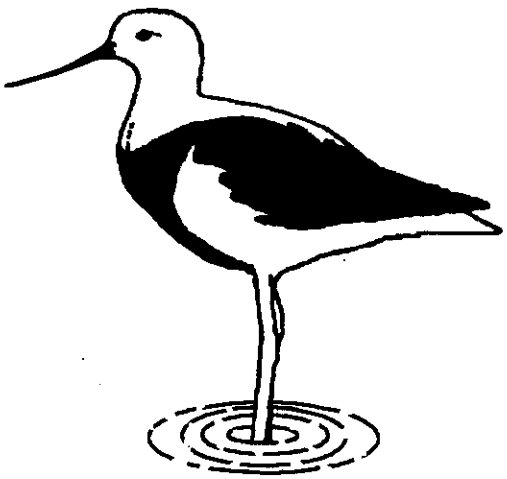
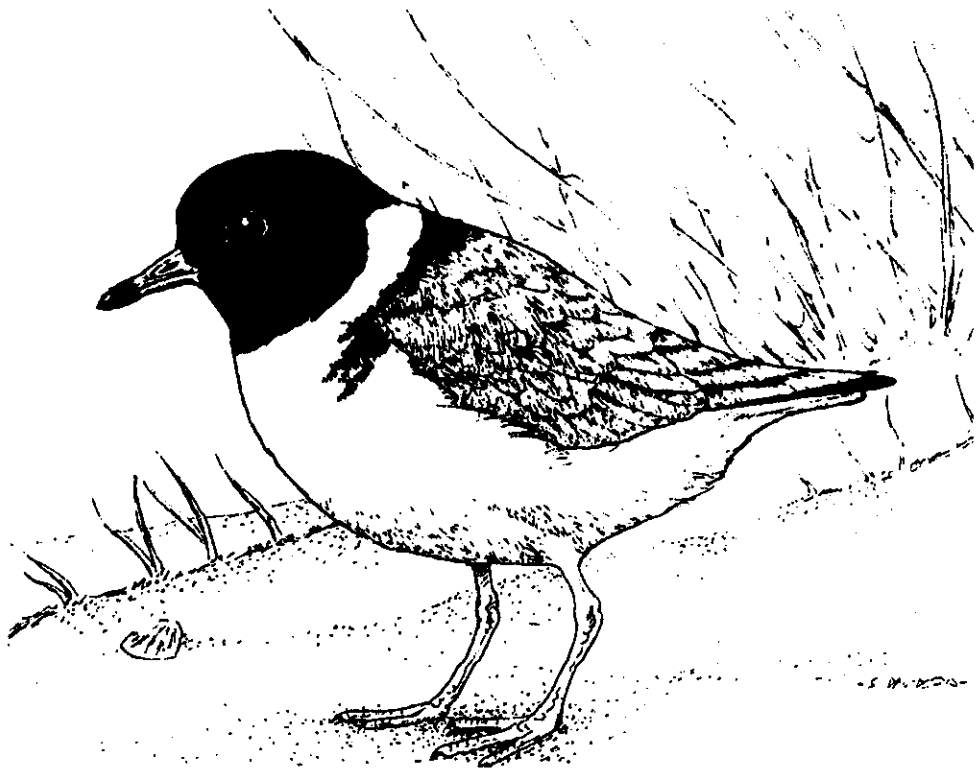
The Stilt



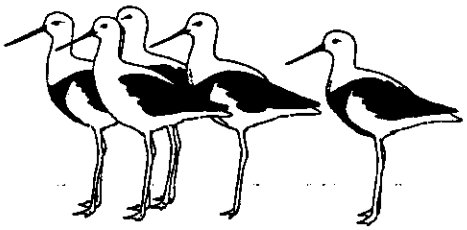
The Bulletin of the East Asian-Australasian Flyway



Australasian Wader Studies Group

A special interest group of Birds Australia

Number 44
October 2003



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.
Ph: 03-9882 2622, fax: 03-9882 2677.
Email: membership@birdsaustralia.com.au

Annual Subscriptions:	Australia	A$35.00
	New Zealand	A$35.00
	Overseas	A$40.00
	Institutions	A$45.00

AWSG WEB SITE: www.tasweb.com.au/awsg/index.htm

Cover Illustration: Stephen Davidson

EDITORIAL

I hope readers enjoy this issue, it covers the whole Flyway and includes articles from as far a field as Siberia, Malaysia and Moreton Bay in south east Queensland. Clive Minton gives a report of his recent trip to Broome and Mark Barter has written an article on another important staging site in coastal northeastern China. I am happy to see more articles from Russian colleagues and the summary of wader recoveries from the breeding grounds in the Chutkotka region of Russia by Pavel Tomkovich makes very interesting reading.

There will be a changing of some of the guard in the *Stilt* editorial team. This will be my last issue as editor and we welcome Ken Rogers to the team as the new editor. My decision to stand down after six years has been brought on by my desire to get out and write more articles myself. Ken will bring in fresh ideas and a new editorial style that I am sure will enhance and improve the quality and readability of *Stilt*. I hope to still remain an active member of the AWSG committee and plan to become involved in analyses of the large count database in Queensland.

I will not be hanging up my editorial hat too soon, as I have agreed to help edit the Proceedings from the forthcoming AWSG Conference in Canberra in December. This will be published jointly by AWSG, Wetlands International and IWSG and we hope to have the proceedings out in time for the international flyways conference in Scotland in April 2004. The AWSG conference looks like being well attended by wader enthusiasts from throughout the Flyway and we hope to have a number of overseas speakers talking about shorebird conservation issues in their countries.

Please keep sending articles for *Stilt* to me as I will be forwarding them on to Ken until we have the official elections of AWSG committee early next year. We made a decision at the last AWSG committee meeting in June to give the editor the discretion to increase the size of *Stilt* beyond the current page limit of 72 pages. This will ensure that articles submitted well before the cutoff date should appear in the next issue.

I have really enjoyed my term as editor and have learnt a lot about waders and the people who study them. I hope to continue to contribute in the future as an author and look forward to seeing everyone in Canberra in December.

David Milton

AWSG ELECTIONS

The following office bearers and members of the committee will have completed their term of office in June 2004 and have volunteered for re-election: Rosalind Jessop, Phil Straw, Clive Minton, Sandra Harding, Peter Collins, Doug Watkins, Hugo Phillips, Danny Rogers, David Close, Mike Bamford, Chris Hassell and Ken Gosbell. If there are no other candidates put forward by members before 31 January 2004 these will be considered re-elected.

David Milton wishes to step down as Editor of *The Stilt* and has nominated Ken Rogers for this position. This proposal has been seconded by Roz Jessop. David has indicated his willingness to remain a member of the committee. Mark Barter has stepped down from the committee after serving on it for over 20 years; he was Chair for 12 years. The committee has expressed its thanks to Mark for his significant contribution over many years.

Any additional nominations for the committee, seconded by a Member of the group shall be sent to the Chair by 31 January 2004. Should an election be necessary ballot papers will be sent out with the April 2004 *Stilt*.

Ken Gosbell, *Secretary-Treasurer*

COMMENTS ON AWSG RULE CHANGES AND A REPLY TO JIM WILSON

During 2001, Birds Australia (BA) received a number of queries from various groups requesting clarification of the legal situation that exists between BA and its various volunteer committees. Legally, the relevant relationship is between RAOU Ltd and the committees, RAOU Ltd being the legal entity and Birds Australia a trading name only.

Legal advice was received by the RAOU in March 2002. The advice given was that in relation to special interest groups, the RAOU would be liable for actions of a committee member where the RAOU authorised or consented to the committee member making the decision or performing the action. However, the RAOU would not be liable if it could be shown that a group was a separate entity and acting autonomously. In light of this advice, the RAOU requested that AWSG alter its rules to remove any doubt that AWSG was a special interest group of the RAOU.

Among areas of contention were:

Rule 3 – full membership of AWSG requires membership of RAOU. RAOU and AWSG agreed that non-members of RAOU could become subscriber members.

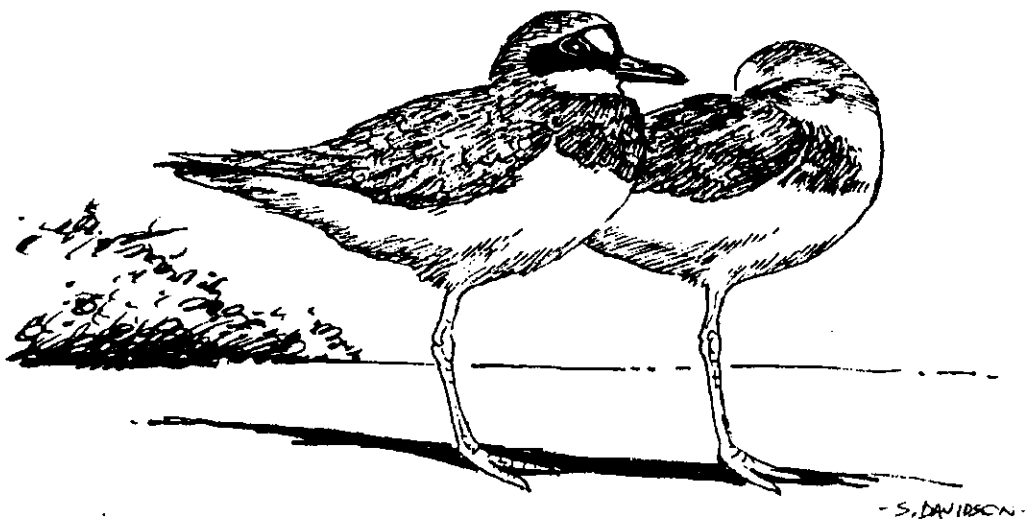
Rule 12 – RAOU constitution gives it the right to amend the rules of special interest groups. AWSG negotiated that these changes will not be made without the advice of AWSG.

Rule 13 – AWSG has paid RAOU to look after our accounts for some years. They appear as a cost centre within the RAOU accounts and are reported each year in *The Stilt.*

Rule 14 – AWSG holds few assets, RAOU is responsible for arranging insurance cover for which AWSG pays a nominal fee.

Changes to the rules were negotiated by the AWSG committee over a period of several months and unanimously agreed upon (*Stilt* 42: 1-3, 2002). No areas of disagreement have appeared between AWSG and RAOU over the last 17 months that they have been in operation.

Rosalind Jessop *Chairperson*



SHOREBIRD NUMBERS IN BOHAI WAN DURING NORTHWARD MIGRATION

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ABSTRACT

Shorebird surveys of the complete coastline of Bohai Wan, and the associated extensive areas of salt-pans and shrimp/fish ponds, were undertaken in May 2000 and April/May 2002. We estimate that Bohai Wan may support about 250,000 shorebirds in these months. A total of 192 805 shorebirds of 37 species was counted, the ten most common being Red Knot, Marsh Sandpiper, Curlew Sandpiper, Grey Plover, Dunlin , Black-tailed Godwit, Kentish Plover, Red-necked Stint, Bar-tailed Godwit and Sharp-tailed Sandpiper. These species represented 88% of the identified shorebirds. Twenty species were present in internationally important numbers, the additional ones being Whimbrel, Eurasian Curlew, Eastern Curlew, Spotted Redshank, Common Greenshank, Asian Dowitcher, Great Knot, Broad-billed Sandpiper, Black-winged Stilt and Pied Avocet. At other times, a further four species were recorded in internationally important numbers in the near-coastal areas of north west Bohai Wan: Common Redshank, Northern Lapwing, Little Ringed Plover and Oriental Pratincole.

The large number of shorebirds using Bohai Wan, the high species diversity, the numbers of internationally important species, and the presence of significant concentrations of breeding birds confirm that the region is one of outstanding importance as a staging area within the East Asian-Australasian Flyway. It is highly desirable that government at all levels, industry and local communities be made aware of the importance of the region for shorebirds and the need for them to plan activities and developments to minimise habitat loss and disturbance to birds.

INTRODUCTION

Shorebird surveys of parts of Bohai Wan and its hinterland indicate that the region could be of major importance as a staging site for migratory shorebirds during northward migration.

A survey conducted along 100 km of the NW coastline of Bohai Wan and the adjacent salt and shrimp/fish ponds in May 2000, resulted in a total of more than 73,000 shorebirds of 31 species being counted, the ten most common being Red Knot, Curlew Sandpiper, Grey Plover, Dunlin, Red-necked Stint, Great Knot, Sharp-tailed Sandpiper, Marsh Sandpiper, Bar-tailed Godwit and Asian Dowitcher. Eight species were present in internationally important numbers (Barter *et al.* 2001).

Surveys of near-coastal wetlands in NW Bohai Wan have found internationally important concentrations of Eurasian Curlew, Spotted Redshank, Common Redshank, Common Greenshank, Black-winged Stilt, Pied Avocet, Northern Lapwing, Little Ringed Plover, Kentish Plover and Oriental Pratincole (S.P. Zhang *in litt.*).

Large numbers of shorebirds have been recorded by visiting bird watchers at Shi Jiu Tuo (Happy Island), near Daqinghe, in far NE Bohai Wan (Barter 2002). Counts in the Huang He delta in the extreme SE part of Bohai Wan have shown that this region is an extremely important staging site for shorebirds, with probably more than 200,000 birds passing through on northward migration (Zhu *et al.* 2001).

In order to learn more of the region's overall importance for shorebirds during northward migration a visit was made from 24 April to 9 May 2002 to survey that part of the bay not previously visited (about 200 km of coastline and associated salt works and shrimp/fish ponds). This paper provides information on the survey methods used, and the conditions encountered, during the counts made in 2000 and 2002. The importance of Bohai Wan for shorebirds, in terms of numbers, distribution and international significance, is discussed.

STUDY AREA

Bohai Wan is located in the western part of the Bohai between 38° 04′/39° 10′ N and 117° 34′/118° 50′ E (Figure 1) and is approximately 125 km from west to east and 125 km from north to south. The coastal region is flat and low lying with a length of about 300 km. The intertidal mud flats range from about 1-4 km in width and are backed by very extensive salt-pans and shrimp/fish ponds for most of their length. A number of large rivers flow into Bohai Wan, including the Hai He near Tianjin. Tides are semi-diurnal in the west and irregularly semi-diurnal in the north and south, with the range

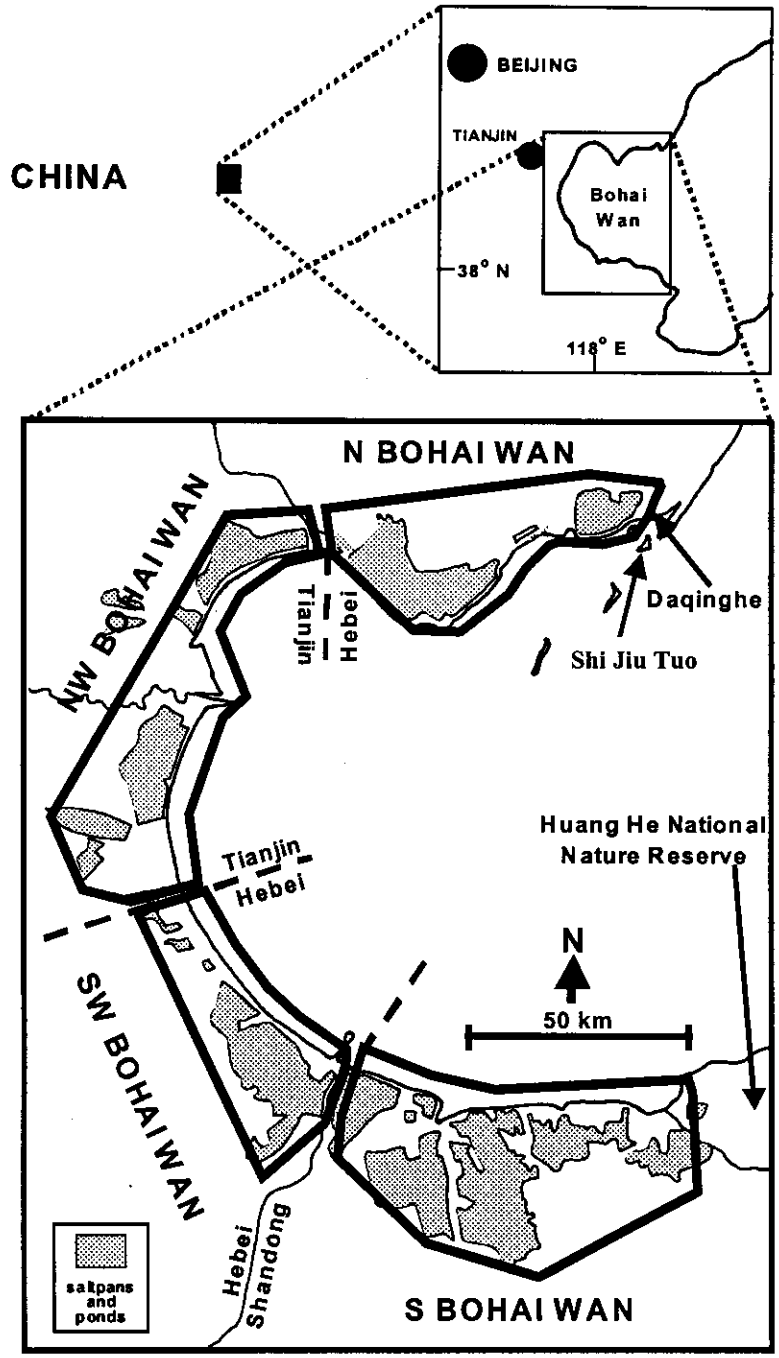

Figure 1. Location of Bohai Wan in northeastern China and the four regions that are treated separately during the counts

varying from 5 m in the west to 3 m in the north and south (ADB 2000).

The largest city in the region is Tianjin with a population of nine million. Tianjin Municipality has several large economic development zones and the region is the largest industrial centre of north China. A major share of the area's export and import trade passes through the port of Tanggu, near Tianjin. The Bohai is the second largest oil-producing region in China and many oil wells are located in the coastal and offshore areas around Bohai Wan (pers. obs.). The high intensity of industrial development, together with the conversion of very large areas to salt works and shrimp/fish ponds, has led to significant wetland loss and alteration. Bohai Wan receives about one third of all the waste water discharged to China's coastal waters and is highly polluted (ADB 2000), resulting in a significant reduction in marine and benthic stocks (Yuan *et al.* 2001). Human disturbance of feeding and roosting birds around the bay is at high levels (pers. obs.).

METHODS

The area surveyed in the two counts included (Figure 1):

a) Intertidal flats -
   - N Bohai Wan – from Daqinghe to the northern Tianjin/Hebei border;
   - NW Bohai Wan (Tianjin Municipality);
   - SW Bohai Wan – from the southern Tianjin/Hebei border to the Hebei/Shandong border;
   - S Bohai Wan – from the Hebei/Shandong border to the Huang He National Nature Reserve;

b) Salt-pans and shrimp/fish ponds in all four regions.

Surveys were conducted from 10 to 14 May 2000 and 24 April to 9 May 2002. Good vehicle access to the coast, possible along mud tracks through the pans and ponds. A boat was used to survey the Xintiao Estuary and the coastline to the west of there.

The extensive areas of salt-pans and shrimp/fish ponds, which occur along most of the coastline (Figure 1) often made it difficult to reach the coastline at the desired locations. However, we mostly succeeded in our plan to survey the intertidal areas from positions around the coast which were approximately 3 km apart. In a few cases the separation between survey points was greater when rivers and large channels restricted access to the coast. We counted shorebirds opportunistically in the salt-pans and shrimp/fish ponds whilst passing through them. We also conducted surveys within some of the salt works and shrimp/fish pond complexes, but these were normally limited in extent because of difficult vehicular access. The coverage of salt-pans and shrimp/fish ponds varied between the different regions but, overall, is unlikely to have been more than 50% of the total area.

Tides were favourable for most of both count periods. High tides reached the sea wall on most days. Birds formed pre-high tide roosts as the tide front approached the sea wall and then moved into the adjacent salt-pans and shrimp/fish ponds as the mud flats were covered. As the tide fell they returned to the mud flats and started feeding, often quickly moving considerable distances along the receding tide edge. Few problems were experienced when it was necessary to count shorebirds at low tide as the mudflats generally did not exceed 2 km in width. However, counting shorebirds at such distances meant that we often could not identify them to species level. The weather was generally good, sometimes excellent, and rain caused little disruption. Visibility was generally satisfactory.

The majority of birds found in salt-pans and shrimp/fish ponds away from the coast (e.g. Marsh Sandpiper, Spotted Redshank, Curlew Sandpiper, Sharp-tailed Sandpiper, Black-winged Stilt and Pied Avocet) both fed and roosted there. Distribution of shorebirds in pans and ponds was patchy. We occasionally found concentrations of 1 000 to 2 000 birds, but most flocks numbered 50 – 100. Birds were also distributed widely in low concentrations in apparently less favoured areas.

The general accuracy of counts is believed to be reasonable although no check counts were carried out. Any errors would tend to lead to under-estimation of shorebird numbers. Appropriate corrections were made to counts when birds moved between adjacent sections. The "1% of estimated flyway population" criterion from Bamford *et al.* (in prep.) was used to determine whether a species was present in internationally significant numbers.

RESULTS

Numbers and general distribution

total of 192 805 shorebirds of 37 species was counted in the two surveys (Table 1). This number included 49 721 unidentified shorebirds (26% of the total count); a further 4 200 unidentified godwit and 8 328 unidentified curlew were counted. The highest numbers occurred in north, north-west and south Bohai Wan. Relatively few birds were found in the south-west of the Bay.

The ten most common species counted, which represented 87.9% of the 130 552 identified shorebirds, were: Red Knot, 18.1%; Marsh Sandpiper, 17.5%; Curlew Sandpiper, 12.1%; Grey Plover 10.2%; Dunlin, 9.8%; Black-tailed Godwit, 5.5%; Kentish Plover, 4.5%; Red-necked Stint, 3.7%; Bar-tailed Godwit, 3.3%; and Sharp-tailed Sandpiper, 3.2%.

Distribution of internationally important species

Twenty species (including all of the ten most common species) were found to occur in internationally important numbers in Bohai Wan during the two surveys. These are: Black-tailed Godwit, Bar-tailed Godwit, Whimbrel, Eurasian

Table 1. The numbers of shorebirds counted in the four regions of Bohai Wan in 2000 (10-14 May) and 2002 (24 April-9 May). See Figure 1 for locations of regions. Percentage identified is the species count as a percentage of the total number of birds identified. Internationally important numbers in **bold**.

Species	Region of Bohai Wan				TOTAL	Birds (%)
	North	North West	South West	South		
Common Snipe *Gallinago gallinago*	10	-	-	-	10	<0.1
Snipe sp. *Gallinago* sp.	-	4	-	-	4	<0.1
Black-tailed Godwit *Limosa limosa*	**6 471**	234	143	301	**7 149**	5.5
Bar-tailed Godwit *Limosa lapponica*	527	2 321	17	1 499	**4 364**	3.3
Godwit sp. *Limosa* sp.	4 200	-	-	-	4 200	3.2
Whimbrel *Numenius phaeopus*	28	126	211	278	**643**	0.5
Eurasian Curlew *Numenius arquata*	**2 890**	52	141	201	**3 284**	2.5
Eastern Curlew *Numenius madagascariensis*	221	26	131	7	**385**	0.3
Curlew sp.	4 905	254	2 656	513	8 328	6.4
Spotted Redshank *Tringa erythropus*	66	24	134	**802**	**1 026**	0.8
Common Redshank *Tringa totanus*	31	7	21	26	85	0.1
Marsh Sandpiper *Tringa stagnatilis*	**4 500**	**2 425**	**1 753**	**14 183**	**22 861**	17.5
Common Greenshank *Tringa nebularia*	89	290	55	185	**619**	0.5
Green Sandpiper *Tringa ochropus*	1	-	-	-	1	<0.1
Wood Sandpiper *Tringa glareola*	6	295	13	5	319	0.2
Terek Sandpiper *Xenus cinereus*	2	31	-	85	118	0.1
Common Sandpiper *Actites hypoleucos*	-	6	-	10	16	<0.1
Ruddy Turnstone *Arenaria interpres*	3	32	-	11	46	<0.1
Asian Dowitcher *Limnodromus semipalmatus*	**1 153**	**966**	-	1	**2 120**	1.6
Great Knot *Calidris tenuirostris*	192	3 610	-	-	**3 802**	2.9
Red Knot *Calidris canutus*	**9 358**	**14 277**	9	2	**23 646**	18.1
Sanderling *Calidris alba*	1	2	-	-	3	<0.1
Red-necked Stint *Calidris ruficollis*	30	**4 285**	23	494	**4 832**	3.7
Temminck's Stint *Calidris temminckii*	49	-	-	4	53	<0.1
Long-toed Stint *Calidris subminuta*	-	1	-	-	1	<0.1
Sharp-tailed Sandpiper *Calidris acuminata*	52	**2 855**	16	1 262	**4 185**	3.2
Dunlin *Calidris alpina*	6 146	4 980	1 298	419	**12 843**	9.8
Curlew Sandpiper *Calidris ferruginea*	564	**12 489**	238	**2 512**	**15 803**	12.1
Broad-billed Sandpiper *Limicola falcinellus*	67	124	-	-	**191**	0.1
Ruff *Philomachus pugnax*	-	-	20	-	20	<0.1
Eurasian Oystercatcher *Haematopus ostralegus*	-	-	-	41	41	<0.1
Black-winged Stilt *Himantopus himantopus*	**334**	44	113	**1 037**	**1 528**	1.2
Pied Avocet *Recurvirostra avosetta*	28	3	**402**	**436**	**869**	0.7
Pacific Golden Plover *Pluvialis fulva*	-	2	10	12	24	<0.1
Little Ringed Plover *Charadrius dubius*	5	-	-	1	6	<0.1
Grey Plover *Pluvialis squatarola*	**2 972**	**6 493**	366	**3 550**	**13 381**	10.2
Kentish Plover *Charadrius alexandrinus*	**1 729**	261	934	**2 886**	**5 810**	4.5
Lesser Sand Plover *Charadrius mongolus*	3	357	4	2	366	0.3
Greater Sand Plover *Charadrius leschenaultii*	1	1	4	1	7	<0.1
Oriental Pratincole *Glareola maldivarum*	1	9	10	75	95	0.1
Unidentified shorebirds	14 699	16 667	3 576	14 779	49 721	
TOTAL	**61 334**	**73 553**	**12 298**	**45 620**	**192 805**	

Curlew, Eastern Curlew, Spotted Redshank, Marsh Sandpiper, Common Greenshank, Asian Dowitcher, Great Knot, Red Knot, Red-necked Stint, Sharp-tailed Sandpiper, Dunlin, Curlew Sandpiper, Broad-billed Sandpiper, Black-winged Stilt, Pied Avocet, Grey Plover, and Kentish Plover. The numbers counted of these species are given in boldface in Table 1.

Very important concentrations, at least 5% of the estimated species flyway population, of Eurasian Curlew, Asian Dowitcher, Red Knot and Marsh Sandpiper occurred in north Bohai Wan, of Red

Knot and Curlew Sandpiper in north-west Bohai Wan, and of Marsh Sandpiper and Black-winged Stilt in south Bohai Wan.

Breeding shorebirds

Kentish Plovers were found breeding widely throughout the coastal regions, particularly along the banks of salt-pans and shrimp/fish ponds. There is no doubt that all the geographical regions around Bohai Wan supported internationally important breeding concentrations.

In one area of south Bohai Wan we counted 25 Pied Avocet nests and, as there were 246 Avocets in the general vicinity, it is very likely that there were more nests present. There were also 696 Black-winged Stilts in the same area, some of which were observed building nests. Avocets were also observed courting and defending territories in other parts of south Bohai Wan.

Paired Eurasian Oystercatchers (of the uncommon subspecies *H. o. osculans*) were encountered around the coastline and some nests were found. We also observed Oriental Pratincoles that may have been breeding.

DISCUSSION

Marsh Sandpiper, Asian Dowitcher, Red Knot, Sharp-tailed Sandpiper and Curlew Sandpiper are comparatively much more common in Bohai Wan than in the Yellow Sea as a whole (Barter 2002) whilst Bar-tailed Godwit, Whimbrel, Great Knot and Dunlin are far less common.

Bohai Wan holds the highest numbers of Red Knot so far found in the Yellow Sea, with the species being concentrated in the north-west and north-east regions of the bay. It seems that a minimum of 25 000 Red Knot occur in the northern part of the bay if allowance is made for numbers counted in the Shi Jiu Tuo area (Barter 2002). It is possible that improved spatial and temporal coverage will lead to the discovery of higher numbers. The numbers of Red Knot counted so far in the Yellow Sea is only about 30% of the estimated flyway population of 220 000 (Bamford *et al.* in prep). It is very important to identify the sites this species is using given that it is an obligate user of intertidal areas and the whole flyway population must be passing through the Yellow Sea on northward migration. The population in Bohai Wan may be the recently described *piersmai* race which breeds on the New Siberian Islands (Tomkovich 2001).

The northern areas of Bohai Wan are also very important for the near-threatened Asian Dowitcher, which only occurs in good numbers elsewhere in the Yellow Sea along the Jiangsu coast line (Barter 2002). More than 2 000 dowitchers were counted in the bay but, as with Red Knot, the species has also occurred in good concentrations at Shi Jiu Tuo and improved coverage may lead to the discovery of higher numbers.

The presence of very high numbers of Marsh Sandpiper, together with those of Curlew Sandpiper and Sharp-tailed Sandpiper, is due to the existence of very extensive areas of their preferred salt-pan habitat. The three species are virtually confined to the east coast of China and it has been suggested that they migrate on a broad front with significant proportions of their populations using inland migration routes with perhaps only the most easterly part of these reaching the Yellow Sea coast (Barter 2002). It should be noted that all three species are probably significantly undercounted due to the incomplete coverage of salt works.

The total number of curlew counted was almost 12 000 of which 8 328 were unidentified. Given that Eurasian Curlew represented 90% of the identified curlew, it seems that perhaps more than 10 000 birds of this species were present at the time of the count. Although Eurasian Curlew are widespread in the Yellow Sea during northward migration (Barter 2002), the high numbers in Bohai Wan confirm that this region is the most important part of the Yellow Sea for the species. The high numbers recorded in the late-April/mid-May period are particularly interesting as this species is considered to be an early migrant (Zhu *et al.* 2001).

A total of 24 species have now been recorded in internationally important numbers in Bohai Wan, with the addition of the records of Common Redshank, Northern Lapwing, Little Ringed Plover and Oriental Pratincole in the near-coastal areas of Tianjin Municipality (S.P. Zhang *in litt.*) to the 20 species identified in the 2000 and 2002 coastal surveys.

The total number of shorebirds present in Bohai Wan and the associated salt-pans and shrimp/fish ponds during the count period is likely to have been higher than the 193 000 actually counted during the two surveys. As mentioned above, it is estimated

that no more than 50% of the pan and pond habitat was surveyed, although we have no way of knowing how evenly birds were distributed across this habitat and, thus, whether we fortuitously counted the more densely populated areas. As a total of 49 787 shorebirds was counted in pans and ponds during the two surveys, it is possible that 100 000 birds may have been present in this type of habitat. Thus, the number of shorebirds in Bohai Wan may have approached 250 000 in total at the time of the counts.

The large number of shorebirds using Bohai Wan, combined with the high species diversity, numbers of internationally important species and presence of significant concentrations of breeding birds, confirm that the region is one of outstanding importance as a staging area within the East Asian-Australasian Flyway.

It is essential that survey coverage be improved, both spatially and temporally, in order to improve our understanding of the importance of Bohai Wan for shorebirds. It is particularly important to determine how many Red Knot are using the intertidal areas in the north and north-west. Emphasis should be given to surveys during southward migration and improved coverage of the pans and ponds during both migrations.

It is highly desirable that all levels of government and local industry be advised of the importance of the region for shorebirds and the need for them to plan activities and developments to minimise habitat loss and disturbance to birds. Local communities should also be made aware of the significance of the area through education programmes. This activity is particularly important because of the extent to which the inhabitants utilize the wetland resources.

ACKNOWLEDGEMENTS

The surveys and counts of north and south-west Bohai Wan would not have been possible without assistance from the management and staff of Tanghai No.7 Farm and the Hebei Forestry Administration, who provided vehicles, advised on access to survey and count sites, and organised accommodation. Zhang Shupin, Biology Department of Beijing University, provided useful advice on access to wetland areas in the north-west as well as making the University's count data available. We also thank Environment Australia for providing the funding to cover participants' travel and accommodation costs through its financial support of the East Asian-Australasian Flyway Shorebird Action Plan.

REFERENCES

ADB 2000. Annex A "Coastal Marine Environment and Living Resources". *In:* Coastal Resource Conservation and Environmental Management Project for the Bohai Sea. Asian Development Bank, Manila.

Bamford, M.J., Watkins, D.G., Bancroft, W. and Tischler, G (in prep.). Migratory Shorebirds of the East Asian-Australasian Flyway: Population Estimates and Important Sites. Wetlands International, Oceania.

Barter, M.A. 2002. Shorebirds of the Yellow Sea: Importance, Threats and Conservation Status. Wetlands International Global Series No. 8, International Wader Studies 12, Wetlands International-Oceania, Canberra.

Barter, M.A., Li, Z.W. & Xu, J.L. 2001. Shorebird numbers on the Tianjin Municipality coast in May 2000. Stilt 39, 2-9.

Tomkovich, P.S. 2001. A new subspecies of Red Knot *Calidris canutus* from the New Siberian Islands. *Bull. Brit. Orn. Cl.* 121, 257-263.

Yuan, J. *et al.* 2001. Yellow Sea Ecoregion: Reconnaissance Report on Identification of Important Wetland and Marine Areas for Biodiversity. Volume 2: China. WWF-Japan, Wetlands International-China and Wetlands & Birds Korea.

Zhu, S.Y., Li, Z.W., Lu, J.Z., Shan, K. & Barter, M.A. 2001. Northward migration of shorebirds through the Huang He delta, Shandong Province, in the 1997-1999 period. Stilt 38, 33-38.

WADER OBSERVATIONS AT THE SERPENTINE RIVER RESERVE, WESTERN AUSTRALIA

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ABSTRACT
The Serpentine River Reserve on the Peel Inlet south of Perth, Western Australia was surveyed from 1996 to 2003. The objective of the study was to determine the number and diversity of wader species that overwinter in the northern Peel Inlet. The seasonal importance of this wetland to waders is assessed.

INTRODUCTION

The extensive wetlands that once graced the northern foreshores of the Peel Inlet have largely disappeared. Many have been transformed into canal developments, a process that continues unabated. Comparison of the present distribution of wetlands with those on topographic maps of 25 years ago shows that at least half of the wetlands around the Mandurah Estuary have been reclaimed. The remaining fragments play an important role as roosting and feeding sites. They also act as staging areas for the flocks of migratory waders arriving in spring when water levels around the Peel Inlet are still high.

Surveys were conducted over a seven year period (1996-2003) to monitor wader populations. in the Serpentine River Reserve and elsewhere. Emphasis was placed on gathering information on the species and numbers of waders that overwinter in the northern Peel Inlet. The Serpentine River Reserve is under the care and control of the City of Mandurah. It is known as Reserve 32836 and zoned a Conservation and Foreshore Reserve. The Peel Regional Scheme proposes that the reserve will become part of the Peel Regional Park. This scheme passed both houses of the Western Australian parliament in March 2003 and it is anticipated that the Peel Regional Park will become the responsibility of the Department of Conservation and Land Management (CALM).

METHODS

The Serpentine River flows into the northern Peel Inlet (Figure 1). A small wildlife sanctuary is located on the western side of the Serpentine River (32° 34'S 115° 46'E). It consists of samphire flats, small tidal pools, sand, and mudflats (Figure 2). A

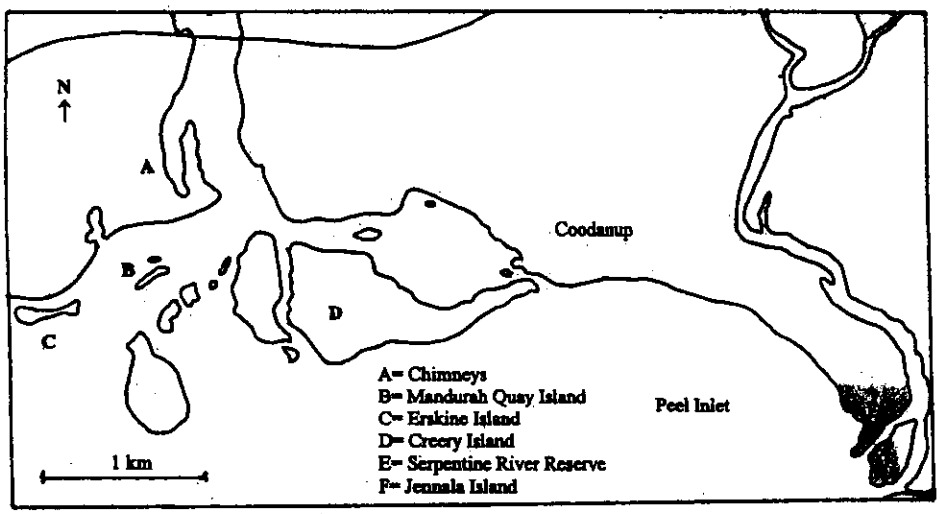

Figure 1. Map of Serpentine River Reserve and adjacent parts of the Peel Inlet, south-western Western Australia.

Figure 2. View of the seaward edge of the Serpentine River Reserve showing the predominant wader habitats.

narrow band of Sheoak *(Casuarina)* fringes the river's western bank. Directly to the north of the reserve is a drainage pond from which it is separated by an embankment. The pond, which is excavated out of limestone and is on private land, was included in the surveys. A channel has formed where the Serpentine River discharges into the Peel Inlet. There are extensive shallow areas on both sides of the channel which are exposed at low tides. The western side, in particular, consists of extensive sand and mudflats. Jennala Island is located in the mouth of the Serpentine River and is largely covered by samphire.

The Reserve was surveyed on a regular basis from 1996 to 2003. Surveys were conducted in all months. Table 1 gives the number of counts in each month of the eight wader years (starting, by convention, on August 1) in which counts were made. It shows that most counting effort was spread fairly evenly over the non-summer months. Waders were sometimes absent during the winter months. This was mainly due to high tides and storm surges. In these situations flooding submerges the reserve and leaves no suitable wader habitat. Wader absences in summer were attributed to the high level of disturbance caused by recreational activities such as people walking their dogs in the reserve (a common occurrence), riding trail bikes, and crabbing. No waders were seen in the reserve on visits on 26 December 96, 17 May 97, 27 June 99, 25 July 99, and 17 June 2000. Surveys were usually carried out in the morning by walking around the reserve and recording all waders seen. All

Table 1. The total number of wader counts at Serpentine River Reserve during the survey from 1996 to 2003.

Season	Month												
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
1995/96	-	-	-	-	-	-	-	-	-	1	1	2	4
1996/97	1	1	1	0	0	0	0	1	1	0	1	2	8
1997/98	2	2	0	0	0	0	1	1	1	1	1	0	9
1998/99	2	3	0	0	0	1	0	1	2	1	1	0	11
1999/00	1	2	1	0	0	1	0	1	0	2	1	0	9
2000/01	1	1	2	1	0	1	1	2	2	0	1	2	14
2001/02	1	2	1	0	0	1	1	1	1	2	1	1	12
2002/03	1	2	2	1	1	0	1	2	1	-	-	-	11
Total	9	13	7	2	1	4	4	9	8	7	7	7	78

observations were made using 15 x 60 binoculars.

RESULTS

Over the period 1996-2003, 24 wader species were recorded in the reserve. Counts by date are given in Table 2. Brief notes on points of interest are given below.

The mudflats near the mouth of the Serpentine River are a favourite feeding site for Bar-tailed Godwit *Limosa lapponica* and a feeding and roosting site for Red-necked Avocet *Recurvirostra novaehollandiae*. Red-necked Avocet gather at the reserve in medium size flocks from May to November.

In times of drought, large numbers of Banded Stilt *Cladorhynchus leucocephalus* congregate on the salt lakes of Creery Island and the adjacent Creery Inlet. Small groups of them spill over into the surrounding wetlands and along the northern foreshore. Records of Banded Stilt at the Serpentine River Reserve coincided with these events. Banded Stilt often fed on the drainage pond.

Common Greenshank *Tringa nebularia* have been recorded throughout the year. A favoured location for them and Black-winged Stilt *Himantopus himantopus* is the shallow pools on Jennala Island. Groups of Common Greenshank were seen departing from Jennala Island in autumn. They were recorded roosting in large numbers at the drainage pond to the north of the Serpentine River Reserve in October 2001. This was away from their usual site at the Chimneys Reserve. The Chimneys Reserve in the Mandurah Estuary is a significant site for Greenshank. Each year Greenshank gather here in considerable numbers, particularly during September and October, before gradually decreasing in number as they disperse over the Peel-Harvey Inlet (Pridham 1998). Some high counts at the Chimneys Reserve were: 135 on 13 October 1997 (Pridham 1998); 110 on 27 October 1999; 97 on 6 October 2000; 94 on 20 October 2001 and 66 on 29 September 2002 (pers obs).

The transit of Grey Plover *Pluvialis squatarola* through the reserve showed a peak towards the end of March and early April with some birds starting to moult into breeding plumage and showing black scalloping on the belly. A similar transit period was noticed for Red Knot *Calidris canutus* with some breeding plumage showing in April.

The Black-fronted Dotterel *Charadrius melanops* frequents the reserve from April to August although it is not seen each year.

Numbers of Red-necked Stint *Calidris ruficollis* and Red-capped Plover *Charadrius ruficapillus* peak in September and October.

The narrow banks of the Serpentine River and the drainage pond are the favoured habitat for Common Sandpiper *Actitis hypoleucos*.

Winter counts produced low numbers of waders which was anticipated. Observations made at the Serpentine River Reserve indicate that at least ten species of migratory wader overwinter in the northern Peel Inlet.

Four species, Terek Sandpiper *Xenus cinereus*, Great Knot *Calidris tenuirostris*, Curlew Sandpiper *Calidris ferruginea*, and Broad-billed Sandpiper *Limicola falcinellus* were only observed once in winter during the survey, suggesting that these species may only overwinter in some years. Others species seen more often were Bar-tailed Godwit *Limosa lapponica*, Eastern Curlew *Numenius madagascariensis*, Common Greenshank *Tringa nebularia*, Red Knot *Calidris canutus*, Red-necked Stint *Calidris ruficollis*, and Grey Plover. Bar-tailed Godwit and Red-necked Stint were the most common and numerous of the winter waders.

Winter observations are presented in Table 3. For the purpose of this survey only June and July were considered to be winter months because the first migratory waders arrive in August. Apart from a solitary Red-necked Stint, there are no wader records from the winter of 1999 due to extensive flooding.

Some historical data are available for the Serpentine River Reserve covering the months February to April 1985 (Baker, 1988). These are presented in Table 4. To provide a basis for comparing results, matching counts were held from February to April 2001. The main difference between the surveys was in the number of Red-necked Stint. Their numbers were considerable higher in the past.

A Pied Oystercatcher *Haematopus longirostris* nest with two eggs was found on 12 November 2002 on the narrow verge between John Street and the foreshore.

Table 2. The numbers of waders counted at Serpentine River Reserve from May 1996 until Sept 1997.

Species	1996							1997									
	12 May	8 Jun	14 Jun	20 Jul	12 Aug	13 Sep	21 Oct	6 Mar	6 Apr	26 Apr	26 Jun	7 Jul	19 Jul	2 Aug	23 Aug	14 Sep	23 Sep
Bar-tailed Godwit	1	.	.	5	4	.	2	5	16	.	.	.	.	.	.	.	.
Eastern Curlew	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Common Greenshank	.	.	.	.	.	1	2	2	.	.	.	.	.	.	.	heard	5
Common Sandpiper	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Grey-tailed Tattler	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Great Knot	53	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
Red Knot	.	.	.	.	.	.	.	19	.	.	.	.	5	.	.	.	.
Red-necked Stint	2	48	.	.	.	9	>500	11	43	.	.	.	.	.	.	.	16
Sharp-tailed Sandpiper	.	.	.	.	.	.	PNC	.	.	.	.	.	.	.	.	.	.
Curlew Sandpiper	.	.	.	.	.	.	PNC	.	.	.	.	.	.	.	.	.	2
Pied Oystercatcher	.	.	.	2	.	.	.	.	.	.	.	2	2	1	.	.	1
Black-winged Stilt	PNC	42	20	.	.	.	.	82	.	31	1	5	32	2	.	.	.
Banded Stilt	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Red-necked Avocet	23	12	35	41	27	.	276	.	.	.	.	.	6	12	.	.	141
Grey Plover	1	1	1	.	.	.	1	10	5	.	.	.	.	.	.	.	.
Red-capped Plover	8	1	.	1	2	4	>100	2	.	.	.	19	7	.	.	6	23
Black-fronted Dotterel	.	.	.	.	.	.	.	.	.	.	1	3	3	3	2	.	.
Total	88	104	56	49	33	14	>883	137	64	31	2	29	55	18	2	6	188

Table 2 (cont.). The numbers of waders counted at Serpentine River Reserve from Feb 1998 until May 1999.

	1998													1999			
	13 Feb	26 Mar	24 Apr	17 May	6 Jun	20 Jun	17 Jul	3 Aug	14 Aug	12 Sep	20 Sep	26 Sep	23 Jan	6 Mar	10 Apr	29 Apr	22 May
Bar-tailed Godwit	.	2	.	.	.	1	5	3	.	2	.	1	2	33	1	.	5
Eastern Curlew	1	3	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Common Greenshank	3	2	1	1	2	.	.	.	.	11	14	3	1	2	.	.	.
Terek Sandpiper	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Common Sandpiper	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Grey-tailed Tattler	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Great Knot	.	.	.	.	.	.	.	.	.	.	.	.	.	64	.	.	.
Red Knot	.	.	.	.	.	.	.	.	.	.	.	1	.	3	.	.	.
Red-necked Stint	87	13	.	1	.	.	65	59	.	2	>330	>700	.	44	1	1	.
Sharp-tailed Sandpiper	.	.	.	.	.	.	.	.	.	.	6	1	.	.	.	.	.
Curlew Sandpiper	.	.	.	.	.	.	16	1	.	.	11	15	.	1	.	.	.
Broad-billed Sandpiper	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.
Pied Oystercatcher	2	.	.	2	.	3	.	.	.	3	.	.	.	.	.	.	.
Black-winged Stilt	11	5	7	24	>150	7	3	5	.	4	.	.	16	.	.	.	.
Banded Stilt	.	3	33	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Red-necked Avocet	.	.	.	.	.	.	.	.	.	.	>20	16	.	.	.	.	.
Grey Plover	3	7	1	1	3	4	1	3	.	2	1	4	.	1	9	.	.
Red-capped Plover	76	8	.	.	.	.	6	7	13	22	38	63	7	6	.	1	.
Greater Sand Plover	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Black-fronted Dotterel	.	.	.	8	9	3	.	3	.	.	.	.	.	.	.	.	.
Red-kneed Dotterel	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Total	183	43	43	37	166	19	97	81	13	46	420	805	26	154	13	2	5

Table 2 (cont.). The numbers of waders counted at Serpentine River Reserve from June 1999 until Feb 2001.

	1999					2000										2001	
	6 Jun	29 Aug	15 Sep	25 Sep	27 Oct	15 Jan	29 Mar	5 May	26 May	11 Jun	20 Aug	27 Sep	6 Oct	24 Oct	28 Nov	27 Jan	17 Feb
Bar-tailed Godwit	.	.	.	.	.	24	21	1	9	.	.	3	.	.	7	36	52
Whimbrel	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Eastern Curlew	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Common Greenshank	.	7	8	.	.	2	3	1	.	.	.	.	heard	3	2	1	2
Terek Sandpiper	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Common Sandpiper	.	.	1	.	.	.	1	.	.	.	.	1	.	.	.	.	2
Grey-tailed Tattler	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.
Ruddy Turnstone	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Great Knot	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Red Knot	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Red-necked Stint	1	.	150	>38	5	37	.	.	.	.	20	>350	>800	350	450	8	2
Long-toed Stint	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Sharp-tailed Sandpiper	.	.	.	.	.	8	.	.	.	.	.	.	.	.	5	2	5
Curlew Sandpiper	.	.	1	.	.	6	.	.	.	.	.	3	3	3	6	8	.
Pied Oystercatcher	.	.	1	.	.	.	2	2	.	1	1	1	2	.	1	.	1
Black-winged Stilt	.	.	.	.	.	18	.	.	.	1	.	.	.	.	.	.	11
Red-necked Avocet	.	.	.	2	.	.	.	.	.	.	.	27	154	240	92	1	.
Grey Plover	.	.	5	.	.	2	18	.	.	.	.	.	.	.	3	3	5
Red-capped Plover	.	.	11	23	47	19	.	.	6	.	16	>188	>60	>40	>46	5	3
Greater Sand Plover	.	.	6	.	.	.	.	.	.	.	.	4	.	.	1	.	.
Total	1	7	185	63	52	118	45	4	15	2	37	577	1020	637	617	64	83

Table 2 (cont.). The numbers of waders counted at Serpentine River Reserve from March 2001 until May 2002.

	2001											2002					
	8 Mar	27 Mar	10 Apr	29 Apr	9 Jun	5 Jul	29 Jul	22 Aug	17 Sep	26 Sep	20 Oct	18 Jan	16 Feb	31 Mar	23 Apr	16 May	30 May
Bar-tailed Godwit	14	3	16	16	13	3	6	1	.	.	6	46	9	3	17	10	13
Eastern Curlew	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Common Greenshank	2	23	2	3	.	1	.	1	4	7	79	1	1	1	3	.	.
Terek Sandpiper	1	1	1	1	1	.	.	.	.	.	1	.	.	.	.	.	.
Common Sandpiper	.	.	1	.	.	.	.	.	.	2	2	1	.	.	.	.	.
Grey-tailed Tattler	.	.	.	.	.	.	.	.	.	.	3	1	.	.	1	.	.
Great Knot	3	.	43	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Red Knot	36	37	22	.	4	.	.	.	.	.	.	.	4	2	70	.	14
Red-necked Stint	.	2	20	16	36	15	.	.	75	50	>300	122	40	11	24	.	31
Sharp-tailed Sandpiper	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Curlew Sandpiper	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Pied Oystercatcher	.	1	2	6	2	3	.	.	.	3	1	6	.	.	2	.	.
Black-winged Stilt	10	20	28	15	8	5	4	5	.	.	.	4	.	12	22	7	25
Banded Stilt	.	.	53	110	.	.	.	.	.	.	62	.	.	4	.	5	19
Red-necked Avocet	.	.	.	.	.	.	>250	>200	252	130	150	1	.	.	7	10	220
Grey Plover	10	11	6	3	2	2	2	3	.	1	.	9	2	6	4	3	.
Red-capped Plover	1	32	30	6	1	20	.	7	4	22	69	74	44	1	.	.	46
Greater Sand Plover	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.
Total	79	130	224	176	68	49	262	217	335	216	674	265	101	40	150	35	369

Table 2 (cont.). The numbers of waders counted at Serpentine River Reserve from June 2002 until April 2003.

	2002									2003			
	23 Jun	23 Jul	18 Aug	8 Sep	29 Sep	9 Oct	14 Oct	12 Nov	15 Dec	9 Feb	11 Mar	23 Mar	23 Apr
Bar-tailed Godwit	.	7	12	.	.	1	1	.	17	.	.	.	.
Whimbrel	.	.	.	.	.	.	.	.	.	.	.	.	.
Eastern Curlew	.	.	.	.	.	.	.	.	.	.	.	.	.
Common Greenshank	.	.	.	5	39	8	1	4	2	1	1	.	2
Terek Sandpiper	.	.	.	.	.	.	.	.	.	.	.	.	.
Common Sandpiper	.	.	.	.	.	.	.	.	1	.	.	.	.
Grey-tailed Tattler	.	.	.	.	.	.	.	.	.	.	.	.	.
Ruddy Turnstone	.	.	.	.	.	.	.	.	.	.	.	.	.
Great Knot	.	.	.	.	.	.	.	.	1	.	.	.	.
Red Knot	.	.	.	.	.	.	.	.	.	.	.	.	.
Red-necked Stint	2	2	68	255	.	1	.	120	>260	92	117	39	2
Long-toed Stint	.	.	.	.	.	.	.	.	.	.	.	.	.
Sharp-tailed Sandpiper	.	.	.	2	.	1	.	6	.	3	.	.	.
Curlew Sandpiper	.	.	2	5	.	.	.	5	10	.	.	.	.
Pied Oystercatcher	2	.	2	1	.	2	.	.	1	.	1	.	.
Black-winged Stilt	24	5	.	.	2	34	19	>12	>13	14	9	25	28
Banded Stilt	120	32	4	3	35	245	130	>54	9	1	11	.	.
Red-necked Avocet	180	47	112	83	14	11	51	50	.	.	1	1	.
Grey Plover	.	5	.	.	.	.	.	.	1	1	3	12	1
Red-capped Plover	17	8	32	44	.	31	4	7	>37	25	2	7	.
Greater Sand Plover	.	.	.	.	.	1	.	.	.	.	.	.	.
Black-fronted Dotterel	.	.	.	.	.	.	.	.	.	.	.	.	2
Total	345	106	232	398	90	335	206	258	342	137	145	84	35

Table 3: Maximum winter of waders at Serpentine River Reserve from 1996-2002 (SRR = Serpentine River Reserve; MQ=Mandurah Quay Island; ERSK=Erskine Island).

Species	Winter	Location	Max No.
Bar-tailed Godwit	1996	SRR	5
	1996	MQ	45
	1997	MQ	9
	1998	SRR	5
	1998	MQ	5
	2000	ERSK	3
	2001	SRR	13
	2002	MQ	4
Whimbrel	1997	MQ	4
Eastern Curlew	1996	MQ	1
	1997	MQ	2
	1998	SRR	1
Common Greenshank	1998	SRR	2
	2001	SRR	1
Terek Sandpiper	2001	SRR	1
Great Knot	1997	MQ	1
	2001	SRR	1
Red Knot	1997	SRR	5
	1997	MQ	3
	2001	SRR	4
Red-necked Stint	1996	SRR	48
	1998	SRR	65
	1999	SRR	1
	2001	SRR	36
	2002	SRR	2
Curlew Sandpiper	1998	SRR	16
Broad-billed Sandpiper	1998	SRR	1
Grey Plover	1996	SRR	1
	1998	SRR	4
	2000	ERSK	2
	2001	SRR	2

Table 4. Historical wader observations at Serpentine River Reserve from February to April 1985 (Baker 1988).

	1985 23 Feb	1985 2 Mar	1985 9 Mar	1985 16 Mar	1985 23 Mar	1985 31 Mar	1985 6 Apr	1985 13 Apr	1985 20 Apr
Black-tailed Godwit	.	.	.	.	.	.	13	1	.
Common Greenshank	2	1	3	3	3	10	3	4	1
Common Sandpiper	.	.	.	.	2	.	.	.	.
Red-necked Stint	13	200	27	89	122	1520	855	750	127
Sharp-tailed Sandpiper	2	.	.	.	1	5	1	2	.
Curlew Sandpiper	.	.	.	.	.	44	1	31	.
Pied Oystercatcher	2	.	.	.	.	.	.	.	.
Black-winged Stilt	78	69	135	32	88	80	76	148	82
Banded Stilt	.	.	.	.	.	.	.	.	10
Red-necked Avocet	14	.	7	37	.	2	.	5	20
Grey Plover	5	2	7	1	1	1	.	.	.
Red-capped Plover	2	5	.	5	11	32	16	1	12
Black-fronted Dotterel	.	.	.	4	1	.	.	.	1
Total	118	277	179	171	229	1694	965	942	253

DISCUSSION

It is possible that the texture and composition of the mudflats in the Serpentine River Reserve has changed over the years. In some parts the mud flats are compacted and covered by sand. The Serpentine River was dredged in August/September 1999 and spoil was deposited offshore from the reserve. It is not known how much was washed back on shore. However, at that time large areas of mudflat were covered in sand.

Disturbance levels at this site are increasing due to the residential development which now fronts the reserve and with the construction of a footpath along the southern boundary.

Water levels around the Peel-Harvey Inlet are higher in winter due to a combination of tidal ranges, storm surges, wind forces, and the larger volume of water flowing in from the Murray, Serpentine, and Harvey river catchment areas. Suitable wader habitat is significantly reduced and sites that remain accessible to waders are limited.

The Peel Inlet is best known as a summer site for migratory waders and the number overwintering in the northern part of the Inlet is not large. Nevertheless, observations made at sites around the northern Peel Inlet, like the Serpentine River Reserve, act as winter and early spring refuges for waders because they only flood in extreme circumstances and are available to waders when other sites are unsuitable. The Serpentine River Reserve, Boundary Island, and Mandurah Quay Island fall into this category. Other sites that were used by waders in winter were some of the small islands in Sticks Channel and to a lesser extent Erskine Island.

Fortunately, most of the wetlands remaining in the northern Peel Inlet are in reserves and protected from further development.

REFERENCES

Baker, G. F. 1988. Wader frequency counts at Peel Inlet, Western Australia, between 1983 and 1985. Stilt 12: 23-29.

Pridham, F. 1998. Greenshank Cove. Western Australian Bird Notes No 87.

SHOREBIRD STUDIES IN NORTH KAMCHATKA FROM JULY 5 – AUGUST 12 2002

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ABSTRACT

Studies of shorebird breeding and migration were conducted in northern Kamchatka from 6 July – 12 August 2002. The first phase of the investigation was carried out on the coast of the Korf Gulf from 6–10 July with the major objective of searching for breeding Spoon-billed Sandpiper. However, we were unable to locate any breeding Spoon-billed Sandpiper. Nesting was recorded for seven species and nest densities of four of these species were estimated by transect counts. Similar transect methods were used in forest-tundra near Manily Town on 11–12 July and in tundra near the mouths of the Penzhina and Talovka Rivers on 12–14 July to estimate nest densities at these sites.

Daily observations of the southward migration of shorebirds in the mouth of Penzhina River were conducted over 30 days from 12 July - 10August, 2002. Two methods of shorebird counting were used each day: a 5-6 hour count on mudflats along a fixed 10 km shoreline length and a count of shorebirds flying over the study area. The survey shows the great importance of the Penzhina River mouth for shorebirds during southward migration. A total 139,627 shorebirds of 29 species were counted. Most numerous were Dunlin (67,316), Red-necked Stint (60,964), Red-necked Phalarope (8,918) and Wood Sandpiper (1,131). We could not obtain reliable counts of night-migrating species (especially Common Snipe and Long-toed Stint). We also believe that most of the late-migrating species such as Dunlin, Long-billed Dowitcher, Pacific Golden Plover, and Grey Plover may pass through the Penzhina River mouth after our survey period. The numbers of Great Knot and Bar-tailed Godwit were unexpectedly low as they are numerous in Rekkiniki Bay (180 km to south-southwest) in July and August. Additional observations of migrating shorebirds were conducted on 10–12 August at the Shestakova River mouth where 808 birds of 16 species were counted.

INTRODUCTION

There have been few ornithological studies of the northern part of Kamchatka, especially for shorebirds. Many shorebird species nest in the region, but their preferred breeding habitats are unknown and there is little information on breeding biology. Few data on shorebird migration are available (Kistchinski 1980). The first study focusing on shorebird migration was the count carried out in the Korf Gulf in May 1998 (Gerasimov 1999). It is highly desirable to carry out more shorebird studies in north Kamchatka as it is potentially important for breeding shorebirds and is likely to be an important staging area during southward migration.

The main investigation area in 2002 was the Penzhina River mouth. This area has the second highest tidal range in the world, with a maximum of 14 m and an average of 9 m. Vast mudflats occur at low tide and it was believed that the area should be very important for shorebirds during southward migration as it is the closest coastal area to many of the breeding grounds. This study is the first carried out on shorebird migration at the Penzhina River mouth.

METHODS

The shorebird studies carried out from 6 July – 14 August 2002 consisted of five parts (the location of study areas is shown in Figures 1 to 3):

1. 6–10 July: A survey was carried out on the coast of the Korf Gulf (60° 24′ N 166° 20′ E). The main purpose was to search for breeding Spoon-billed Sandpipers *Eurynorhynchus pygmeus*. Additional information was collected on other species including transect counts of breeding birds.
2. 11–12 July: Study of breeding birds near Manily Town. A count of birds nesting in forest-tundra was made on the morning of 12 July.
3. 12–14 July: A count of nesting birds was made in tundra between the mouths of the Penzhina and Talovka Rivers.
4. 12 July–10 August: Daily observations of shorebird migration were conducted at the Penzhina River mouth (62° 28′ N 165° 15′ E).
5. 10–12 August: Observation of shorebird migration was conducted at the Shestakova River mouth and the adjacent area (62° 41′ N 164° 36′ E).

We searched about 100 km of coastline for Spoon-billed Sandpipers and nesting birds (Figure 2). Nesting density was estimated using fixed-width transects of 100m. We counted only nesting birds. These were identified by breeding song, food collection for chicks, or alarm displays due to our proximity to nests or broods. We mainly walked but

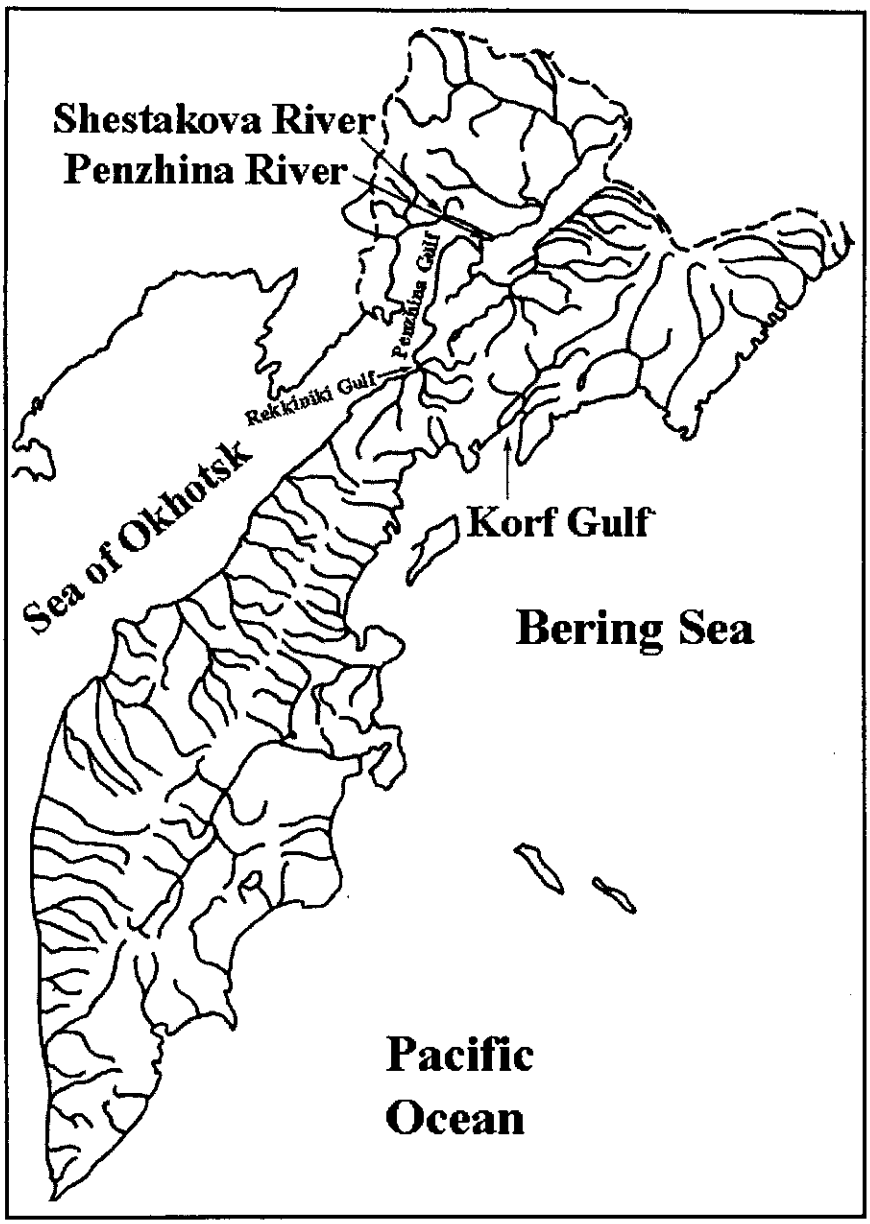

Figure 1. Location of the study areas on northern Kamchatka, eastern Russia.

used a boat and 4WD for moving between the various study areas.

We used two methods to study southward migration of shorebirds at the Penzhina River mouth. On a daily basis, we carried out a 5–6 hour count of shorebirds on mudflats along a fixed 10 km shoreline length (Figure 3). Shorebirds generally remain at the Penzhina River mouth no more than one day as suitable roosting places for species such as Dunlin *Calidris alpina* and Red-necked Stint *Calidris ruficollis* are not available during high tide. There are no beaches and only areas of grassland remain uncovered by water during high tide. Large numbers of shorebirds fly over the mudflats without stopping; these are not included in the mudflat count. The total daily count of total migrating birds includes both the count of birds on mudflats and those birds in passing flocks.

Study area and weather conditions

In Korf, the average annual temperature ranges from -0.9° to -3.5°C; the temperature range is from -39.3° C to +27.8° C. Normally, snow cover starts between 20 October – 1 December. Snow melt occurs from 4 May – 2 June. In Manily, the figures are -5.1° to -8.3° C for average temperature; from -52.4° C to +28.1° C for temperature range; 2 October – 9 November for snow cover; and from 3–31 May for snow melt (Anon 1970, 1971). During our studies in Korf Gulf maximum daytime temperatures varied from +14° to +16° C.

The Penzhina River is 713 km long and has a catchment area of 73,500 km^2, the Talovka River

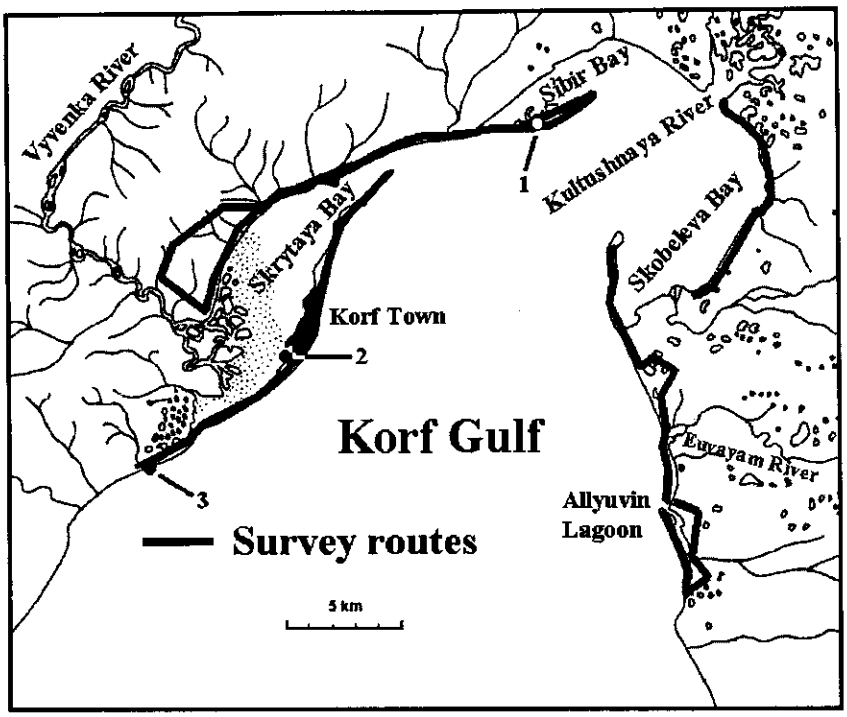

Figure 2. Map of the northern part of Korf Gulf. The lines show the walk routes and the numbered locations of shorebird concentrations (see text).

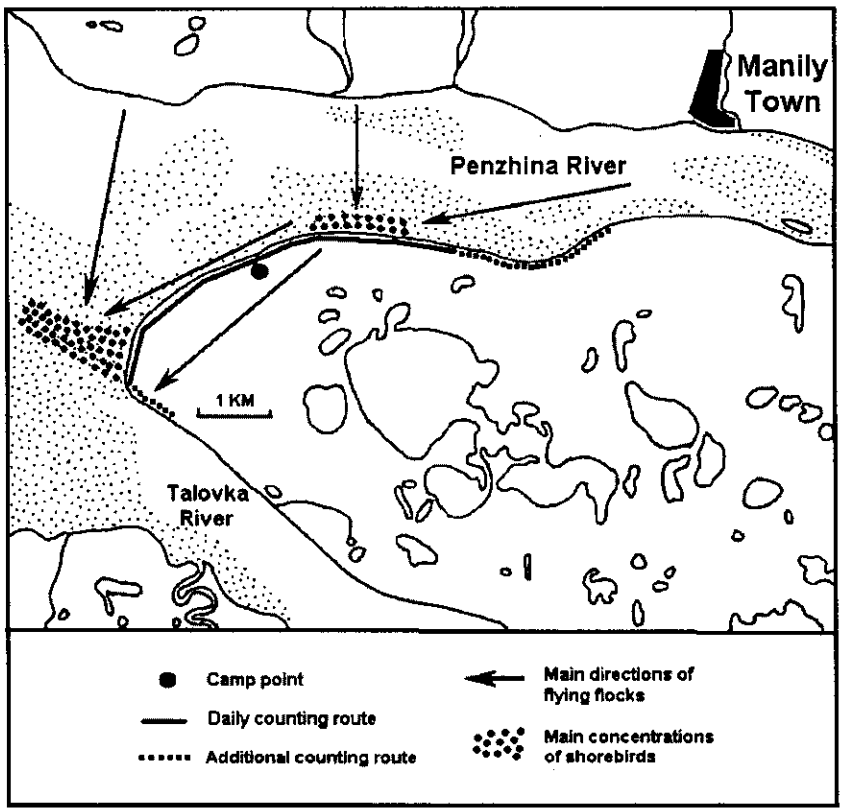

Figure 3. Map of Penzhina and Talovka River mouths.

has a length of 458 km and a catchment area of 24,100 km^2. The duration of ice cover on the rivers is about 200 days (Anon 1973). Sunny weather prevailed during our stay at the Penzhina River mouth. Two long periods of rain occurred from 18–19 July and 29 July– 1 August. The daily maximum temperatures are shown in Figure 4.

The main habitats of the northern Kamchatka lowlands are wet tundra and forest-tundra with

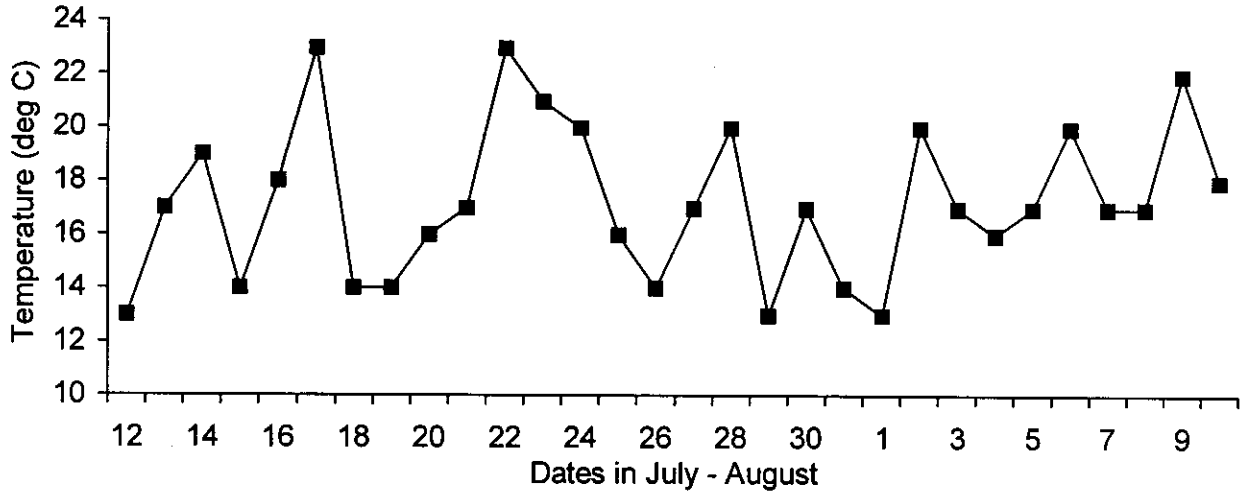

Figure 4. Daily maximum temperatures at the Penzhina River mouth in July and August 2002.

many lakes and streams. Forests are usually located along rivers except in the upper basin of the Penzhina where big larch forests grow.

RESULTS AND DISCUSSION

Northern part of Korf Gulf – 6 and 10 July

Unfortunately, we did not find any Spoon-billed Sandpipers during our surveys of the northern coast of the Korf Gulf (Figure 2). Breeding density estimates in Korf Gulf are given in Table 1. Activity at the three numbered locations in the figure is summarised below.

1. A few pairs of Red-necked Phalarope *Phalaropus lobatus* were obviously breeding on the interior side of the spit where some creeks are located. We saw one phalarope which was probably exhibiting disturbance behaviour near its brood.

A flock of 26 Red-necked Stints was seen feeding on the bay mudflats. We also saw a small flock of 3 Great Knots *Calidris tenuirostris* and some Ringed Plovers *Charadrius hiaticula* on the seaward side of the spit.

2. Temminck's Stint *Calidris temminckii* breeding area - located on the 2.8 km long spit to southwest of Korf Town. We saw 14 birds which were obviously with broods. (N.B. One bird of each pair remains with the brood after hatching.) The birds were located on the spit at regular intervals. Thus, each pair of Temminck's Stints was occupying about 200 m of the spit. We failed to locate any other nesting of this species.

3. At least 7 pairs of Ringed Plover were located with their broods within a breeding colony of Arctic, Common and Aleutian Terns (*Sterna paradisaea, S. hirundo, S. aleutica*). We did not find any other breeding Ringed Plover during our survey.

More than 1000 Red-necked Stint, in small flocks, were observed resting and feeding on the Korf Spit and flying over the bay on 9 July.

Eastern part of Korf Gulf – 7 to 8 July

Surveys of the east coast of the Korf Gulf for shorebirds gave the following results:

a). Dunlin is a common breeding species in wetlands near Allyuvin Lagoon and in the tundra. The tundra breeding density was 2.6 pairs.km^2

Table 1. Nesting density of shorebirds (pairs.km^{-2}) on the Korf Bay coast.

Species	Open tundra 7-8 July	Forest tundra 10 July
Total transect length	15.2 km	10.6 km
Long-toed Stint	-	2.8
Dunlin	2.6	0.5
Red-necked Phalarope	1.3	-
Pacific Golden Plover	0.2	-

(Table 1). Most of the Dunlin had broods.

b). Wood Sandpiper *Tringa glareola* breed in the wetlands on the river and creek shores. We saw some birds with broods.

c). Some pairs of Red-necked Phalarope were breeding in the wetland near the Euvayam River mouth. We saw birds with broods on 8 July.

d). We heard the disturbance call of a Pacific Golden Plover *Pluvialis fulva* in the tundra on 7 July.

e). We saw some flocks of feeding Red-necked Stints on Allyuvin Lagoon on 7–8 July. Flock size was up to 25 individuals and the total number was a few hundred birds.

f). A feeding flock of five Ringed Plovers was seen on Allyuvin Lagoon on 7 July.

Penzhina River mouth – 11 July to 10 August

In the afternoon of 11 July and on the morning of 12 July, we surveyed around Manily Town (Figure 3) and observed and counted breeding birds in the forest-tundra. Two species of shorebird, Wood Sandpiper and Common Sandpiper, were found breeding near the town. Breeding density estimates are in Table 2. The number of breeding shorebird species is probably much higher in this area but we had insufficient time to obtain additional information.

Some additional transect counts were made on 12–14 July in the tundra between the Penzhina and Talovka River mouths and we found breeding Dunlin, Red-necked Phalarope and Ruff *Philomachus pugnax*.

The main part of our work commenced on the afternoon of July 12 when we arrived at our camp near the Penzhina River mouth. Total numbers counted of each species are given in Table 3. Daily counts of 14 more common species are given in Table 4. Results by species are commented on below.

Bar-tailed Godwit *Limosa lapponica* was common and we counted 140 birds. We saw a passing flock of 8 individuals on July 15 and observed feeding Bar-tailed Godwit on mudflats at the Penzhina – Talovka confluence on 21–24 August with a maximum of 80 birds at one time.

Whimbrel *Numenius phaeopus* was fairly common and 58 individuals were counted. This species is breeding in tundra close to the study area. Local people said that migration of this species usually finished before August 1 and that the number seen during the migration period is small. We saw the last birds on 6 August (Table 4).

Table 3. Total numbers of each species counted at the Penzhina River mouth.

Species	Number
Bar-tailed Godwit	140
Whimbrel	58
Eastern Curlew	8
Spotted Redshank	1
Common Greenshank	34
Wood Sandpiper	1,131
Terek Sandpiper	382
Common Sandpiper	44
Grey-tailed Tattler	25
Wandering Tattler	1
Ruddy Turnstone	1
Long-billed Dowitcher	166
Great Knot	12
Red Knot	51
Sanderling	27
Red-necked Stint	60,964
Temminck's Stint	92
Long-toed Stint	15
Dunlin	67,316
Spoon-billed Sandpiper	1
Ruff	10
Red-necked Phalarope	8,918
Grey Phalarope	2
Common Snipe	3
Eurasian Oystercatcher	1
Pacific Golden Plover	123
Grey Plover	13
Ringed Plover	45
Lesser Sand Plover	43

Eastern Curlew *Numenius madagascariensis* was rare. Eight single birds were counted, the last on 9 August.

Spotted Redshank *Tringa erythropus* was rare. One bird was seen on 25 July.

Table 2. Nesting density of shorebirds (pairs km^{-2}) at the Penzhina River mouth.

Species	Open tundra 12-14 July	Forest tundra 11 July
Total transect length	11.6 km	5.7 km
Wood Sandpiper	-	3.5
Dunlin	1.7	-
Red-necked Phalarope	5.2	-
Ruff	0.4	-

Table 4. Daily numbers counted at the Penzhina River mouth.

Date	Whimbrel	Common Greenshank	Wood Sandpiper	Terek Sandpiper	Common Sandpiper	Long-billed Dowitcher	Red Knot	Red-necked Stint	Temminck's Stint	Dunlin	Red-necked Phalarope	Pacific Golden Plover	Ringed Plover	Lesser Sand Plover
July														
12	7	-	-	-	-	-	-	460	-	14	2	-	-	-
13	2	-	-	6	-	-	-	1156	-	67	26	-	-	-
14	-	-	-	8	-	-	-	1260	-	76	20	-	-	-
15	-	-	-	-	-	-	-	1500	-	80	-	-	2	-
16	8	1	-	24	-	-	-	1106	-	58	19	-	2	-
17	-	-	-	14	-	-	-	220	-	30	5	-	-	-
18	-	-	-	2	-	-	-	240	-	60	1	-	-	-
19	-	-	-	-	-	-	-	430	-	50	-	-	-	-
20	8	8	4	49	-	-	-	2484	-	107	1	-	-	-
21	-	10	18	22	-	-	-	1061	2	23	3	14	-	-
22	13	-	15	18	-	-	-	1038	5	39	6	4	-	-
23	-	-	41	2	-	-	-	237	-	10	-	5	-	-
24	-	1	72	14	-	-	3	6670	1	56	12	-	-	-
25	-	-	54	7	5	-	7	1272	2	35	6	7	-	-
26	-	-	50	4	4	-	-	2685	-	57	5	19	2	-
27	-	1	75	28	3	-	-	8851	-	147	137	16	6	1
28	-	-	43	43	3	-	-	10412	-	121	60	-	2	3
29	-	-	129	19	-	-	5	2020	-	209	3	5	-	-
30	-	-	76	6	-	-	-	-	-	19	4	-	-	-
31	1	-	105	12	-	-	-	200	2	51	13	-	-	-
August														
1	-	-	31	6	-	-	-	-	-	26	10	-	-	-
2	-	3	84	17	2	-	-	390	-	42	95	3	-	-
3	6	2	90	23	-	-	8	3520	1	233	281	3	-	-
4	6	4	69	20	3	-	-	3636	21	440	3461	-	-	-
5	-	-	50	11	5	50	-	3522	15	1421	1368	7	5	2
6	7	1	61	6	4	35	22	1787	11	1339	2245	15	12	23
7	-	1	17	6	3	8	-	2716	5	31162	991	2	2	8
8	-	-	18	4	3	51	6	749	9	7602	104	14	10	-
9	-	1	25	9	6	17	-	806	16	15452	26	7	2	2
10	-	1	4	2	3	5	-	536	2	8290	14	2	-	4

Common Greenshank *Tringa nebularia* was fairly common and a total of 34 birds was counted. We saw mostly single flying birds. Migration was in small numbers and irregular (Table 4). Almost all birds passed along the right-hand river shore towards the southwest.

Wood Sandpiper *Tringa glareola* was numerous. We counted 1,131 birds and obtained important migration data. It seems that it was present for most of the migration period (Table 4). However, this species migrates on a wide front and the total number passing through the Penzhina mouth region is probably much higher than we recorded. The species was not breeding around our camp and was absent from the study area before 20 July. Migration occurred in small flocks which seldom exceeded ten individuals. During the day some tens of birds fed in wetlands around our camp. The daily migration peak was usually soon after sunset and we could observe the start of migration from our camp.

Terek Sandpiper *Xenus cinereus* was common. The large number of Terek Sandpipers (382) (Table 4) counted is interesting as we do not encounter this species in southern Kamchatka. It seems that we were present during the main migration period. Migration of Terek Sandpiper occurs on a broad front, similar to Wood Sandpiper, and the total number passing through the Penzhina Mouth area is probably at least 1,000. Migration occurred in small flocks. Some birds were seen feeding near our camp at all times. For feeding and roosting Terek

Sandpiper preferred steep slopes – the border between wetlands and mudflats, similar to Common Sandpiper. During the day, peak migration was usually soon after sunset, as for the Wood Sandpiper. From our camp we sometimes observed the start of migration.

Common Sandpiper *Actitis hypoleucos* was fairly common with 45 birds being counted. Migration started on 25 July (Table 4) and took place mainly at night. Common Sandpiper preferred feeding and resting on the slopes of creeks or the steep slopes at the border between wetlands and mudflats.

Grey-tailed Tattler *Heteroscelus brevipes* was fairly common. We counted 25 birds; migration was in small numbers and irregular.

Wandering Tattler *Heteroscelus incanus* was rare. One bird was seen on 20 July.

Ruddy Turnstone *Arenaria interpres* was a rare species .One bird was seen on the mudflats on 8 July.

Long-billed Dowitcher *Limnodromus scolopaceus* was common. This species was completely absent from the study area until it suddenly appeared in rather large numbers on 5 August (Table 4). It was obvious that they were migrating from west to east, instead of to the south and west as with other species.

Great Knot *Calidris tenuirostris* was uncommon. We counted a total of only 12 individuals, many fewer than we expected as this region contains the closest mudflats to much of the breeding range of this species.

Red Knot *Calidris canutus* was fairly common with 51 birds counted. The first birds were seen, in breeding plumage, on 24 July (Table 4). On 3 August, we saw three flying birds in non-breeding plumage.

Sanderling *Calidris alba* were fairly common and 27 birds were counted. Migration took place only at night.

Red-necked Stint *Calidris ruficollis* was abundant with 60,964 birds being counted. We estimate that at least 100,000 Red-necked Stints migrated through the study area during our stay. This species breeds close to the Penzhina River. As flocks of non-breeding birds remain on the mudflats during the breeding season, it is difficult to determine when southward migration starts.

Some hundreds of birds were seen feeding, with numbers gradually increasing from 12–15 July. Following this numbers started fluctuating (Table 4). Therefore, we believe that active migration started no later than 16 July. On this day we saw the first flock flying past. In the middle of July nearly all Red-necked Stint have bright breeding plumage, with a few birds having a slightly lighter-coloured head. Maybe this latter group had commenced post-breeding moult.

On 20 July, there was an increased number of passing birds. All flocks that we were able to observe closely, consisted of adult birds with bright breeding plumage. On 24 July, the number of Red-necked Stint feeding on the mudflats increased greatly to about 6,000 individuals. About 30% had bright breeding plumage but a few had a very light-coloured plumage (finished moulting or juvenile).

Peak migration occurred on 27–28 July. In the morning we observed some big flocks arriving on the mudflats on the opposite side of the river. On 2 August, we could see the plumage of about 400 newly arrived Red-necked Stint. This flock consisted of about 30–40% light-coloured birds, which looked like juveniles. However, we could not distinguish between juvenile and adult birds which had not finished moulting. Few birds in this flock had bright breeding plumage.

On 4 August, we checked the plumage of some hundreds of Red-necked Stint and could not find any birds with bright breeding colour. Clearly, most of these birds were juveniles. However, by August 5, 15–20% of newly arrived birds had bright breeding plumage. On 8–9 August, the number of Red-necked Stint decreased significantly with most being juvenile.

Temminck's Stint *Calidris temminckii* were fairly common with 92 birds being counted. The first bird was seen on 21 July (Table 4). Active migration started on 4 August. We saw single birds and flocks up to 10 individuals. Temminck's Stint fed on the mudflats but usually separately from other species as they prefer the muddy slopes of creeks running into the river.

Long-toed Stint *Calidris subminuta* were fairly common. We counted only 15 birds but the actual number passing through the area is probably much higher as this species migrates through the night.

Dunlin *Calidris alpina* were numerous. Some Dunlin were breeding in the study area. Our observations showed that Dunlin leave their broods in middle of July before they fledged. Breeding adults disappeared soon after our arrival although we saw juveniles every day during our counts. They

fed on muddy grasslands at the border between mudflats and non-tidal wetlands.

On 23 July, we found one weakly-flying juvenile; also we caught and banded one non-flying juvenile. From this date new juveniles appeared on the coastal grasslands, started flocking, and gradually moved from the grasslands to the mudflats.

Dunlin migration was very small until 4 August, increased from 5–6 August and then massively on 7 August continuing actively when our observations ended on 10 August (Table 4). On 7 August, we saw about 30,000 Dunlin resting in three large flocks at the Penzhina – Talovka confluence. This was the highest number seen during our visit. Obviously the major Dunlin migration only starts in August and the peak period occurred following our departure. Local people told us that the peak of migration takes place in the first half of September.

About 90% of the Dunlin seen in large flocks between 5–10 August were in bright breeding plumage.

Spoon-billed Sandpiper *Eurynorhynchus pygmeus* was rare. We saw only one bird feeding with a flock of Red-necked Stint on 14 July. The number of Spoon-billed Sandpipers migrating through the study area could be much higher as this species is difficult to identify when mixed with flocks of other species.

Ruff *Philomachus pugnax* was rare. This species breeds in the study area. A disturbed female, obviously with brood, was observed in wetland near the river shore on 12–13 July. On 27 August, we saw an unfledged juvenile Ruff near our camp.

Red-necked Phalarope *Phalaropus lobatus* was numerous. We counted 8,918 birds, a much larger number than expected. From 12 July to 2 August, we regularly observed small number of Red-necked Phalarope feeding on mudflats, sometimes with Dunlin and Red-necked Stint. Migration became more active from 3 August when we also heard night migration which is not typical for this species. Very active migration occurred from 4–7 August (Table 4). Most flocks stopped to feed on the water surface along the shoreline. Some feeding flocks numbered up to 500.

Apart from the Penzhina mouth, we only have migration information for this species from Lopatka Cape, the most southerly point of the Kamchatka Peninsula. Migration had probably not finished when we left as the most active migration on Lopatka Cape takes place in September.

Grey Phalarope *Phalaropus fulicaria* was rare. We saw two adult birds in breeding plumage on the first day.

Common Snipe *Gallinago gallinago* was rare. This species migrates silently at night. We saw only a few birds near our camp.

Eurasian Oystercatcher *Haematopus ostralegus* was rare. This species breeds on sand spits and beaches in the Penzhina Gulf but suitable places in the Penzhina mouth are absent. We saw one bird passing over the river to southwest on 28 July.

Pacific Golden Plover *Pluvialis fulva* was common and we counted a total of 123 individuals. Migration started on 21 July (Table 4) and we saw them both flying past and on the mudflats. On 26 July and 27 July we saw a flock of adult birds, all of them moulting out of breeding plumage.

Grey Plover *Pluvialis squatarola* was fairly common. The first bird appeared on July 20. Two small flocks of five and seven individuals were seen flying past on 22 July and 24 July. The first flock of five individuals in breeding plumage was seen passing our camp at a great height towards the southeast. A second flock of seven, five in breeding plumage, passed our camp on 24 July at height flying along the river towards the southwest.

Ringed Plover *Charadrius hiaticula* was fairly common and a total of 45 birds were counted, mostly on the mudflats. The first birds were seen on 15 July (Table 4).

Lesser Sand Plover *Charadrius mongolus* was fairly common and a total of 43 birds was counted. Migration started on 27 July (Table 4). Most birds were observed feeding on the mudflats, often with Dunlin and Red-necked Stint.

It is important to note that the numbers of species which migrate mainly at night (e.g. Common Snipe and Long-toed Stint) are significantly underestimated.

Our studies have shown the great importance of the Penzhina mouth for shorebirds during southward migration. However, the number of Great Knot and Bar-tailed Godwit was unexpectedly low as both species are numerous in Rekkiniki Bay, only 180 km away, on the southeastern coast of Penzhina Gulf in the July–August period (Lobkov 1998). Continuation of observations until the middle of September is necessary in order to obtain a general picture of southward migration, particularly for later migrating species such as Dunlin and for juveniles of most species.

During our investigations we noted the different habitat preferences of species in the Penzhina River mouth area. Dunlin, Red-necked Stint and Ringed Plover are the most common species on mudflats. Juvenile Dunlin before flocking prefer feeding on muddy grassland. We saw Temminck's Stint mainly on the slopes of creeks between mudflats and muddy grasslands. Wood Sandpiper and Ruff are typical non-tidal wetland species. Terek Sandpiper and Common Sandpiper prefer feeding where grasslands are being eroded on steep slopes (Figure 5).

Shestakova River mouth – 10 to 12August

The Shestakova River runs into the Penzhina Gulf at its most northerly point (Figure 1). The region is potentially important for shorebirds as it has extensive mudflats, up to 1.5–2 km wide, located near the river mouth. We investigated this area from 10–12 August seeing 16 shorebird species (daily counts are in Table 5). On the first day we surveyed about 5 km of the Gulf coast in a westerly direction but saw few birds. Most birds were seen at the mouth of the river and the nearby mudflats. Local people told us that many shorebirds (obviously Dunlin) migrate through the area in early September.

There was active migration of shorebirds, from the upper part of the river to the coast, during the night of 11 August. Common Sandpiper were the commonest species. Wood Sandpiper, Terek Sandpiper, Temminck's Stint, Long-toed Sandpiper, and Sanderling were also heard.

Although we could not confirm the international importance of the Shestakova River mouth for shorebirds, it is very probable that the total number of shorebird migrating southwards through the area exceeds 20,000. However, it seems to be less important than the Penzhina River mouth.

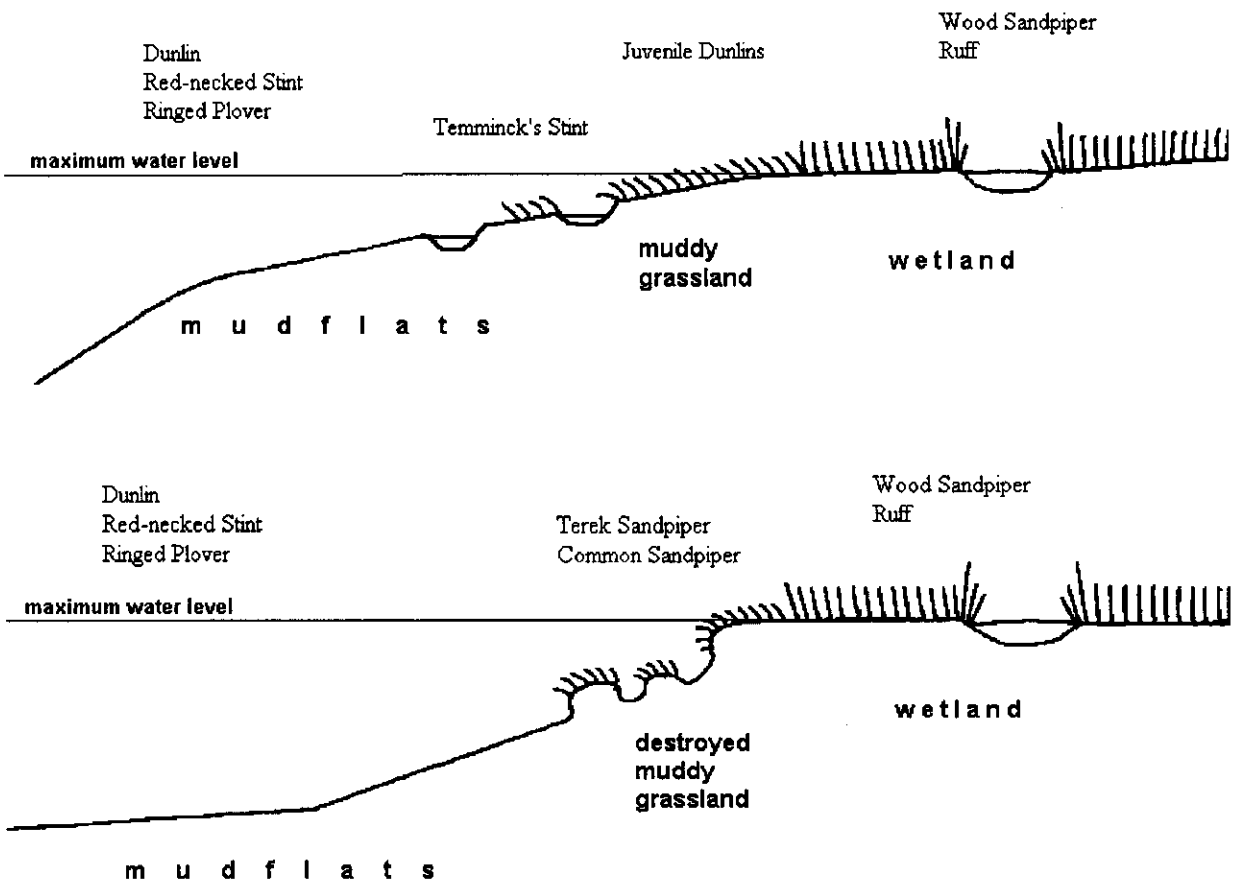

Figure 5. Feeding habitat preferences of different shorebird species on Kamchatka.

Table 5. Daily numbers counted at the Shestakova River mouth.

Species	10 August	11 August	12 August
	evening	all day	morning
Whimbrel	-	1	-
Common Greenshank	1	-	-
Wood Sandpiper	3	12	1
Terek Sandpiper	1	5	-
Long-billed Dowitcher	-	3	-
Sanderling	-	5	-
Red-necked Stint	92	154	86
Temminck's Stint	-	11	-
Long-toed Stint	-	9	-
Dunlin	165	571	300
Red-necked Phalarope	19	5	-
Common Sandpiper	8	21	-
Eurasian Oystercatcher	3	2	-
Pacific Golden Plover	2	11	-
Ringed Plover	-	5	1
Lesser Sand Plover	-	3	-
TOTAL	294	808	388

Threats

We believe that there are no significant threats to migrating shorebirds in all the areas visited. Shorebirds, except for Whimbrel, are traditionally not popular targets for hunters. Other species occur infrequently in hunters' bags. In the 1990s the difficult economic situation in Russia led to a decrease in hunting activity. Additionally, the human population has fallen and continues to decline.

The probability of pollution is low due to the small human population and absence of industry, especially oil exploration.

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REFERENCES

Anon. 1970. The Climate Directory of USSR, 1970. Leningrad, 27: 1–336.

Anon. 1971. The Climate Directory of USSR, 1971. Leningrad, 27: 1–359.

Anon. 1973. Surface water resources of the USSR, 1973. Leningrad, 20: 1–367.

Gerasimov, Yu.N. 1999. Observation of the spring migration of waders in the Korf Bay. The biology and conservation of the birds of Kamchatka. 1: 73–76. Moscow.

Kistchinski, A. A. 1980. Birds of the Koryak Highland. Moscow.

Lobkov E.G. 1998. Main concentration of migrating waders on the Kamchatka peninsula. International Wader Studies 10: 233–236.

LIST OF WADER SPECIES OF CHUKOTKA, NORTHERN FAR EAST OF RUSSIA: THEIR BANDING AND MIGRATORY LINKS

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ABSTRACT

Sixty species of waders are known from the Chukotka Autonomous Region, Russia in the extreme north-easternmost Asia. Of these, 41 species breed in the region, and breeding of two more species is expected. One species, the Eskimo Curlew, is probably extinct and a further 14 species are vagrants. Of these, 11 species have American origin and 12 are known from only one or two records. Small-scale banding and colour-marking of waders in Chukotka has taken place since the early 1970s, and 0.63% of these bands have produced long-distance recoveries/controls/sightings. In total, 59 records of banded birds of 14 wader species link Chukotka with eight countries. These and other data indicate that the majority (probably 26) wader species regularly use the East Asian - Australasian Flyway on the way to and/or from Chukotka. Eleven species migrate to the New World for the non-breeding season, five take the Central Pacific Flyway and five species use the Central Asian Flyway.

INTRODUCTION

Chukotka, or Chukotsky Autonomous Region, covers the most north-eastern portion of Russia roughly north of 62°N and between 158°E and 170°W, thus belonging to both Eastern and Western Hemispheres. The region is bordered to the north by the Chukchi and East Siberian seas and in the east by the Bering Sea. The Bering Sea has a number of islands (the largest are Aion, Wrangel, Herald, Kolyuchin, Big Diomid islands), and the mainland is separated from Alaska, USA, by the Bering Strait that is only 80 km wide at the narrowest point. The protrusion of this region to the east bears the name Chukotsky (Chukchi) Peninsula, which is often incorrectly confused with Chukotka in general.

This region is of special value for both breeding and migrant waders due to its geological history, geographical position and diversity of habitats. Unlike other northern regions, Chukotka was never covered with vast ice sheets during the Pleistocene. Being a part of Beringia together with Alaska, it played a role as a refugium for wildlife during adverse periods. The size of the region with predominantly mountain landscape and a gradient between maritime coastal and continental climate of inland areas is currently responsible for the diversity of habitats. These range from forested valleys in the south-west to high arctic tundra in the extreme north and alpine deserts in the highest altitudes.

A complete list of the waders of Chukotka has not been published and faunal reviews are available only for portions of the region (Portenko, 1939, 1972; Kretchmar et al., 1978, 1991; Kistchinski, 1980; Tomkovich & Sorokin, 1983). Similarly, no regional review has been undertaken summarising bird banding activity or band recoveries. Although information about some recoveries can be found scattered in a number of sources (Lebedeva, 1974; McClure, 1974; Ostapenko, 1980; Liedel & Biancki, 1985; Minton, 1996; Tomkovich, 1996a & b). These reasons became a stimulus for compiling and analysing accumulated information for this paper.

BANDING AND COLOUR-MARKING ACTIVITIES IN THE REGION

The absence of a review of banding history or a summary of wader banding in Chukotka is possibly a result of the low level of banding activity in the region. Sheets of the annual banding summaries in the Moscow Ringing Centre archive are not complete. The earliest report is of about six birds of four wader species banded in the region in 1972 by the Institute of Biological Problems of the North in Magadan (Table 1). Then, A.A. Kistchinski did some occasional banding with his colleagues in the mid 1970s during their fauna surveys. Later, between the late 1970s and mid 1890s, P. Tomkovich undertook the largest banding activity with help from students. The results were used as part of studies of the breeding biology of various wader species. Small numbers of waders were also banded in the same period on different occasions by other banders. For example, by the staff of the Nature Reserve on Wrangel Island and a Russian-Swedish expedition. A new period of banding activity started in the 2000 when the International Arctic Expedition (IAE) of the Russian Academy of Sciences has expanded its activity to Chukotka. Dunlin and Spoon-billed Sandpiper were the target species for banding by the

Table 1. Banding totals for waders in Chukotka and the projects when they were banded. The years, sites and banders are as follows: 1 – 1972, Iultino District – Institute of Biological Problems of the North; 2 - 1975, Wrangel Island – E.Sychev; 3 – 1975, Kanchalan River, Anadyr District – expedition led by A.A. Kistchinski; 4 – 1976, Koryak Highland, Beringovsky District – expedition led by A.A. Kistchinski; 5 – 1978-1980, Uelen, Chukotsky District – studies of P.S. Tomkovich with students; 6 – 1984, east-central Chukotsky Peninsula, Providenia District – V.A. Zubakin; 7 – 1986-1988, Belyaka Spit, Chukotsky District – studies of P.S. Tomkovich with students; 8 – 1986, 1988, Wrangel Island – "Ostrov Vrangelya" Nature Reserve; 9 – 1993-1995, Upper Anadyr River, Markovo District – studies of P.S. Tomkovich with students; 10 – 1994, several sites in Chaun District and on Wrangel Island – Russian-Swedish Tundra Ecology-94 expedition; 11 – 2000, Anadyr Estuary area, Anadyr District – International Arctic Expedition of Russian Academy of Sciences; 12 – 2001, Koryak Highland, Beringovsky District – International Arctic Expedition of Russian Academy of Sciences; 13 – 2002, various sites in Chukotsky District – International Arctic Expedition of Russian Academy of Sciences.

Species	Banding projects													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Grey Plover	-	-	-	-	-	-	9	-	-	7	22	-	-	38
Pacific Golden Plover	-	-	-	10	8	-	2	-	17	-	1	2	7	47
Ringed Plover	-	-	2	7	30	-	42	-	19	1	9	1	22	133
Semipalmated Plover	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Mongolian Plover	-	-	-	2	-	-	-	-	-	-	-	3	-	5
Eurasian Dotterel	-	-	-	-	-	-	-	-	5	-	-	-	-	5
Wood Sandpiper	-	-	1	2	-	-	-	-	2	-	-	-	-	5
Grey-tailed Tattler	-	-	-	5	-	-	-	-	-	-	-	-	-	5
Wandering Tattler	-	-	-	-	-	-	-	-	-	-	-	3	-	3
Common Sandpiper	-	-	-	2	-	-	-	-	5	-	-	-	-	7
Terek Sandpiper	-	-	-	2	-	-	-	-	20	-	-	-	-	22
Grey Phalarope	-	-	-	-	24	-	19	-	-	-	6	-	12	61
Red-necked Phalarope	-	-	1	5	-	-	11	-	-	5	13	-	18	53
Turnstone	1	7	-	-	22	-	47	23	-	3	5	-	11	119
Ruff	-	-	5	-	-	-	3	-	-	1	-	-	2	11
Spoon-billed Sandpiper	2	-	1	5	-	-	342	-	-	-	15	29	59	453
Little Stint	-	-	-	-	-	-	4	-	-	-	-	-	5	9
Red-necked Stint	-	-	1	4	267	-	47	-	4	-	1	7	29	360
Long-toed Stint	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Temminck's Stint	-	-	6	-	3	-	76	-	8	7	18	-	36	154
Baird's Sandpiper	-	-	-	-	21	-	1	1	-	-	-	-	-	23
Dunlin	2	-	6	-	139	-	151	-	-	20	51	4	95	468
Rock Sandpiper	-	-	-	-	272	3	8	-	-	-	-	-	22	305
Sharp-tailed Sandpiper	-	-	-	-	-	-	2	-	-	-	-	-	-	2
Pectoral Sandpiper	1	-	3	-	-	-	40	-	-	2	5	-	13	64
Great Knot	-	-	-	1	-	-	-	-	205	-	-	3	-	209
Red Knot	-	-	-	-	-	-	-	2	-	5	-	-	5	12
Western Sandpiper	-	-	-	-	253	-	31	-	-	-	3	-	17	304
Semipalmated Sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Common Snipe	-	-	1	1	-	-	-	-	-	-	-	-	1	3
Solitary Snipe	-	-	-	-	-	-	-	-	7	-	-	-	-	7
Whimbrel	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Bar-tailed Godwit	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Long-billed Dowitcher	-	-	2	-	-	-	8	-	-	-	-	-	1	11
Total	**6**	**7**	**31**	**47**	**1039**	**3**	**843**	**26**	**292**	**51**	**149**	**52**	**358**	**2904**

expedition, although chances to band other species were also used.

A.Y. Kondratyev (1982) was the very first person who colour-marked waders in Chukotka. He used neck-collars for his ecological studies in 1973-1974, but at the same time he probably did not use standard numbered metal bands. Later, in 1978 near Uelen, other types of colour-marks and numbered neck-ties were tried for individual bird recognition. However, they found that these marks severely reduce the survival rate of birds (Tomkovich, unpubl. data). Therefore, the majority of waders banded in Chukotka since 1976 have been mostly been banded with a combination of colour-flags (formerly they were hand-made from celluloid, but recently from Darvic) for individual bird recognition in ecological studies. During the period of the IAE activities, banded birds were marked mostly with a single colour flags (pale green in southern Chukotka and pale blue at northern Chukotka) to facilitate observation of these birds on the flyway. In some cases individual combinations

of colour bands were added to the regional colour code when necessary.

All known banding activities in Chukotka are listed and their results summarized in Table 1. It can be seen from the table, that a total of 2866 birds of 34 species have been banded in this region of Russia. Proportions of birds banded among wader species only slightly reflect their abundance in the region (see below). Rather, they are more related to research priorities in the period of banding activities. Thus, numbers of banded birds of some rare or only locally distributed species are rather high (Spoon-billed, Western and Rock Sandpipers), while the numbers are low in many common and widely distributed species (e.g. Pacific Golden Plover, Wood, Common, Terek Sandpipers, phalaropes, Common Snipe). Some breeding wader species were probably never banded in Chukotka, including Greenshank, Spotted Redshank, Green, Buff-breasted and Curlew Sandpipers and Black-tailed Godwit.

BAND RECOVERIES AND COLOUR-MARK RECORDS

In total, there have been 48 band recoveries of waders and additional sight records of 11 colour-marked birds from Chukotka by the end of 2002 (Table 2, Appendix). All these sightings belong to 14 wader species. Eighteen of these 59 birds (30.5%) were banded in Russia and recorded farther south in Russia (n = 4), or abroad (n = 14). The overall recovery rate for waders banded in Chukotka is 0.62% (18 of 2904). The other 41 records (69.5%) belong to birds banded in foreign countries and recorded in Chukotka. Most recoveries of foreign bands in Chukotka were obtained from hunters (33 of 41, or 80%), and it is important to note that all these were obtained in the period from late 1960s to mid 1970s, not a single recovery of a wader killed by hunters is know since then (one bird purposely collected by ornithologists is not taken into consideration). This is not a result of greatly reduced banding activity, because for example large-scale banding started in Australia in late 1970s (e.g. Minton, 2002). Rather, it appears that waders have not been a target of hunters in Chukotka in recent decades as most hunters target geese and ducks.

One could expect that the active colour marking in East Asian – Australasian Flyway and in the Americas since the late 1980s (many tens of thousand waders were colour-marked there in total) will be reflected in an increase in sight records of colour-marked waders in Chukotka. Unfortunately, this is not the case, with only four birds with foreign colour-marks seen in Chukotka since the late 1980s. Of these, one bird was purposely collected (Great Knot), while combination of colour bands of another bird (Pectoral Sandpiper) were not traced and its origin is still unknown. Such poor recovery rate is not unexpected because of an absence of birdwatchers in Russia. Only a few ornithologists visit the region and breeding birds are widely dispersed. This means that colour marking on flyways does not give many records from the

Table 2. Number of band records for Chukotka waders to and from other countries or regions. Number of foreign bands is given as a numerator, number of Russian bands as a denominator.
1 – Australia; 2 – Bangladesh; 3 – China; 4 – India; 5 – Japan; 6 – Philippines; 7 – Russia; 8 – South Africa; 9 – USA.

Species	Country									
	1	2	3	4	5	6	7	8	9	Total
Wood Sandpiper	-	-	-	-	-	1/-	-	-	-	1
Grey-tailed Tattler	1/-	-	-	-	1/-	-	-	-	-	2
Ruddy Turnstone	-	-	-	-	6/-	-	-	-	21/-	27
Ruff	-	-	-	2/-	-	-	-	1/-	-	3
Spoon-billed Sandpiper	-	-/2	-/1	-	-/1	-	-	-	-	4
Red-necked Stint	-/1	-	-/1	-	-	-	-/2	-	-	4
Dunlin	-	-	-	-	-	-	-/1	-	1/-	2
Rock Sandpiper	-	-	-	-	-	-	-	-	-/5	5
Pectoral Sandpiper	-	-	-	-	-	-	-	-	1/-	1
Great Knot	1/3	-	-	-	-	-	-/1	-		5
Bristle-thighed Curlew	-	-	-	-	-	-	-	-	1/-	1
Whimbrel	-	-	-	-	-	1/-	-	-	-	1
Bar-tailed Godwit	1/-	-	-	-	-	-	-	-	1/-	2
Long-billed Dowitcher	-	-	-	-	-	-	-	-	1/-	1
Total:	7	2	2	2	8	2	4	1	31	59

breeding grounds, although it brings at least some data for species where there are a complete absence of other recent band recoveries.

This situation is opposite of that found for birds colour-marked in Chukotka. Only about two thousand waders were colour-flagged in Chukotka since the mid 1970s (over a half of them were downy chicks for which low survival rate is characteristic), and these produced 10 foreign sight records of nine individuals, which represent 53% of long-distance records outside Chukotka, and ca. 0.4% of all waders colour-marked in Chukotka. It means that banding and colour-marking on the breeding grounds is clearly more fruitful for obtaining records of geographic links with breeding grounds. A similar conclusion was reached when recoveries and sight records were analysed for Taimyr, north-central Siberia (Tomkovich *et al.*, 2000).

It turned out that banding of different species on their breeding grounds produces recoveries and/or sight records at a different rate. A comparison of data presented in Tables 1 and 2 shows the wide variation in reporting rates among the species banded. Thus, long-distance reporting rates varied from 1.9% of records for banded Great Knots, 1,7% for Rock Sandpipers, 1.1% for Red-necked Stints and 0.9% for Spoon-billed Sandpipers for the four most frequently recorded species. At the same time, some commonly banded species such as Ringed Plover, Western Sandpiper and Temminck's Stint did not produce a single recovery. As well, surprisingly few recoveries (0.4%) were obtained for Dunlin.

Among foreign bands recovered from /seen in Chukotka (n = 41, Table 2) great majority (n = 27, 66%) are Ruddy Turnstone and are the result of large-scale banding activity both in the USA (n = 21) (see Appendix) and Japan (n = 6). For ten other species only one or two (maximum three in Ruff) recoveries or sight records were obtained (Table 2).

ANNOTATED LIST OF WADER SPECIES KNOWN FOR CHUKOTKA

The order of species in the list below and taxonomy follows Stepanyan (1990). After each species name two numbers are given, which refer to the total bird number of that species that have been banded in Chukotka (first figure) and the number of recoveries or sight records for Chukotka waders with both Russian and foreign bands (second figure).

Grey Plover – *Pluvialis squatarola*. (38/0)

Within the breeding range of this species on mainland Chukotka, there appears to be two main areas where Grey Plover are more abundant, the arctic and southern coast (Tomkovich *et al.*, 2002). Migratory links are not known for either of these two breeding grounds. However, absence of pronounced visible passage of Grey Plover along shores of the Bering Sea as well as in the direction to America and back suggests the species migrates across the Sea of Okhotsk to South-east Asia and/or Australia.

Pacific Golden Plover – *Pluvialis fulva* (47/0)

This species breeds widely, but sometimes patchily on tundra lowlands and mountains. Observations of birds on migration are scarce. Eastward passage of juveniles toward Alaska was recorded at coastal northern Chukotsky Peninsula during the post-breeding season with almost total absence of migrating adult birds in the same areas (Tomkovich & Sorokin, 1983; other pers. obs.). It is not known where adult birds go. The species general distribution pattern gives grounds for an assumption that birds from Chukotsky use islands of the western and southern Pacific, as well as Australia as non-breeding grounds.

American Golden Plover – *Pluvialis dominica* (0/0)

In late 19th and early 20th centuries, American Golden Plover were recorded in the Anadyr River catchment (Portenko 1939) and farther north. Currently it is a regular visitor in small numbers to northern Chukotsky Peninsula (Tomkovich & Sorokin, 1983; Tomkovich, 1988; Tomkovich & Soloviev, 1988). Breeding is possible, but not confirmed. According to their general distribution pattern, American Golden Plover migrates to the Americas.

Ringed Plover – *Charadrius hiaticula tundrae* (133/0)

Breeds throughout the whole region. No band recoveries are available. Probably migrates to south-west Asia or even to Africa.

Semipalmated Plover – *Charadrius semipalmatus* (2/0)

This American species has only recently been identified from the Chukotka region. Recently recorded at Wrangel and Herald Islands, as well as on Chukotsky Peninsula (Stishov *et al.*, 1991; Eichorn, 2001), and they suspected the species was breeding. Breeding was subsequently confirmed in 2002 (Tomkovich & Syroechkovski, in prep.).

Killdeer – *Charadrius vociferus* (0/0)

One record of a vagrant bird of this New World species is known to northern Chukotsky Peninsula (Tomkovich & Soloviev, 1988).

Lesser Sand Plover – *Charadrius mongolus stegmanni* (5/0)

Lesser Sand Plover are a rare to uncommon breeding species in Chukotka. Migration occurs along the Asian cost of the Pacific. However, a complete absence of band recoveries means that the non-breeding grounds for birds from Chukotka are unknown.

Eurasian Dotterel – *Eudromias morinellus* (5/0)

Uncommon alpine breeding species with wintering grounds in northern Africa and South-West Asia. No band recoveries exist for birds from Chukotka.

Northern Lapwing – *Vanellus vanellus* (0/0)

One record exists of a vagrant bird in northern Chukotka (Stishov & Maryukhnich, 1992).

Oystercatcher – *Haematopus ostralegus* (0/0)

One old record of this species is known (Portenko, 1939).

American Black Oystercatcher – *Haematopus bachmani* (0/0)

A single observation only (Konyukhov, 1995).

Green Sandpiper – *Tringa ochropus* (0/0)

Uncommon Palearctic species with a localised distribution in Chukotka and birds supposedly breed there (Kretchmar *et al.*, 1978). Longitudinal migrations most probably bring these birds to South-East Asia and/or Philippines.

Wood Sandpiper – *Tringa glareola* (5/1)

A common breeding species in large portions of inland Chukotka. Migrants probably go to South-East Asia, with some reaching Australia. The only band recovery from an adult bird connects northern Chukotka with the Philippines (Lebedeva, 1974; McClure, 1974; Lebedeva *et al.*, 1985; Appendix).

Common Greenshank – *Tringa nebularia* (0/0)

Another locally distributed in Chukotka and the level of knowledge about this species is similar to that for Green Sandpiper. Migrates from this part of its breeding range possibly to South-east Asia and/or Australia.

Greater Yellowlegs – *Tringa melanoleuca* (0/0)

At least one vagrant bird of this New World species was recorded on Wrangel Island (Gluschenko & Dorogoi, 1986; Stishov *et. al.*, 1991).

Lesser Yellowlegs – *Tringa flavipes* (0/0)

Rare vagrant species to Chukotsky Peninsula and Wrangel Island (Tomkovich & Sorokin, 1983; Dorogoi, 1991; Stishov *et al.*, 1991).

Spotted Redshank – *Tringa erythropus* (0/0)

Rare to common breeder on lowlands of Chaun Gulf and lower Anadyr River. Assuming mostly longitudinal migrations of this Palearctic species, birds from Chukotka probably spend the non-breeding season in South-east Asia.

Grey-tailed Tattler – *Heteroscelus brevipes* (5/2)

Rare to uncommon breeder on some gravely rivers and creeks in Chukotka. Two band recoveries link breeding grounds in Chukotka with eastern Australia and indicate southward passage via Japan (McClure, 1974; Ostapenko, 1980; Appendix). Birds of this population possibly also come to other parts of the species non-breeding range (West Australia, Oceania and South-east Asia).

Wandering Tattler – *Heteroscelus incanus* (3/0)

This American counterpart of Grey-tailed Tattler has a small Asiatic breeding population for which breeding was first documented only in 2001 (Lappo & Syroechkovski, 2002). As suggested by Kozlova (1961), birds of this population possibly form the westernmost branch of the migration path, which passes across Kamchatka Peninsula, Commander and Sakhalin islands to the Mariana and Caroline islands.

Common Sandpiper – *Actitis hypoleucos* (7/0)

Commonly breeds in some inland parts of Chukotka. Common Sandpiper probably migrates down to South-east Asia similar to Spotted Redshank. No band recoveries.

Spotted Sandpiper – *Actitis macularia* (0/0)

One record of a vagrant bird is known near the Bering Strait (Tomkovich & Sorokin, 1983).

Terek Sandpiper – *Xenus cinereus* (22/0)

Breeding species of muddy gravel and sand flats on some river banks. In spite of an absence of band recoveries from Chukotka, migration can be expected along the eastern coasts of Asia to South-east Asia and/or Australia (Higgins & Davies, 1996).

Grey Phalarope – *Phalaropus fulicarius* (61/0)

Common to abundant breeding species of coastal Chukotka. Birds are rare further south along Asian coasts during all seasons. In the northern summer time, mass south-eastward migration can be observed in some offshore areas of the Chukchi Sea and Bering Strait (Portenko, 1972; Tomkovich & Sorokin, 1983). These facts indicate migration of the species to eastern Pacific where non-breeding area is known off western South and North America (*e.g.* Paulson, 1993). No band recoveries.

Wilson's Phalarope – *Phalaropus tricolor* (0/0)

One unconfirmed record on Wrangel Island is known (Dorogoi, 1985).

Red-necked Phalarope – *Phalaropus lobatus* (53/0)

Common breeder of most lowland areas in Chukotka. There have been no banding recoveries of Red-necked Phalarope. The mass southward migration across the Bering Sea and the Sea of Okhotsk indicates birds from Chukotka contribute to the population that spends the non-breeding season off southern Philippines to the Bismarck Archipelago (Higgins & Davies, 1996; Rubega *et al.*, 2000).

Ruddy Turnstone – *Arenaria interpres oahuensis* (119/27)

Breeds through Wrangel Island and on coastal mainland. Migrations of this species are known better than those of other species mostly due to active banding undertaken on Pribilof Islands, Alaska, USA in 1964-1968, when 16,152 Ruddy Turnstones were banded (Thompson, 1973). Numerous band recoveries accumulated by early 1970s were processed by Thompson, and some additions can be found in later publications (Lebedeva, 1974; McClure, 1974; Ostapenko, 1980; Liedel & Biancki, 1985; Higgins & Davies, 1996). The available data (see Appendix) show that Ruddy Turnstones from Chukotka and St. Lawrence Island undertake a loop migration. On southward migration to the non-breeding grounds in central and southern Pacific (from Hawaii Islands to Australia), they cross the Pacific with stops on the Pribilofs and Hawaii. On northward migration they follow the Asian coasts.

Black Turnstone – *Arenaria melanocerphala* (0/0)

Only one confirmed record is known for Chukotsky Peninsula (V.Buzun, in prep.).

Ruff – *Philomachus pugnax* (11/3)

Rare to common breeder on mainland Chukotka. It is well known that Ruff breeding in Siberia arrive from India, Africa and Europe (McClure, 1974; Cramp & Simmons, 1983; Lebedeva & Dobrynina, 1985; Underhill *et al.*, 1999). As to Chukotka, this conclusion is supported by three recoveries, two of Indian bands and one South African (Appendix).

Spoon-billed Sandpiper – *Eurynorhynchus pygmeus* (453/4)

It was found with the help of banding and colour-marking (Appendix) that Spoon-billed Sandpiper from breeding population of northern coastal Chukotsky Peninsula winter in the Ganges River delta in Bangladesh, and migrants follow the Chinese coast (Tomkovich, 1992b). Recently a juvenile bird from the same population was also found close to Tokyo, Japan, on the way southward. All these records are in agreement with the general notion about the species distribution outside its breeding grounds (Hoves & Parish, 1989; Tomkovich, 1992a).

Little Stint – *Calidris minuta* (9/0)

Rare to uncommon breeding species at coastal northern Chukotka. There are no information indicating the migratory links of this population. I suppose these birds migrate to/from the most eastern regular non-breeding grounds that are known on the Indian subcontinent.

Red-necked Stint – *Calidris ruficollis* (360/4)

Rare to common breeding species in the Chukotka region. Based on an analysis of band recoveries and sightings of colour-marked birds, Minton (1996) hypothesized that the migration routes of Red-necked Stints from western and eastern Australia cross. As a result, birds from West Australian non-breeding grounds head in the direction of Chukotka. This hypothesis is only supported by one band recovery. This links Uelen, in the extreme north-east of the Chukotsky Peninsula with Perth in south-west of Australia (Appendix). It cannot be excluded, however, that birds from Chukotka also migrate to South-east Asia. One of Chukotkan birds was captured on northward migration in the Yangtze (Chang Jiang) River mouth, China. Southward migration also goes along the Pacific coast as indicated by two recoveries of young birds from the Kamchatka Peninsula, Russia (Morozov & Tomkovich, 1988; Appendix).

Long-toed Stint – *Calidris subminuta* (1/0)

Rare breeding species in southern Chukotka. No band recoveries exist. Migrates probably to South-

east Asia and may reach Australian non-breeding grounds.

Least Sandpiper – *Calidris minutilla* (0/0)

One record of a vagrant bird is known (Tomkovich & Soloviev, 1987).

Temminck's Stint – *Calidris temminckii* (154/0)

Common breeding species at many sites in Chukotka. No band recoveries known. Probably migrates to South-east Asia and/or Indian subcontinent.

Baird's Sandpiper – *Calidris bairdii* (23/0)

Mostly a rare breeder on Wrangel, Kolyuchin and Big Diomid Islands as well as on Chukotsky Peninsula. Even without band recoveries no doubts that birds of this species normally migrate across North America to their principal non-breeding grounds in South America (Jehl, 1979).

White-rumped Sandpiper – *Calidris fuscicollis* (0/0)

One record of a vagrant bird is known (Tomkovich & Soloviev, 1988).

Stilt Sandpiper – *Calidris himantopus* (0/0)

Once a vagrant bird was recorded (Anonymous, 1990).

Curlew Sandpiper – *Calidris ferruginea* (0/0)

Rare breeder on coastal northern Chukotka. No band recoveries exist for the region. These birds possibly go to the easternmost non-breeding grounds in South-east Asia and Australia.

Dunlin – *Calidris alpina sakhalina, C. a. arcticola* (468/2)

Dunlin widely breeds in north-eastern Asia and nearby Alaska. Chukotka is inhabited by *C. a. sakhalina* subspecies only (Tomkovich, 1998; Engelmoer & Roselaar, 1998). However, birds of the north-Alaskan subspecies *C. a. arcticola* also appear there on seasonal migration. Two existing band recoveries for Chukotka belong to birds of both these races. One of them belongs to a series of recoveries from the Far Eastern Russia and Japan that resulted from banding activity in northern Alaska (Gromadzka, 1985; Stiefel & Scheufler, 1989). Chukotka has a position on the way between the Alaskan breeding grounds and the wintering grounds in Japan. The second recovery indicates migration of birds breeding in northern Chukotka across the northern coast of the Sea of Okhotsk.

Rock Sandpiper – *Calidris ptilocnemis tschuktschorum* (305/5)

One recovery and a series of sight records of colour-marked birds link the breeding grounds on the Chukotsky Peninsula with a staging and moulting site in the Yukon Delta, south-western Alaska. Other recoveries in North America indicate probable further migration of birds from Chukotka to British Columbia (Canada) and as far south as California USA (Gill *et al.*, 2002).

Sharp-tailed Sandpiper – *Calidris acuminata* (2/0)

Breeds in north-western Chukotka. No band recoveries are known. Based on museum specimens and direct observations (Gill & Handel, 1981; Tomkovich, 1982) adult and young Sharp-tailed Sandpipers use different routes on southward migration to their Australian non-breeding grounds. Adults follow an inland route across Siberia, Mongolia and China. Young birds go directly to the Pacific coasts with largest concentrations in western Alaska. In accordance with this conclusion, the majority of Sharp-tailed Sandpipers in Chukotka are juveniles, probably during their move to Alaska. Then they possibly cross the Pacific directly to Australia (Mlodinow, 2001). On northward migration birds do not visit the northern Pacific.

Pectoral Sandpiper – *Calidris melanotos* (64/1)

Breeds in portions of Chukotka at variable densities. The main non-breeding grounds are situated in South America where birds from Chukotka (both local breeders and migrants) probably go. One available band recovery links Kansas USA, where a bird was marked in its first southward migration, and northern Chukotka where it was shot two years later on the way to the Siberian breeding grounds (Appendix).

Great Knot – *Calidris tenuirostris* (209/5)

A set of recoveries and sight records of marked birds was obtained as a result of species breeding biology study in the mountains of inland Chukotka. Thus, it was found that Great Knots from this part of the species breeding range spend their non-breeding season on the coasts of both north-western and north-eastern Australia (Tomkovich, 1996a; Appendix). One of the birds was recorded several times both on the breeding and non-breeding grounds (Tomkovich, 1996a). Another one-year-old banded bird was shot at Sakhalin Island, south-eastern Russia. This was supposedly a non-breeder

that had moved far north on the way to its breeding range.

Red Knot – *Calidris canutus rogersi, C. c. roselaari* (12/0)

Red Knots of *rogersi* subspecies breed in the mountains of Chukotka and birds of *roselaari* race inhabit Wrangel Island. Based on external morphological characteristics (Tomkovich, 1992), there are no doubts that *rogersi* birds migrate along the Pacific coasts of Asia, although this is not supported by band recoveries so far. Non-breeding grounds of these birds may extend from New Zealand to the Indian subcontinent. However, this is still yet to be confirmed. The year-around distribution of *roselaari* birds is even less clear, supposedly they follow the American Pacific coast on the way to the Gulf of Mexico.

Sanderling – *Calidris alba* (0/0)

Senderling is a rare, but regular vagrant species to Chukotka in springtime. These birds are equally likely to belong to either of the Palearctic and Nearctic breeding populations and their provenance is not known for certain.

Western Sandpiper – *Calidris mauri* (304/0)

Breeds on the Chukotsky Peninsula. No band recoveries are known so far, however there are no doubts that the species has migratory links with the New World.

Semipalmated Sandpiper – *Calidris pusilla* (1/0)

Situation is identical to that in Western Sandpiper.

Buff-brested Sandpiper – *Tryngites subruficollis* (0/0)

Rare species, breeds on Wrangel and Aion Islands, also in coastal areas of northern mainland Chukotka. Migrates undoubtedly together with North American birds to inland South America. No band recoveries.

Broad-billed Sandpiper – *Limicola falcinellus sibirica* (0/0)

Rare vagrant species with one or two records only (Portenko, 1939; Zoeckler, pers. comm.).

Common Snipe – *Gallinago gallinago gallinago* (3/0)

Common breeding species on many inland lowlands. Birds belong to the nominate subspecies[1] and this clearly indicates that they migrate within the Old World, possibly to China and South-east Asia. No band recoveries.

Pin-tailed Snipe – *Gallinago stenura* (0/0)

Palearctic species breeding in the mountains of Chukotka sporadically at low densities. Nothing is known about its migrations. However, I suspect that birds from Chukotka go to the easternmost non-breeding grounds in South-east Asia.

Solitary Snipe – *Gallinago solitaria japonica* (7/0)

Solitary Snipe have only recently been found breeding in one inland area of Chukotka (Tomkovich & Shitikov, 1994). It is a short-distance migrant, which possibly does not go outside Russia from Chukotka.

Eskimo Curlew – *Numenius borealis* (0/0)

Only a few historical records of this American species are known for Chukotka. There is even an opinion, that birds were possibly breeding in this part of the world (Portenko, 1939; 1972).

Little Curlew – *Numenius minutus* (0/0)

Only one breeding site is known in inland western Chukotka (Artyukhov, 1988). No recoveries exist. The non-breeding area is entirely situated in Australia, and birds predominantly migrate across inland eastern Siberia, eastern Mongolia and the Huang He Delta in China (Barter, 2002).

Bristle-thighed Curlew – *Numenius tahitiensis* (0/1)

One record of this species is known for Chukotka and Russia in general. It happened that the bird was colour-marked a year before as an adult on its nest in Alaska (Konyukhov, 1992; Konyukhov & McCaffery, 1993; Appendix). Non-breeding grounds cover the central Pacific.

Eastern Curlew – *Numenius madagascariensis* (0/0)

Vagrant species (possibly regular) to Chukotka, with records known throughout the 20th century (*e.g.* Portenko, 1939; Tomkovich & Sorokin, 1983).

Whimbrel – *Numenius phaeopus variegatus* (1/1)

Wide but patchy breeding is known across Chukotka, except the Chukotsky Peninsula and some other areas. The only available band recovery indicates that at least some birds from Chukotka

[1] Recently (Banks et al., 2002) the American Ornithologists Union decided to recognize the New World Snipe not as a subspecies of Common Snipe, but as a separate species, Wilson's Snipe *Gallinago delicata*.

visit Philippines on southward migration (Lebedeva, 1974; McClure, 1974; Appendix). Non-breeding grounds of these birds are possibly in Australia (Higgins & Davies, 1996).

Black-tailed Godwit – *Limosa limosa melanuroides* (0/0)

Only a small breeding population in central Chukotka is known (Portenko, 1939; Kretchmar et al., 1991). No band recoveries exist. Migrants probably go along the Pacific coasts of Asia to/from Australia and/or SE Asia.

Bar-tailed Godwit – *Limosa lapponica menzbieri, L .l. baueri* (1/2)

The latter of these two subspecies breeds in Alaska, spends the non-breeding season in eastern Australia and New Zealand after straight transoceanic flight. These birds are found in Chukotka mostly during northward migration (McCaffery & Gill, 2001). This is supported by the mid May band recovery in SE Chukotka of a bird marked three years before on the Pribilof Islands. Another available band recovery came from the *menzbieri* breeding range in NW Chukotka. The bird was marked during its first year of life in NW Australia. Birds of this subspecies are also known in non-breeding season in SE Asia. East-central Chukotka is inhabited by a small breeding population, with intermediate characteristics between *menzbieri* and *baueri* (Kistchinski *et al.*, 1983). The migration route and non-breeding grounds of birds from this population are totally unknown.

Long-billed Dowitcher – *Limnodromus scolopaceus* (11/1)

Breeds with fluctuating densities in northern and eastern Chukotka. One band recovery obtained there during northward migration (Ostapenko, 1980; Appendix) confirms the migration of these birds from North America to northern Asia.

DIVERSITY OF CHUKOTKA WADERS AND THEIR MIGRATION ROUTES

A total of 60 species of waders have been recorded in Chukotka, including one probably extinct species, Eskimo Curlew. A further 12 species are rare vagrants and known from only one or two records. For 41 of the remaining 47 species, breeding is known to occur in Chukotka and the six other species are rare, or vagrants. Two of these rarer species (American Golden Plover and Green Sandpiper) probably breed in the region. The great majority of the vagrants (11 of 14 species) have American origin.

Band recoveries and records of colour marks are available for 14 species and link Chukotka with eight foreign countries (Table 2). Most of these are coastal species and often congregate in large flocks. Single recoveries are available for only three species that can be considered as mostly inland migrants: Wood and Pectoral Sandpipers and Long-billed Dowitcher. Similarly, those of the commonly banded species in Chukotka that have not produced a single recovery (see 'Band recoveries and colour-mark records' above) belong to inland migrants. Migrations of these and other species that take inland routes are the least known.

Apart from the 14 species for which band/colour-mark records were obtained, migration directions are quite clear for some other regular inhabitants of Chukotka, based on the position of their breeding and non-breeding ranges. This is especially true for a number of species that do not have large non-breeding concentrations outside the Americas: American Golden Plover, Semipalmated Plover, Western, Semipalmated, Buff-breasted and Baird Sandpipers. The general direction of migration of Ringed Plover and Eurasian Dotterel are also clear, because their non-breeding area covers Africa and south-western Asia. Similarly, it is clear that Little Curlew migrates to Australia, and the eastern race of the Black-tailed Godwit is not known outside the East Asian - Australasian Flyway.

If we omit vagrant species, it is safe to state that 11 wader taxa from Chukotka are known to use the East Asian - Australasian Flyway and 15 other taxa, including all *Tringa* species are supposed to belong to this flyway (Figure 1). Nine Chukotkan taxa spend their non-breeding season in the New World for certain and two more (Grey Phalarope and Red Knot) can be expected to migrate there. Five taxa are known or expected to migrate from Chukotka into or across the central Pacific. For most of these species, loop migration is recorded or expected with regular appearance of adult Alaskan Bar-tailed Godwits (spring) and juvenile Sharp-tailed Sandpipers (autumn) in Chukotka on one-way migration only. Five species mostly use the Central Asian Flyway.

Thus, more than a half of the wader taxa that regularly breed or appear in Chukotka belong to the East Asian - Australasian Flyway. A smaller number migrate to Americas, and the smallest portions are linked with both Central Pacific and Central Asian flyways (Figure 1). Such numerical

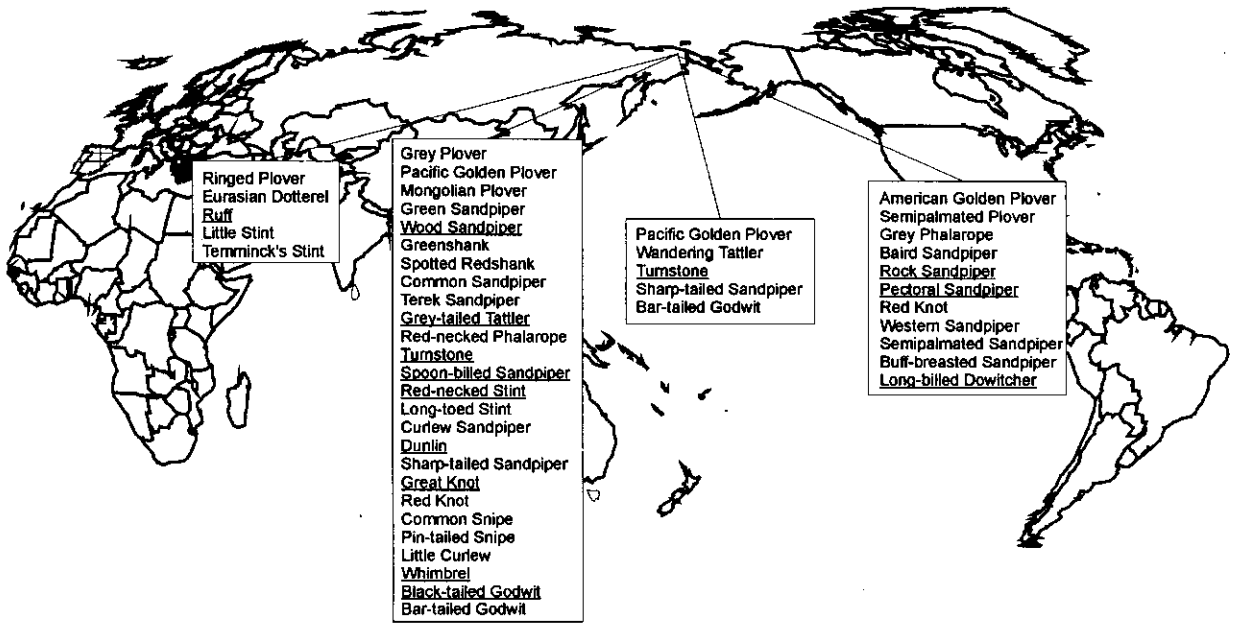

Figure 1. Flyway assignment of wader species breeding at or regularly visiting Chukotka. Underlined species are those, for whom the link is proven by band recovery(ies).

distribution of species is not surprising give the location of Chukotka in north-easternmost part of the Asian continent as well as the isolation of Beringian region (Chukotka and Alaska) from central North America by extensive ice sheets in the late Pleistocene.

In the list of 11 species migrating to the New World, only three taxa supposedly have Beringian origin (Rock and Western Sandpipers and *roselaari* subspecies of Red Knot). Others probably expanded into Chukotka as a part of Beringia during the post-glaciation period. Breeding of most birds in southern and western Alaska starts notably earlier than in north-eastern Asia (personal unpublished data). As a result, I hypothesize that those waders that reach Alaska from their American non-breeding grounds easily reach Chukotka and they often appear in Chukotka before birds arriving via the East Asian - Australasian Flyway. Being first they may get some advantages over Asian species, and this has probably helped to establish breeding populations of at least some American waders in Chukotka. If this is true, further expansion of American wader populations can be expected into north-eastern Asia with global warming. This hypothesis is supported by the fact that at least two new American wader species have started to breed in Chukotka in the last 20 years (Semipalmated Plover and Semipalmated Sandpiper).

Migration through the Central Pacific flyway with long transoceanic flights is too risky and needs special adaptations. Possibly this reason, together with small chances in the evolution "to find" this route explain the small number of wader taxa that use the flyway. The Central Asian Flyway is also remote from Chukotka, and only a few species with extensive Eurasian breeding ranges use this flyway when they reach Chukotka at the eastern edge of their breeding distribution.

A small number of long-distance records for marked birds from Chukotka are known for only nine of the 26 wader species of the East Asian - Australasian Flyway and this is inadequately few for our needs. To better understand migration of waders breeding in Chukotka, it will be necessary to undertake much more banding and colour-marking. For this purpose, I have shown that banding on the breeding grounds is most productive in the current situation of an absence of recoveries from hunters in the region and when searching for limited colour-marks on dispersed birds. To date, only rather small-scale banding has been undertaken in Chukotka, and this situation should be greatly improved.

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REFERENCES

Artyukhov, A.I. 1988. A new nesting area of Little Curlew. Pp. 40-41. *In*: Kondratyev, A.Y. (ed.). Information of the Working Group on Waders (USSR). Vladivostok. (In Russian)

Banks, R.C., Cicero, C., Dunn, J.L., Kratter, A.W., Rasmussen, P.C., Remsen, J.V., Jr., Rising, J.D. & Stotz, F. 2002. Forty-third supplement to the American Ornithologists' Union Check-list of North American Birds. Auk 119 (3). 897-906.

Barter, M. 2002. Shorebirds of the Yellow Sea: Importance, threats and conservation status. Wetlands International Global Series 9, International Wader Studies 12, Canberra. 103 p.

Cramp, S. & Simmons, K.E.L. 1983. The Birds of the Western Palearctic, Vol. 3. Oxford Univ. Press, Oxford, L., N.Y. 913 p.

Dorogoi, I.V. 1991. To the fauna and distribution of birds in north-eastern Chukotski Peninsula. Ornithologia (Moscow) 25, 102-109. (In Russian)

Eichhorn, G. 2001. Semipalmated Plover *Charadrius semipalmatus* – first confirmed record for the Asian mainland. Pp. 31-33. *In*: Tomkovich, P.S. & Shubin, A.O. (Eds.) Information Materials of the Working Group on Waders (CIS) 14. Moscow. (In Russian with English summary)

Engelmoer, M. & Roselaar, C. S. 1998. Geographical Variation in Waders. Kluwer Academic Publishers, Dordrecht, Boston, London.

Gill, R.E., Jr. & Handel, C.M. 1981. Shorebirds of the Eastern Bering Sea. Pp. 719-738. *In*: Hood, D.W. & Calder, J.A. (Eds.) The Eastern Bering Sea shelf: Oceanography and resources. Vol. 2. University of Washington Press, Seattle.

Gill, R.E., Jr., Tomkovich, P.S. & McCaffery, B.J. 2002. Rock Sandpiper (*Calidris ptilocnemis*). *In*: The Birds of North America 691. Poole, A. & Gill, F. (Eds.) The Birds of North America, Inc., Philadelphia, PA. 40 p.

Gluschenko, Y.N. & Dorogoi, I.V. 1986. Greater Yellowlegs – a new species in the USSR avifauna. Ornithologia (Moscow) 21, 131-132. (In Russian)

Gromadzka, J. 1985. Dunlin - *Calidris alpina*. Pp. 193-220. *In*: Viksne, J.A.& Mihelsons, H.A. (Eds.) Migrations of birds of Eastern Europe and northern Asia: Gruiformes - Charadriiformes. Moscow, Nauka. (In Russian)

Higgins, P.J. & Davies, S.J.J.F. (Eds.) 1996. Handbook of Australian, New Zealand and Antarctic birds. Volume 3: Snipe to Pigeons. Oxford Univ. Press, Melbourne. 1028 p.

Hoves, J. & Parish, D. 1989. A preliminary review of the INTERWADER Programme 1983-89 and priorities for the future. Asian Wetland Bureau Publication No.42. 32 p.

Jehl, J.R., Jr. 1979. The autumn migration of Baird's Sandpiper. Studies in Avian Biology 2, 55-68.

Kistchinski, A.A., 1980. Birds of Koryak Highland. Nauka, Moscow. 336 p. (In Russian)

Kistchinski, A.A., Tomkovich, P.S. & Flint, V.E. 1983. Birds of the Kanchalan River basin, Chukotsky Autonomous Area. Archives of Zool. Mus. of Moscow State Univ. 21, 3-76. (In Russian)

Konyukhov, N.B. 1992. Vagrant Bristle-thighed Curlew to Chukotka. P. 65. *In*: Yurlov, A.K. (Ed.) Information of the Working Group on Waders (CIS). Novosibirsk. (In Russian)

Konyukhov, N.B. & McCaffery, B.J. 1993. Second record of a Bristle-thighed Curlew from Asia and first record for the former Soviet Union. Wader Study Group Bull. 70, 22-23.

Kozlova, E.V. 1961. Charadriiformes. Suborder Limicolae. In: Fauna of the USSR. Birds. Vol.2, issue 1, part 2. Academy of Sci. of the USSR, Moscow & Leningrad. 501 p. (In Russian)

Kretchmar, A.V., Andreev, A.V. & Kondratyev, A.Ya. 1978. Ecology and distribution of birds in the North-Eastern USSR. Nauka, Moscow. 195 p. (In Russian)

Kretchmar, A.V., Andreev, A.V. & Kondratyev, A.Ya. 1991. Birds of the northern plains. Nauka, Leningrad. 288 p. (In Russian)

Lappo, E.G. & Syroechkovski, E.E., Jr. 2002. On breeding of Wandering Tattler *Heteroscelus incanus* at southern Chukotka. Pp. 50-52. *In*: Tomkovich, P.S. & Shubin, A.O. (Eds.) Information Materials of the Working Group on Waders (CIS) 15. (In Russian with English summary)

Lebedeva M.I. 1974. To the study of transcontinental links of some waders of Siberia. Ornithologia (Moscow) 11, 298-306. (In Russian)

Lebedeva M.I. & Dobrynina I.N. 1985. Ruff - *Philomachus pugnax* (L.). Pp. 154-171. *In*: Viksne, A.Ya.& Mikhelson, Kh.A. (Eds.) Migrations of birds of Eastern Europe and Northern Asia: Gruiformes - Charadriiformes. Nauka, Moscow. (In Russian)

Lebedeva M.I., Lambert K. & Dobrynina I.N. 1985. Wood Sandpiper - *Tringa glareola* L. Pp. 97-105. *In*: Viksne, A.Ya. & Mikhelson, Kh.A. (Eds.) Migrations of birds of Eastern Europe and Northern Asia: Gruiformes - Charadriiformes. Nauka, Moscow. (In Russian)

Liedel K. & Biancki V.V. 1985. Turnstone - *Arenaria interpres* L. Pp. 143-154. *In*: Viksne, A.Ya. & Mikhelson, Kh.A. (Eds.) Migrations of birds of Eastern Europe and Northern Asia: Gruiformes - Charadriiformes. Nauka, Moscow. (In Russian)

McCaffery, B. & Gill, R. 2001. Bar-tailed Gotwit (*Limosa lapponoca*). *In*: Poole, A.& Gill, F. (Eds.). The Birds of North America 581. The Birds of North America, Inc., Philadelphia, PA. 36 p.

McClure, H.E. 1974. Migration and survival of the birds of Asia. Bangkok. 476 p.

Minton, C.D.T. 1996. The migration of the Red-necked Stint *Calidris ruficollis*. The Stilt 29, 24-35.

Minton, C. 2002. Annual wader banding totals by VWSG. VWSG Bull. 25, 14.

Mlodinow, S.G. 2001. Possible anywhere: Sharp-tailed Sandpiper. Birding, August 2001, 330-341.

Morozov, V.V. & Tomkovich, P.S. 1988. Breeding biology of Red-necked Stint (*Calidris ruficollis*) in eastern Chukotsky Peninsula. Archives of Zool. Mus. of Moscow State Univ. 26, 184-206. (In Russian)

Ostapenko, V.A. 1980. New data on wader migration in East Asia. Pp. 114-116. *In*: Flint, V.E. (Ed.) News in studies of biology and distribution of waders. Nauka, Moscow. (In Russian)

Paulson, D. 1993. Shorebirds of the Pacific Northwest. Univ. of Washington Press, Seattle. 406 p.

Portenko, L.A., 1939. Fauna of Anadyr Land. Birds. Part I. Glavsevmorput, Leningrad. 209 p. (In Russian)

Portenko, L.A., 1972. Birds of Chukotski Peninsula and Wrangel Island. Part I. Nauka, Leningrad. 424 p. (In Russian)

Stepanyan L.S. 1990. Conspectus of the ornithological fauna of the USSR. Nauka, Moscow. 727 p. (In Russian)

Stiefel, A. & Scheufler, H. 1989. Der Alpenstrandlaufer: *Calidris alpina*. Die Neue Brehm-Bucherei 592. Wittenberg Lutherstadt, Ziemsen. 248 S.

Stishov, M.S. & Maryukhnich, P.V. 1992. Northern Lapwing at northern coast of Chukotka. P. 67. *In*: Yurlov, A.K. (Ed.). Information of the Working Group on Waders (USSR). Novosibirsk. (In Russian)

Stishov, M.S., Pridatko, V.I. & Baranyuk, V.V. 1991. The Birds of Wrangel Island. Nauka, Novosibirsk. 253 p. (In Russian)

Thompson, M.C. 1973. Migratory patterns of Ruddy Turnstones in the Central Pacific region. Liv. Bird 12, 5-23.

Tomkovich, P.S. 1982. Peculiarities of autumn migration in the Sharp-tailed Sandpiper (*Calidris acuminata*). Bull. of Moscow Soc. of Naturalists. Biol. Div. 87(4), 56-61. (In Russian)

Tomkovich, P.S. 1988. American Golden Plover in Siberia. Pp. 38-39. *In*. Kondratyev, A.V. (Ed.) Information of the Working Group on Waders (USSR). DVO AN SSSR, Vladivostok. (In Russian)

Tomkovich, P.S. 1992a. Migration of the Spoon-billed Sandpiper *Eurynorhynchus pygmeus* in the Far East of the Russian Federation. The Stilt 21, 29-33.

Tomkovich, P.S. 1992b. Spoon-billed Sandpiper in north-eastern Siberia. Dutch Birding 14, 37-41.

Tomkovich, P.S. 1996a. A third report on the biology of the Great Knot *Calidris tenuirostris* on the breeding grounds. The Stilt 28, 43-45.

Tomkovich, P.S. 1996b. The individual story of the Great Knot migrations - An unexpected result from colour-marking. Pp. 20-21. *In*: Tomkovich, P.S. (Ed.). Information Materials of the Working Group on Waders (CIS) 9. (In Russian with English summary).

Tomkovich, P.S. 1998. Breeding schedule and primary moult in Dunlins of the Far East. Wader Study Group Bull. 85, 29-34.

Tomkovich, P.S. & Shitikov, D.A. 1994. Discovery of breeding grounds of Eastern Solitary Snipe (*Gallinago solitaria japonica*), and some thoughts about migratoriness of the species. p. 34. *In*: Tomkovich, P.S. (Ed.) Information Materials of the Working Group on Waders (CIS). Moscow. (In Russian)

Tomkovich P.S., Lappo E.G. & Syroechkovski, E.E. Jr. 2000. Ringing and migratory links of Taimyr waders. P. 458-475. *In*: Mazurov, Yu.I., Ebbinge, B.S.& Tomkovich, P.S. (Eds.) Heritage of the Russian Arctic: research, conservation and international cooperation. Ecopros Publishers, Moscow.

Tomkovich, P.S., Lappo, E.G. & Syroechkovski, E.E., Jr. 2002. Southern breeding population of Grey Plover *Pluvialis squatarola* in Chukotka. Bull. Moscow Society of Naturalists. Biol. Div. 107, 3-8. (In Russian)

Tomkovich, P.S. & Soloviev, M.Y. 1987. New data on bird distribution in North-Eastern Asia. Zoologicheski Zhurnal 66, 312-313. (In Russian)

Tomkovich, P.S. & Soloviev, M.Y. 1988. New records of waders in Chukotsky Peninsula. Zoologicheski Zhurnal 67, 1756-1757. (In Russian)

Tomkovich, P.S. & Sorokin, A.G. 1983. The bird fauna of eastern Chukotka. Archives of Zool. Mus. of Moscow State Univ. 21, 77-159. (In Russian)

Underhill, L.G., Tree, A.J., Oschadleus, H.D. & Parker, V. 1999. Review of ring recoveries of waterbirds in southern Africa. Avian Demography Unit, University of Cape Town, Cape Town. 119 p.

APPENDIX

Recoveries and controls of bands from Chukotka waders. Countries are indicated only when outside Chukotka.

Key for age (as indicated in the reported data): U – unknown; pull. – unfledged young; juv. = 1y – first year of life; 2y – second year of life; 2+ – second year or elder; ad = FG – fully grown (adult); HY – hatching year (hatched during the calendar year of banding); AHY – after hatching year (hatched before the calendar year of banding); ASY – after second year (hatched earlier than the calendar year preceding the year of banding).
Key for sex: M – male; F – female.

Ring	Age, sex	Ringing and recovery dates	Ringing (upper row) and recovery (lower row) locality	
Wood Sandpiper – *Tringa glareola*				
	ad	25.10.1965	**Philippine Is.**, Palavan I., Iwahig:	09°40'N; 118°27'E
HONG KONG 040-15891				
		02.06.1966	Baranikha, Chaun Distr.:	68°34'N; 168°27'E
Grey-tailed Tattler – *Heteroscelus brevipes*				
Australia 061-01758	FG	27.04.1974	**Australia**, NSW, Kooragang I.	32°52'S; 151°46'E
	ad, M	20.06.1976	Khatyrka River, Beringovsky Distr.:	62°37'N; 174°58'E
Hong Kong 050-05605	FG	19.08.1967	**Japan**, Chiba, Urayasa:	35°39'S; 139°54'E
		26.05.1971	Machvavaam R., Bilibino Distr.	68°22'N; 165°02'E
Ruddy Turnstone – *Arenaria interpres*				
	AHY	12.03.1963	**USA**, Lisianski I., Hawaiian Is.:	26°00'N; 173°50'W
USA 632-20623				
		26.05.1971	Lavrentia, Chukotsky Distr.:	65°34'N; 170°59'W
USA 712-07006	AHY	26.08.1965	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		10-20.06.1968	Billings, Shmodt Distr.:	69°52'N; 175°52'E
	AHY	11.08.1966	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
USA 722-11726				
		20.05.1967	Lavrentia, Chukotsky Distr.:	65°34'N; 170°59'W
USA 722-12044	AHY	12.08.1966	**USA**, St. George, Pribilof Islands	56°35'N; 169°36'W
		30.04.1971	Lavrentia, Chukotsky Distr.:	65°34'N; 170°59'W
USA 722-12544	AHY	14.08.1966	**USA**, St. George, Pribilof Islands	56°35'N; 169°36'W
		30.04.1971	Lavrentia, Chukotsky Distr.:	65°34'N; 170°59'W
USA 722-14130	HY	18.08.1966	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		20-30.06.1971	Dzhenretlen Cape, Chukotsky Distr.:	67°07'N; 173°35'W
USA 722-14957	HY	22.08.1966	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		00.09-11.1970	Providenia:	64°25'N; 173°12'W
USA 722-14959	HY	22.08.1966	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		00.09-11.1970	Providenia:	64°25'N; 173°12'W
USA 1103-00112	ASY	01.08.1967	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		22.05.1978	Lakhtina Lagoon, Beringovsky Distr.:	63°04'N; 179°21'E
USA 1103-00560	ASY	05.08.1967	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		03.06.1969	Mys Shmidta:	68°55'N; 179°30'W
USA 1103-02445	HY	20.08.1967	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		18.05.1974	Alyautyn River, Iultinsky Distr.:	66°26'N; 179°14'W
USA 1103-02631	HY	20.08.1967	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		02.05.1971	Uel'kal, Anadyr Distr.:	65°32'N; 179°20'W
USA 1103-02747	HY	21.08.1967	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		00.09-11.1970	Uel'kal, Anadyr Distr.:	65°32'N; 179°20'W
USA 1103-03100	HY	24.08.1967	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°20'W
		26.05.1970	Alkatvaam Estuary, Beringovsky Distr.:	63°15'N; 179°07'E
USA 1103-04126	AHY	03.08.1968	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		24.05.1972	Beringovsky:	63°03'N; 179°20'E
USA 1103-04388	AHY	05.08.1968	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		03.06.1969	Konergino, Iultinsky Distr.:	65°54'N; 178°50'W
USA 1103-04413	AHY	05.08.1968	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W

Ring	Age, sex	Ringing and recovery dates	Ringing (upper row) and recovery (lower row) locality	
		26.05.1971	Ryrkarpy, Shmidt Distr.:	68°56'N; 179°30'W
USA 1103-04450	AHY	06.08.1968	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		05.06.1971	Ryrkarpy, Shmidt Distr.:	68°56'N; 179°30'W
USA 1103-04968	AHY	12.08.1968	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		30.05.1971	Nagorny, Beringovsky Distr.:	63°04'N; 179°15'E
USA 1103-05420	HY	13.08.1968	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		00.00.1976	25 km W of Lorino, Chukotsky Distr.:	65°40'N; 172°25'W
USA 1103-05828	AHY	17.08.1968	**USA**, St. Jorge, Pribilof Is.:	56°35'N; 169°30'W
		00.05.1975	Mys Shmida:	68°55'N; 179°30'W
Japan B 2260	ad	17.05.1962	**Japan**, Chiba, Nekozane:	35°40'N; 139°55'E
		06.06.1962	Ryrkarpy, Shmidt Distr.:	68°56'N; 179°30'W
Japan 050-17219	FG	09.05.1971	**Japan**, Chiba, Ichikawa:	35°40'N; 139°57'E
		30.05.1971	Beringovsky:	63°03'N; 179°20'E
Japan 050-47036	FG	08.05.1971	**Japan**, Chiba, Ichikawa:	35°40'N; 140°00'E
		30.05.1971	Lavrentia, Chukotsky Distr.:	65°34'N; 170°59'W
Japan C 3089	ad	07.05.1963	**Japan**, Chiba, Ichikawa:	35°40'N; 139°57'E
		27.05.1965	Anadyr Estuary [near Shakhtersky], Anadyr Distr.:	64°45'N; 177°40'E
Hong Kong 050-17223	ad	09.05.1968	**Japan**, Chiba, Ichikawa:	35°40'N; 139°55'E
		05.06.1968	22 km NE of Pevek, Chaun Distr.:	69°52'N; 170°44'E
Blue and white leg-flags	U	1997-2002	**Japan**, Tokyo Bay, Obitsu R.:	35°25'N; 139°54'E
	ad	13.07.2002	Belyaka Spit, Chukotsky Distr.:	67°04'N; 174°35'W
Ruff – *Philomachus pugnax*				
Bombay B 23558	ad, F	20.12.1970	**India**, Point Calimere:	13°06'N; 80°18'E
		10.06.1971	Bystry, near Pevek:	69°17'N; 170°28'E
Bombay C 7347	ad, M	17.10.1969	**India**, Bharatpur:	27°15'N; 77°32'E
		00.05.1970	Lyuleveem River, Chaun Distr.:	68°50'N; 170°10'E
Zoo Pretoria 643-08081	U, F	08.12.1968	**South Africa**, Cape Prov. Blue Lagoon:	33°35'S; 26°53'E
		31.05.1971	Baimka Stream, Bilibino Distr.:	66°51'N; 164°00'E
Spoon-billed Sandpiper – *Eurynorhynchus pygmeus*				
MOSKWA 0250241	pull	14.07.1987		67°04'N; 174°30'W
			BELYAKA SPIT, CHUKOTSKY DISTR.:	
		10.05.1990	**China**, Hangzhou Bay:	30°48'N; 121°27' E
MOSKWA FS00258	pull	10.07.2002		67°04'N; 174°33'W
			BELYAKA SPIT, CHUKOTSKY DISTR.:	
	juv	8-10.09.2002	**Japan**, Chiba, Sabanze:	35°40'N; 139°57' E
Red and white leg-flags	ad	1986-1988	Belyaka Spit, Chukotsky Distr.:	67°04'N; 174°30'W
		28.01.1989	**Bangladesh**, Mauldavir Char:	22°30'N; 91°30' E
Orange leg-flag	U	1986-1988	Belyaka Spit, Chukotsky Distr.:	67°04'N; 174°30'W
		02.02.1989	**Bangladesh**, Char Piya:	22°30'N; 91°30' E
Red-necked Stint – *Calidris ruficollis*				
MOSKWA S-925214	pull	08.07.1979	Uelen, Chukotsky Distr.:	66°09'N; 178°56'W
		22.08.1979	**Russia**, Kamchatka, Petropavlovsk-Kamchatsky:	53°03'N; 158°40'E
MOSKWA S-925081	pull	29.06.1979	Uelen, Chukotsky Distr.:	66°09'N; 178°56''W
		18.08.1979	**Russia**, Kamchatka, Ust' Kamchatsk:	56°14'N; 162°38'E
MOSKWA S-925602	pull	11.06.1980	Uelen, Chukotsky Distr.:	66°09'N; 178°56'W
		00.05.1984	**China**, Hangzhou Bay:	30°48'N; 121°27'W
MOSKWA S-925103	ad, F	17.06.1979	Uelen, Chukotsky Distr.:	66°09'N; 169°47'W
		25.10.1980	West **Australia**, Perth, Point Waylen:	32°02'S; 115°48'E
Dunlin – *Calidris alpina*				
USA 76-134742	AHY	24.06.1972	**USA**, Alaska, Barrow:	71°20'N; 156°20'W
		31.08.1974	60km S of Anadyr:	64°15'N; 177°30'E
	pull	11.07.1988	Belyaka Spit, Chukotsky Distr.:	67°04'N; 174°30'W
MOSKWA 187497				
		10.09.1988	**Russia**, Magadan Region, Evensk:	61°52'N; 159°15'E

Ring	Age, sex	Ringing and recovery dates	Ringing (upper row) and recovery (lower row) locality	
Rock Sandpiper – *Calidris ptilocnemis*				
	pull	15.07.1978	Uelen, Chukotsky Distr.:	66°09'N; 169°47'W
MOSKWA 359666				
	ad, M	29.08.1980	**USA**, Alaska, 25 km WSW Old Chevak:	61°32'N; 165°37'W
MOSKWA 673484	ad, F	30.06.1980	Uelen, Chukotsky Distr.:	66°09'N; 169°47'W
		29.08.1980	**USA**, Alaska, 25 km WSW Old Chevak:	61°32'N; 165°37'W
MOSKWA 673425	ad, F	16.07.1979	Uelen, Chukotsky Distr.:	66°09'N; 169°47'W
		03.09.1979	**USA**, Alaska, 25 km WSW Old Chevak:	61°32'N; 165°37'W
		26.06.1980	Uelen, Chukotsky Distr.:	66°09'N; 169°47'W
Red leg-flag on right tarsus	pull	07-08.1978-1979	Uelen, Chukotsky Distr.:	66°09'N; 169°47'W
		26.08.1979	**USA**, Alaska, 25 km WSW Old Chevak:	61°32'N; 165°37'W
Red leg-flag	pull	07-08.1978-1979	Uelen, Chukotsky Distr.:	66°09'N; 169°47'W
		08.09.1979	**USA**, Alaska, 25 km WSW Old Chevak:	61°32'N; 165°37'W
Pectoral Sandpiper – *Calidris melanotos*				
USA 76-129682	HY	03.09.1970	**USA**, Kansas, Great Bend:	38°20'N; 98°40'W
		28.05.1972	Komsomol'sky, Chaun Distr.:	69°12'N; 172°53'E
Great Knot – *Calidris tenuirostris*				
MOSKWA P904976	pull	08.07.1993	Schuchy Range, Markovo Distr.:	64°55'N; 168°35'E
		03.06.1994	**Russia**, Sakhalin I., Aniva Bay:	46°30'N; 143°00'E
MOSKWA P952069	pull	02.07.1995	Schuchy Range, Markovo Distr.:	64°55'N; 168°35'E
		13.09.1996	NW **Australia**, Roebuck Bay:	18°00'S; 122°22'E
MOSKWA P904986	ad, F	22.06.1994	Schuchy Range, Markovo Distr.:	64°55'N; 168°3' E
		09.09.1994	NW **Australia**, Roebuck Bay:	18°00'S; 122°22'E
		19.09.1994	NW **Australia**, Roebuck Bay:	18°00'S; 122°22'E
		17.10.1995	NW **Australia**, Roebuck Bay:	18°00'S; 122°22'E
MOSKWA P952142	ad, F	18.06.1995	Schuchy Range, Markovo Distr.:	64°55'N; 168°35'E
		17.12.1995	**Australia**, Queensland, Burdekin River mouth:	19°37'S; 147°30'E
Australia 061-90273	2 y	07.10.1992	NW **Australia**, 80 mile Beach:	19°15'S; 121°20'E
	ad, F	12.07.1995	Schuchy Range, Markovo Distr.:	64°55'N; 168°35'E
Bristle-thighed Curlew – *Numenius tahitiensis*				
	ad, F	21.06.1988	**USA**, Yukon delta, Curlew Lake:	62°21'N; 163°30'W
USA 794-28008				
		21.05.1989	Sireniki, Providenia Distr.:	64°24'N; 173°55'W
Whimbrel – *Numenius pheopus*				
	FG	12.09.1965	**Philippine Is.**, Batangas I., Calatagan:	13°48'N; 120°37'E
HONG-KONG 070-06204				
		01-10.06.1968	Baimka, Belibinsky Distr.:	66°37'N; 164°13'E
Bar-tailed Godwit – *Limosa lapponica*				
	AHY	31.05.1966	**USA**, St. George I., Pribilof Is.:	56°30'N; 169°20'W
USA 635-26 024				
		15-20.05.1969	Nagorny, Beringovsky Distr.:	63°03'N; 179°22'E
	1y	26.03.1988	NW **Australia**, Roebuck Bay:	18°00'S; 122°22'E
AUSTRALIA 071-85042				
		05.07.1993	Bilibino:	68°03'N; 166°20'E
Long-billed Dowitcher – *Limnodromus scolopaceus*				
	AHY	18.08.1971	USA, Kansas, Great Bend:	38°20'N 98°40'W
USA 762-67179				
		26.05.1973	Baranikha, Chaun Distr.	68°34'N 168°27'E

SPECIES COMPOSITION AND USE OF MUDFLAT OF KAPAR, WEST COAST OF PENINSULAR MALAYSIA BY MIGRATORY SHOREBIRDS

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ABSTRACT

Shorebirds their habitat were surveyed on the intertidal mudflats of Kapar, adjacent to Sultan Salahuddin Abd Aziz Hydrological Power Station in the state of Selangor, west coast of Peninsular Malaysia during the 2001 and 2002 southward and northward migration periods. The species composition of migrant shorebirds varied between migration seasons and a total of 23 species and 21 species were recorded during southward (year 2001 and 2002) and northwards migration periods (year 2001 and 2002) respectively. Lesser Sand Plover (*Charadrius mongolus*), Common Redshank (*Tringa totanus*), Black-tailed Godwit (*Limosa limosa*), Eurasian Curlew (*Numenius arquata*), Bar-tailed Godwit (*Limosa lapponica*), and Whimbrel (*Numenius phaeopus*) were the most abundant species during migrations. The mean relative abundances differed significantly between southwards and northward migration. Shorebird use of intertidal mudflat habitat ranged from dry, moist, wet mud and shallow water (edge ≤ 4 cm) to moderate (> 16 cm depth). Medium-sized probing species (Bar-tailed Godwit, Black-tailed Godwit and Common Redshank) showed similar preferences for water depths. They preferred wet mud and avoided dry mud (except Common Redshank) and moderately deep water. Large probing species, such as Eurasian Curlew and Whimbrel, preferred shallow water habitat and were the only species that utilized moderate deep water.

INTRODUCTION

Thousands of shorebirds annually migrate through the East Asian-Australasian Flyway from the breeding grounds in Alaska and Siberia and to tropical wintering areas in South-east Asia and Australia (Pepping *et al.*, 1999). During these long migrations, which may range from 12,000 km to 25,000 km (Hows & Parish 1989), many shorebirds rely on stopover areas along the migratory route to replenish energy and nutrient reserves. Myers (1984) suggested that such areas are critical for continuation of migration and ultimately critical for the survival of many shorebirds.

The importance of the mudflats at Kapar, Selangor as wintering and stopover areas of shorebirds migrating through the west coast of Peninsular Malaysia has only recently been investigated (Lane & Mundkur, 1992; Riak *et al.*, 2002). Most of the earlier studies were reported from other sites (Parish & Wells, 1984; Edwards *et al.*, 1986; Hawkins & Howes 1986; Silvius *et al.*, 1987), and very little is known about migrating shorebirds in Malaysia.

In order to fully assess the importance of wintering and stopover areas on the west coast of Peninsular Malaysia, information about species composition and habitat use by shorebirds is necessary to develope management and conservation strategies for migrating shorebirds. Thus, the objectives of this study were to document the relative abundances of shorebirds during southward and northward migration and to determine habitat selection of migrant shorebirds on the mudflats at Kapar on west coast of Peninsular Malaysia.

METHODS

Study Area

This study was conducted on the intertidal mudflat of Kapar, situated (3° 7'N, 101° 19.25' E) on the western side of Sultan Salahuddin Abd Aziz Hydrological Power Station on the west coast of Peninsular Malaysia (Figure 1). The selected area comprises approximately 10 ha of intertidal zone north of the Kapar Mangrove Forest Reserve. Previous literature on the intertidal mudflat and adjacent Hydrological Power Station of Kapar, Selangor reported that this site is one of the most important foraging and roosting sites for over 5,000 wintering shorebird during the migration periods (Lane & Mundkur, 1992). The selection of this site was based on past history of shorebirds use, available shorebird habitats, and accessibility.

Shorebird Counting

Shorebird (Scolopacidae and Charadriidae) counts on the intertidal mudflat of Kapar was done during the migration periods in 2001 and 2002. Surveys were conducted with methods defined by Rose & Scott (1997) on three plots (each 200 m^2) two times a month during southward migration (August, September, October, November and December) and

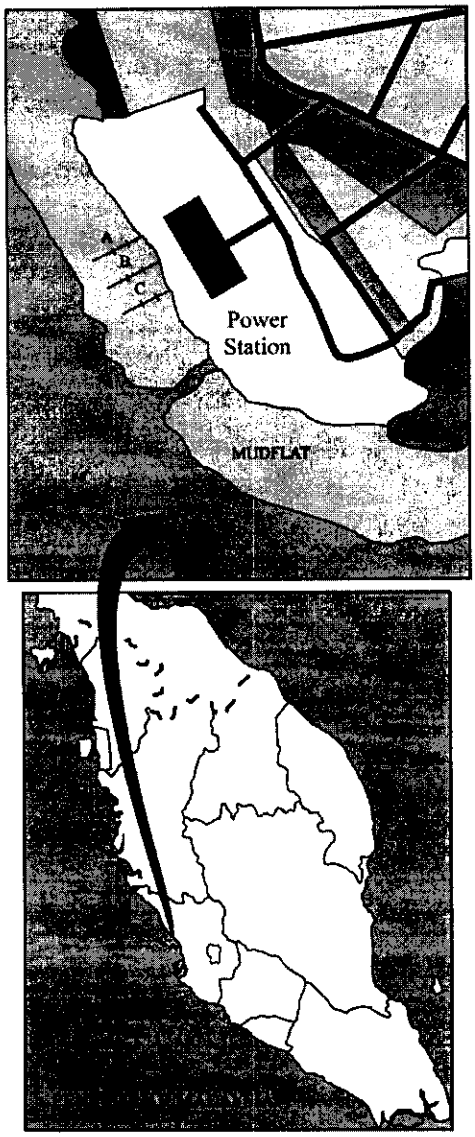

Figure1. Kapar study area on the west coast of Selangor, Malaysia

northward migration (January, February, March, April and May).

Shorebirds counts were conducted during daylight hours on low, rising and falling tides within three plots (each 200m^2) that were marked with fishing stakes. To minimise possible biases associated with conducting surveys on the same plot at the same time on consecutive sampling occasions, sampling activities were assigned for each plot to 1 of 3 tidal periods: low, rising and falling tides (Bergan *et al.*, 1989). Surveys were conducted on foot and shorebirds were observed with either field binoculars (8 x 40) or 15 x 45 spotting scope and counts were recorded using a tally counter. Because the intertidal mudflat of Kapar was relatively open and unvegetated, all shorebirds species present within each plot were counted. Care was taken to locate all birds present within the marked area and to avoid double counting.

Use of Habitat

Use of habitat for six shorebirds species (Eurasian Curlew *Numenius arquata*, Whimbrel *Numenius phaeopus*, Bar-tailed Godwit *Limosa lapponica*, Black-tailed Godwit *Limosa limosa*, Common Redshank *Tringa totanus* and Lesser Sand Plover *Charadrius mongolus*) was recorded within the following habitat types: dry mud, moist mud (mud with no standing water); wet mud, shallow water (edge of mudflats $\approx \leq 4$ cm depth); and moderate water (4-16 cm depth). Water depths were estimated relative to the length of each shorebird's leg (Baker, 1971). Selection of habitat was evaluated for these species because they were the most abundant species at the site. For each species, we recorded the observed use of a habitat as the number of flocks in each sub-habitat during the count period.

Data Analysis

The univariate measure calculated were Shannon-Weaver Diversity index (Shannon and Weaver, 1963) and Pielou's Evenness (Pielou, 1969). These measures were calculated with the DIVERSE procedure of the PRIMER (Plymouth Routines in Multivariate Ecological Research) program Version 5.2.8. Statistical differences in shorebirds abundant between two-migration seasons were assessed using *t*-test for two independent samples. For this test abundance data were transformed using $\sqrt{\sqrt{x+0.5}}$ to normalize their distribution (Zar, 1984).

RESULTS

Community Composition

Table 1 shows the list of shorebird species encountered at Kapar during study period. A total of 26 shorebird species were observed during the study period, 22 in southward (year 2001 and 2002) and 21 in northward migration periods (year 2001 and 2002) (Table 2). The most abundant species during both migration periods were *Charadrius mongolus*, *Tringa totanus*, *Limosa limosa*, *Numenius arquata*, *Limosa lapponica* and *Numenius phaeopus* (Table.2). Spotted Redshank *Tringa erythropus* and Wood Sandpiper*Tringa glareola* were not observed during southward migration seasons. However, two Wood Sandpiper were recorded during northward migration year 2001 and six Spotted Redshank in

Table 1. Species encountered at Kapar during the study period

Common Name	Scientific Name
Asian Dowitcher	***Limnodromus semipalmatus***
Bar-tailed Godwit	*Limosa lapponica*
Black-tailed Godwit	*Limosa limosa*
Common Greenshank	*Tringa nebularis*
Common Redshank	*Tringa totanus*
Common Ringed Plover	*Charadrius hiaticula*
Common Sandpiper	*Actitis hypoleucos*
Curlew Sandpiper	*Calidris ferruginea*
Eurasian Curlew	*Numenius arquata*
Great Knot	*Calidris tenuirostris*
Grey Plover	*Pluvialis squatarola*
Lesser Sand Plover	*Charadrius mongolus*
Little Stint	*Calidris minutus*
Malaysian Plover	*Charadrius peronii*
Marsh Sandpiper	*Tringa stagnatilis*
Oriental Pratincole	*Glareola maldivarum*
Pacific Golden Plover	*Pluvialis fulva*
Red Knot	*Calidris canutus*
Red-necked Stint	*Calidris ruficollis*
Ruddy Turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Sharp-tailed Sandpiper	*Calidris acuminata*
Spotted Redshank	*Tringa erythropus*
Terek Sandpiper	*Xenus cinereus*
Whimbrel	*Numenius phaeopus*
Wood Sandpiper	*Tringa glareola*

year 2002. During southward migration, the less abundant species accounted for < 0.5% of total shorebirds abundance. These were *Calidris acuminata*, *Limnodromus semipalmatus*, *Glareola maldivarum* and *Calidris ruficollis*.

The relative abundance of most species varied between northward and southward migration periods (Table.2). The relative abundance of *Tringa erythropus* and *Tringa glareola* was greater during northward than southward migration, whereases the relative abundance of *Limnodromus semipalmatus* and *Calidris minutus* was greater during southward migration. Species diversity ($\hat{H}$) and evenness ($\hat{J}$) values are given in Table 3. These values did not vary greatly between years or migration seasons.

Shorebirds Selection of Habitat

Most of the shorebirds utilized intertidal mudflat habitat that is characterized by moist mud, wet mud, shallow edge, and moderate water depth (Table 4). Medium-sized probing species (*Limosa lapponica*, *Limosa limosa* and *Tringa totanus*) exhibited a similar preferences for water depths. They preferred wet mud and avoided dry mud (except *Tringa totanus*) and moderate deep water. Larger probing species (*Numenius arquata* and *Numenius phaeopus*) preferred shallow water and are the only species that utilized moderately deep water. Lesser Sand Plover *Charadrius mongolus* showed unique trend among the rest of shorebirds species in terms of habitat selection. They strongly preferred dry mud and avoided wet mud, shallow and moderate water.

DISCUSSION AND CONCLUSION

Community composition

The species richness of shorebirds migrating and utilizing the intertidal mudflat of Kapar on the west coast of Peninsular Malaysia is within the range or similar to major stopover sites within the East Asian-Australasian Flyway. This study recorded 26 species, whereas Ma *et al.* (2002) reported 32 species on the eastern intertidal areas of Chongming Island in China and Wilson (2001) reported > 32 species at the Coorong, South Australia. Skagen & Knot (1994) noted that different assemblages of shorebirds species appear to exclusively use different regions within the same flyway. This study did not observed many plover species, only recording Lesser Sand Plover. Conversely, Asian Dowitcher (*Limnodromus semipalmatus*) and Spotted Redshank (*Tringa erythropus*) were observed in this study but neither species was observed at the Coorong in South Australia, nor on the intertidal areas of Chongming Island in China. The possible explanation for more species being reported in the Coorong is that this site may comprises a greater variety of habitat that support a diversity of shorebird species.

The species composition of migrant shorebirds on the mudflat of Kapar varied between seasons and years. For example, less than 80 Common Redshank (*Tringa totanus*) were observed during southward migration in 2001, but more than 280 during the same season in 2002. Similarly, Helmers (1991) and Skagen & Knopf (1994) reported a large variation in seasonal and yearly composition of shorebirds. High variability in the species composition of migrant shorebirds is caused by several variables such as duration of stay at the stopover site, habitat availability, food availability, number of useable wetlands within the area and the degree of disturbance by human and other predator species.

Table 2. Total numbers and relative abundances (% of total shorebirds) present during southward and northwards migration at Kapar, Peninsula Malaysia.

Species	Southwards Migration				Northwards Migration			
	2001		2002		2001		2002	
	N	%	N	%	N	%	N	%
Actitis hypoleucos	62	1.29	185	3.01	29	1.41	34	1.60
Arenaria interpres	49	1.02	90	1.47	4	0.19	12	0.56
Calidris acuminata	0	0.00	1	0.02	0	0.00	0	0.00
Calidris alba	29	0.60	3	0.05	0	0.00	7	0.33
Calidris canutus	34	0.71	59	0.96	24	1.17	17	0.80
Calidris ferruginea	80	1.66	253	4.12	53	2.57	43	2.02
Calidris minutus	3	0.06	0	0.00	0	0.00	0	0.00
Calidris ruficollis	25	0.52	20	0.33	16	0.78	0	0.00
Calidris tenuirostris	32	0.66	112	1.82	47	2.28	29	1.36
Charadrius hiaticula	116	2.41	153	2.49	81	3.93	34	1.60
Charadrius mongolus	1386	28.79	1082	17.61	516	25.06	583	27.36
Charadrius peronii	74	1.54	59	0.96	40	1.94	31	1.45
Glareola maldivarum	12	0.25	0	0.00	0	0.00	6	0.28
Limnodromus semipalmatus	0	0.00	2	0.03	0	0.00	0	0.00
Limosa lapponica	321	6.67	301	4.90	128	6.22	148	6.95
Limosa limosa	539	11.19	519	8.45	149	7.24	26	1.22
Numenius arquata	373	7.75	494	8.04	177	8.60	194	9.10
Numenius phaeopus	289	6.00	433	7.05	149	7.24	185	8.68
Pluvialis fulva	51	1.06	129	2.10	29	1.41	24	1.13
Pluvialis squatarola	248	5.15	390	6.35	191	9.28	225	10.56
Tringa glareola	0	0.00	0	0.00	2	0.10	0	0.00
Tringa guttifer	0	0.00	0	0.00	0	0.00	6	0.28
Tringa nebularis	88	1.83	285	4.64	48	2.33	49	2.30
Tringa stagnatilis	115	2.39	186	3.03	45	2.19	85	3.99
Tringa totanus	750	15.58	1264	20.58	315	15.30	376	17.64
Xenus cinereus	139	2.89	123	2.00	16	0.78	17	0.80
TOTAL	4815		6143		2059		2131	

Table 3. Estimates of the shorebird community metrics during the 2001 and 2002 migration periods at Kapar, western Peninsula Malaysia. (S=Total Species, J=Pielou's evenness= H/Log (S), H= Shannon index= -sum (P_i*$\log_{10}P_i$).

Index	Southwards migration		Northwards Migration	
	2001	2002	2000	2001
S	22	22	20	21
$\hat{J}$	0.7864	0.8341	0.8174	0.7803
$\hat{H}$	1.071	1.136	1.081	1.048

Table 4. Availability and use of habitat by six common shorebirds species on the mudflat of Kapar during (August and September 2001) migrational period (BAG=Bar-tailed Godwit, BLGD=Black-tailed Godwit, CR=Common Redshank, EC=Eurasian Curlew, LSP=Lesser Sand Plover, W=Whimbrel).

Habitat	% Use					
	BAG	BLGD	CR	EC	LSP	W
Dry mud	0.0	0.0	6.3	0.0	63.5	0.0
Moist mud	15.9	14.3	28.5	16.05	52.5	15.8
Wet mud	44.5	48.8	38.9	29.32	0.0	28.8
Shallow (edge ≤ 4 cm)	39.6	36.9	26.3	42.59	0.0	42.7
Moderate (4-16 cm depth)	0.0	0.0	0.0	12.04	0.0	12.7
No. of flocks	221	258	260	324	202	330

The variability in the species composition of migrant shorebirds at Kapar may be attributed to the duration of stay and disturbance from human activity especially boating and collection of shellfish. Shorebird abundance during southward migration were considerable higher ($p > 50$) then during northward. Possibly, the higher abundance may be due to the longer duration of stay and many may be overwintering at Kapar. In conclusion, although shorebirds abundances recorded in this study were low compared to other stopover and wintering sites elsewhere, the intertidal mudflats at

Kapar may be just as important as a national stopover site.

Shorebirds Selection of Habitat

Shorebirds are a morphologically diverse group, yet they exhibit a rather narrow range of habitat requirements. Water depth is an important factor influencing shorebird use of wetlands (Hands *et al.*, 1991; Helmers, 1991; Skagen & Knof 1994). Shorebird use of intertidal mudflat at Kapar ranged from dry, moist or wet mudflat and shallow water to moderate and deep water. Moist, wet, and shallow water habitats were preferred by most of the shorebirds. Large shorebirds (*Numenius arquata* and *Numenius phaeopus*) also preferred shallow and moderately deep water. Most of the shorebirds exhibited preferences for at least two habitat types. By exhibiting preferences for more than one habitat, shorebirds are able to partition themselves to avoid interspecific competition and possibly exploit a wider range of food resources. Consequently, morphologically similar species that may occupy the same habitat and forage on the same foods can avoid costly competitive interaction because one of the competitors will be able to shift to another habitat.

In conclusion, it is obvious from the result of habitat selection that, shorebirds select foraging sites at a landscape scale (select based on perceived suitable habitat from landscape view). At this scale, shorebirds are likely to key in on the landscape features of the mudflat of Kapar such as availability of mudflat and shallow water habitat. Thus, for the management and conservation of shorebirdsand their foraging sites, these two components are essential and need to be maintained to ensure the site will continue to attract shorebirds.

REFERENCES

Alldredge, J. R and Ratti, J. T. 1986. Comparison of some statistical techniques for analysis of resource selection. Journal of Wildlife Management 50: 157-165.

Baker, M. C. 1971. A comparative study of the foraging ecology of six species of shorebirds *(Charadriiformes, Charadrii)* on their breeding and wintering ranges. Ph.D. Thesis. Yale University of New Haven, Conn. pp 179.

Bergan, J. F, Smith, L. M and Mayer, J. J. 1989. Time-activity budgets of living ducks wintering in South Carolina. Journal of Wildlife Management. 53: 769-776.

Doug, W. 1993. A national plan for shorebird conservation in Australia. Australia Wader Study Group of the Royal Australasian Ornithologists Union. Report No. 90.

Edwards, P. J., Parish, D., and NPWO. 1986. Evaluation of Sarawak wetland and their importance to waterbirds. Report 2: Western Sarawak. Interwader Publication No. 5, Kuala Lumpur.

Hands, H. Ryan, M. R and Smith, J. W. 1991. Migrant shorebirds use of marsh, moist-soil, and flooded agricultural habitat. Wildlife Society Bulletin. 19: 457-464.

Hawkins, A. F. and Howes, J. R. 1986. Preliminary assessment of coastal wetlands and shorebirds in South-west Peninsular Malaysia. Interwader Publication No. 13, Kuala Lumpur.

Helmers, R. 1991. Habitat use by migrant shorebirds and invertebrate availability in managed wetland complex. MSc. abstract, University of Missouri, Columbia.

Howes. J. and Parish, D. 1989. New information on Asian shorebirds: A preliminary review of the interwader program 1983-1989 and priorities for the future, second edn. AWB, Kuala Lumpur.

Lane, B and Mundkur, T. 1992. Wader study at Malaysian Power Station. The Stilt 20: 42.

Ma, Z. J, Jing, K, tang, S.M and Chen, J. K. 2002. Shorebirds in the eastern intertidal areas of Chongming Island during the 2001 Northward Migration. The Stilt 42: 6-10.

Myers, J. P. 1984. Conservation of migrating shorebirds: Staging areas, geographic bottlenecks, and regional movements. American Birds 37: 23-25.

Parish, D and D. R. Wells (eds). 1984. INTERWADER 83 report. Kuala Lumpur.

Pepping, M., Piersma, T., Pearson, G. and Lavaleye. 1999. *Intertidal sediments and benthic animals of Roebuck Bay, Western Australia*. NIOZ. Curtin University of Technology, Perth, WA. pp 212.

Pielou, E.C, 1969. *An introduction to mathematical ecology*. Wiley-Interscience, New York

Riak, K. M. Ismail, A. Arshad, A and Rahim I.A. 2002. The importance of Kapar Mudflat and Kuala Selangor Nature Park to the migrant shorebirds. In tropical Marine Environment: Charting Strategies for the Millennium, F. M. Yusoff, M. Shariff, H. M. Ibrahim, S. G. Tan & S. Y. Tai (eds), pp. 517-524. Malacca Straits Research and Development Centre (MASDEC), Universiti Putra Malaysia, Serdang, Malaysia.

Rose, P. M and Scott, D. A. 1997. Waterfowl population estimates. Second edition. *Wetland International Publications* 44, Wageningen, The Netherlands. 106 pp.

Shannon, C. E and Weaver, W. 1963. The mathematical theory of communication. University of Illinois press, Urbana, 117p.

Silvius, M. J., Chan, H. J. and Shamsudin, I. 1987. Evaluation of wetlands of the West Coast of Peninsular Malaysiaand their importance for natural resource conservation. World Wide Fund for Nature Malatsia.

Skagen, S. K. and Knopf, F. L.1994. Migrating shorebirds and habitat dynamic at a prairie wetland complex. Wilson Bulletin 106: 91-105.

Sokal, R. R and Rofhlf, J. F. 1981. Biometry. Second ed. W. H. Freeman & Co., New York, N. Y. pp 859.

Wilson, J. R. 2001. Wader surveys in the Coorong, South Australia in Jaunuary and February 2001. The Stilt 40: 38-54.

Zar, J. H. 1984. Biostatistical analysis. Prentice-Hall International Inc., Englewood, N. J. 620 pp.

A SURVEY OF BAR-TAILED GODWITS IN SOUTH-EAST QUEENSLAND

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The majority of Bar-tailed Godwits that migrate to eastern Australia and New Zealand are the *Limosa lapponica baueri* subspecies that breeds in northern and western Alaska. Another subspecies, *L. l. menzbieri*, which migrates to north west Australia, breeds in central northern Siberia.

We know from flag sightings in recent years that both subspecies use major staging sites in the extensive intertidal areas of the Yellow Sea on northward migration. In contrast, all band recoveries and leg-flag sightings in this area during peak southward migration have been of the *L. l. menzbieri* subspecies. There is growing evidence to suggest that on southward migration most, if not all, of the *baueri* subspecies makes a direct non-stop flight across the Pacific Ocean to New Zealand and eastern Australia (Barter 2002).

To help establish whether there is a link between observations of departing flocks on the coast of south-west Alaska and new arrivals on the non-breeding grounds, counts of Bar-tailed Godwits were made at the Manly Boat Harbour roost in Moreton Bay, south-east Queensland. The counts were carried out from September through to early December 2002.

As can be seen from Table 1, the numbers of Bar-tailed Godwits roosting at the site throughout the first three weeks of September were low, lower in fact than the average winter 2002 count of 255. I think that nothing of significance can be read into the higher number recorded on September 1 or the very low numbers on September 13 and 21. These may well be due to any one or more local factors on the day, including disturbance at other roost sites and the height of the high tide. It could even be that birds over-wintering in Moreton Bay moved further south in mid-September. On the other hand, the slight increase on the September 28 count was probably due to arriving migrants even though no breeding plumage was recorded on any of the birds.

October 6 saw a significant increase in numbers of Godwits, but no juveniles were identified. One wonders now whether there may well have been a few juveniles in the large flock. Significantly, on that date about 300 birds had traces of breeding plumage, confirming the arrival of migrating birds. Although there was a slight drop in total birds on October 13, the first juveniles for the Australasian summer were recorded.

Table 1. Counts of Bar-tailed Godwits Manly roost during the arrival period of birds returning from the breeding grounds in 2002 (% = percentage juveniles in the sample).

Date	Total	Juvs	%
1 September	481	-	-
8 September	219	-	-
13 September	121	-	-
21 September	128	-	-
28 September	600	-	-
6 October	1008	-	-
13 October	870	5	0.57
20 October	711	5	0.70
26 October	1130	8	0.71
2 November	900	15	1.66
9 November	1396	16	1.15
30 November	2000	25	1.25
8 December	2934	30	1.02
Overall	9941	104	1.05

The percentage of juveniles remained much the same until double the number appeared on November 2. While the percentage for that date is the highest recorded, it should be borne in mind that the total number of birds for the day was an estimate only. An accurate count may have revealed a total more consistent with the weeks before and after. Again, the estimated count on November 30 may be slightly understated resulting in the percentage for that date being a little higher.

With these considerations in mind, the data is consistent in showing just over 1% of the totals being juveniles. In itself, the data is inconclusive to confirm the direct migration link to south east Queensland. Significantly, the peak in arrivals is later than that I would expect for birds departing the breeding grounds from mid-August to early September.

However, one can speculate that an explanation for this is that birds arriving directly from the breeding grounds first make landfall in northern Australia before making their way further south, including to Moreton Bay. Such an explanation is consistent with the data showing a continuing build up in numbers in late November and early December. Accepting the

numbers of juveniles present at this time and their fairly constant percentages, clearly the increase is a result of the arrival of migrating adults and juveniles and not only juveniles.

While it cannot be said the data in itself supports the direct migration view, it may be of help in providing evidence when read with other data, particularly observations on departures from Alaska and arrivals in other parts of eastern Australia and New Zealand.

Of additional interest is the fact that the percentage of juveniles was so low in this season. It suggests that breeding had been poor in northern Alaska during 2002. Data on breeding success collected from the breeding grounds could be compared with my data to ascertain if these data are consistent. As well, comparisons with the percentage juveniles in other parts of Australia would show whether the sub-species breeding in northern Siberia *L. l. menzbieri* also had poor breeding success during 2002.

REFERENCES

Barter, M.A. 2002. Shorebirds of the Yellow Sea: Importance, threats and conservation status. Wetlands International Global Series 9, International Wader Studies 12, Canberra, Australia.

A SHOREBIRD CENSUS OF SCHASTYA BAY AND THE AMUR ESTUARY, SEA OF OKHOTSK, RUSSIA FROM 6 AUGUST – 21 SEPTEMBER 2002

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ABSTRACT

A shorebird survey of Schastya Bay and the Amur River estuary was conducted from August 6 – September 21 2002. A total of 26 326 shorebirds of 27 species was counted, the most common being Dunlin (26% of identified birds), Red-necked Stint (26%), Whimbrel (23%), Great Knot (7%), Bar-tailed Godwit (5%), and Lesser Sand Plover (5%). It is believed, based on this survey and a similar one conducted last year, that at least 200 000-250 000 shorebirds pass through Schastya Bay on southward migration. It is recommended that Schastya Bay should be registered as a State Wildlife Sanctuary and be nominated as a Wetland of International Importance.

METHODS

The survey covered the whole of Schastya Bay during the period from August 6 to September 13, 2002. The final days, from September 17-21, were spent surveying the Amur River mouth as far as Lazarev town in the south (Figure 1). Most of the coast of Schastya Bay was traversed using a rubber boat. The coastline length surveyed was about 80 km. The Amur River estuary coastal area was covered by motor boat with separate surveys to the Mi and Timi River mouths. Two people were involved in the field work for most of the time.

Schastya Bay is shallow with extensive sea-grass shoals. Chkalov and Baydukov Islands are low-lying, with numerous muddy estuaries of swampy brackish streams, small bays, and lagoons of

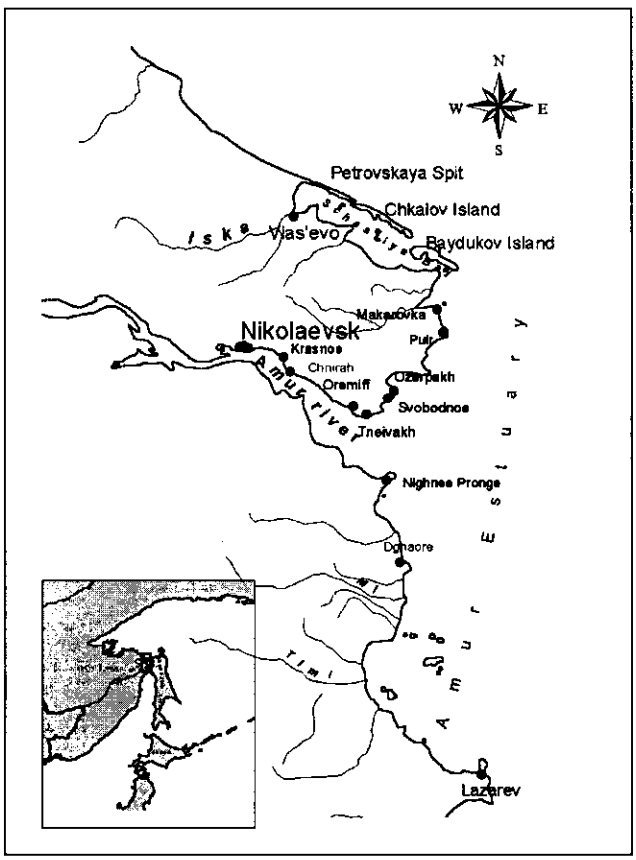

Figure 1. The survey region of the Sea of Okhotsk, north-eastern Russia.

brackish water. The widest mudflats (1-2 km at low tide) are located between the Iska River mouth and Petrovskaya Spit, which is sandy and less used by shorebirds. The time spent in the different habitats at Schastya Bay was as follows: mudflats, muddy estuaries – 15%, sandy beaches – 38%, pebble shores – 20%, brackish marshes and lagoons - 27%.

RESULTS AND DISCUSSION

Schastya Bay

A total of 26 028 shorebirds of 27 species was counted during a shorebird survey of Schastya Bay and the Amur River estuary from August 6 – September 21, 2002 (Table 1). Dunlin, Red-necked Stint, Great Knot, Lesser Sand Plover, Bar-tailed Godwit and Whimbrel were the most abundant species, comprising more than 65 % of the total number of shorebirds counted. The overwhelming majority of the 7 600 unidentified shorebirds were of the smaller species.

The first migration peak on August 6-8 consisted mainly of Dunlin, Red-necked Stint, Great Knot, Ruddy Turnstone and Lesser Sand Plover. Five species dominated the second peak during the second third of August: Dunlin, Red-necked Stint, Whimbrel, Bar-tailed Godwit and Lesser Sand Plover. The final peak, from 7-9 September, was mainly of Dunlin and Red-necked Stint actively migrating. Information on the daily numbers and proportions of the major species at different times is summarised in Figure 2 and Table 2. Shorebirds were mainly seen flying to the south and south-east. The great majority of birds were juveniles.

Amur Estuary

Shorebirds were scarce in the Amur Estuary (southward from the river mouth), from mid-September and were mainly seen in flight. A total of 298 from four species were seen. There are no mudflats in this area and the small number of shorebirds utilized sea-grass shoals that mainly supported geese, swans, and ducks. However, the lateness of the survey probably contributed towards the small numbers.

A combination of this year's survey and last year's (July 20 – August 5 2001) provides support for an estimate of at least 200 000 to 250 000 shorebirds using Schastya Bay during the southward migration. Comparison of shorebird numbers during the two halves of southward migration (from the 2001 and 2002 surveys) shows much higher total abundance in the July 20-August 5 2001 period (49 347). Unfortunately, the high numbers of unidentified birds (40 000) in 2001 makes it impossible to compare species numbers between the two periods. A complete assessment of the importance of the Bay will require similar surveys during northward migration and the northern summer (June to mid-July).

Table 1. Results of the shorebird census in Schastya Bay and Amur Estuary, 6 August – 21 September 2002.

Species	Scientific name	Number
Ruddy Turnstone	*Arenaria interpres*	573
Dunlin	*Calidris alpina*	4 867
Red-necked Stint	*C. ruficollis*	4 789
Great Knot	*C. tenuirostris*	1 374
Sanderling	*C. alba*	2
Curlew Sandpiper	*C. ferruginea*	2
Sharp-tailed Sandpiper	*C. acuminata*	1
Spoon-billed Sandpiper	*Eurynorhynchus pygmaeus*	1
Grey Plover	*Pluvialis squatarola*	72
Pacific Golden Plover	*P. fulva*	30
Lesser Sand Plover	*Charadrius mongolus*	906
Little Ringed Plover	*Ch. dubius*	6
Ruff	*Philomachus pugnax*	2
Common Sandpiper	*Actitis hypoleucos*	27
Terek Sandpiper	*Xenus cinereus*	7
Common Redshank	*Tringa totanus*	324
Common Greenshank	*T. nebularia*	216
Green Sandpiper	*T. ochropus*	2
Wood Sandpiper	*T. glareola*	38
Grey-tailed Tattler	*Heteroscelus brevipes*	41
Black-tailed Godwit	*Limosa limosa*	128
Bar-tailed Godwit	*L. lapponica*	953
Long-billed Dowitcher	*Limnodromus scolopaceus*	1
Whimbrel	*Numenius phaeopus*	4 325
Eastern Curlew	*N. madagascariensis*	8
Common Snipe	*Gallinago gallinago*	14
Pin-tailed Snipe	*G. stenura*	2
Unidentified snipes	*Gallinago spp.*	15
Unidentified shorebirds		7 600
TOTAL		26 326

A hunter supplied a yellow leg-flag (NW Australia) obtained from a Great Knot (metal band 061-90113, location 53°20′ N, 141°15′ E). Local people advised that they had seen yellow-flagged (three sightings in 2002, including the Great Knot), green-flagged (Brisbane region, Australia. One in 1999) and white-flagged (North Island of New Zealand in 2001) shorebirds. All birds were seen at the end of June and beginning of July.

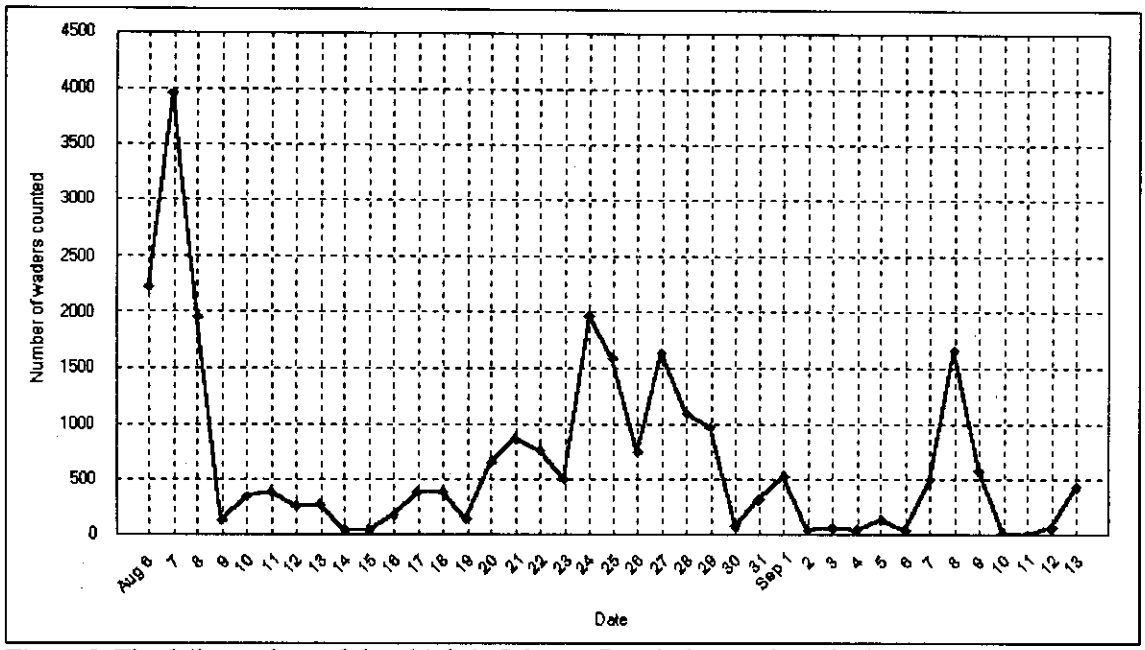

Figure 2. The daily numbers of shorebirds in Schastya Bay during southward migration.

Table 2. Total numbers and proportions of the major shorebird species counted during the survey.

Time interval	Total counted	Number identified	Major species	%	Number of species
6-10 August	8607	3607	Red-necked Stint	22	19
			Great Knot	21	
			Dunlin	14	
			Ruddy Turnstone	10	
			Lesser Sand Plover	10	
			Bar-tailed Godwit	4	
11-15 August	1003	1003	Whimbrel	54	13
			Red-necked Stint	19	
			Great Knot	17	
16-20 August	1781	1781	Whimbrel	63	10
			Red-necked Stint	17	
			Great Knot	11	
21-25 August	5697	5697	Red-necked Stint	35	20
			Whimbrel	27	
			Dunlin	26	
26-30 August	4517	4517	Dunlin	42	15
			Red-necked Stint	24	
			Bar-tailed Godwit	13	
			Lesser Sand Plover	8	
			Whimbrel	7	
31 August - 4 September	1009	649	Whimbrel	67	15
			Red-necked Stint	11	
5 – 9 September	2899	1099	Dunlin	57	16
			Red-necked Stint	20	
			Whimbrel	10	
10 -13 September	515	135	Dunlin	39	10
			Red-necked Stint	21	
			Great Knot	16	
			Grey Plover	8	
17-21 September	298	238	Dunlin	62	4
			Grey Plover	23	

THREATS

Currently, only minor to moderate levels of fishing and hunting activity occur due to the remoteness of the region and lack of fuel. Fishery protection vessels regularly call. A whaling team is located at Schastya Bay during the northern summer.

Hunters and poachers take ducks and geese rather than shorebirds and I estimate that hunting takes hundreds of shorebirds per season. Larger bodied shorebirds, particularly Whimbrel, and abundant medium-sized species like Great Knot and Dunlin are the predominant shorebirds in hunters' bags.

According to unofficial information Schastya Bay forms part of a petroleum basin and might be affected by the prospective Sakhalin-2 oil and gas production project.

There were several well-populated settlements along the coast of Schastya Bay in the first half of the last century and one would think that pressure on shorebirds would be lower now than then. However, local people state that shorebird numbers have declined in recent years.

Schastya Bay should be registered as a State Wildlife Sanctuary and nominated as a Wetland of International Importance since it regularly supports over 20 000 shorebirds.

ACKNOWLEDGEMENTS

The counts were made possible through financial support from Environment Australia and Yuri Darman, Far East office of WWF. I wish to thank Aleksey Roslyakov for assistance during the survey and also the local people who helped us. I also greatly appreciate Mark Barter's assistance with the final revision of the manuscript

REPORT ON POPULATION MONITORING COUNTS, 2002

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The Population Monitoring Project counts for Summer and Winter of 2002 are published below. There was considerable improvement in the coverage of the core PMP sites in 2002 thanks to continued effort and dedicated organisation by the state and area co-ordinators.

Many of the PMP sites have been counted regularly since 1986, when 23 sites were designated in the original programme. Some have been irregularly reported or have lapsed, while other sites have been included on a short- or long-term basis over the years. In the interests of consistency, I intend to report on a standard set of 31 sites, which consists of the original 23, two of which have since been split (Clarence/Richmond in NSW and Corner Inlet East and West in Victoria) plus six others which are significant, well-established and regularly counted each summer and winter. These are Townsville, Bowen, Tweed Estuary, Broome, Eighty Mile Beach and North-west Tasmania. The full list of PMP sites that will be reported on in future is that shown in the Winter 2002 table.

This is not to discourage monitoring of wader populations in other suitable areas. Many other counting programmes are carried out. Many are published as part of other studies, and all counts can be recorded in the AWSG count database. Data can also be published here as Occasional Counts. Please do not hesitate to send in your counts!

A few of the original PMP sites have not been counted for some time, but recent efforts by some dedicated wader enthusiasts have led to a revived interest in counting in these areas. I hope the tables will be even more complete in the 2003 report. There is always room for more counters and I encourage any interested persons to contact their local Wader Group where they are certain to be welcomed. Finally, I would like to express my thanks to all the counters who braved the elements on their appointed day, the organisers of cars, boats, telescopes and people, and the co-ordinators who collated the data and sent it, promptly or otherwise, to be incorporated in this report.

NOTE: After the publication of the 2001 counts in Stilt 41 an error was reported in the figures for the Summer count of the South-east coast of South Australia (p. 58). There were two Bar-tailed Godwits observed, but no Black-tailed Godwits. I would appreciate readers letting me know of any other errors in the published data.

SUMMER 2002	QUEENSLAND						NEW SOUTH WALES						
	Cairns	Townsville	Mackay	Moreton Bay	Bowen	Tweed	Richmond	Clarence	Hastings	Hunter	Parramatta River	Botany Bay	Shoalhaven
Latham's Snipe	-	-	-	-	-	-	-	1	-	-	-	-	-
Black-tailed Godwit	79	96	-	433	-	-	-	104	-	355	-	-	2
Bar-tailed Godwit	40	65	402	9458	134	317	29	370	65	-	145	314	196
Little Curlew	-	-	-	-	-	-	-	-	-	-	-	-	-
Whimbrel	9	45	128	872	53	65	19	119	60	25	-	31	
Eastern Curlew	21	99	316	2448	5	141	8	158	45	617	-	241	17
Marsh Sandpiper	2	-	40	39	25	15	-	52	-	98	-	-	-
Common Greenshank	8	4	-	175	15	36	17	28	7	100	5	-	-
Wood Sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-
Terek Sandpiper	9	-	-	62	-	-	50	18	-	41	-	1	-
Common Sandpiper	-	1	-	-	1	1	1	2	-	-	1	-	-
Grey-tailed Tattler	26	1	1	1607	36	35	33	104	22	16	-	98	-
Wandering Tattler	-	1	-	-	-	-	1	-	-	-	-	-	-
Tattler Spp	-	-	-	-	-	-	-	-	-	-	-	-	-
Ruddy Turnstone	-	-	-	54	1	2	17	29	-	-	-	32	1
Great Knot	273	5164	-	1613	3	-	6	187	-	8	-	-	4
Red Knot	-	-	-	7	-	-	2	-	1	54	-	-	-
Sanderling	-	-	-	50	-	-	42	-	-	-	-	-	-
Red-necked Stint	74	192	8	904	147	-	28	23	12	11	-	66	120
Pectoral Sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-
Sharp-tailed Sandpiper	47	18	15	152	93	-	-	514	-	640	49	-	-
Curlew Sandpiper	58	-	-	504	140	4	49	-	-	340	25	9	1
Bush Stone-curlew	-	-	3	-	-	-	-	-	-	-	-	-	-
Beach Stone-curlew	-	-	-	-	-	-	-	2	-	-	-	-	-
Pied Oystercatcher	2	7	2	557	5	4	9	24	4	11	-	44	5
Sooty Oystercatcher	-	-	-	1	1	2	-	20	-	-	-	11	-
Black-winged Stilt	-	8	1	534	44	86	8	446	-	697	697	-	2
Banded Stilt	-	-	-	-	-	-	-	-	-	-	-	-	2
Red-necked Avocet	-	-	-	90	-	-	-	-	-	2019	14	-	-
Pacific Golden Plover	39	-	-	268	-	15	163	72	-	197	5	9	100
Grey Plover	-	-	-	128	-	-	-	-	-	-	-	-	-
Red-capped Plover	1	74	17	58	63	-	2	-	-	-	8	-	36
Double-banded Plover	-	-	-	-	-	-	-	1	-	-	-	5	4
Lesser Sand Plover	31	119	-	436	38	-	12	41	8	-	-	3	-
Greater Sand Plover	14	6	-	187	11	-	63	17	-	-	-	2	-
Oriental Plover	-	-	-	-	-	-	-	-	-	-	-	-	-
Black-fronted Dotterel	6	10	-	-	10	4	-	6	-	17	39	-	-
Hooded Plover	-	-	-	-	-	-	-	-	-	-	-	-	-
Red-kneed Dotterel	-	-	-	-	-	-	-	1	-	-	-	-	-
Banded Lapwing	-	-	-	-	-	-	-	-	-	-	-	-	-
Masked Lapwing	31	9	10	97	25	17	14	132	6	68	17	6	-
Long-toed Stint	-	-	-	-	-	-	-	-	-	-	-	-	-
Redshank	-	-	-	-	-	-	-	-	-	-	-	-	-
Broad-billed Sandpiper	1	-	-	-	-	-	-	-	-	-	-	-	-
Ruff	-	-	-	-	-	-	-	-	-	-	-	-	-
Swinhoe's Snipe	-	-	-	-	-	-	-	-	-	-	-	-	-
Asian Dowitcher	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified small	-	-	-	126	-	-	-	-	-	-	-	-	-
Unidentified medium	-	-	-	810	-	-	-	-	-	-	-	-	-
Unidentified large	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	771	5919	943	21670	850	0	744	573	2471	230	5314	1005	872	490
No SPECIES	20	18	12	27	20	0	15	21	25	10	18	11	15	13

SUMMER 2002		**VICTORIA**							**TASMANIA**			
		Corner Inlet East	Corner Inlet West	Westernport	East Port Phillip	Altona	Werribee/ Avalon	BellarinePen/ Mud Is	EDerw/Pittwater	Marion Bay	Northwest	Cape Portland/ NNE
	Date	9/2	8/2	16/2		29/1	4/2	2-10/2	9/2	10/2	2/2	12/2
Latham's Snipe		-	-	-	39	-	-	157	-	-	2	-
Black-tailed Godwit		-	-	-	-	-	-	-	-	-	-	-
Bar-tailed Godwit		5980	971	400	-	-	-	1	49	-	300	23
Little Curlew		-	-	-	-	-	-	-	-	-	-	-
Whimbrel		-	14	36	-	-	-	-	3	-	2	6
Eastern Curlew		512	40	637	-	-	1	143	69	-	170	45
Marsh Sandpiper		-	-	-	-	-	10	221	-	-	-	-
Common Greenshank		-	44	161	8	49	92	150	40	-	12	14
Wood Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Terek Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Common Sandpiper		-	-	-	1	-	-	-	-	-	-	-
Grey-tailed Tattler		-	-	1	-	-	-	2	-	-	1	1
Wandering Tattler		-	-	-	-	-	-	-	-	-	-	-
Tattler Spp		-	-	-	-	-	-	-	-	-	-	-
Ruddy Turnstone		30	-	21	-	-	1	-	-	-	1322	76
Great Knot		300	-	-	-	-	-	-	-	-	6	-
Red Knot		1200	-	240	-	-	42	1	-	-	1920	-
Sanderling		102	-	-	-	-	-	-	-	-	1	-
Red-necked Stint		15800	2170	8673	11	1048	8895	6881	1695	910	12595	1575
Pectoral Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Sharp-tailed Sandpiper		-	-	333	1658	119	2894	1358	-	-	-	-
Curlew Sandpiper		600	259	3170	-	425	1404	1609	159	-	226	47
Bush Stone-curlew		-	-	-	-	-	-	-	-	-	-	-
Beach Stone-curlew		-	-	-	-	-	-	-	-	-	-	-
Pied Oystercatcher		662	176	342	-	-	36	68	1066	154	1024	76
Sooty Oystercatcher		52	139	1	-	-	-	-	47	4	383	42
Black-winged Stilt		-	-	-	116	424	212	727	-	-	-	-
Banded Stilt		-	-	-	-	570	897	5921	-	-	-	-
Red-necked Avocet		-	-	-	70	1029	486	406	-	-	-	-
Pacific Golden Plover		-	-	57	-	-	6	3	46	-	188	52
Grey Plover		400	-	-	-	-	-	-	-	-	-	-
Red-capped Plover		-	-	128	-	15	57	140	93	61	309	81
Double-banded Plover		30	-	10	-	-	1	-	4	3	12	5
Lesser Sand Plover		1	-	-	-	-	-	-	-	-	6	-
Greater Sand Plover		10	-	-	-	-	-	-	-	-	-	-
Oriental Plover		-	-	-	-	-	-	-	-	-	-	-
Black-fronted Dotterel		-	-	-	13	-	2	15	1	-	-	-
Hooded Plover		-	-	-	-	-	-	6	4	10	54	14
Red-kneed Dotterel		-	-	-	25	-	19	54	-	-	-	
Banded Lapwing		-	-	-	-	-	-	-	3	-	-	59
Masked Lapwing		-	8	176	107	54	295	480	349	13	358	48
Long-toed Stint		-	-	-	1	-	-	-	-	-	-	-
Redshank		-	-	-	-	-	-	-	-	-	-	-
Broad-billed Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Ruff		-	-	-	-	-	-	-	-	-	-	-
Swinhoe's Snipe		-	-	-	-	-	-	-	-	-	-	-
Asian Dowitcher		-	-	-	-	-	-	-	-	-	-	-
Unidentified small		-	-	-	-	-	-	-	-	-	-	-
Unidentified medium		-	-	-	-	-	-	-	-	-	-	-
Unidentified large		-	-	-	-	-	-	-	-	-	-	-
TOTAL		25679	3821	14386	2049	3733	15350	18343	3628	1155	18891	2164
No SPECIES		14	9	16	11	9	18	20	15	7	20	16

SUMMER 2002		**SA**				**WA**			**NT**	
		SE coast SA	Gulf St Vincent	West Eyre pen	Albany	Swan Est/Rottnest	80 Mile beach (km 10-30)	Broome	Darwin	Total- all sites
	Date	15/2				10/2	12/11	28/11		
Latham's Snipe		-	N	N	-	-	-	-	N	199
Black-tailed Godwit		-	O	O	6	-	-	-	O	1075
Bar-tailed Godwit		-	T	T	22	20	10507	11955	T	41763
Little Curlew		-			-	-	130	229		359
Whimbrel		-	C	C	-	1	7	360	C	1855
Eastern Curlew		-	O	O	-	-	64	221	O	6018
Marsh Sandpiper		-	U	U	13	-	46	-	U	561
Common Greenshank		16	N	N	176	13	937	128	N	2235
Wood Sandpiper		-	T	T	-	-	-	-	T	0
Terek Sandpiper		-	E	E	-	-	6186	432	E	6799
Common Sandpiper		-	D	D	1	3	-	14	D	26
Grey-tailed Tattler		11			5	11	12420	1690		16121
Wandering Tattler		-			-	-	-	-		2
Tattler Spp		-			-	-	-	-		0
Ruddy Turnstone		450			28	402	54	417		2937
Great Knot		-			355	50	47994	12450		68413
Red Knot		-			85	-	5781	1881		11214
Sanderling		329			-	121	233	-		878
Red-necked Stint		1548			2491	1419	9080	3705		80081
Pectoral Sandpiper		-			-	-	-	-		0
Sharp-tailed Sandpiper		19			14	-	190	-		8113
Curlew Sandpiper		88			237	64	6330	1076		16824
Bush Stone-curlew		-			-	-	-	-		3
Beach Stone-curlew		-			-	-	-	-		2
Pied Oystercatcher		12			30	71	-	25		4416
Sooty Oystercatcher		2			2	-	-	17		724
Black-winged Stilt		-			121	32	-	-		4155
Banded Stilt		-			187	5090	-	-		12667
Red-necked Avocet		-			390	13	-	-		4517
Pacific Golden Plover		76			36	-	1	14		1347
Grey Plover		-			144	26	75	168		941
Red-capped Plover		78			483	190	668	457		3019
Double-banded Plover		6			-	-	-	-		81
Lesser Sand Plover		-			-	3	-	15		713
Greater Sand Plover		-			13	1	33495	4470		38289
Oriental Plover		-			-	-	8445	2		8447
Black-fronted Dotterel		-			-	-	-	-		123
Hooded Plover		4			-	-	-	-		92
Red-kneed Dotterel		-			-	-	-	-		99
Banded Lapwing		-			-	4	-	-		66
Masked Lapwing		105			-	-	-	-		2425
Long-toed Stint		-			-	-	-	-		1
Redshank		-			-	-	-	-		0
Broad-billed Sandpiper		-			-	-	-	2		3
Ruff		-			-	-	-	-		0
Swinhoe's Snipe		-			-	-	-	-		0
Asian Dowitcher		-			-	-	-	3		3
Unidentified small		-			40	-	-	-		166
Unidentified medium		-			-	-	-	-		810
Unidentified large		-			-	-	-	-		0
TOTAL		2744	0	0	4879	7534	142643	39731	0	348582
No SPECIES		14	0	0	22	19	20	23	0	41

WINTER 2002	QUEENSLAND								NEW SOUTH WALES			
	Cairns	Townsville	Mackay	Moreton Bay	Bowen	Tweed	Richmond	Clarence	Hunter	Parramatta	Botany Bay	Shoalhaven
Date												
Latham's Snipe	-	-	-	-	-	-	-	N	-	-	-	-
Black-tailed Godwit	-	-	-	12	-	-	-	O	1	-	-	-
Bar-tailed Godwit	-	86	17	674	9	-	-	T	100	20	70	66
Little Curlew	-	-	-	-	-	-	-		-	-	-	-
Whimbrel	-	32	-	313	8	-	5	C	40	-	27	-
Eastern Curlew	-	33	28	392	4	-	-	O	82	-	26	19
Marsh Sandpiper	-	-	-	-	-	-	-	U	-	-	-	-
Common Greenshank	-	-	-	5	3	-	-	N	5	-	-	-
Wood Sandpiper	-	-	-	-	-	-	-	T	-	-	-	-
Terek Sandpiper	-	-	-	1	-	-	-	E	-	-	1	-
Common Sandpiper	-	-	-	-	-	-	-	D	-	-	-	-
Grey-tailed Tattler	-	151	58	129	-	-	-		-	-	4	-
Wandering Tattler	-	-	-	-	-	-	-		-	-	-	-
Tattler Spp	-	-	-	-	-	-	-		-	-	-	-
Ruddy Turnstone	-	-	-	5	-	-	-		-	-	3	-
Great Knot	-	684	6	195	-	-	-		-	-	-	-
Red Knot	-	1	-	-	-	-	-		3	-	-	-
Sanderling	-	-	-	-	-	-	-		-	-	-	-
Red-necked Stint	-	265	142	813	5	-	2		-	-	7	2
Pectoral Sandpiper	-	-	-	-	-	-	-		-	-	-	-
Sharp-tailed Sandpiper	-	-	-	-	-	-	1		-	-	-	-
Curlew Sandpiper	-	-	-	169	8	-	-		-	-	-	-
Bush Stone-curlew	-	-	5	-	-	-	-		-	-	-	-
Beach Stone-curlew	-	-	2	2	-	-	-		-	-	-	-
Pied Oystercatcher	-	3	2	306	4	-	2		15	-	37	2
Sooty Oystercatcher	-	-	1	-	1	-	8		-	-	2	-
Black-winged Stilt	11	2	-	1897	37	10	18		615	143	14	-
Banded Stilt	-	-	-	-	-	-	-		-	-	-	-
Red-necked Avocet	-	-	-	472	-	-	-		1900	-	-	-
Pacific Golden Plover	-	3	-	26	-	-	23		-	-	-	-
Grey Plover	-	-	-	-	-	-	-		-	-	-	-
Red-capped Plover	7	225	42	397	28	-	-		4	4	-	12
Double-banded Plover	-	-	-	137	-	-	48		-	-	47	8
Lesser Sand Plover	-	-	-	55	-	-	-		-	-	-	-
Greater Sand Plover	-	14	-	6	-	-	-		-	-	-	-
Oriental Plover	-	-	-	-	-	-	-		-	-	-	-
Black-fronted Dotterel	3	-	-	5	1	4	6		24	19	-	-
Hooded Plover	-	-	-	-	-	-	-		-	-	-	-
Red-kneed Dotterel	-	-	-	80	-	-	-		58	22	-	-
Banded Lapwing	-	-	-	-	-	-	-		-	-	-	-
Masked Lapwing	16	-	48	111	27	8	2		28	16	5	2
Long-toed Stint	-	-	-	-	-	-	-		-	-	-	-
Redshank	-	-	-	-	-	-	-		-	-	-	-
Broad-billed Sandpiper	-	-	-	-	-	-	-		-	-	-	-
Ruff	-	-	-	-	-	-	-		-	-	-	-
Swinhoe's Snipe	-	-	-	-	-	-	-		-	-	-	-
Asian Dowitcher	-	-	-	-	-	-	-		-	-	-	-
TOTAL	37	1499	351	6202	135	22	115		2875	224	243	111
No SPECIES	4	12	11	23	12	3	10		13	6	12	7

WINTER 2002		VICTORIA							TASMANIA			
		Corner Inlet East	Corner Inlet West	Westernport	East Pt Phillip	Altona	Werribee/Avalon	Bellarine Peninsula/ Mud Islands	East Derwent/ Pittwater	Marion & Blackman Bays	North-west	Cape Portland/ NNE
	Date	26/6	9/8	13/7	17,23/6	18/7	19/7	19-21/7				
Latham's Snipe		-	-	-	-	-	-	-	-	-	-	-
Black-tailed Godwit		-	-	-	-	-	8	-	-	-	-	-
Bar-tailed Godwit		450	9	8	-	-	-	-	8	-	-	-
Little Curlew		-	-	-	-	-	-	-	-	-	-	-
Whimbrel		-	-	5	-	-	-	2	1	-	-	-
Eastern Curlew		26	191	31	-	-	1	-	3	-	1	-
Marsh Sandpiper		-	-	-	-	-	5	1	-	-	-	-
Common Greenshank		-	-	11	2	3	1	53	2	-	-	-
Wood Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Terek Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Common Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Grey-tailed Tattler		-	-	-	-	-	-	-	-	-	1	-
Wandering Tattler		-	-	-	-	-	-	-	-	-	-	-
Tattler Spp		-	-	-	-	-	-	-	-	-	-	-
Ruddy Turnstone		5	-	16	-	-	3	-	-	-	170	49
Great Knot		-	-	-	-	-	-	-	-	-	-	-
Red Knot		400	-	-	-	-	77	43	-	-	116	-
Sanderling		20	-	-	-	-	-	-	-	-	1	-
Red-necked Stint		4840	1244	1373	5	957	1178	1390	550	200	1150	518
Pectoral Sandpiper		-	-	-	-	-	--	-	-	-	-	-
Sharp-tailed Sandpiper		-	-	2	-	-	-	20	-	-	-	-
Curlew Sandpiper		3	112	106	2	32	233	36	1	-	35	-
Bush Stone-curlew		-	-	-	-	-	-	-	-	-	-	-
Beach Stone-curlew		-	-	-	-	-	-	-	-	-	-	-
Pied Oystercatcher		586	146	198	-	-	40	63	884	34	810	75
Sooty Oystercatcher		176	143	2	-	-	-	1	45	-	181	46
Black-winged Stilt		-	-	-	123	93	321	310	-	-	-	-
Banded Stilt		-	-	-	-	66	416	76	-	-	-	-
Red-necked Avocet		-	-	461	60	428	406	575	-	-	-	-
Pacific Golden Plover		-	-	-	-	-	-	-	-	-	-	-
Grey Plover		10	-	-	-	-	-	6	-	-	-	-
Red-capped Plover		21	-	148	4	173	67	389	151	17	210	149
Double-banded Plover		495	332	449	-	110	233	472	85	7	340	16
Lesser Sand Plover		-	-	-	-	-	-	-	-	-	-	-
Greater Sand Plover		-	-	-	-	-	-	-	-	-	-	-
Oriental Plover		-	-	-	-	-	-	-	-	-	-	-
Black-fronted Dotterel		-	-	-	43	-	49	16	1	-	-	-
Hooded Plover		5	-	-	-	-	-	4	14	-	50	58
Red-kneed Dotterel		-	-	-	66	12	106	29	-	-	-	-
Banded Lapwing		-	-	-	-	-	-	-	-	-	2	14
Masked Lapwing		2	2	59	86	24	55	243	42	5	2	14
Long-toed Stint		-	-	-	-	-	-	-	-	-	-	-
Redshank		-	-	-	-	-	-	-	-	-	-	-
Broad-billed Sandpiper		-	-	-	-	-	-	-	-	-	-	-
Ruff		-	-	-	-	-	-	-	-	-	-	-
Swinhoe's Snipe		-	-	-	-	-	-	-	-	-	-	-
Asian Dowitcher		-	-	-	-	-	-	-	-	-	-	-
TOTAL		7039	2179	2869	391	1898	3199	3729	1787	263	3069	939
No SPECIES		14	8	14	9	10	17	19	13	5	14	9

WINTER 2002	SA			WA				NT	
	SE coast SA	Gulf St Vincent	Eyre peninsula	Albany	Swan Est/Rottnest Is	80 Mile Beach (10-30km)	Broome	Darwin	Total- all sites
Date	11/7			19/7	14/6	7/6	8/6		
Latham's Snipe	-			-	-	-	-	-	0
Black-tailed Godwit	-	N	N	-	-	37	200	N	258
Bar-tailed Godwit	-	O	O	-	-	2050	1195	O	4762
Little Curlew	-	T	T	-	-	-	-	T	0
Whimbrel	-			-	1	13	268		715
Eastern Curlew	1	C	C	-	-	60	240	C	1138
Marsh Sandpiper	-	O	O	-	-	6	-	O	12
Common Greenshank	-	U	U	-	-	193	-	U	278
Wood Sandpiper	-	N	N	-	-	-	-	N	0
Terek Sandpiper	-	T	T	-	-	2065	300	T	2367
Common Sandpiper	-	E	E	-	-	-	-	E	0
Grey-tailed Tattler	-	D	D	-	3	1245	217	D	1808
Wandering Tattler	-			-	-	-	-		0
Tattler Spp	-			-	-	-	-		0
Ruddy Turnstone	166			-	52	25	41		535
Great Knot	-			-	-	3490	1650		6025
Red Knot	-			-	-	745	470		1855
Sanderling	-			-	-	10	-		31
Red-necked Stint	400			-	40	880	590		16551
Pectoral Sandpiper	-			-	-	-	-		0
Sharp-tailed Sandpiper	-			-	-	-	-		23
Curlew Sandpiper	9			-	-	250	130		1126
Bush Stone-curlew	-			-	-	-	-		5
Beach Stone-curlew	-			-	-	-	-		4
Pied Oystercatcher	7			46	30	2	53		3345
Sooty Oystercatcher	3			-	-	-	21		630
Black-winged Stilt	-			-	73	-	310		3977
Banded Stilt	-			60	2674	-	-		3292
Red-necked Avocet	-			-	9	-	23		4334
Pacific Golden Plover	-			-	-	1	-		53
Grey Plover	-			-	3	81	2		102
Red-capped Plover	35			-	33	575	200		2891
Double-banded Plover	20			-	-	-	-		2799
Lesser Sand Plover	-			-	-	14	-		69
Greater Sand Plover	-			-	-	2300	400		2720
Oriental Plover	-			-	-	-	-		0
Black-fronted Dotterel	-			1	-	-	-		172
Hooded Plover	3			-	-	-	-		134
Red-kneed Dotterel	-			-	-	-	-		373
Banded Lapwing	-			-	26	-	-		42
Masked Lapwing	4			-	-	-	-		801
Long-toed Stint	-			-	-	-	-		0
Redshank	-			-	-	-	3		3
Broad-billed Sandpiper	-			-	-	3	6		9
Ruff	-			-	-	-	-		0
Swinhoe's Snipe	-			-	-	-	-		0
Asian Dowitcher	-			-	-	1	12		13
TOTAL	648			107	2944	14046	6331		63252
No SPECIES	10			3	11	22	21		36

POPULATION MONITORING COUNTS – VICTORIAN COUNTS UPDATE

PMP counts for Winter 1999, Summer 2000 and Winter 2000 were published in *The Stilt* 38, April 2001. It was mentioned that some Victorian counts were not available at that time, and these are published below. Readers may wish to update the published table

Species	WINTER 1999	SUMMER 2000		WINTER 2000	
	West Corner Inlet 14-Jul-99	Westernport 18-Mar-00	Altona 17-Feb-00	West Corner Inlet 02-Jul-01	Bellarine Pen 08-Jul-01
Latham's Snipe	-	-	-	-	-
Black-tailed Godwit	-	-	-	-	-
Bar-tailed Godwit	-	508	-	13	43
Little Curlew	-	-	-	-	-
Whimbrel	-	28	-	-	-
Eastern Curlew	62	188	-	2	5
Marsh Sandpiper	-	-	85	-	4
Common Greenshank	12	54	22	-	4
Wood Sandpiper	-	-	-	-	-
Terek Sandpiper	-	1	-	-	-
Common Sandpiper	-	-	-	-	-
Grey-tailed Tattler	-	-	1	-	-
Wandering Tattler	-	-	-	-	-
Tattler Spp	-	-	-	-	-
Ruddy Turnstone	-	117	-	-	23
Great Knot	-	-	-	-	-
Red Knot	-	60	-	14	-
Sanderling	-	-	-	-	-
Red-necked Stint	20	9625	1858	1600	1765
Pectoral Sandpiper	-	-	-	-	-
Sharp-tailed Sandpiper	-	-	493	-	7
Curlew Sandpiper	-	3309	1765	30	395
Bush Stone-curlew	-	-	-	-	-
Beach Stone-curlew	-	-	-	-	-
Pied Oystercatcher	72	392	-	147	65
Sooty Oystercatcher	146	4	-	276	-
Black-winged Stilt	-	-	253	-	158
Banded Stilt	-	-	400	-	110
Red-necked Avocet	-	-	-	-	-
Pacific Golden Plover	-	76	-	-	3
Grey Plover	-	-	-	-	-
Red-capped Plover	-	124	83	5	483
Double-banded Plover	-	1075	-	853	469
Lesser Sand Plover	-	1	-	-	-
Greater Sand Plover	-	1	-	-	-
Oriental Plover	-	-	-	-	-
Black-fronted Dotterel	-	-	-	-	62
Hooded Plover	-	-	-	-	3
Red-kneed Dotterel	-	-	-	-	-
Banded Lapwing	-	-	-	-	-
Masked Lapwing	4	216	54	10	220
Long-toed Stint	-	-	-	-	-
Redshank	-	-	-	-	-
Broad-billed Sandpiper		-	-	-	-
Ruff	-	-	-	-	-
Swinhoe's Snipe	-	-	-	-	-
Asian Dowitcher	-	-	-	-	-
TOTAL	316	15779	5014	2950	3819
No SPECIES	5	17	10	10	17

A SUMMARY OF THE RESULTS OF THE NORTHWESTERN AUSTRALIA WADER AND TERN EXPEDITION FROM 28 JUNE TO 19 JULY 2003

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SUMMARY

This was the 22nd Australasian Wader Studies Group visit to northwest Australia. It was aimed particularly at filling a gap in the data relating to the immature populations of migratory and resident waders present in northwest Australia in late June/July when the fully adult waders are away at their northern hemisphere breeding grounds.

The specific objectives of this expedition were:

a. To catch, band, leg flag and fully process (weight/moult/other biometrics) the immature waders of a wide variety of species.
b. To determine, by counting, the size of these non-breeding immature populations.
c. To determine the age structure of each species present by plumage/moult characteristics, retraps and sightings of previously colour banded age cohorts.
d. To delineate the most appropriate criteria to use for ageing birds at this time of year.

These objectives were realised with ageing criteria, based primarily on moult and feather wear, being satisfactorily confirmed or developed. Marked differences in the age structure of the different species of waders were found. Fifteen hundred and five waders of 17 species, 174 terns of four species, and 15 gulls were caught.

A complete count of the waders on Roebuck Bay was undertaken and we found 30,723 birds at Bush Point and 6,771 on the northern shores. We also undertook the first ever austral winter count of the whole 220km length of 80 Mile Beach. There, we counted 41,498 waders, including 192 breeding pairs of Pied Oystercatchers.

LOGISTICS

Itinerary

As usual, fieldwork was divided between Roebuck Bay (Broome) and 80 Mile Beach (Anna Plains). Time was spent as follows:

Site	Banding Days	Counting Days
Roebuck Bay/Broome	9	2
80 Mile Beach/Anna Plains	7	2

An additional day was taken up in transferring from Broome to 80 Mile Beach, but we were still able to make a catch that day.

Participants

Fourteen visitors to Broome took part in the expedition including eight for the full three-week period. These participants came from Australia (7), New Zealand (2), Singapore (2), UK (1), Israel (1), and Japan (1) and is consistent with the usual 50% participation rate by overseas-based people. Only six out of this core team had participated in previous NWA expeditions.

In addition, considerable help was received from Broome-based members of the Northwest Wader Study Group: 11 individuals in addition to John Curran's family and the warden and assistant wardens of Broome Bird Observatory. Many of these also came down to 80 Mile Beach for a period. At one stage, six members of the Broome Bird Observatory Management Committee were present. This level of local support meant that the rather smaller than usual core group was a more

than adequate team of people for the cannon net catches and major counting activities.

Finances

Expedition members paid $23 per day for food and overheads and $170 per week for transport (car providers excluded). The actual food costs worked out at $12.50 per person per day. Preliminary income and expenditure details are given below.

Income	
Contributions from participants	**$10,501**
Expenditure	
Food	$ 3,408
Fuel	$ 1,269
Vehicles	$ 4,147
Equipment	$ 870
Miscellaneous	$ 59
Total Expenditure	$ 9,753
Provisional surplus	**$ 748**

Some costs still have to be received and incorporated. However there should still be a small surplus that will go towards offsetting the $974 deficit from the final accounts for the NWA 2002 expedition and the $61 loss from NWA 2001. The financial viability of the expedition was greatly enhanced by the provision of personal vehicles by several expedition members. Food costs were slightly reduced by the provision of free fresh fish by professional fishermen for three of the nights we were camped at 80 Mile Beach.

COUNTING

A complete census of the winter wader populations on Roebuck Bay and 80 Mile Beach was carried out

Table 1. Waders counted at Roebuck Bay and 80 Mile Beach during June-July 2003.

Species	Scientific Name	Roebuck Bay		TOTAL	80 Mile Beach		TOTAL
		North Shores	Bush Point		Northern 100km	Southern 120km	
		26/06/03	16/07/03		8/7/03	9/7/03	
Black-tailed Godwit	*Limosa limosa*	200	50	250	-	-	-
Bar-tailed Godwit	*Limosa lapponica*	1900	12000	13900	11076	2691	13767
Whimbrel	*Numenius phaeopus*	160	30	190	5	4	9
Eastern Curlew	*Numenius madagascariensis*	120	470	590	133	30	163
Marsh Sandpiper	*Tringa stagnatilis*	-	-	-	2	-	2
Common Greenshank	*Tringa nebularia*	24	41	65	152	-	152
Terek Sandpiper	*Xenus cinereus*	30	400	430	292	4	296
Common Sandpiper	*Actitis hypoleucos*	1	3	4	-	-	-
Grey-tailed Tattler	*Heteroscelus brevipes*	300	750	1050	80	44	124
Ruddy Turnstone	*Arenaria interpres*	30	250	280	40	187	227
Asian Dowitcher	*Limnodromus semipalmatus*	3	5	8	-	-	-
Great Knot	*Calidris tenuirostris*	2280	6000	8280	7667	2998	10665
Red Knot	*Calidris canutus*	500	800	1300	2266	50	2316
Sanderling	*Calidris alba*		700	700	294	707	1001
Red-necked Stint	*Calidris ruficollis*	130	3500	3630	3664	1430	5094
Sharp-tailed Sandpiper	*Calidris acuminata*	1	1	-	-	-	-
Curlew Sandpiper	*Calidris ferruginea*	250	1300	1550	357	6	363
Broad-billed Sandpiper	*Limicola falcinellus*	30	30	-	-	-	-
Pied Oystercatcher	*Haematopus longirostris*	55	120	175	22	593	615
Sooty Oystercatcher	*Haematopus fuliginosus*	13	-	13	-	1	1
Black-winged Stilt	*Himantopus himantopus*	500	206	706	2	-	2
Red-necked Avocet	*Recurvirostra novaehollandiae*	87	-	87	-	-	-
Pacific Golden Plover	*Pluvialis fulva*	1	-	1	-	-	-
Grey Plover	*Pluvialis squatarola*	5	160	165	133	5	138
Red-capped Plover	*Charadrius ruficapillus*	120	900	1020	2554	411	2965
Lesser Sand Plover	*Charadrius mongolus*	2	7	9	1	-	1
Greater Sand Plover	*Charadrius leschenaultii*	60	3000	3060	3173	424	3597
TOTAL		6771	30723	37494	31913	9585	41498

during the expedition. Details are in Table 1.

Northern shores of Roebuck Bay

The high tide roosting population was repeatedly counted over the first few days of the expedition on neap and low spring tides. On later, higher tides, birds roosted in inaccessible and uncountable locations in or behind the mangroves near Crab Creek. A total of 6,771 waders of 23 species were counted with Great Knot (2,280) and Bar-tailed Godwit (1,900) being the most numerous. Also counted were good numbers of Red Knot (500), Black-tailed Godwit (200), Curlew Sandpiper (250), and Whimbrel (160). Red-necked Stint (130), Terek Sandpiper (30) and Greater Sand Plover (60) were present in smaller numbers than expected. Unusually large numbers of some Australian resident species were present: Black-winged Stilt (500), Red-necked Avocet (87), and Pied Oystercatcher (55) being the most noticeable. Gull-billed Terns (280) were also plentiful.

Bush Point

A day-long visit to Bush Point was made by road via Thangoo Station on 16th July. Although the 8.3m tide was lower than is normally used for visits to Bush Point, it proved ideal for counting as all birds roosted on the sandbanks close to the high dunes with none going inland to the unflooded saltmarsh areas.

A total of 30,723 waders of 23 species were counted, including 12,000 Bar-tailed Godwit and 6,000 Great Knot. Other notable figures were 3,500 Red-necked Stint and 3,000 Greater Sand Plover. Curlew Sandpipers were again prominent and, as at other locations, several individuals colour marked in the 2002/03 summer in Victoria and South Australia were seen. It seems increasingly clear that most of the first year Curlew Sandpiper in south-eastern Australia move to the northern shores of the continent in the winter. There were also 700 Sanderling – a further indication of the exceptional breeding season which this species experienced during the Arctic summer of 2002. A total of 450 Little Tern – almost all in non-breeding plumage – were a surprise. Which population were they from – Australian or northern hemisphere?

80 Mile Beach

A late decision was made to count the whole of 80 Mile Beach, not just the planned northern 100km. This was partly because no complete winter count had ever been undertaken and also because initial reconnaissance of the normally most heavily used northern sections of the beach showed that the winter distribution was rather different to that found in October/November when peak numbers of birds are present. A further stimulus for a complete count was the confirmation that July is the breeding season for Pied Oystercatchers in northwest Australia and that it would be an ideal time to do the first census of breeding pairs.

Waders

A total of 41,498 waders was counted along the 220km length of the beach over a two day period – the northernmost 100 km on 8th July and the remainder on 9th July. Counts were undertaken on neap tides (6.2m on the 8th and 5.9m on the 9th) to allow easy access and circumvention of flocks once they had been counted.

The most numerous species were Bar-tailed Godwit (13,767) and Great Knot (10,665). It is notable that in these winter flocks Bar-tailed Godwit were more numerous than Great Knot. The opposite applies in the much larger spring and summer populations at 80 Mile Beach. The same situation also occurred in Roebuck Bay. Bar-tailed Godwits would seem to mature at least a year later than Great Knot (see below) and more age cohorts are remaining in the winter population.

Other good totals were 5,094 Red-necked Stint, 3,597 Greater Sand Plover, 2,965 Red-capped Plover, 2,316 Red Knot and 1,001 Sanderling. The Red-necked Stint and Red-capped Plover were distributed in small groups, typically less than 30, along virtually the whole length of the beach. The unexpectedly high population of Sanderling, 30% of the summer population, is probably a reflection of their excellent breeding success in the Arctic last year. In contrast, Terek Sandpiper (296) and Grey-tailed Tattler (124) were surprisingly scarce considering their normal summer populations are in the 10-15,000 range; this supports the idea that many first year birds of these species make a partial northward migration possibly out of Australia. The same is probably true for Greater Sand Plover where the numbers, although quite large at 3,597, were only about 6% of the summer population. It is surprising that only 363 Curlew Sandpipers were counted when banding and flagging evidence from Roebuck Bay suggests that a significant number of one-year-old birds from southern Australia were

present in northwestern Australia at this time (Table 1).

The distribution of waders along the beach during the 8/9th July count was also somewhat different from that of the October/November counts. In those counts between 79% and 87% of birds were in the 55km length of beach between 25-80km south of Cape Missiessy. In this count only 65% of birds were in this section. The most noticeable differences occurred in the 25-50km south of Cape Missiessy section, the area in which almost all banding is carried out in the summer, where there were no large concentrations at all; the maximum was 2,106 birds in a 5km stretch. As in October 1998 and November 2001, the largest concentration was close to the 60km mark, 40km south of the Anna Plains entrance, where the beach is at its flattest and broadest at high tide. Over 12,000 birds, almost 30% of the total population found on the whole beach, were roosting at high tide in this area. There were, however, isolated single flocks of Bar-tailed Godwit, Great Knot, and Red Knot, with 2-3,000 birds in each flock, in the sections 90-95km, 185-190km and 200-205km south of Cape Missiessy. These are areas which do not normally have such large concentrations in summer. The southern parts of 80 Mile Beach, especially, do not hold such significant proportions of the total population in summer.

One consequence of this new information on the winter distribution of waders is that it further emphasises that a major section of 80 Mile Beach needs to be counted to obtain a realistic figure for the population of each species. It is not satisfactory, as is currently done, just to take a 10-30km section for counting in what is normally the most populous area during the summer. It is recommended that the northernmost 100km of the beach be the standard area for both summer and winter counts in future population monitoring. The northernmost 20km of this could be omitted if counting resources are short.

Pied Oystercatchers

The total Pied Oystercatcher population of 615 was not dissimilar to the October/November counts of 653 and 694. As in these previous counts, birds were divided between paired birds on territories and birds still remaining in flocks. One hundred and ninety two pairs of Oystercatchers were located, plus an additional 231 birds present in 11 non-breeding flocks (with between 3 and 80 birds). Eight pairs were present on the 20km of shore at the north end of 80 Mile Beach between the Anna Plains entrance and Cape Missiessy. Only three pairs were present in the 80km section between the Anna Plains entrance and the beach entrance from Mandora Station – the area most used by migratory waders. The remaining 181 pairs of Oystercatchers were all on the southernmost 110 km of beach, starting from 10 km north of the campsite beach entrance near Wallal station and continuing right down to Cape Kenaudren at the southern end of the beach. Many territory-holding pairs were located at the tide edge. In other cases, only a single bird was present at the tide edge, the other member of the pair presumably incubating eggs at the edge of the sand dunes at the top of the beach. On some occasions individuals were seen in such locations; on others they appeared from that direction to join their mate on the tide edge. One newly hatched chick was seen and two nests, each with two eggs, were located. No systematic searching for nests was undertaken due to lack of time.

This is an unexpectedly large breeding population and is probably the largest concentration of breeding Pied Oystercatcher in Australia outside Corner Inlet in Victoria, the islands of Bass Strait, and Tasmania.

Terns

A total of 4,298 terns was also counted (Table 2). The number of Gull-billed Terns (1,794) was higher than on any previous count. The majority were of the Australian race *macrotarsus*, mostly in close to full breeding plumage. The much smaller *affinis* birds from Asia were all in non-breeding plumage and were probably first year birds. As at Bush Point, it was rather surprising to find so many Little Terns (199). The Roseate Terns (110) are also an unusual sighting on 80 Mile Beach.

BANDING

Waders – Catches

A total of 1,505 waders of 17 species were caught in 15 cannon net catches (Table 3). Catches ranged in size from none (when the wrong net was accidentally fired) to 505 in a small-mesh, two-cannon net. The overall average size of all catches was 100 birds. Weather conditions throughout the expedition were perfect for cannon netting with dry, calm conditions prevailing throughout and only moderate temperatures (25-33° C). Nevertheless, shade was generally erected over the keeping cages

Table 2. Terns and gulls counted at Roebuck Bay and 80 Mile Beach during June-July 2003.

Species	Roebuck Bay			80 Mile Beach		
	North 26/06/03	Bush Point 16/07/03	TOTAL	Northern 8/7/03	Southern 9/7/03	TOTAL
Terns						
Gull-billed Tern	280	80	360	1681	113	1794
Lesser Crested Tern	200	800	1000	423	1159	1582
Crested Tern		15	15	13	388	401
Caspian Tern	8	20	28	15	162	177
Whiskered Tern	100	120	220	35		35
Little Tern		450	450	79	120	199
Roseate Tern					110	110
TOTAL	588	1485	2073	2246	2052	4298
Gulls						
Silver Gull	200	80	280	743	313	1056

Table 3. The number of waders, terns and gulls caught at Roebuck Bay and 80 Mile Beach – 29th June to 18th July 2003. The number in brackets is the percentage of the total for each species that were first year birds.

Species	New	Retrap	TOTAL	First Year
Waders				
Great Knot	311	18	329	246 (75)
Curlew Sandpiper	264	19	283	280 (99)
Bar-tailed Godwit	190	9	199	96 (48)
Red-necked Stint	113	6	119	117 (98)
Red Knot	117	-	117	95 (81)
Greater Sand Plover	85	-	85	84 (99)
Grey-tailed Tattler	79	2	81	78 (96)
Black-winged Stilt	73	2	75	1 (1)
Red-necked Avocet	54	15	69	11 (16)
Red-capped Plover	51	3	54	3 (6)
Pied Oystercatcher	35	5	40	7 (18)
Black-tailed Godwit	39	-	39	33 (85)
Terek Sandpiper	10	-	10	10 (100)
Ruddy Turnstone	2	-	2	2 (100)
Greenshank	1	-	1	1 (100)
Asian Dowitcher	1	-	1	-
Pacific Golden Plover	1	-	1	1 (100)
Totals	**1426**	**79**	**1505**	
Terns				
Gull-billed tern	117	40	157	-
Whiskered Tern	15	-	15	-
Lesser Crested Tern	1	-	1	-
Caspian Tern		1	1	-
Totals	133	41	174	-
Gulls				
Silver Gull (BBO bands)	15	-	15	-
TOTAL (all species)			1694	

after all birds had been extracted from the net. The lack of the strong onshore sea breeze present in spring and summer meant that small mesh nets could sometimes be used. They are much easier for extraction, but not effective if fired even into a moderate wind.

There were some interesting catches. The 505 bird catch had a good mixture of species: 235 Great Knot, 115 Red Knot, 62 Bar-tailed Godwit, 51 Curlew Sandpiper and 38 Black-tailed Godwits, and an Asian Dowitcher. Catches were also good for

resident species with 73 Black-winged Stilts in one catch, 24 and then 45 Red-necked Avocets in two other catches, and 40 Pied Oystercatchers (the largest Oystercatcher catch in NWA) on the last day. For both of the last two catches, and an earlier catch of 59 medium and large migratory waders, the nets were set well below high tide at a level reached by the tide some two hours before high water. This was necessary because birds moved to less catchable sites at high tide. This process was practicable on moderate size catches (59, 45 and 40) with a skilled team of extractors backed up by an enthusiastic band of runners taking birds to pre-erected keeping cages set up at the top of the beach.

Overall, satisfactory samples for developing ageing criteria and determining the age structure of a population were obtained for 9 migratory and 4 resident wader species. Great Knot (329), Curlew Sandpiper (283) and Bar-tailed Godwit (199) topped the totals list. The only species present in reasonable numbers that were not sampled were Eastern Curlew and Whimbrel.

In all, 1,125 of the waders were caught at Roebuck Bay and 380 at 80 Mile Beach. A particularly successful initial week was had at Roebuck Bay when seven catches in six days produced 1,025 waders. The seven banding days at 80 Mile Beach were less productive in numbers because of the practical difficulties of catching on neap tides, which occurred on several days, and on the very wide and flat beaches 40km south of the Anna Plains entrance on which the main wader flocks had chosen to roost. The last three catching days, back in Broome, produced only 100 waders. This was not surprising as small catches of species not previously sampled were targeted and the relatively higher tides led to the large and medium-sized waders roosting in clearings in the Crab Creek mangroves or on inaccessible pools behind them.

Waders – Flagging

With the following two exceptions, all birds caught were colour flagged with a yellow flag on the right tibia.

Bar-tailed Godwit, Great Knot, and Red Knot that were definitely identifiable as first year birds at Roebuck Bay were given a yellow colour band above the metal band on the left tarsus (and no leg flag). Colour marking age cohorts in this way is a process which has now been in practice for five years and which is giving valuable results, from scans of roosting flocks in the May/July period, on which age groups are still present on the shores in Roebuck Bay when the fully mature adult birds are away on their breeding grounds in the northern hemisphere. During this expedition 37 Bar-tailed Godwit, 95 Red Knot, and 139 Great Knot were marked with these yellow "2002 age cohort" bands. A further 57 Great Knot were not colour banded because of a shortage of yellow bands.

Eighteen of the Pied Oystercatchers were given individually engraved 1mm thick leg flags. These have a combination of two letters and figures (in this case T1-9 and R1-9) engraved on each side of the flat portions of the flag. These laser-engraved black-ink-filled symbols have proved readily visible in the field and the practice may be extended to other species (e.g. Eastern Curlew) in the future. The 1mm thick material is necessary because many Oystercatchers have been known to remove 0.5 mm thick flags. It is hoped that suitable bicoloured Darvic bands can be used in the future as we expect them to be more durable

Waders – Retraps

There were 28 recaptures of previously banded migratory waders, 13 of resident waders, and 38 of birds banded on the expedition. This low recapture rate was due to the young age groups having little previous exposure to banding. Recently, adult birds of most species have 10-20% now carrying bands and most also have flags. The only bird captured that had been banded elsewhere was a first year Curlew Sandpiper caught at Roebuck Bay, which was originally banded at Werribee Sewage Farm (near Melbourne) on 28th December 2002. This control is further evidence of the tendency noted earlier for some birds of this species to move north for their first winter. There are a growing number of recoveries and flag sightings to show that a several species, such as Sanderling, Red-necked Stint and Red Knot migrate northwards within Australia during their first year.

A few of the retraps did relate to old birds, either resident species or migrants which had somehow missed out in 2003 on the normal journey to Siberia. Two Great Knot, one caught twice during the expedition, had originally been banded as adults in September/October 1992 and are now therefore at least 13 years old, presumably taking a year off from breeding. Two of the Black-winged Stilts were banded in 1993 and 1994.

With only one exception, the ages assigned in the field to retraps tallied with the known age of such birds determined from the original banding data. This confirms that the criteria used (see below) for ageing each species are appropriate. Thus all five previously banded Red-necked Stint (four first year, one adult) and both Curlew Sandpipers and both Grey-tailed Tattlers (all first year birds) were correctly aged.

There were 12 retraps of previously-banded Great Knot. Eight of these were first year birds, one was aged two, and the other three were old adults (including the two mentioned above).

There were seven recaptures of previously-banded Bar-tailed Godwits. Two were correctly identified as first years, three as second years and one as a third year. One second year bird was incorrectly considered to be in its third year.

Recapture of birds of known age was clearly aided by the immature birds banded in the November/December NWA 2002 expedition, and also that there was a similar expedition in October/November 2001 (NWA 2001). The marked absence of birds hatched in Arctic summer 2000 and banded in the NWA expedition in late December 2000/January 2001 further supports the view that most species, Bar-tailed Godwit is an exception, migrate northwards for the first time at age 3 or younger.

Terns

Details of terns (and Silver Gulls) caught during the expedition are in Table 1. Gull-billed Terns were present in good numbers on both the northern shores of Roebuck Bay and the northern section of 80 Mile Beach. In total, 157 were caught, 124 of these in a single catch on 2nd July at One Tree Point near Crab Creek. There were 40 retraps in total of which 39 were birds banded before the expedition. One of the retraps was banded in 1993 but the majority were from 1998 and more recent years. The majority of Gull-billed Terns caught and seen were the Australian race *macrotarsus* in full, or near full, breeding plumage. However, 12 *affinis* birds, the Asian race, were caught and all of these were in complete non-breeding plumage; most were thought to be first year birds. The single Caspian Tern caught a retrap, was banded in 1994 and subsequently recaptured in 1998 and 2001.

WADER AGEING CRITERIA AND POPULATION AGE STRUCTURES

Ageing Criteria

In most first year migratory waders still present in northwest Australia in June/July, diagnostic juvenile feathers had either been moulted or were so worn that the distinctive ageing features were absent. Birds older than one year had no diagnostic body or wing covert plumage characteristics to help with age identification other than some individuals which showed significant traces of breeding plumage. Correct ageing of birds was largely dependent on examining the state of wear and moult of the primaries, supplemented by similar examinations of the secondaries and the tail.

Using primary moult for ageing birds has complications. There is a marked difference in the extent and mode of first year primary moult between species. Also, there is considerable individual variation in moult in some species (especially Red Knot and Great Knot), often between the wings of the same bird.

The most widespread age group of birds caught during the expedition was first year birds, i.e. birds hatched in the 2002 northern hemisphere breeding season and now nearing the end of their first year. In many species these were easily recognisable either because they had an extremely worn set of primaries (i.e. no primary moult had occurred in the first year; moult formula 0^{10}) or because only a partial primary moult had been carried out (usually of the outer half of the wing only, e.g. $0^{5}5^{5}$) leaving two markedly contrasting sets of primaries in each wing. Most of the small and medium sized waders fell into this category.

Difficulty arises when first year birds have completed a primary moult (5^{10}). This occurs particularly in Greater Sand Plovers but is common in Great Knot, Red Knot and Bar-tailed Godwit. The difficulty is to distinguish such birds from second year individuals (age 2). Two methods were found which resolved this issue for most individuals. An examination of the secondaries revealed that in nearly all first year birds only some of the secondaries had been moulted. The contrast between these new secondaries and the very old juvenile secondaries was most marked – both in the much greater extent of feather wear and in the much paler brown colour of the old feathers. On a few individuals, all the original juvenile secondaries had

been replaced but an examination of the tail showed that a couple of old juvenile tail feathers were still present or that two tail feathers, often the central pair, were missing due to moult. Finally, the presence of the occasional brown, faded, worn wing covert was a further indication of a first year bird.

All second year birds had primaries that had been completely renewed during the moult at the beginning of that second year, often finishing in December/January. There was already some fading and wear on the tips of the outer primaries of these birds. This was noticeably different from the almost pristine blackish unfaded and unworn outer feathers present on first year birds which had carried out a complete moult which probably didn't finish this until April or later. Second year birds of some species showed noticeable traces of breeding plumage, nearly complete in a few birds. The secondaries and tail feathers of second year birds were not useful for ageing as they were always all new. An additional feature of some second year birds was the unusual completed or continual remoulting of inner wing feathers that replaced feathers previously moulted earlier in the second year. We scored this moult as a 6.

Second year birds were rarely present in the small and medium wader species. The majority were Great Knot, Red Knot, Bar-tailed Godwit, and Black-tailed Godwit.

Bar-tailed Godwit was the only species present for which substantial numbers of birds were thought to be in their third year (age 3). Small numbers of Great Knot and Red Knot appeared to be third year birds. Third year birds could generally be distinguished from second year birds by:

- the primaries being in very new condition, i.e. black and unworn. This is because the outer primaries would only have finished their moult in February, at about the same time as adult birds but later than second year birds;

- third year birds nearly always showing partial breeding plumage, sometimes quite extensive amounts.

Age Structure

Table 3 shows that the waders handled can be divided into the following four categories based on the age composition of samples.

Category 1. Over 95% of Red-necked Stint, Curlew Sandpiper, Greater Sand Plover, Grey-tailed Tattler and Terek Sandpiper caught were aged as first year. This indicates that all birds depart on their first northward migration, probably back to their breeding grounds, at the end of their second year (Age 2).

Category 2. Samples of Red Knot, Great Knot , and Black-tailed Godwit (with 81%, 75%, and 85% first year birds) contained good numbers of second year birds. This indicates that many, probably most, birds of these species probably do not migrate northwards back to their breeding grounds before the end of their third year. There have been only one Red-Knot and six Great Knot recoveries in Asia at age 2 compared with three and nine recoveries respectively at age 3; these data are consistent with the view that the greatest proportion of the population probably migrates northward for the first time until they are three years old.

Category 3. Only 48% of the Bar-tailed Godwit caught were aged as first year birds. The remainder were aged as second year (36%) or third year (15%) birds. This suggests that many Bar-tailed Godwit do not migrate northwards until their fourth year. It is possible that some of the birds thought to be Age 3 were in fact older than this (there is a retrap at Roebuck Bay in a previous July of a four year old bird) and that some birds delay their first return to the breeding grounds even longer. Banding recoveries show no Bar-tailed Godwits having moved northwards out of Australia at age 2, but there were 5 Asian recoveries of both 3 and 4 year old birds, and 6 each of 5 and 6 year old birds. This pattern suggests that northward migration to breed probably first occurs at a range of ages – at least age 3 to age 5- with the majority probably not doing so until their fourth year. The relatively high numbers of Bar-tailed Godwits counted at Roebuck Bay (13,900) and 80 Mile Beach (13,767) during the expedition would also support this, given that Godwits generally are a low breeding productivity and long lived species.

Category 4. In the four Australian resident species sampled, the proportion of first year birds ranged from 1 to 17%. This is not dissimilar to the population in the summer months for migratory waders in Australia. It reflects breeding success in the previous season. There was some uncertainty in ageing the Black-winged Stilts with many showing incomplete breeding plumage but being thought to be not in their first year. It suggests they have hatched sometime before the previous July

31st/August 1st year change deadline applied for ageing all waders in Australia. If these birds were in fact in their first year, the juvenile proportion would be correspondingly higher. The 17% first year Pied Oystercatchers in the flock sampled is particularly interesting as this represents the proportion of young in a non-breeding flock, rather than the population as a whole. HANZAB gives the age of first breeding by Tasmanian birds as 4 to 6 years (M. Newman). All the adult birds in the Pied Oystercatcher population were away in the breeding territories and therefore not available for sampling. The proportion of first year birds therefore in relation to the population of Pied Oystercatchers as a whole in northwest Australia will therefore be much lower – not unexpected in a long lived wader of low breeding productivity.

CONCLUSION

Overall, the NWA 2003 Expedition was successful in testing existing and developing new criteria for ageing immature birds of most species of waders present in northwest Australia in the June/July period. There seem to be fairly clear differences between species in the age groups still present in the non-breeding flocks present during the northern hemisphere breeding season. This information will be valuable in population dynamics studies that examine the balance between reproductive and mortality rates in wader species. The data gained on the moult patterns, many of which are complex, and the timing of the moult in the different age groups will further assist in ageing birds correctly at other times of the year.

FUTURE EXPEDITION

A further wader and tern expedition to northwest Australia is planned for 14th January to 24th February 2004.

This period is specifically chosen to fill in the last main remaining gap in the comprehensive data obtained in northwest Australia in the series of expeditions which commenced in 1981, supplemented by the regular ongoing counting and banding efforts of the Northwest Wader Study Group and Broome Bird Observatory. Data is currently lacking on the timing of the final stages of the primary moult for migratory waders and the commencement of the weight gain and breeding plumage processes prior to their departure on northward migration back to their breeding grounds in March/April.

There has already been a strong expression of interest in participating in this expedition and therefore anyone interested should make contact with one of the leaders as soon as possible as numbers are limited (by transport considerations).
After the 2004 expedition, the program of wader and tern studies in northwest Australia will be reviewed. It is likely that expeditions will continue into the future to meet specific scientific and conservation needs, especially making catches to determine the annual breeding success of migratory wader species and the population monitoring counting of waders in Roebuck Bay and on the northern half of 80 Mile Beach. Expeditions will also continue in order to assist training Australian and international personnel in various aspects of wader studies and to facilitate ongoing beneficial liaison between wader workers from different places around the world.

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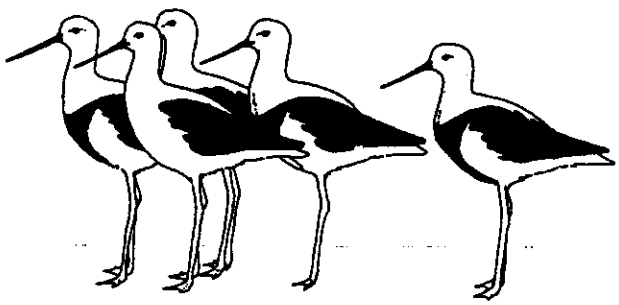
The closing dates for submission of material have been revised. They are **1 March** and **1 September** for the April and October editions respectively. **Extensions to these dates must be discussed with the Editor.** Contributors are reminded that they will probably have some comments to consider, and possibly incorporate, at some time after submission. It would be appreciated if this could be done promptly.



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