survey was funded by the Natural Heritage Trust.

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DISTURBANCE DISTANCES FOR WATER BIRDS AND THE MANAGEMENT OF HUMAN RECREATION WITH SPECIAL REFERENCE TO THE COORONG REGION OF SOUTH AUSTRALIA

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Final report for the National Wetlands Program, Environment Australia, May 2000

Abstract

The distances at which various waterbirds responded to disturbances were measured by recording changes in the proportion of alert birds in roosting or foraging flocks as various types of disturbances were advanced towards them. The distance at which a significant disturbance was detected coincided with the distance at which the number of alert birds was significantly higher over a two minute period than the baseline undisturbed number. Five types of disturbance were considered: walking alone, walking with a dog, canoeing, boating and simulated jet-skiing.

In general, a significant increase in vigilance was detected at distances of 25-110m for various calidrine sandpipers, 26-204m for larger waders (stilts, avocet, godwit, curlew, oystercatcher) and from 85-347m for various waterbirds (ibis, duck, cormorant, swan). The distances at which birds eventually took flight also varied with flush distances ranging from 17-54 m for sandpipers, 8-128m for the larger waders, and 50-157m for the waterbirds that were studied. In general the distances at which the birds were flushed reflected the distances at which the birds first became alert to the disturbance with the larger waterbirds being the most sensitive, followed by the larger waders, with the smaller sandpipers being the most tolerant of an approaching disturbance. Overall, canoeing was the least disruptive human recreational activity and jet-skiing and walking along the shore with a dog the most disruptive.

For calidrine waders like Curlew Sandpipers, the disturbance caused by someone walking along the shore to within 30m of them would result in the birds losing about a minute of foraging time. One or two such disturbances per hour would result in the birds potentially losing 20 minutes of foraging time per day. Current levels of disturbance in significant areas like the estuarine areas near the Murray River mouth are estimated at 0.5 per hour during weekdays and higher on weekends during summer. Given that human recreational activities are likely to increase in coastal areas like the Murray R. mouth, some attempt to manage recreational activity in areas that are important for the birds is warranted. Management may need to consider setting buffer zones around areas important for the birds, limiting the numbers of people using an area at any one time, limiting the type of recreational activity or a combination of these. Measurements of disturbance distances provide a basis for setting buffer distances. Ideally these should be set at those distances at which the most sensitive species are disturbed. Based on our measurements of disturbance distances, buffer zones of around 350m would be required. This is unlikely to be acceptable to the general public and some compromise will be needed. This compromise should be determined in advance and used to set limits on recreational activities before those limits are reached since this is likely to be more readily accepted by the general public, than attempting to reduce human recreational activity once it has established in an area.

DISTRIBUTION AND ABUNDANCE OF MIGRATORY WADERS AND THEIR FOOD IN THE ESTUARINE AREAS OF THE MURRAY MOUTH AND PATTERNS IN THE COMPOSITION OF SEDIMENTS

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Final report for the National Wetlands Program, Environment Australia, June 2000

Abstract

During the 1990s, the numbers of shorebirds using the estuarine areas associated with the Murray Mouth have ranged between 5,000 and 15,000 and have been consistently lower than similar counts made in the 1980s when 24,000 to 36,000 shorebirds were counted in the same area.

Most shorebirds were distributed widely over the study area. However, the largest concentrations of birds were on extensive mudflats opposite Tauwitchere Island and Tauwitchere Barrage, on the southeastern shore of Ewe Island, and to a lesser extent on the southern shore of Mundoo Island and southern shore of Hindmarsh Island immediately east of the Goolwa Barrage. These areas were areas where the sediments were finer and where invertebrate prey densities were highest.

Human activity was concentrated in the region of the Murray Mouth and to about 5km E of the Murray Mouth and was largely separated from the locations used extensively by shorebirds. The areas used extensively by humans tended to have coarser sediments and were used less intensively by shorebirds. Nevertheless, areas used extensively by shorebirds should be afforded some protection from expanding recreational activity in the area.

Future studies should continue to monitor the numbers of shorebirds, the composition of the sediments and aquatic foods in the area. Changes in the quantities and timing of flows of freshwater over the barrages should influence the composition of sediments and invertebrate densities. This study provides baseline data that will allow changes in these variables to be monitored with changes in releases of water and may aid the development of better management of the estuary for migratory shorebirds.

Copies of either of these reports are available from Ms Trixi Walsh, Wetlands Unit, Environment Australia, GPO Box 123, Canberra 2601 ACT, AUSTRALIA

BOOK REVIEW

POPULATION LIMITATIONS IN BIRDS

By Ian Newton

1998. Academic Press, London. Available in paperback ($85) or Hard cover ($180).

This book on bird population studies is easy to read and easy to understand. Whether you are a birdwatcher, researcher, wildlife manager, conservationist or concerned with pest control, this book provides an extensive overview of studies of bird populations. As its title suggests this book deals extensively with what limits the size of bird populations. The book comes out at an ideal time for Australian ornithologists with the introduction the graduate certificate in ornithology and the more recent graduate diploma and forthcoming masters degree courses being held at the Charles Sturt University.

The book is divided into three parts, behaviour and density regulation, natural limiting factors and human impacts. The first explains the dominance hierarchies, the role of territories in limiting the number of breeding birds and how the growth of a population is stabilized due to increased competition between birds at high densities. This section also covers fragmentation of habitat, which can produce partially isolated sub-populations. Part 2 covers 'Natural limiting factors' such as predation, food supply and nest sites and territories and competition between species. Part 3 covers human impacts including hunting, pest control and the use of pesticides. It then leads on logically to conservation biology.

Newton takes many of the classical theories and evaluates their relevance to real bird populations. To make the book even more user friendly and useful to the student who needs to find information fast, each of the 16 chapters includes a summary.

Of particular use to the researcher is the impressive array of examples and comments and for those wishing to look further, 1865 references that cite some 734 bird species. Ian Newton appears to have synthesized almost all of the relevant ornithological literature from the pre-1950s to 1997.

To sum up in Iain Taylor's words regarding Ian Newton's appearance as guest speaker at Owls 2000 Conference in Canberra "There can be few, if any, who can match Ian's breadth of experience and his ability to crystallise seemingly complex issues and present them in commonsense, no-nonsense language." No serious ornithologist should be without this book in his or her library.

Phil Straw

ABSTRACTS

AUSTRALASIAN WADER STUDIES GROUP CONFERENCE, GRIFFITH UNIVERSITY, BRISBANE, AUSTRALIA 1-2 JULY 2000

Compiled by

Jim Wilson
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Following the success and interest shown in the two previous AWSG conferences held in 1996 and 1999, the committee decided to organise a third wader conference in conjunction with the Southern Hemisphere Ornithological Congress (SHOC) at Griffith University, Brisbane. The timing and location were chosen to take advantage of the presence of the larger audience at SHOC and presence of potential speakers from other continents. The theme of the conference was 'Long distance migrations in the Flyway'.

THE MIGRATION STRATEGIES OF THE GREAT KNOT *CALIDRIS TENUIROSTRIS*

Mark Barter

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The Great Knot is an excellent example of a long-distance migrant which uses a limited number of staging sites on its annual round trip between breeding grounds in the mountain tundra of the Russian Far East and non-breeding areas in northern Australia. The paper describes, and speculate on, the migration strategy of the species by drawing on recent information gained about preparation for, and timing of, departures from north-western Australia, staging patterns through the Yellow Sea region (on northward migration) and the Sea of Othotsk (on southward migration), and breeding behaviour.

THE YELLOW SEA – WHAT FUTURE FOR MIGRATORY SHOREBIRDS?

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Surveys conducted during the last decade have shown that the vast intertidal flats of the Yellow Sea play host to millions of migratory shorebirds, many of which spend the non-breeding season in Australasia. However, the Yellow Sea ecosystem is under serious environmental threat. The presence of 10% of the world's human population in the basins that drain into the Sea is leading to significant habitat loss and degradation, serious pollution problems and unsustainable use of natural resources. The presentation will summarise the importance of the Yellow Sea for migratory shorebirds and discuss initiatives being planned to ensure that shorebirds will be able to migrate successfully through one of the most densely populated regions of the world.

A PRELIMINARY REPORT ON THE WADERS OF THE TOP END OF THE NORTHERN TERRITORY

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The coast and coastal wetlands of the Top End of the Northern Territory are very remote and difficult to access, and little has been documented of much of this area's fauna. Over the past ten years, I have conducted extensive aerial and ground surveys of this area, concentrating mainly on waterbirds, seabirds, shorebirds, coastal raptors and marine turtles. This presentation deals with some very preliminary analysis of the shorebird data (over 13000 species or species group records) from these surveys, and aims to provide an introduction into the distribution and status of these birds around the NT coast and coastal wetlands.

DISTRIBUTION AND SITE SELECTION IN EASTERN CURLEW AT FEEDING GROUNDS IN MORETON BAY

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Low tide surveys of Eastern Curlew were conducted to assess habitat use on feeding grounds, where 51 skilled

volunteers counted at 160 sites during summer 1998-99 and winter 1999. Sites typically comprised sections of tidal flat from high water to low water, or a sandbank or banks, spanned a distance of c.115 km of coast, and varied in size (0.5-310 ha), substrate, topography, and other features. These results provide the most comprehensive count of Eastern Curlew on their feeding grounds ever completed.

There was a strong correspondence (high and significant correlation) between counts on different days within a month and different months within a season, across all sites. Winter count numbers totalled about 25% of summer counts, and the pattern of variation in numbers across sites was generally similar to that seen in summer. The within-season constancy of curlew numbers across sites suggests that short surveys can give reliable results, and may occur for several reasons, including the possibility that curlew are faithful to particular sites. We also tested the correspondence between the summer low tide counts at feeding flats and summer counts at high tide roosts (data collected by QWSG over a seven-year period). There was a high correlation, especially when the data from both flats and roosts were grouped into nine larger areas, based on grouping roost sites within a five kilometre area and associating adjacent feeding sites. Factors that may underlie the differences in curlew numbers among sites will be discussed.

FEEDING ECOLOGY OF HUDSONIAN GODWIT (*LIMOSA HAEMASTICA*) ON AN ATLANTIC MUDFLAT SYSTEM IN BUENOS AIRES PROVINCE, ARGENTINA

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This work describes aspects of the feeding ecology of the Hudsonian Godwit (*Limosa haemastica*) on an Atlantic mudflat system in Samborombon Bay, Buenos Aires province, Argentina. I examined diet, prey size selection and intake rates of a long-distance migrant. Godwits fed successfully on a nereid polychaete, *Laeonereis acuta*, and selected the largest worms. The length of the worms closely correlated with the length of their jaws, but I failed to locate worm jaws in the faeces of the godwits. Thus, I could not validate my field estimates of worm length. Alternative prey included the fiddler crab *Uca uruguayensis*, comprising a mere 0.6 % of the diet in terms of numbers, but was more important in terms of biomass. On the basis of my field observations, I estimated that intake rates averaged 0.21 mg AFDW/s. However, this may have been an underestimate. On the basis of published allometric relationships, I estimate the mean metabolic rate (MMR) at 273 kj per day. In combination with my estimates of feeding time and digestive efficiency, this leads to an intake rate of 0.29 AFDW/s. While I cannot decide which estimate of intake rate is closer to the truth, my conclusion that the Godwits positively selected the largest worms is reinforced.

GEOGRAPHIC ORIGIN OF THE RED KNOTS WINTERING IN AUSTRALIA

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Almost the entire population of Red Knot (*Calidris canutus*) utilising the East Asian-Australasian flyway is thought to spend the non-breeding season in Australasia. On the basis of band-records and flag sightings, several authors have suggested the birds found in Australia to be comprised of two separate populations: one in north-western Australia and one in south-eastern Australia, the latter of which is linked to that wintering in New Zealand. However, recent sightings in Victoria of birds flagged in the north-west have cast doubt on this matter. To determine whether the two populations can be distinguished on the basis of their biometrics, we analysed data from Victoria collected by the VWSG during the past 23 years and from north-west Australia collected by the AWSG over the past 18 years. The data were also compared to a recently published survey of museum specimens from the breeding grounds, using the POSCON software, in order to trace the breeding grounds of these populations.

A REVIEW OF OVERSEAS RECOVERIES AND FLAG SIGHTINGS OF AUSTRALIAN-BANDED WADERS

Clive Minton[1], Ros Jessop[2], Belinda Dettman[3] and Barry Baker[3]

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Sufficient data has now accrued from 25 years of banding and 10 years of colour leg flagging of waders in Australia for the initial analyses of migration patterns of a number of species to be meaningful. These show that China is a key area used by almost all species of waders on their northward migration but rather less so on the southward migration. A detailed comparison of recovery rates and flag sighting rates is also presented. Flagging has increased the rate of data generation markedly and it is

strongly recommended that all waders captured in the flyway continue to be flagged.

VISIBLE DEPARTURES OF WADERS ON NORTHWARD MIGRATION FROM NW AUSTRALIA

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Daily observations of departures of waders on northward migration have been carried out in March/April at Roebuck Bay, Broome, since 1990. This analysis describes the departure process, with most birds leaving between 1600 and 1800, just prior to darkness. Flight direction was generally north-north-west. Most birds migrated in single species flocks with an average flock size of under 100, though flocks of up to 2,000 were occasionally seen. The period of departure of each species was similar each year, with some species leaving over a narrow time-span and others over a more prolonged period. Eastern Curlew, Greater Sand Plover and Great Knot were the first species to leave, commencing in the first week of March and mostly departing before the end of the month. There was a marked correlation between local weather conditions and the intensity of migratory departures. Birds preferred to leave when tail winds occurred in the 600 – 2,500 m levels: there was almost always an adverse sea breeze at ground level. Unsettled weather conditions could halt migration for several days. Tidal conditions appeared to have only a minor influence on departures.

SILVER GULL PREDATION AT BANDED STILT COLONIES

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Observations of the Banded Stilt colony at Lake Eyre North in April 2000 have confirmed that massive predation of eggs and chicks by Silver Gulls, first noted at the Lake Torrens colony in 1989, is still occurring. In contrast, such predation has not been recorded at Banded Stilt breeding colonies in Western Australia. It is recommended that gull control be introduced at future Banded Stilt breeding colonies in South Australia in order to prevent a major decline in the population.

MIGRATION ROUTES AND MIGRATION STRATEGY OF BAR-TAILED GODWITS *LIMOSA LAPPONICA* AND RED KNOTS *CALIDRIS CANUTUS* WHICH SPEND THE NON-BREEDING SEASON IN NEW ZEALAND

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About 40 species of Arctic breeding waders have occurred in New Zealand. Of those some 19 species can be considered regular visitors, but mostly in small numbers. Only two species, Bar-tailed Godwit (102,000) and Red Knot (59,000) occur in globally significant numbers. Between 1979 and 1999 the New Zealand Wader Study Group banded 1599 Bar-tailed Godwits and 5793 Red Knots. In addition, since 1992 593 Bar-tailed Godwits and 1193 Red Knots had a single white leg-flag fitted to the tibia. Recoveries and flag sightings show that the two species have different breeding areas and different migration strategies. Both are long hop migrants, covering many thousands of kilometres in one flight. On northward migration, Bar-tailed Godwits follow an easterly route through Korea and Japan to breeding grounds in Alaska. Red Knots stage in regions around the Gulf of Carpentaria and migrate slightly more westerly. Recent evidence suggests that their breeding grounds are in eastern Siberia. Less is known about the southward migration. Bar-tailed Godwits may fly direct from Alaska to New Zealand. Counts and banding data and flag sightings show that Red Knots stage in eastern Australia.

AGE-RELATED VARIATION IN FORAGING ECOLOGY OF GREAT KNOTS AND RED KNOTS IN ROEBUCK BAY, NORTH-WESTERN AUSTRALIA

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Age-related variation in foraging success was investigated in Red Knots and Great Knots in Roebuck Bay, tropical north-western Australia. Both are long-distance migrants specialised to eat bivalves. In both species, foraging of young birds differed from that of adults. Recently arrived juveniles (about four months old) fed in different places to adults, and took different prey. When a few months older,

immatures fed in mixed flocks with adults. Their foraging behaviour was generally similar to that of adults, but their food intake rates were lower, apparently because they were less adept at finding buried bivalves. Implications for the delayed maturity of Red Knots and Great Knots are discussed.

THE MACRO ENVIRONMENT FOR WADERS MIGRATING LONG DISTANCES TO THE SOUTHERN CONTINENTS: AN ATTEMPT TO EXPLAIN WHY THEY DO IT

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This paper attempts to explain why waders migrate to the southern continents through a study of the differing ecological conditions they face. It is shown that macro distributions can partly be explained by the varying position of the January 0 °C isotherm around the world and by the distribution of areas with large tidal amplitude. At least three species, Sanderlings *Calidris alba*, Grey Phalaropes *Phalaropus fulicarius* and Red-necked Phalaropes *Phalaropus lobatus* show a strong correlation with coastal upwellings. In Australia, Africa and in South America there are several long distance migrants that have adapted to the savannah grasslands mainly lying south of the equator. A comparison of Golden Plovers *Pluvialis apricaria*, *P. fulva*, and *P. dominica* show that the Eurasian Golden Plover is a short distance migrant to agricultural lands in Europe or North Africa, the Pacific Golden Plover is mainly coastal and often occurs on oceanic islands, and the American Golden Plover migrates to the Pampas grasslands of South America. It is suggested the Golden Plovers have selected their non-breeding season habitat to what is available in differing parts of the world and this has determined their migrations. Examples are given where lack of suitable non-breeding habitat and the distance between last staging areas and the breeding grounds may have affected the distribution of high Arctic breeding waders.

THE NORTHWARD MIGRATION STRATEGIES OF BAR-TAILED GODWITS *LIMOSA LAPPONICA* WHICH SPEND THE NON-BREEDING SEASON IN AUSTRALIA

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This paper is based on data from 5,000 Bar-tailed Godwits caught in NW Australia and 700 caught in Victoria (SE Australia) between January and April. Biometrics, banding recoveries and flag sightings show that there is little movement between the two areas, and that the populations belong to different races. Victorian birds follow a more easterly migration route through Asia. They possibly breed in Alaska. North-west Australian birds breed in eastern Siberia. Departure weights and timing between the two regions are compared. Birds from NW Australia can reach the known staging areas near Shanghai (5,500 kms), or beyond, in one flight. Birds from Victoria are putting on proportionally more weight, but theoretically still cannot reach known staging areas in Korea and Japan (8,000 kms) in one flight without considerable wind assistance. We also present data on departure and arrival dates that suggests that there is an unaccounted for gap in the migration. It suggests that there may be an undiscovered intermediate staging site in North Australia or Irian Jaya. A comparison between Australian and African birds suggest that the former have far greater flight ranges for the same relative body weights.

WADER SURVEYS IN SOUTH AUSTRALIA IN 2000

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In January and February 2000, the Australasian Wader Studies Group and the South Australian Ornithologists Association counted waders on the Coorong, Gulf St Vincent, Spencer Gulf and West Eyre Peninsula. The purposes of this census was to update wader population estimates for parts of South Australia, gather information to advise the Department of Environment on possible Ramsar sites, check to see if large declines reported in wader populations in South Australia were real, and to set up a count network in South Australia. There were indeed very large declines in populations of many species in parts of the study area, although in some cases this could be attributed to waders moving inland after good rains. It seems, however, that Curlew Sandpipers have declined by over 50% in large parts of southern Australia. New important sites were found in the Ceduna area, making it one of the top ten sites in Australia, in terms of numbers of important species.

SEX-SPECIFIC INTERTIDAL HABITAT USE IN THE BAR-TAILED GODWIT *LIMOSA LAPPONICA* WINTERING IN EASTERN AUSTRALIA

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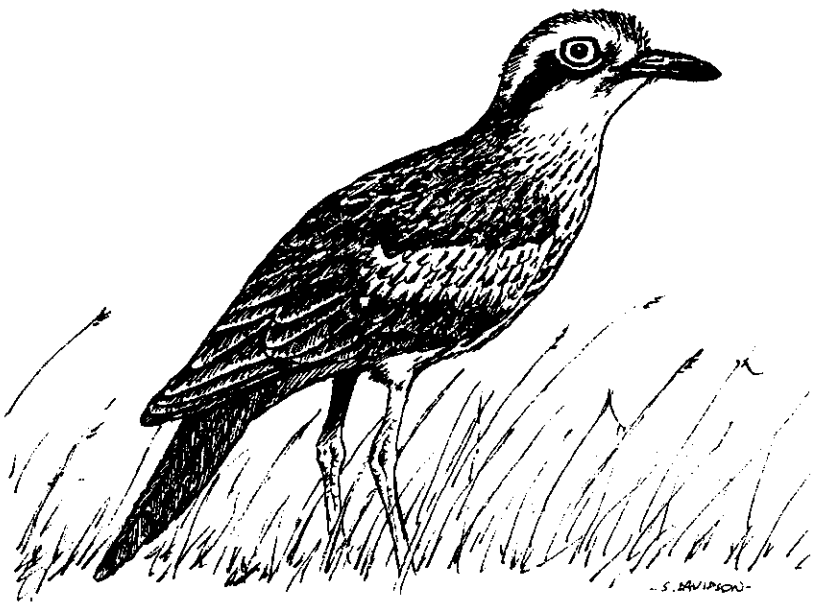
We studied low tide distribution of Bar-tailed Godwits *Limosa lapponica* at an important wader staging site – Moreton Bay, SE Queensland – during two periods: mid-wintering (December-January) and the pre-migratory period (early-mid March). We found a high degree of segregation between sexes with males being predominant in seagrass (65%) while females were more common on sandy flats (83%) in both seasons. In general seagrass plots supported twice as many birds (10.5 ha^{-1}) as did sandy flats (5.3 ha^{-1}) probably due to their greater density of potential benthic prey. It is puzzling now why the females – a physically superior phenotype – use an apparently inferior habitat (sand) so extensively.



BIRD SPECIES INDEX

The Stilt: Nos.31-36

Compiled by Hugo Phillipps

The use of this index for finding references to particular birds in *The Stilt* should be fairly straightforward. Issue numbers are in bold with the relevant page numbers following. References are only to species, not to higher taxa or subspecies. Species are listed alphabetically under both the scientific name and the common substantive name. A page reference means that the bird is mentioned on that page, possibly more than once. Names of Australian birds generally follow the conventions of RAOU Monograph 2 (*The Taxonomy and Species of Birds of Australia and its Territories*, by Christidis & Boles, 1994). The scientific and vernacular names of other (non-Australian) shorebird species largely follow *Shorebirds: an identification guide to the waders of the world* (Hayman, Marchant & Prater, 1986). It is a comprehensive index; all obvious and identifiable mentions of species are listed, including trivial ones, but excluding those in earlier indexes. Comments, corrections and constructive criticism should be directed to the Compiler at the Birds Australia National Office: 415 Riversdale Road, Hawthorn East, VIC 3123, Australia. Tel: (03) 9882 2622. Fax: (03) 9882 2677. Email: h.phillipps@birdsaustralia.com.au

AUTHOR INDEX

The Stilt: Nos.31-36

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INSTRUCTIONS TO AUTHORS

The Stilt is the bulletin of the Australasian Wader Study Group and publishes original papers, technical notes and short communications on all aspects of waders (shorebirds) of the East Asian-Australasian Flyway and nearby parts of the Pacific region. Authors should send an original and one hard copy of any manuscript plus the document saved on a 3 1/2" computer disc to the editor, Dr David Milton, 336 Prout Rd., Burbank Qld 4156 or by e-mail: *david.milton@marine.csiro.au*. Material sent to *The Stilt* is assumed to be original and must not have been published elsewhere. Authors are asked to carefully follow the instructions in the preparation of manuscripts and to carefully check the final typescript for errors and inconsistencies in order to minimise delays in publication. Suitable material submitted before **1st March** or **1st September** will normally be published in the next issue of *The Stilt* in April or October respectively. Late submissions may be accepted at the editor's discretion and he should be contacted to discuss the situation. Articles, including tables should be in 11 pt Times Roman font typed in MS Word 6.0 for PC or a wordprocessing package readable by Word 6.0. A disc copy of the figures is also preferred and can be included if they have been produced in MS Powerpoint or Excel, Harvard Graphics 3.0 or less, or Grapher 2.0 software.

Full research papers of more than 6 typed double-spaced text should contain the following elements:
TITLE - in bold, capitalised type
Authors name and address - John Smith[1], Stephen Brown[2] and Max Well[3]
[1] 1 Main St., Melbourne 3001 Vic. AUSTRALIA
[2] Dept. Biology, Univ. Queensland, St Lucia 4068 Qld. AUSTRALIA
[3] Birds Singapore, National Univ., Jurong N4321 SINGAPORE

ABSTRACT - Usually less than 200 words summarising the most important findings of the study.
INTRODUCTION - This should be a short section of about half a journal page to "set the scene" and explain to the reader why the study was important. It should end with a clear definition of the aims of the study. The first reference to a species of bird should have the scientific name in *italics* after it.
METHODS AND MATERIALS - Clearly sets out the methods used in the study and should include sufficient detail to enable the reader to duplicate the research. First level subheadings should be **Bold and lower case** and further subheadings in *italics*.
RESULTS - Highlights the key points that came out of the study in relation to the objectives set out in the introduction. Data should be presented in figures or tables.
DISCUSSION - Puts the study in context with other previous research on the same topic and explains the significance of the major results presented in the **RESULTS** section.
ACKNOWLEDGEMENTS - Recognises the contribution of others to the completion of the study.
REFERENCES - Records all the literature cited in the text, tables or figures. They should be in alphabetic and chronological order with multi-authored references after single author citations by the same author. These should be formatted as follows:

Single author papers: Smith, F.T.H. 1964. Wader observations in southern Victoria, 1962-1963. Aust. Bird Watcher 2, 70-84.

Multi-authored papers: Dann, P., R.H. Loyn & P. Bingham 1994. Ten years of water bird counts in Westernport Victoria 1973-83. II. Waders, gulls and terns. Aust. Bird Watcher 15, 351-67.

Books: Kershaw, K.A. 1964. Quantitative and dynamic ecology. Edward Arnold, London.

Reports: Noor, Y.R. 1994. A status overview of shore birds in Indonesia. Pp. 178-88. *In:* Wells, D.R. & T. Mundur (Eds.) Conservation of migratory water birds and their wetland habitats in the East Asian-Australia Flyway. Asian Wetland Bureau, Malaysia.

Authors should look at previous issues of *The Stilt* for the formatting of other reference combinations.

Tables - Captioned as **Table 1.** The list of suitable names of Australian waders.

There should be no lines in the table except for above and below the column headings and at the bottom of the table. All tables should be laid out in the same document as the text but located after the **REFERENCES** using the table facility in the word processing package. Wide tables can be set out in a separate, suitably titled document. All measurements should be in metric units (e.g. mm, km, °C etc) and rates should be recorded thus: $.d^{-1}$ rather than /day or

per day. Lists of species names in tables should follow the common and scientific names and taxonomic order of Christidis and Boles (1994). Where a species has not been recorded in Australia, the order and names in Hayman *et al.* (1986) should be used.

Captions to Figures
Lists the captions of all the figures sequentially on a separate page. They should be captioned as:
Figure 2. The number of hunters of each age class interviewed in Shanghai during April 1998.

All maps should have a border, distance scale, reference latitude and longitude and/or inset map to enable readers unfamiliar with the area to locate the site in an atlas.

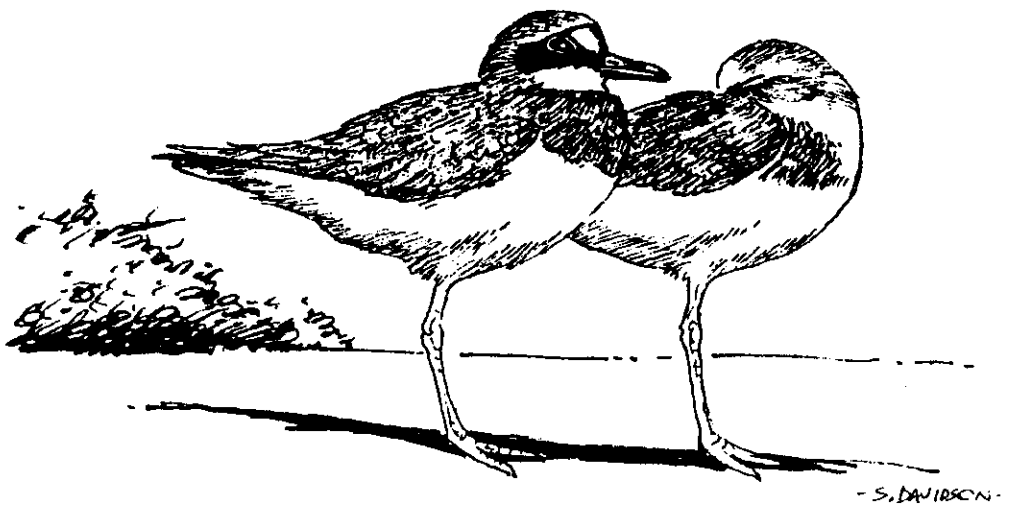
Other figures should have axis numbers and labels of sufficient size to be at least 1.5 mm high after 50% reduction. This usually corresponds to 14 - 16 pt or larger. Multi-graph figures should all be separately identified as (a), (b) etc. Legends should be located at the outer edge of a graph at the bottom or top right and in 12 pt.

SHORT COMMUNICATIONS and REPORTS usually are not subdivided like RESEARCH PAPERS and do not have a separate abstract. These sections usually include less technical material, often of a non-scientific nature. For example, unusual behaviours, leg-flag sightings or conservation issue statements. Authors are encouraged to look at the format of articles in these sections of previous issues of *The Stilt.*

REFERENCES

Christidis, L., & W.E. Boles 1994. The Taxonomy and Species of Birds of Australia and its Territories. RAOU monogr. 2. 112pp.

Hayman, P., J. Marchant & T.Prater 1986. Shorebirds: An Identification Guide to the Waders of the World. Christopher Helm, London.



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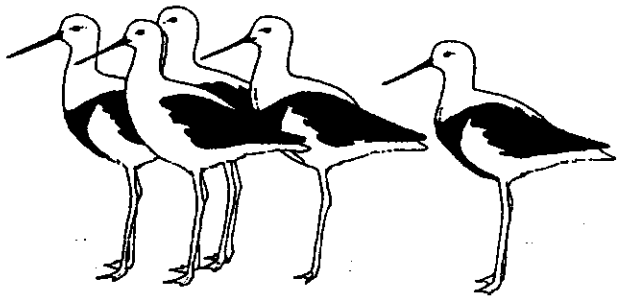
Indexes:

Author and species indexes have been published within *The Stilt* to volume 30.

Volumes Indexed	Volume containing Index
1-6	7
7-12	13
13-18	19
19-24	25
25-30	31

Deadlines:

The closing dates for submission of material have been revised. They are **1 March** and **1 September** for the April and October editions respectively. **Extensions to these dates must be discussed with the Editor.** 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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