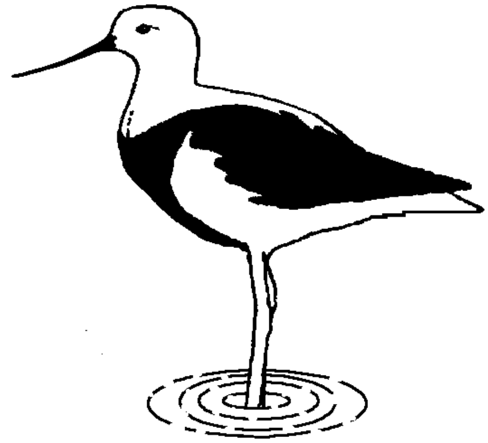
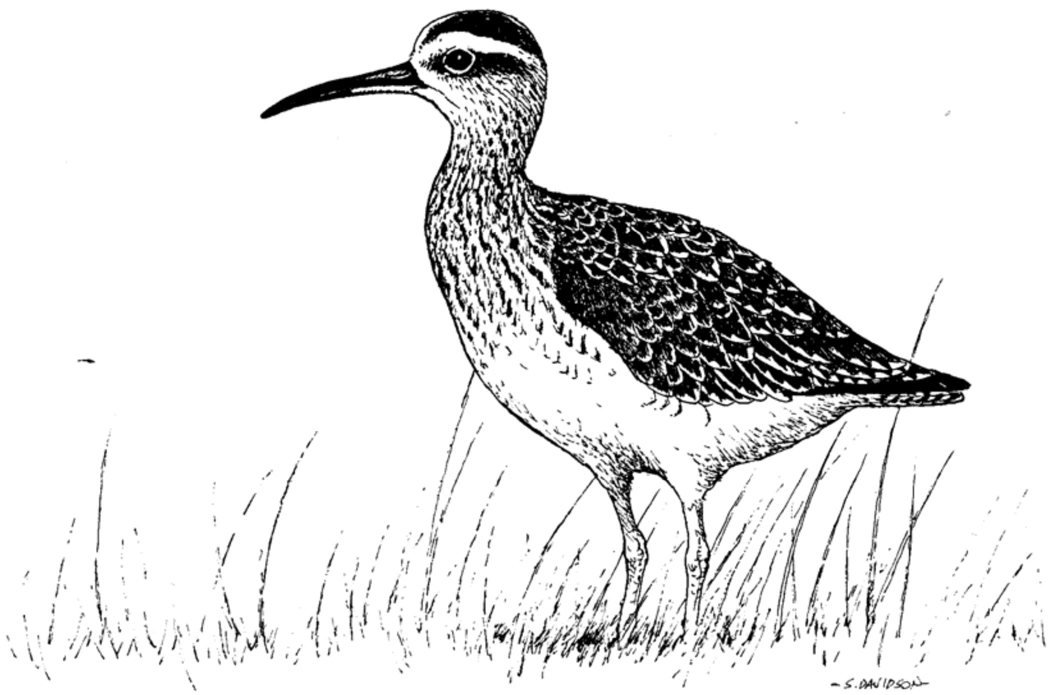
The Stilt



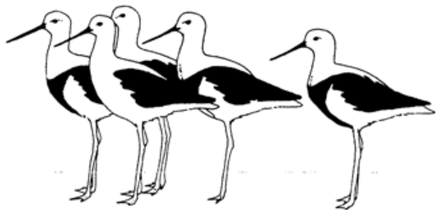
The Bulletin of the East Asian-Australasian Flyway



Australasian
Wader
Studies
Group

A special interest group of Birds Australia

Number 31
October 1997



The Stilt

ISSN 0726-1888

OBJECTIVES OF THE AUSTRALASIAN WADERS STUDIES GROUP (AWSG) OF BIRDS AUSTRALIA, A DIVISION OF THE ROYAL AUSTRALASIAN ORNITHOLOGISTS UNION (RAOU):

1. To develop or assist with plans for wader research in Australasia in conjunction with other interested bodies.
2. To co-ordinate and encourage counting, banding, foraging studies and other scientific programmes involving amateur and professional skills.
3. To encourage and assist with the publication of results.
4. To maintain effective communication between wader enthusiasts within Australasia and with similar groups overseas.
5. To formulate and promote policies for the conservation and management of waders and their habitat.

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Ken Harris, David Henderson, Laurie Living, Clive Minton, Brenda Murlis and Doug Watkins.

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@RAOU.COM.AU

Cover Illustration: Stephen Davidson

EDITORIAL

This volume of *The Stilt* marks the end of my Editorship. Unfortunately, other commitments mean that I can no longer devote the time that the job deserves. Since taking over the position, over two years ago, I have endeavored to work on a few of the weaker aspects of the bulletin. These aspects were few and far between, as a strong foundation had been set by previous Editors, notably Jeff Campbell. There can be little doubt that there are still improvements to be made, but that will be the challenge of the new Editor. A few of the achievements made in the last two years have been:

1. the formation of an Editorial Team, which has made an important, active and enthusiastic contribution to our publication.
2. the move to professional printing, made largely possible thanks to financial support from *Wetlands International.* In order to facilitate the printing, cost reductions have been made in areas such as desktop publishing.
3. the revision of both inside and outside covers, including updating addresses, contact numbers etc.
4. the widespread use of referees, important because of the increased citation of material published in *The Stilt* in other scientific journals.
5. the formalisation of submission procedures.
6. the new AWSG Committee policy on including material on Terns.

All of the above were only made possible thanks to the enormous help and support by many people. These include Andrew Dunn, whose contribution to the last four volumes cannot be underestimated. The AWSG is fortunate that Andrew is prepared to continue as Formatting Editor, and he deserves our special thanks. Mark Barter (and the AWSG committee) was a great source of support and understanding. Brenda and Mick Murlis tirelessly prepared and stuffed envelopes, before posting them out. Of course, without contributors there would be no *Stilt*. And then there are the members, without whom the AWSG would not exist. *Wetlands International* and *Birds Australia* have also been a tremendous help. I would also like to express my personal thanks to the letters of support from a number of members, in particular those from David Stroud, the former Editor of the *International Wader Study Group Bulletin*. To everyone who helped, thank you!

On the negative side, the time between submission and publication has increased. But this has allowed a greater editorial input, and it is now more in line with almost all other journals. The number of pages has decreased slightly as well, but we have compensated for this by formatting so that we fit the maximum possible information into each edition.

The future of this bulletin is bright indeed, but we must not be complacent. I hope to see a greater component of international papers, but this rests on the submission of material from overseas. In addition, there is a need to develop clear Editorial Policies. I wish the new Editor the best of luck, and trust that he/she will receive your full support.

Michael Weston, ***Editor***

ELECTION OF OFFICE BEARERS

The term of office of the current AWSG Committee expires on 31 May 1998.

In accordance with Rule 7 of the Rules of the Australasian Wader Studies Group of Birds Australia, written nominations for Committee positions, seconded by a financial member of the Group, shall be sent to the Chairperson by 31 January 1998. The new Committee shall take office on 1 June 1998 and shall have a term of two years.

The current Chairperson, Mark Barter, and Editor, Michael Weston, have indicated that they do not intend to accept nomination for their respective positions and therefore nominations for these offices are required. The Committee positions and names of office bearers willing to stand are:

Chairperson	NOMINATION REQUIRED
Vice-Chair	Peter Driscoll
Secretary-Treasurer	Jeff Campbell
Research Coordinator	Rosalind Jessop
Editor	NOMINATION REQUIRED
Assistant Editor	Phil Straw
Conservation Editor	Sandra Harding
Liaison Officer	Hugo Phillipps
Committee Members	Mark Barter
(maximum of six)	Ken Harris
	Laurie Living
	Clive Minton
	Brenda Murlis
	Doug Watkins

Should an election be necessary, ballot papers will be included in the April 1998 edition of *The Stilt*.

Jeff Campbell, *Secretary-Treasurer*

STAGING OF GREAT KNOT *CALIDRIS TENUIROSTRIS*, RED KNOT *C. CANUTUS* AND BAR-TAILED GODWIT *LIMOSA LAPPONICA* AT CHONGMING DAO, SHANGHAI: JUMPERS TO HOPPERS?

Barter, M[1], D. Tonkinson[2], T. Sixian[3], Y. Xiao[4] and Q. Fawen[5]

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ABSTRACT

Banding and count data obtained for Great Knot, Red Knot and Bar-tailed Godwit on Chongming Dao, Shanghai, from 25 March-16 April 1966, indicate that these three species are moving through quickly after flying non-stop from north-west Australia. It is suggested that they could be using a time-minimisation migration strategy to reach wetlands in the northern Yellow Sea which may be offering better feeding opportunities than those on the east China coastline. These northern wetlands are of critical conservation importance as they would probably be the last used by many migrating waders before flying directly into the breeding areas in the Russian Far East.

INTRODUCTION

The longest, heavily used wader migration stage in the world extends for some 5,500km from north-west Australia to the east coast of China.

The connection between north-west Australia and the Shanghai region is well established from band returns. There have been 73 movements of Great Knot, 24 of Bar-tailed Godwit, and 7 of Red Knot between the two regions (B. Dettmann pers. comm.).

Barter & Wang (1990) argued, on the basis of flight range calculations, lack of birds on the ground in-between and synchronisation of departures and arrivals, that Great Knot *Calidris tenuirostris*, Bar-tailed Godwit *Limosa lapponica* and Red Knot *C. canutus* are capable of flying non-stop between the two regions. Fast movements of banded birds between the two areas (two Great Knot and two Bar-tailed Godwit within 12 days), confirm that they use this capability (Pook 1991).

If it is assumed that wader populations are stable, the annual survival rate is 80% and Great Knot, Red Knot and Bar-tailed Godwit first return to the breeding grounds when they are almost three years old, it can be shown that approximately 60% of the north-west Australian populations of these three species migrates to the breeding grounds each year. Thus, the average numbers attempting the flight from the Broome-Port Hedland area to east China is approximately 225,000 birds (*c.* 110,000 Great Knot, 60,000 Bar-tailed Godwit and 55,000 Red Knot) (see Watkins 1993 for Australian regional population estimates). Other species, such as Black-tailed Godwit *L. limosa*, Eastern Curlew *Numenius madagascariensis*, Grey-tailed Tattler *Heteroscelus brevipes*, Oriental Plover *Charadrius veredus* and Ruddy Turnstone *Arenaria interpres*, probably have a similar capability, implying that more than a quarter of a million birds fly the stage non-stop.

Whilst a large amount of data (e.g. biometrics, departure timing) have been obtained for many species during the departure period from north-west Australia (see, for example, Barter 1986, Barter *et al. 1988*, Barter 1989, Fry 1989, Houston & Barter 1990), there are limited corresponding arrival data for east China (but see, for example, Wang & Qian 1988, Wang & Tang 1989, 1990). Such data are essential if an understanding of the relevant migration energetics and strategies is to be developed.

An excellent opportunity to collect arrival data occurred in March/April 1996, when the Australasian Wader Studies Group and the National Bird Banding Centre of China ran a cooperative Shorebird Research and Training Workshop at Chongming Dao, an island to the north of Shanghai in the Yangtze estuary (see Figure 1). Much useful biometric, count and habitat data were collected by the workshop participants from 25 March to 16 April.

This paper focusses on mass and count data obtained for Great Knot, Red Knot and Bar-tailed Godwit, discusses the role that Chongming Dao may play in their migrations and speculates about onward movements.

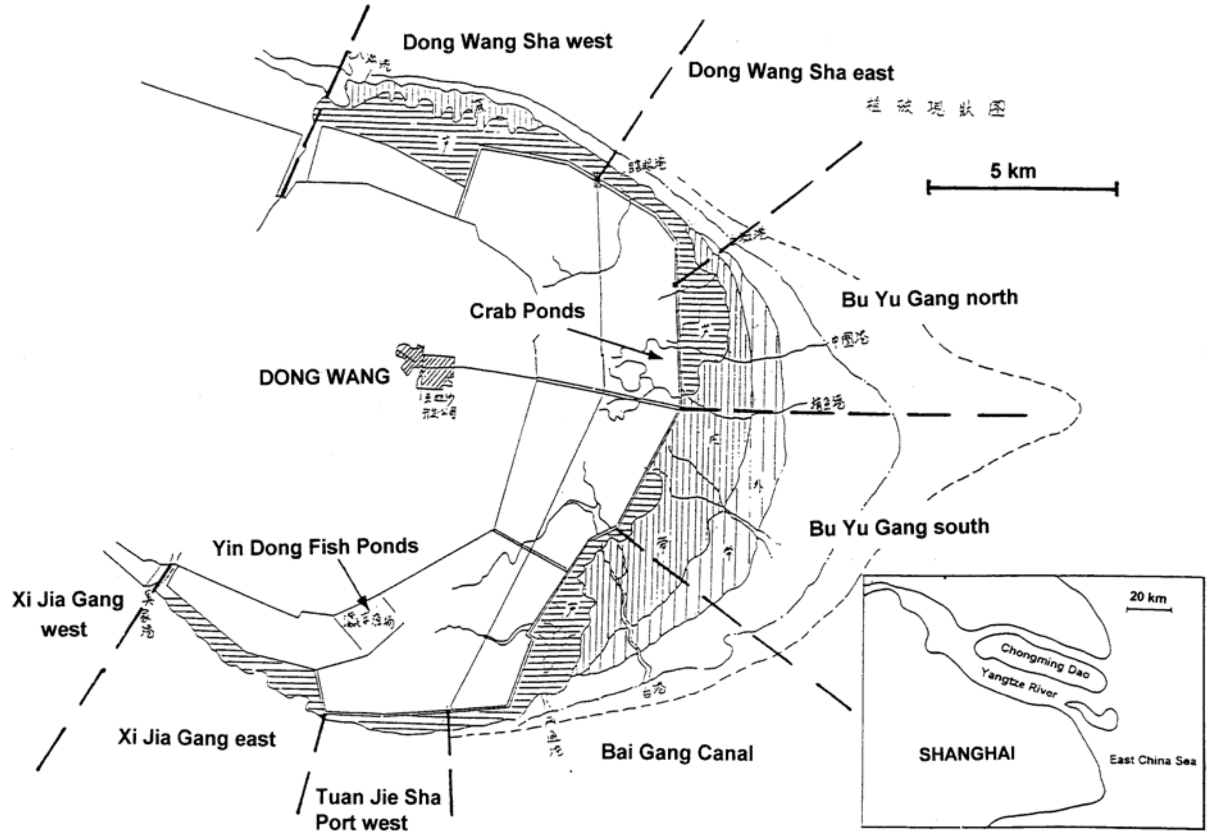

Figure 1. Map of Chongming Dao showing banding and counting sites, and general location (inset).

METHODS

Banding

All birds were obtained from hunters, who caught them with clap nets (2m x 5m) set to catch over shallow circular pools in which stuffed and live decoy birds were standing. Birds were attracted by hunters employing calls made using a bamboo whistle. Upon capture the birds were promptly removed from the net and most were placed in closed wicker baskets, but a few were employed as additional live decoys.

All birds processed came from the south and south-east coasts of Chongming Dao. Prior to 1 April, a limited number of birds (6% of the total) were banded in an *ad-hoc* manner when we met hunters whilst surveying and counting on inter-tidal areas. Some of the birds processed had been used as decoys, with a number having been held for up to 24h.

From 1 April onwards, arrangements were made with hunters to bring their catch at a fixed time each day to the sea wall, where birds were banded, measured and weighed by either the AWSG representatives or supervised workshop participants. Only two out of the following 15 potential catching days were missed, both due to conflicting workshop activities (13 and 15 April). Birds were released after processing.

Biometric data were obtained using standard techniques (Rogers 1989). Bill and total-head length were measured to the nearest 0.1 millimetre, wing length to the nearest whole millimetre, and weight to the nearest gram using Pesola balances. . Field guide colour plates (Sonobe & Usui 1993 and WBSJ 1982) were used to standardise the assessment of breeding plumage, which was recorded using ratings of 0, trace, 25, 50, 75 and 100%. Body moult was assessed in four categories: (0) absent, (1) light, (2) moderate and (3) heavy. Time from capture to processing (“keeping time”) was recorded for each bird.

Weight data were standardised for structural size using wing length in the case of Great and Red Knots, and culmen length for Bar-tailed Godwit. The method involved adjusting the average sample weight to that for a sample of average wing (or culmen) length using regression equations of weight on wing (or culmen) length (see Figure 7 caption for the relevant equations).

Also included in the analysis are weight data obtained from 6-12 April 1989 during a banding training workshop (Wang & Tang 1989).

Counts

Wader counts were carried out along a 44 km length of east Chongming Dao during a seven day period (25-31

March) before the workshop commenced and by the workshop participants, in five teams, on 15 April. There was also a limited number of *ad hoc* counts of short sections of the coastline at other times.

Other data

Information was obtained during hunter interviews concerning staging times and comparisons of 1996 movements with previous years.

Weather data for the 25 March-16 April period (temperature, rainfall and wind strength and direction) are recorded in Figure 2 and Table 1.

Departure data from north-west Australia for the March/April 1996 period were supplied by Broome Bird Observatory.

Statistical analyses were carried out using Systat 5.0 for Windows.

RESULTS

Numbers caught and weather

A total of 314 waders of 20 species was processed; of these Great Knot numbered 150, Bar-tailed Godwit 36 and Red Knot 17. The daily catches of the three species and the combined totals are shown graphically in Figure 3.

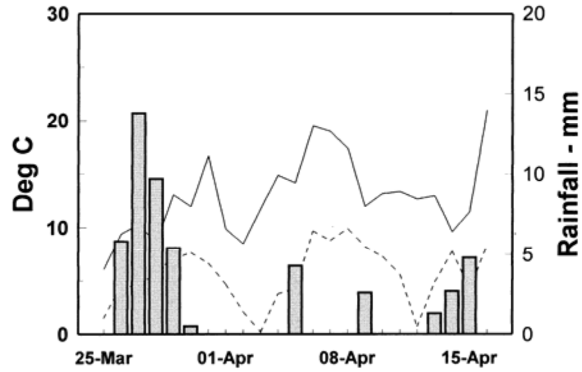

Figure 2. Temperature and rainfall details for Chongming Dao for 25 March to 16 April 1996. Maximum temperature - continuous line; minimum temperature - dashed line; rainfall - bars.

Comparison of the catch and wind direction data in Figure 3 and Table 1, for the 1-16 April period, indicates that larger daily catches were made when winds had a northerly element, mostly between ENE and NNW. Very few birds were caught when winds blew from a southerly direction, particularly from the SE quarter. Tang & Wang (1991) also found that catching was favoured by a northerly wind; in their case NW. Migrating waders leaving Chongming Dao fly in a N to NE direction (Barter *et al.*. In press) and head winds could discourage active migration, causing numbers on the ground to rise, leading to the possibility of increased catches.

Table 1. Wind directions and strengths (m/s = metres/second) at Chongming Dao for 25 March to 16 April 1996.

	0200 Direction	0200 m/s	0800 Direction	0800 m/s	1400 Direction	1400 m/s	2000 Direction	2000 m/s
25-Mar	N	2	NW	3	NW	3	W	5
26-Mar	NW	1	N	2	NE	4	ENE	5
27-Mar	ENE	2	NE	3	ENE	2	NE	4
28-Mar	ENE	6	NE	6	NE	7	N	5
29-Mar	N	2	NE	6	SE	11	SE	8
30-Mar	SSW	10	W	8	SSW	6	SE	3
31-Mar	E	2	ENE	4	NE	6	N	4
01-Apr	N	5	NNE	5	NNE	7	NNE	2
02-Apr	NNW	1	N	7	NNW	8	ENE	2
03-Apr	WW	2	W	2	SSW	3	SE	4
04-Apr	SSE	2	SSW	3	SSE	3	SE	3
05-Apr	ESE	2	SE	6	SE	9	SE	7
06-Apr	SSE	5	SSE	2	W	3	SSW	2
07-Apr	NW	2	ENE	3	ENE	5	E	1
08-Apr		0	E	1	E	5	NE	2
09-Apr	NE	1	NE	5	ENE	7	ENE	8
10-Apr	NNE	2	NNE	3	ENE	5	NE	3
11-Apr	NNE	3	ENE	6	ENE	7	ENE	3
12-Apr	E	2	ESE	5	E	6	ENE	2
13-Apr		0	E	4	SSE	5	SE	2
14-Apr	E	2	ESE	4	NNE	4	ENE	2
15-Apr		0	SSW	4	ESE	3	SW	4
16-Apr	SSW	4	WSW	5	SSW	6	SSE	6

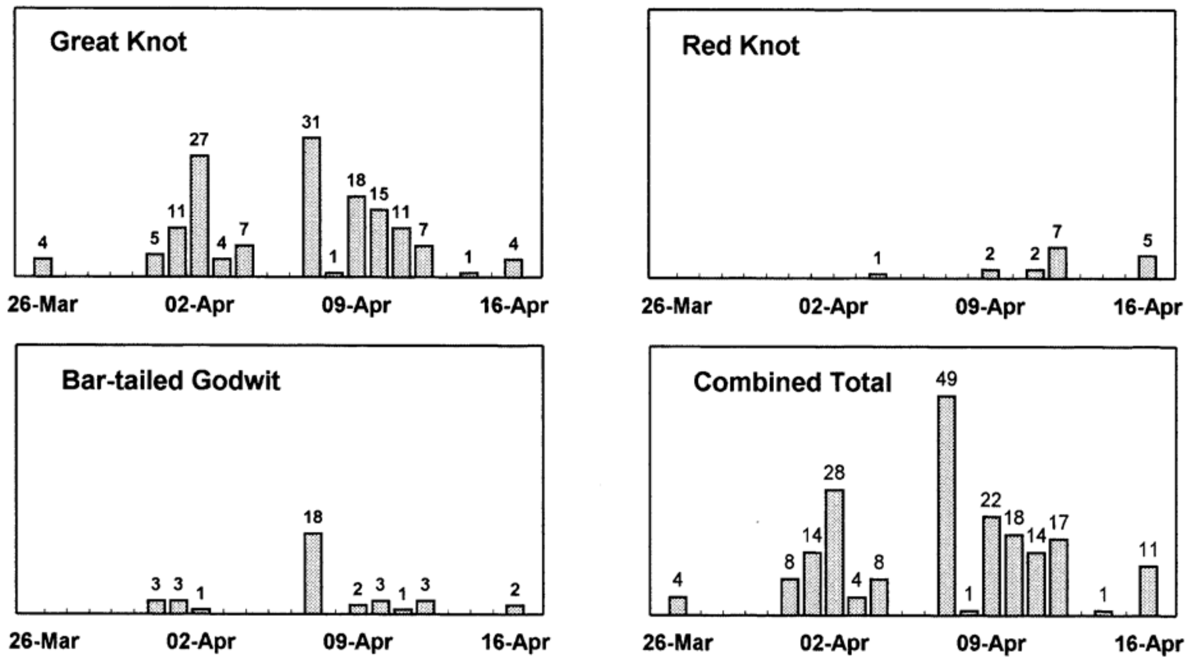

Figure 3. Sample sizes of Great Knot, Bar-tailed Godwit and Red Knot, and the combined total, by date.

There is some evidence that the daily Great Knot catch size is linked to recent arrivals from Australia. Major departures from Broome occurred from 29 March to 1 April, and on 4 April (AWSG unpub. data). Allowing for a 3 day transit time, these birds should arrive in the Shanghai area between 1 and 4 April, and on 7 April. The catch data in Figure 3 is consistent with this observation.

Keeping time and weights

The frequency distributions of keeping times for Great Knot, Red Knot and Bar-tailed Godwit are given in Figure 4. It can be seen that the majority of Great Knot were processed within four hours of capture, whilst the comparable time for Red Knot and Bar-tailed Godwit was five hours. However, a proportion of Great Knot had been in captivity for up to 24h.

It is well established that waders lose mass during captivity (see Table 1 in Castro *et al.* 1991 for a comprehensive listing of relevant papers). Castro *et al.* (1991) showed that mass loss was about 1.5%/h between 18^0C and 29^0C, but this increased markedly above 30^0C and approached 8%/h between 33^0C and 38^0C. They noted that mass loss occurs in two phases. Up to eight hours keeping time, most mass decrease is due to water loss whilst, at longer times, fat and tissue metabolism also contribute significantly to mass loss. They concluded that the potential for significant mass loss makes it important to minimise time between capture and weighing, especially on hot days.

Extended keeping times seem to have no effect on average weights (see Figure 5). Even after 24h a sample of eight Great Knots had an average weight similar to the overall mean. Therefore, all weight data has been included in the relevant analyses of the three species.

There are a number of potential reasons why weight losses with keeping time are minimal at Chongming Dao. Firstly, temperatures were relatively low when most birds were caught (compare Figures 2 and 3). Maximum daily temperatures were generally below 15^0C and most birds would have been handled at lower temperatures still, as processing generally occurred before noon. Thus, the temperature effect, if any, will be minor. Secondly, birds kept for long periods of time (e.g. >16h) had been used as live decoys and were able to drink and, to a limited extent, feed. Finally, as is shown below, birds were generally lighter than their expected non-breeding weight, often by a considerable amount and, therefore, did not have much available mass to lose.

Catch weights

The average catch weights are plotted in Figure 6. There is no evidence that average weights are increasing during the sampling periods of 22 days for Great Knot, 17 for Bar-tailed Godwit and 13 for Red Knot. Great Knot in 1989 behaved similarly over a seven day period. The weight variability that does exist between days could be caused by differences in migration energy costs, e.g. varying wind direction and strength, during the flight from Australia. Potential reasons for this interesting result are explored below in the Discussion.

Scatter plots of weight versus wing length (Great Knot and Red Knot) and culmen length (Bar-tailed Godwit) are given in Figure 7. As expected, bigger birds (on the basis of wing or culmen length) are heavier. The standard errors of the means of the regressions, ie. 12.4, 8.9 and 24.1 for Great Knot, Red Knot and Bar-tailed Godwit, respectively, are only a little above those for birds during the non-migratory October-November period in north-west Australia, ie. 10.3, 7.9 and 20.2, (Barter 1996; AWSG unpub. data). This similarity supports the view that birds are not putting on significant mass at Chongming Dao, as the weight variance would normally be expected to increase substantially as birds gain mass at different times and rates (Barter 1984, Haward & Barter 1991, Rogers *et al.* 1996).

Regression lines for samples obtained during the non-breeding season in north-western Australia have also been plotted on Figure 7. The substantial majority of Great Knot and Red Knot, and all Bar-tailed Godwit, weighed at Chongming Dao are below their expected non-breeding weights and appear not only to have used all their nutrient stores during the flight from north-western Australia, but also some of their reserves.

Breeding plumage and moult

Breeding plumage was generally more developed on the underparts (particularly the breast) than the back (mantle and wing coverts) for Great Knot (means of 55 versus 23%, n=146) and Red Knot (means of 71 versus 48%, n=17), but the reverse for male godwit (42 versus 54%, n=25). Female godwit breeding plumage was not assessed, as many birds of this sex showed little appreciable difference from non-breeding plumage appearance.

Despite the fact that many birds were only in partially developed breeding plumage, only one bird, a Great Knot, was in active body moult, and then only lightly. This is in contrast to Bar-tailed Godwit, from Mauritania, staging in the Dutch Waddensee, where 14.6% of males and 1.6% of females had commenced moult 8 - 10 days after arrival. Later these levels rose to 71 and 62% for males and females, respectively (Piersma and Jukema 1993). Zwarts *et al.* (1990) consider that lack of active body moult is a prerequisite for migration and, therefore, the absence of active moult on Chongming Dao is consistent with the view that birds are passing through quickly.

Counts

As estimated above (see Introduction), at least 110,000 Great Knot, 60,000 Bar-tailed Godwit and 55,000 Red Knot should, on average, be migrating from north-west Australia through east China to the breeding grounds.

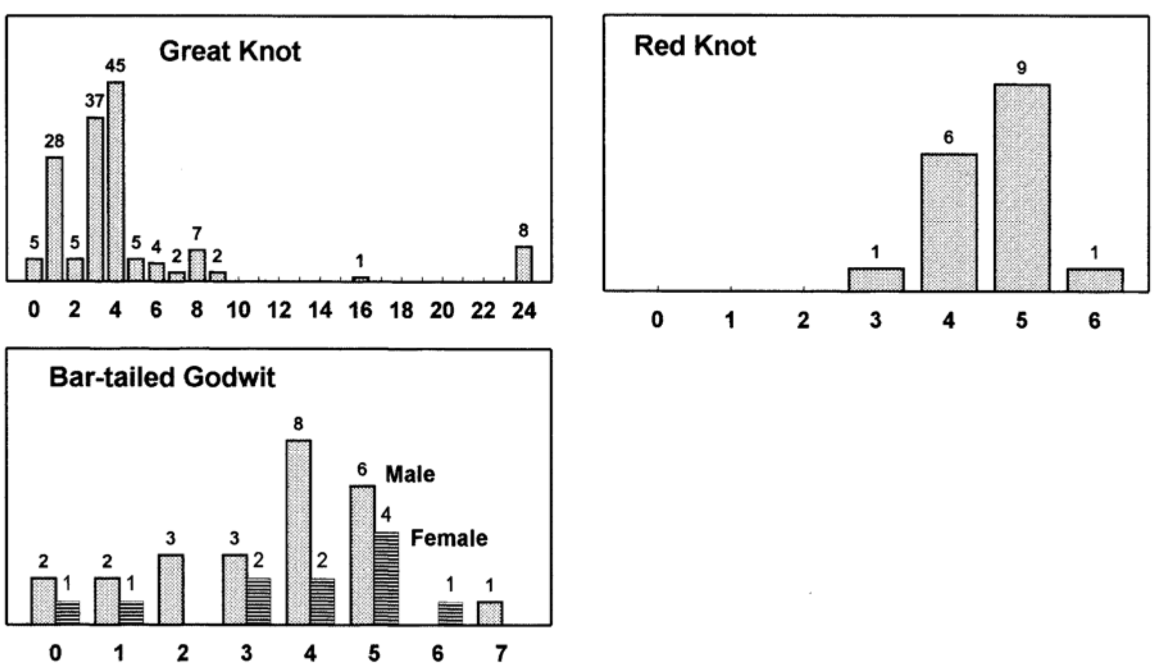

Figure 4. Sample sizes of Great Knot, Red Knot and Bar-tailed Godwit for different keeping times.

Thus, Great Knot having departed from north-west Australia by the end of March (Barter 1996, AWSG unpub. data) should be occurring in large numbers along the east coast of China in early April. In confirmation, Wang & Qian (1988) observed that peak numbers of arriving Great Knot occurred in the first third of April. From 25 to 31 March, the total number of Great Knot counted was 5,781 (out of a total of 24,770 waders) (Barter *et al.* 1997). A complete survey on 15 April resulted in 1,262 Great Knot out of 10,950 birds counted. Other *ad-hoc* counts, mainly in the north-eastern sector, gave numbers of 500 to 2,000 birds. The distinct impression gained was that Great Knot were not remaining long on Chongming Dao, as numbers were highly variable, and that numbers fell between the end of March and mid-April. It seems that the maximum numbers present on Chongming Dao at any time represented less than 5% of the north-west Australian breeding population.

Numbers of Bar-tailed Godwit (maximum = 309) and Red Knot (maximum = 12) seen were small. This could be due to the later departure of these two species from north-west Australia (Barter 1996, Lane & Jessop 1985, AWSG unpub. data). Wang & Qian (1988) confirm that Bar-tailed Godwit arrive on Chongming Dao in the middle third week of April, whilst Red Knot are mainly present during the end April/early May period.

Lu Jian Jian (pers. comm.) reports that a total of 160,000-200,000 waders were seen on Jiuduansha island (in the Yangtze estuary to the east of Shanghai) from 29-31 March, with Great Knot being the most common species. One of five hunters interviewed on 15 April reported that "a large mud bank in the middle of the Yangtze" supported many birds. This bank may have been Jiuduansha. The general view of hunters was that there were less birds present than normal and that birds

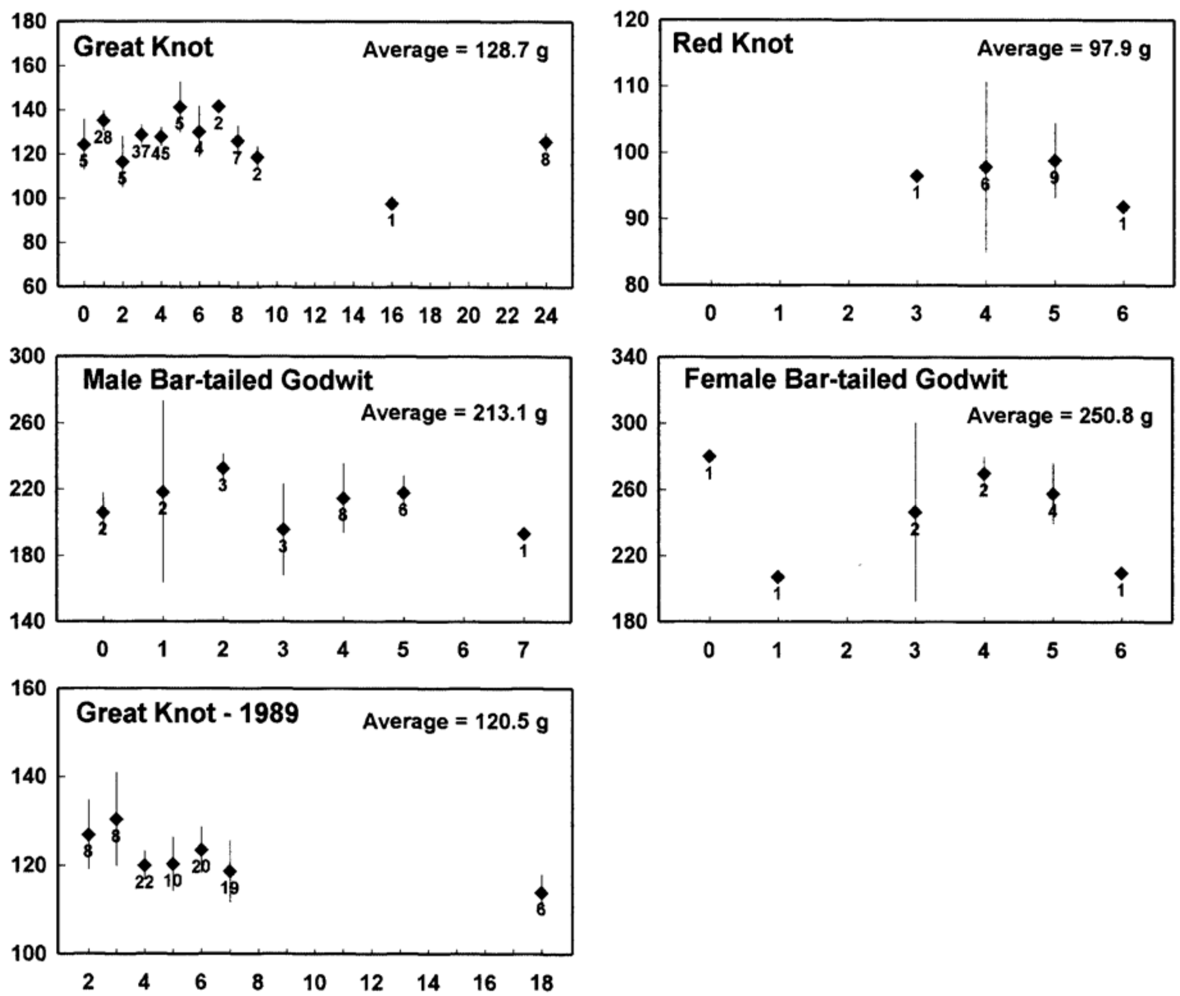

Figure 5. Average sample weights (grams) of Great Knot, Red Knot and Bar-tailed Godwit (male and female) for the different keeping times (hours); bars cover four standard errors; sample sizes are given. Weights have been adjusted to allow for average structural size differences between catch samples.

were arriving later and leaving earlier (Barter *et al.* In press, a). It is possible that the “missing” waders may have concentrated on Jiuduansha, but it seems unlikely that birds from Chongming Dao were moving there as this would require back tracking SSE for a distance of 60 km. No information is available on how long waders remained on Jiuduansha.

The total numbers seen in mid-April 1996 were five times those counted at the same time in 1990, when 2,148 waders were seen of which Great Knot numbered 382, Bar-tailed Godwit 93 and Red Knot zero. No count was made in late March 1990. However, a count in late April/early May 1990 totalled 9,519 waders including 20 Great Knot, 4 Bar-tailed Godwit and 80 Red Knot. Even allowing for the probability that the mid-April 1996 count was more comprehensive than that of 1990, it appears that the numbers present in 1996 were at least similar to those in 1990, and probably greater.

In summary, the count data supports the view that the three species are moving through quickly. The data also indicates that they are behaving similarly to previous years in terms of numbers and timing; this is contrary to the hunters' views.

DISCUSSION

Great Knot, Red Knot and Bar-tailed Godwit are arriving directly from north-west Australia at low individual weights, which are mostly below their expected non-breeding values. Therefore, it seems that the majority of birds have consumed all their nutrient stores during the journey and are incapable of an immediate long onwards flight.

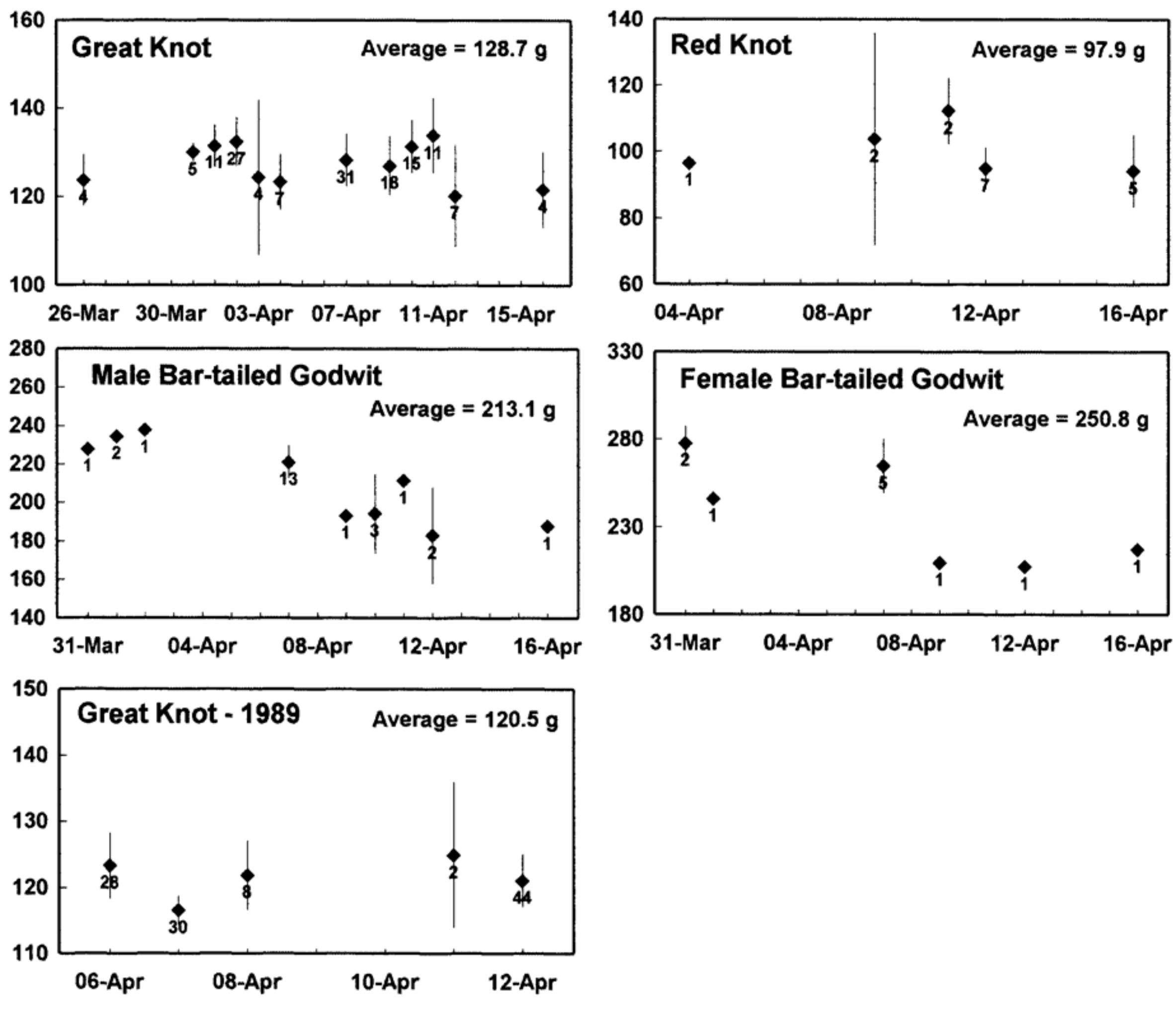

Figure 6. Average catch weights (grams), by date, for Great Knot; Red Knot and Bar-tailed Godwit (male and Female); bars cover four standard errors; sample sizes are given. Weights have been adjusted to allow for average structural size differences between catch samples.

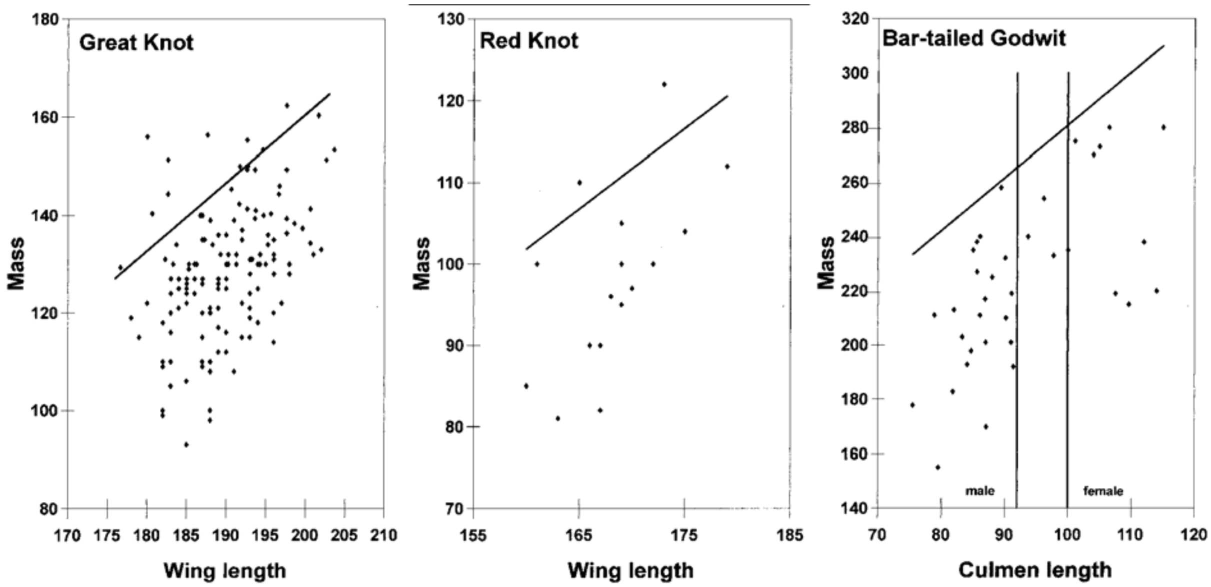

Figure 7. Scatterplots of weight versus wing, or culmen length, for Great Knot, Red Knot and Bar-tailed Godwit. Weight in grams; wing and culmen length in millimetres. Regression equations for estimating weights on Chongming Dao are: Great Knot: Weight = -45.1 + 0.916 x wing length (n = 145; r^2 = 0.145; SE = 12.4g; $p<0.05$); Red Knot: Weight = -131.84 + 1.365 x wing length (n = 17; r^2 = 0.367; SE = 8.9g; $p<0.05$); Bar-tailed Godwit: Weight = 68.60 + 1.69 x culmen length (n = 36; r^2 = 0.366; SE = 24.1g; $p<0.01$). Regression lines for the north-west Australia non-breeding samples are also plotted (from Barter 1996, AWSG unpub. data). NB. Allowance has been made for wing length differences between the non-breeding and March-April samples).

None of the three species appears to be gaining weight whilst on Chongming Dao with the implication being that they move on quickly after arrival. However, another explanation for the apparent lack of weight gain is that the catching method in some way selects birds that have just arrived. In this respect, it is interesting to note that hunters did not seem to favour areas with large flocks of waders and were generally located in regions with relatively low numbers of birds. Perhaps the hunters' decoys, and their imitations of familiar calls, are more attractive to arriving migrants seeking con-specifics when large flocks are not present as an alternative lure.

However, the count data, lack of substantial weight variability within catch samples and the almost total lack of active body moult tends to support the conclusion that the three species move on quickly after arrival.

So what role is Chongming Dao playing in the migration strategies of the three species? According to Lindstrom & Alerstam (1992), optimal migration strategies, ie. how birds safely reach their destinations within the required period, reflect selection forces. They list three strategies:

1. Energy expenditure minimisation, ie. putting on just enough mass to reach the next staging site in order to minimise costs of carrying excess mass.
2. Migration duration minimisation, which involves leaving a staging site as soon as another can be reached that provides a higher potential migration speed, e.g. a site with better food availability.
3. Predation minimisation, in which migration behaviour is modified to reduce predation risk.

The migration schedule of the Great Knot (see Figure 8) poses some interesting strategy questions. Birds mostly leave north-western Australia by the end of March and arrive in the Shanghai area a few days later, say by the end of the first week in April. Count data indicate that Great Knot numbers fall quickly after the first third of April. Arrival on the breeding grounds occurs during the last week of May (Tomkovich 1966), some seven weeks after arrival in Shanghai.

The furthest part of the breeding range is 5,500 km from Shanghai - identical to the north-west Australia/Shanghai stage distance. The closest part is some 2,000 km less in distance. Tomkovich (in press) reports that Great Knot pass through the Russian Far East quickly during a few days in the last third of May, with large ground concentrations only occurring during unfavourable weather conditions. In April and early May, only the Tatarsky Straits region southwards (between Sakhalin Is. and the Russian mainland) is ice-free with suitable feeding habitat (Tomkovich in press, V. Zykov pers. comm.). It seems that Great Knot normally fly non-stop from staging areas west of the Russian Far East into the breeding grounds. The flying time would be 2-3 days

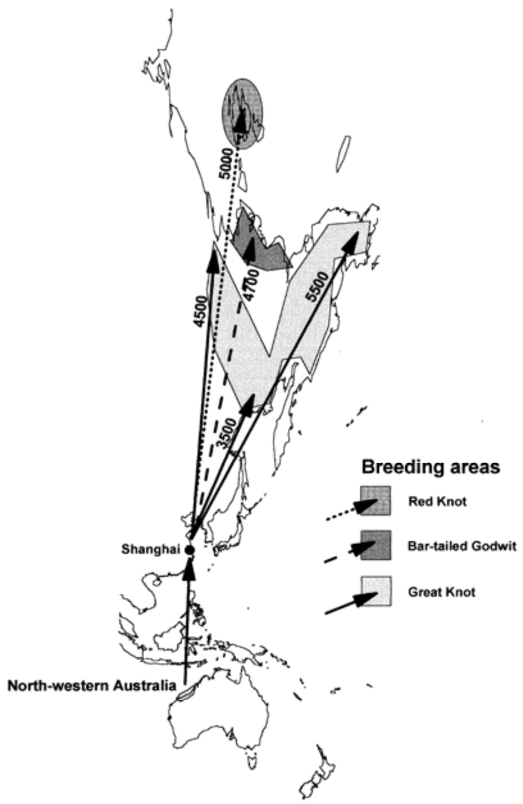

Figure 8. Diagrammatic migration systems of Great Knot, Red Knot and Bar-tailed Godwit showing north-west Australia, Shanghai and known breeding areas for birds migrating from north-west Australia. Distances from Shanghai to the breeding grounds are in kilometres. Gnomonic projection, on which straight lines are great circles; but note that the scale varies from north to south.

depending on which part of the breeding range birds are heading for. Thus, approximately six weeks of the total migration period is unaccounted for.

Both Red Knot and Bar-tailed Godwit are also closer to their breeding grounds than to north-west Australia.

If it assumed that the three species leave the final staging area with a weight similar to that of birds departing from Australia, most birds would be able to comfortably reach the furthest point in their breeding ranges. The unused nutrient stores would be useful in the event of food being limited during the early days after arrival or, alternatively, for egg production (Davidson & Evans 1989). The time required to put on the required mass can be calculated using this departure weight assumption.

Zwarts *et al.* (1990) estimate that the maximum theoretical daily rate of mass increase is 4-5%. Their extensive review of published data confirmed that rates of, or rates approaching, this level have been achieved by a number of staging wader species, including Red Knot and Bar-tailed Godwit. However, some staging rates were of the order of 2%/day.

The following assumptions have been made in calculating the time required to reach departure weight: upper and lower mass gain rates of 2 and 4%/hour; arrival weights, for birds of average wing (or culmen) length (based on the Chongming Dao weight data), of: Great Knot - 128.9 g; Red Knot - 98.4 g; Bar-tailed Godwit: male - 214.7 and female - 248.5 g; departure weights, based on birds of average wing length leaving north-west Australia (Barter 1989, Barter 1996), of: Great Knot - 240g; Red Knot - 165 g; Bar-tailed Godwit: male - 380 and female - 440 g.

The calculations indicate a need for staging times ranging from 21-42 days for Great Knot, 17-34 days for Red Knot and 19-38 days for Bar-tailed Godwit.

Thus, it seems possible that Great Knot, wherever they stage, are gaining mass at the relatively slow rate of 2%/day, as the period required to reach departure weight (six weeks) is equivalent to the available time (see above). The apparently shorter staging periods for Red Knot and Bar-tailed Godwit may be a reflection of their later arrival dates on Chongming Dao (Wang & Qian 1988).

The seemingly slow mass gain rate could be a function of low food availabilty, which could be a natural circumstance or caused by habitat destruction and alteration, pollution or severe human disturbance.

What particular migration strategies Great Knot, Red Knot and Bar-tailed Godwit are adopting is not clear. However, it seems that these "olympic class jumpers", reaching Chongming Dao with little in the way of reserves, probably become "hoppers', perhaps due to relatively poor feeding conditions, until they reach more favourable sites. It is possible that they are "time-minimising" on their way to better sites in the northern Yellow Sea where very extensive inter-tidal mud flats exist (J. Wilson pers. comm.). These could be the final staging sites before direct flights into the breeding areas.

Considerably more information is required on the numbers, and timing, of Great Knot, Red Knot and Bar-tailed Godwit in the Yangtze estuary and at staging sites further north, and on the way in which they are using these sites, before the role that Chinese and Korean wetlands play in the migration strategies of the three species can be satisfactorily explained. Obviously, such information is of extremely important conservation significance.

ACKNOWLEDGEMENTS

The workshop participants assisted greatly with data collection during banding. Our thanks are also due to

Doug Watkins for making available the 1989 Workshop data. Ken Rogers, Danny Rogers and Doug Watkins provided both useful and insightful comments on an early draft.

Environment Australia and the Chinese Ministry of Forestry provided funding for the Workshop.

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WADER DEPARTURES FROM CHONGMING DAO (NEAR SHANGHAI, CHINA) DURING MARCH/APRIL 1996

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ABSTRACT

Waders departing from east Chongming Dao, a large island in the Yangtze estuary north of Shanghai, behave in a similar manner to that observed for departing waders elsewhere with respect to vocalisations, recruitment flights, flock size, composition and shape, and diurnal timing. Departure directions indicate that flocks are leaving for the Yellow River delta, or beyond, the Korean Peninsular or Japan.

INTRODUCTION

Conventional wader study techniques, such as feeding studies, carcass analysis, banding and counting, can tell us much about how waders prepare for migration. For example: how, and at what rate, they build nutrient stores for the next stage of their journey, what comprises a "full tank", and what their onward migration plan may be.

But what about those final moments, before and during departure, when potentially vital decisions have to be made? Decisions which could make the difference between a successful flight or not. Is there a preferred flock composition, size and shape, time of day, stage of tide, departure direction, and meteorological situation? These pieces of information form vital parts in putting together the migration strategy jigsaw puzzle.

In late March and the first half of April 1996, we observed, on an *ad-hoc* basis, waders departing from both brackish water and mudflat habitats at Chongming Dao, near Shanghai, on the east coast of China. This paper describes the results and compares them with observations elsewhere, ie. north-western Australia (Tulp *et al.* 1994), Mauritania and the Wadden Sea, Netherlands (Piersma *et al.* 1990), North Dakota, USA and the Bay of Fundy, Canada (Lank 1989) and Iceland (Alerstam *et al.* 1990).

METHODS

Opportunistic observations were made on Chongming Dao whilst we were carrying out field work associated with the Shorebird Research and Training Workshop run by the Australasian Wader Studies Group and the National Bird Banding Centre of China from 25 March - 15 April 1996.

A map of the area showing the locations where departing waders were seen is shown in Figure 1. Observed

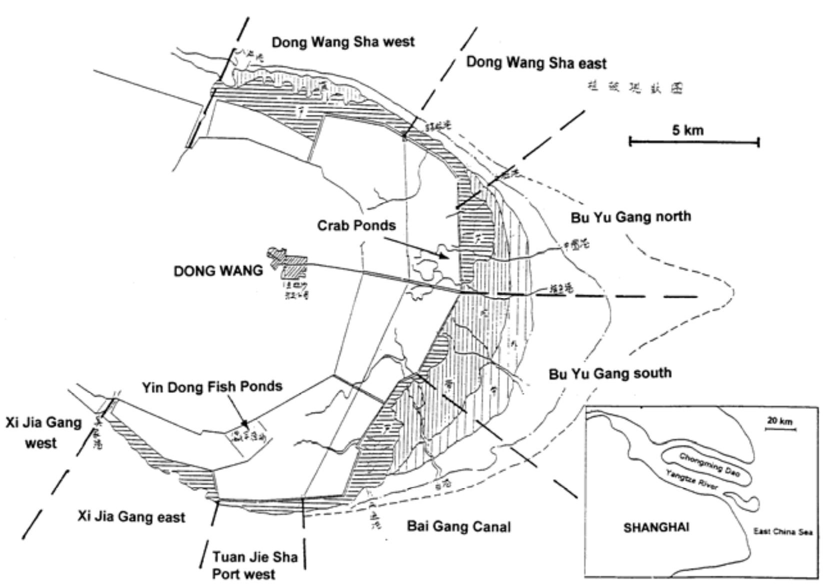

Figure 1. Map showing migration departure observation sites, with Chongming Dao location in inset.

Table 1. Wind data for 25 March - 15 April, showing wind direction and speed (metres/second) for 0200, 0800, 1400 and 2000 h each day.

Time	0200		0800		1400		2000	
	Direction	Speed	Direction	Speed	Direction	Speed	Direction	Speed
25-Mar-96	N	2	NW	3	NW	3	W	5
26-Mar-96	NW	1	N	2	NE	4	ENE	5
27-Mar-96	ENE	2	NE	3	ENE	2	NE	4
28-Mar-96	ENE	6	NE	6	NE	7	N	5
29-Mar-96	N	2	NE	6	SE	11	SE	8
30-Mar-96	SSW	10	W	8	SSW	6	SE	3
31-Mar-96	E	2	ENE	4	NE	6	N	4
01-Apr-96	N	5	NNE	5	NNE	7	NNE	2
02-Apr-96	NNW	1	N	7	NNW	8	ENE	2
03-Apr-96	WW	2	W	2	SSW	3	SE	4
04-Apr-96	SSE	2	SSW	3	SSE	3	SE	3
05-Apr-96	ESE	2	SE	6	SE	9	SE	7
06-Apr-96	SSE	5	SSE	2	W	3	SSW	2
07-Apr-96	NW	2	ENE	3	ENE	5	E	1
08-Apr-96		0	E	1	E	5	NE	2
09-Apr-96	NE	1	NE	5	ENE	7	ENE	8
10-Apr-96	NNE	2	NNE	3	ENE	5	NE	3
11-Apr-96	NNE	3	ENE	6	ENE	7	ENE	3
12-Apr-96	E	2	ESE	5	E	6	ENE	2
13-Apr-96		0	E	4	SSE	5	SE	2
14-Apr-96	E	2	ESE	4	NNE	4	ENE	2
15-Apr-96		0	SSW	4	ESE	3	SW	4

Table 2. Departure details from the Crab Ponds. Dir. = direction; under "Shape": E = echelon, V = V-formation, B = bunch.

			WIND				FLOCK		
Date	**Species**	**Time**	**Dir.**	**Strength**	**Cloud**	**Visibility**	**No.**	**Shape**	**Dir.**
29 March	Marsh Sandpiper	1630	SE	strong	100	c.5km	10	E	N
Notes: Flock flew in straight line, steadily gaining height. Prior to departure, Marsh Sandpipers and Spotted Redshanks were calling continuously and made a number of recruitment flights. A number of flocks attempted to leave, but returned.									
2 April	Black-tailed Godwit	1700	N	moderate	nil	excellent	40	E -> V	N
Notes: Flock flew in straight line, steadily gaining height. No pre-departure behaviour seen. No other species showed signs of imminent departure. Another 18 Black-tailed Godwit attempted to leave at 17:30, but returned.									
6 April	Marsh Sandpiper	1615	SW	light	nil	good	27	B -> E	N
Notes: Very quiet before departure, then 10 seconds of excited calling followed by departure with continuous calling, but no response from other birds on ground. Climbed steeply at first, then steadily.									
11 April	Marsh Sandpiper	1800	E	light/mod.	light	good	40+	E	N
Notes: No pre-departure behaviour seen. Called loudly during departure, climbing steadily. After *c.* 1 minute, broke up into smaller flocks: 12 and 8 seen, remainder probably did, also. Another loudly calling flock of 26 left at 18:08, but returned. A single bird left calling loudly at 18:15, but returned.									

departures took place from the brackish Crab Ponds and the mudflats of Bu Yu Gang south and Bai Gang Canal.

A standard form was used to record data on pre-departure behaviour, flock composition, size and shape, departure time and direction, and weather and tidal conditions (see Appendix 1.).

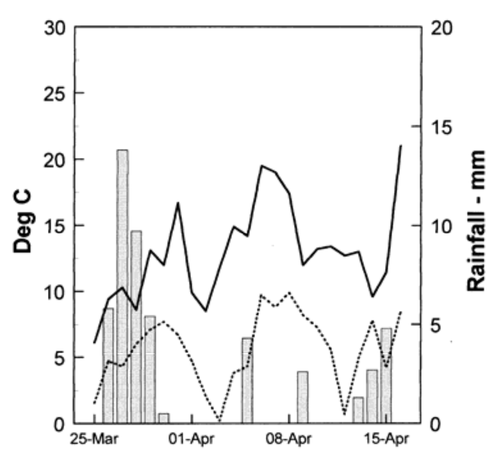

Figure 2

Figure 2. Maximum (continuous line) and minimum (dashed line) temperatures, and rainfall (bars) for 25 March - 15 April.

Wind data are given in Table 1, and temperatures and rainfall are graphed in Figure 2. Sunset during our stay varied from approximately 18:00-18:30 h.

RESULTS AND DISCUSSION

Departure data has been tabulated separately for waders leaving the Crab Ponds (Table 2) and from the mudflats (Table 3).

General observations

The first visit to the Crab Ponds was made on 26 March, the day after our arrival, when 297 waders of 8 species were present. Marsh Sandpipers *Tringa stagnatilis* and Spotted Redshank *Tringa erythropus* were the predominant species, as they were in all Crab Pond counts. The weather was windy from the north, with light rain. No migration attempts, successful or otherwise, were seen or heard.

Significant rain fell on the following three days (Figure 2), and the wind blew consistently from the N - ENE sector until early afternoon on the 29th, when the wind changed to a strong south-easterly (Table 1) and later that day we saw the sun for the first time during our stay on Chongming Dao!

When the Crab Ponds were next visited on 29 March, there had been a dramatic increase in the number of waders present (1346 birds of 15 species). The large increase was possibly due to the earlier inclement weather causing migrating birds to land and those "ready to go" to delay departure. Numbers of Dunlin *Calidris alpina* and Kentish Plover *Charadrius alexandrinus* were also present. It is probable that these latter two species were sheltering at the Crab Ponds, as large numbers of both were seen on the nearby mudflats during a number of visits and few were present later at the Ponds.

During the afternoon of 29 March, Marsh Sandpipers and Spotted Redshanks were calling continuously, with numerous flights taking place with the apparent objective of attracting additional migrants. Despite all this activity only one flock (of Marsh Sandpipers) was seen to depart, although a number tried to leave. It seems that the arrival of the first potentially suitable departure conditions for a number of days (a following wind, good visibility and the setting sun as a directional cue) had led to considerable pre-migratory activity.

Counts of 300 and 500 birds on 2 and 3 April, respectively, indicates that many of the waders present on 29 March had left, but numbers had built up again to 1162 on 10 April.

Flocks were observed departing on four of the six visits made to the Crab Ponds, all being of Marsh Sandpipers (29 March, 6 and 11 April), except for one flock of Black-tailed Godwits *Limosa limosa* (2 April).

Opportunities to observe waders departing from the mudflats were relatively limited, due to the nature of Workshop activities. However, three flocks of Grey Plover *Pluvialis squatarola* and one of Eastern Curlew *Numenius madagascariensis* were seen departing on 8 April, and another of Eastern Curlew on the 15 April.

Departure behaviour

Vocalizations

Flocks generally departed calling loudly and frequently. Sometimes birds were heard calling noisily whilst still on the ground, in particular at the Crab Ponds on 29 March when the weather improved after a period of rain and wind. Similar behaviour has been observed in waders departing from Iceland, north-western Australia, Mauritania and the Wadden Sea and it has been suggested that such vocalization assists in recruitment and in optimising departure direction through information exchange (Piersma *et al.* 1990).

Flock size, composition and shape

Alerstam *et al.* (1990) suggest that flocking during migration has three potential benefits: improvement of aerodynamic efficiency, synchronization of migratory rythym and promotion of orientational accuracy.

Departing flock sizes varied from four to 40, compared to averages, for a variety of species, of: 13-94 in north-western Australia, 17-92 in Mauritania, 5-113 in the Wadden Sea and 13-200 in Iceland. Grey Plover flock sizes (13-20) were about half those observed for the same species departing from north-western Australia, but of the same order as those seen leaving Mauritania and the Wadden Sea, whilst Eastern Curlew flocks (4-11) were similar to those observed for the same species leaving north-western Australia and for Eurasian Curlew *N. arquatus* departing from Mauritania and the Wadden sea.

No mixed species flocks were observed leaving Chongming Dao, although Great Knot *C. tenuirostris* attempted unsuccessfully on two separate occasions to join departing Grey Plovers. The distinct preference for single species flocks is similarly experienced elsewhere, eg. north-western Australia: 98% single species flocks; Mauritania: 96%; Wadden Sea: 96%; and Iceland: 92%. The preference for a species to fly with conspecifics can be explained by the need to match size and flight speed in order to gain maximum energetic benefits from flying in flocks (Piersma *et al. 1990).*

Departing flocks climbed steadily at a constant heading. These observations are consistent with those from north-western Australia, Mauritania and the Wadden Sea, but differ from Iceland, where flocks often circled and soared whilst gaining height.

All flocks, except a small one of Eastern Curlew, finally adopted either an echelon or V-formation shape. Similar preferences occurred in Mauritania (72%) and north-western Australia. Considerable energy savings are available by using such flight strategies, as Lissaman & Shollenberger (1970) estimated that formation flight energy costs could be reduced by 30-40% below that for a single bird, whilst Hummel (1983) indicated that a reduction of 20-25% would occur. Alerstam *et al.* (1990) state that such energy savings mean that the flight range of a flock may increase by 20-70%, compared to that of a single bird.

Diurnal timing
All observed departures took place between 1530 and 1800 h, ie. within three hours of sunset. High tides, on the two days that waders were observed departing from mudflats, occurred at 1432 h (8 April) and 1005 h (15 April).

The preponderance of migratory wader departures in the hours preceding sunset is well documented. For example, waders departed from Mauritania and the Wadden Sea within a period of about five hours before sunset, or shortly afterwards. In north-western Australia, the highest departure intensities occurred in the two to three hours before sunset. It was similarly found that Semi-palmated Sandpipers *C. pusilla* left an inland site (North Dakota) during the hour prior to sunset, whilst modal peak departure took place two hours before sunset for the same species leaving a coastal area (Bay of Fundy, Canada) .

Piersma *et al.* (1990) suggest that sunset departures allow waders to obtain the best mix of non-magnetic orientational cues, ie. the setting sun and stars. They also suggest that the preference for dusk, rather than dawn, departures may be due to the benefits of nocturnal migration, eg. availability of the most profitable feeding time before departure, reduced heat load due to nil solar radiation, less turbulence and more constant winds.

Little can be said about the effects of tide on departure timing from Chongming Dao, due to the limited “mudflat” departure observations.

Departure direction
All flocks leaving the Crab Ponds departed to the north, perhaps aiming for the Yellow River delta or wetlands further north in the Gulf of Chihli (Figure 3). Single flocks of Grey Plover and Eastern Curlew also left in a northerly direction, but two flocks of Grey Plover

Table 3. Departure details from mudflats. Dir. = direction; under “Shape”: E = echelon, V = V-formation, B = bunch.

			WIND				**FLOCK**		
Date	**Species**	**Time**	**Dir.**	**Strength**	**Cloud**	**Visibility**	**No.**	**Shape**	**Dir.**
8 April	Grey Plover	1530	SE	light	nil	c.10km	13	V -> E	N
Notes: No pre-departure behaviour seen; flock already 50m high when first seen. Birds calling loudly and frequently. Climbed steadily in one direction. Great Knot attempted to leave with this flock, but returned.									
	Eastern Curlew	1700	SE	light	nil	c.10km	4	B	ENE
Notes: Birds left calling continuously and climbing steadily. One Eurasian Curlew left with flock, but returned after some time. 2 additional Eastern Curlew tried, belatedly, to join flock, but failed after attempting to get 2 more (feeding) Eastern Curlews to join them.									
	Grey Plover	1740	SE	light	nil	c.10km	28	V	NNE
Notes: Left calling loudly. 36 tried to leave; 8 returned.									
	Grey Plover	1745	SE	light	nil	c.10km	20	E	NNE
Notes: Great Knot attempted to leave with this flock, but returned.									
15 April	Eastern Curlew	1430	S	moderate	100%	c.5km	29	V -> E	N
Notes: Calling frequently, when first seen at 50m height. 29 left, splitting into 3 groups; 11 and 8 continuing, 10 returning.									

appeared to be heading towards the northern part of the Korean peninsular, whilst the second Curlew flock departed in the direction of Kyushu, the westernmost large Japanese island.

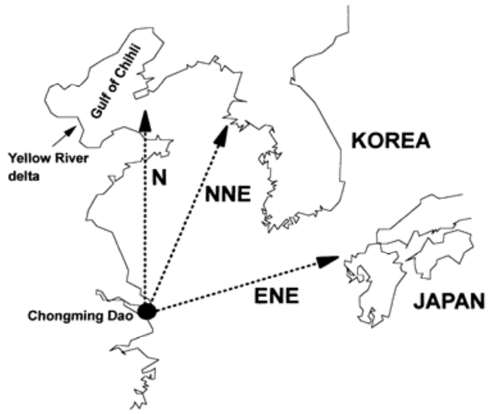

Figure 3. Departure directions, and potential destinations, of flocks leaving Chongming Dao.

Winds were generally favourable during departure, being behind or abeam, but the flock of Black-tailed Godwit left into a moderate northerly.

Ground wind direction and/or strength may not be an influencing factor in departure decisions, as the prevailing winds in the March/April period are from the ESE/ENE at approximately 20 km/h at 1500 m, and become stronger at greater heights (Chin & Lai 1974). It is, thus, possible that the flocks climb to locate favourable winds and that those leaving in a northerly direction are headed for the Korean peninsular, when allowance is made for wind drift.

Conclusions

The limited observations of migrating wader flocks at Chongming Dao show that they exhibit similar departure behaviour to waders elsewhere in the world. Considerably more data are required in order to adequately outline the pre-migratory "checklist of energetic and orientational considerations" (Piersma *et al.* 1990) used by waders departing from Chongming Dao.

ACKNOWLEDGEMENTS

We are grateful to the Chinese Ministry of Forestry and Environment Australia for providing funding for the workshop and, thus, making these departure observations possible.

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APPENDIX 1. The data sheet used to record details of migratory departures.

MIGRATION DEPARTURE RECORD

Date: **Sunrise:** **Sunset:**

High tide **time:** **Low tide** **time:**

height: **height:**

Weather: **general (eg. sun, rain, cloud):**

% cloud cover: **temperature:**

wind direction: **visibility (km):**

Time:

Pre-departure behaviour (eg. recruitment flights, vocalisation, flock size):

Did flock depart? **yes / no**

Departure flock **composition:** **number:**

shape (eg: bunch, echelon, V-formation)

Departure direction:

Additional notes:

Time:

Pre-departure behaviour (eg. recruitment flights, vocalisation, flock size):

Did flock depart? **yes / no**

Departure flock **composition:** **number:**

shape (eg: bunch, echelon, V-formation)

Departure direction:

Additional notes:

HUNTING OF MIGRATORY WADERS ON CHONGMING DAO: A DECLINING OCCUPATION?

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ABSTRACT
Information obtained on wader hunting on Chongming Dao, located in the Yangtze estuary north of Shanghai, during the first part of the 1996 northward migration indicates that the expected harvest is similar to that of five years previously. Predictions in 1992 that the harvest would decline, due to falling hunter numbers, increasing incomes and habitat reclamation, have not been borne out. The rise in the average price received by hunters for live waders has greatly exceeded increases in both inflation and average incomes.

INTRODUCTION

During 1990-92, the East China Waterbirds Ecology Group studied the hunting of waders in the Shanghai region during two northward (1991 & 1992) and two southward (1990 & 1992) migrations (Tang & Wang 1990, 1991, 1992).

The project involved collecting data on:
1. Numbers and species of birds hunted
2. Numbers and locations of hunters
3. Prices obtained
4. Demographic status of hunters, eg. age, education, income, and conservation attitudes of hunters

In March/April 1996, an opportunity occurred to obtain comparable data concerning hunting activity on east Chongming Dao (one of the three sites covered in 1990-92) during a joint Australasian Wader Studies Group/National Bird Banding Centre of China Research and Training Workshop. Although the data collection method was not as structured as in 1990-92, the results allow a useful comparison to be made between the two periods.

The important outcomes of the 1990-92 study are summarised in the Appendix. The summary concentrates on reviewing results of the two northwards migrations (1991 & 1992) at Chongming Dao during the study period, in order to ensure comparability with the data obtained in 1996.

Chongming Dao accounted for c.75% of the estimated total number of waders caught in the Shanghai area on northwards passage in 1991, and c.50% in 1992. More than six times as many birds were caught on northwards passage in 1991 than during the previous southwards movement and about three times as many were caught on northward compared to southward migration in 1992. Thus, hunting on Chongming Dao during northwards migration is the most important contributor to the total hunting activity in the Shanghai area.

METHODS

We were present at Chongming Dao from 25 March to 16 April, a period which covers the commencement of the migration of waders originating from Australia (Wang & Qian 1988). The timing also coincided with the first half of both the 1991 and 1992 survey periods.

Refer to Figure 1 of Barter *et al.* (1997) on page 3 of this edition of Stilt for the various areas on Chongming Dao that are referred to below.

During our stay we sought from seven hunters their views concerning:
1. duration of the main catching period,
2. main species caught,
3. numbers caught,
4. prices obtained, and
5. numbers of hunters in their immediate locality.

asked five hunters on 15 April:
1. had they been catching many birds in the previous days?
2. was 1996 better or worse than previous years? And
3. were birds arriving and departing at normal times?

All interviews were conducted at the hunting locations on the mud flats. We were also able to investigate the catching technique and on a number of occasions witnessed birds being caught.

During numerous surveys and wader counts along the east Chongming Dao coast line, we were able to obtain our own counts of the numbers of hunters present in the various areas.

We also banded 314 waders. A limited number (approximately 10% of the total) were banded prior to 1 April whilst we were on the mud flats surveying and counting. From 1 April onwards, arrangements were made for selected hunters from the Bai Gang Canal area to bring their catch to the sea wall for banding by the workshop team. Although the catching effort was not standardised, the daily catches were probably a reasonable measure of bird presence, except for April 13 and 15 when no banding was carried out due to conflicting workshop activities.

Comprehensive counts of a 44 km length of the east Chongming Dao coast line were conducted over a seven day period (25-31 March) and on a single day on 15 April.

RESULTS

Hunter interviews

The main catching period starts in the first half of April (4th [n=5], 10th [n=1], 15th [n=1]) and lasts until end April/early May.

The main species caught are Great Knot and Bar-tailed Godwit (n=4).

During the main catching period the expected peak harvest per hunter averaged around 17 birds/day (range 10 to >20; n=7). This value lies between the measured average catch rates of 20.8 in 1991 and 14.1 in 1992 (Tang & Wang 1992).

Prices received averaged 37 Yuan/kg (range: 30-40 Yuan/kg; n=5). (at April 1996 :1 Yuan = c.AU$0.16/US$0.12). This represents a nearly four-fold increase over the price received in 1991-92. Inflation in China during the same period was about 85%, whilst average incomes in Shanghai grew by 135% (Chinese Govt. data).

The estimated numbers of hunters, in those localities where hunters were interviewed, were Dong Wang Sha east: 5 (n=2); Bai Gang Canal: 4-6 (n=3); Xi Jia Gang west: 3-5 (n=2) and Xi Jia Gang east (n=1).

Concerning their views on the current season, the hunters stated that:
they had not been catching many birds in recent days (n=5),
this year was better than last (n=1); worse than last (n=4),
birds were arriving and departing at the usual times (n=1); arriving later, leaving earlier (n=4),
on recent low tides a mudbank in the river had probably supported many birds (n=4).

Our own data

Maximum numbers of hunters seen on any one day in the different areas of Chongming Dao in 1996, were:

	Our estimate	Hunters estimate
Dong Wang Sha east	3	5
Dong Wa Sha west	3	–
Bu Yu Gang north	2	–
Bu Yu Gang south	4	–
Bai Gang Canal	6	4–6
Tuan Jie Sha Port west	0	–
Xi Jia Gang east	0	1
Xi Jia Gang west	4	3–5

This leads to a minimum estimate of 22 active hunters along the 44 km of coast line. In all probability the number of hunters operating at some stage during the season is a good deal higher, perhaps close to 30, as indicated by the higher hunters' estimates in four of the areas (see above). The 1996 minimum estimate is similar to the minima of 22 recorded in 1991 and 18 in 1992.

The ten most common species captured for us by hunters are listed in Table 1. The fact that the most frequently supplied species are Great Knot and Bar-tailed Godwit confirms hunters' statements regarding the main species they expect to catch.

Table 1. Banding totals

Species	Number	%
Great Knot	150	48
Bar-tailed Godwit	36	11
Common Redshank	20	6
Red Knot	17	5
Grey Plover	17	5
Sharp-tailed Sandpiper	14	4
Dunlin	11	4
Marsh Sandpiper	10	3
Wood Sandpiper	7	2
Terek Sandpiper	4	1
Remaining 10 species	28	9
TOTAL	314	

The overall species composition is different in 1996 to that in the 1990-92 period (see Appendix). This is probably explained by the fact that the peak passages of a number of the "missing" species occur towards the end, or later than, the relatively early 1996 study period. On the other hand Great Knot are amongst the earliest migrants and form a higher percentage of the birds caught in 1996 than in 1990-92.

The species percentages for the six most commonly counted waders during the two comprehensive counts are listed in Table 2. The fact that the larger waders were caught in disproportionately high numbers, compared to their count percentages, can be attributed to hunters actively targetting larger birds (ie. the most profitable) through choice of catching site and hunting technique (ie. use of large decoys and imitating the appropriate calls).

Table 2. Percentages of the top six species recorded during the two counts.

Species	**25-31 March**	**15 April**
	%	%
Dunlin	36	71
Kentish Plover	29	12
Great Knot	23	11
Eastern Curlew	3	1
Grey Plover	1	2
Bar-tailed Godwit	1	1
	93	98
Count total	24,770	10,950
Species	28	21

The number of birds caught daily during the 1-16 April period is shown in Figure 3. It seems that a northerly wind is conducive to increased catch size, which is in agreement with the findings in 1991 (Tang & Wang 1991). The daily catching rate for 1-16 April is seven per hunter (allowing for two non-banding days and assuming birds were supplied by an average of three hunters/day). This is around 40% of the expected rate and confirms hunters' observations that the 1996 catching rate was lower than usual.

[[~~???~~]INSERT FIGURE 2 here - note that Mark calls this fig 3 but it is the 2nd figure]Figure 2. Total wader numbers caught by date. Days when the wind blew from the northerly quarter, ie. between NW and NE, during at least one of the two recording times of 2 am and 8 am, are indicated by "N". Note that the great majority of birds processed during the 1-16 April period were caught in the morning.

The main hunting areas, as in the 1990-92 study, are located on the eastern tip of Chongming Dao where substantial, and ongoing, accretion is continually supplying new wader habitat to replace reclaimed areas. The exception is Tuan Jie Sha Port west, where the mud flats have been reclaimed since 1992 with little subsequent accretion occurring.

CONCLUSIONS

The hunting survey carried out in 1996 clearly shows that:
hunter numbers are similar to those which existed in 1991, and higher than those occurring in 1992,
price rises have exceeded both inflation and average income increases over the 1992-95 period.

Despite the fact that the harvesting rate in the first two weeks of April appeared to be lower than in previous years, the *expected* harvest was similar to that achieved in 1991-92. As the hunters expectations would, presumably, be based on experience, it appears that total numbers caught annually in recent years would be similar to those of 1991, when hunter numbers were similar.

Thus, the decline in hunting activity and harvesting rate predicted by Tang & Wang (1992) does not appear to have taken place, despite improving living standards and declining family sizes

It seems that the greatly increased price is maintaining the attractiveness of wader hunting as an additional source of income, even though incomes have risen substantially.

The fact that the price increase has out-stripped both inflation and average income growth indicates that waders may have achieved a "specialty food" status.

ACKNOWLEDGEMENTS

We wish to thank the other workshop participants for helping with data collection whilst surveying and counting the many kilometres of muddy shoreline.

The Dong Wang Hotel assisted considerably by providing transport, copious nourishment before, during and after the surveys, and by happily putting up with all the mud when we returned from the field.

Doug Watkins, Wetlands International - Oceania Program, helped significantly in getting the Workshop off the ground through his assistance during the preliminary planning phase.

The Chinese Ministry of Forestry and Environment Australia provided funds for the Workshop.

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APPENDIX

Summary of 1991-92 Chongming Dao northward migration results

Numbers and distribution of hunters

In 1991 the number of hunters varied from 22 to 35. In 1992 the numbers were 18 to 20. The location of the hunting areas is shown in Figure 3.

[[~~???~~]INSERT FIGURE 3 here - note Mark calls this figure 2 but it is the 3rd figure]Figure 3. Location of hunters in 1991 and 1992 (from Tang & Wang 1991).

Catching period, number of birds caught, catching rate and hunter activity

The catching period extended from 25 March - 15 May (52 days) in 1991, whilst in 1992 it lasted for a total of 34 days from late March. In 1991 it was estimated that between 23,800-37,900 birds were caught, whilst in 1992 the numbers were 8,629-9,588. The average number of birds caught/day by each hunter was 20.8 in 1991 and 14.1 in 1992. The intensity of hunting activity (measured as hunter-days) declined from 1,413-1,820 in 1991 to 612-680 in 1992.

The suggested reasons for the reduction in numbers of birds caught between 1991 and 1992 are:
reduction in area available for catching due to reclamation,
less favourable weather conditions for catching in 1992, ie. lack of NW wind,
availabilty in 1992 of more attractive alternative occupations, eg. collection of finfish, shellfish, eels, crabs, etc.,
enforcement of hunting regulations, including stopping the sale of birds in local markets.

Species composition

In 1991, the ten most commonly caught species comprised 85% of the total caught (see below).

Species	1991 %	1992* %
Great Knot	22	30
Whimbrel	12	?
Sharp-tailed Sandpiper	11	15
Terek Sandpiper	8	7
Red-necked Stint	6	6
Dunlin	6	?
Kentish Plover	5	?
Common Greenshank	5	?
Common Redshank	5	?
Bar-tailed Godwit	5	11

* = includes two other major wader sites in the Shanghai region.

It can be seen that the Great Knot was by far the most commonly caught species.

Prices obtained

Prices received in both 1991 and 1992 were 10 Yuan/live kg. More than 80% of birds were sold either to peddlers or directly to restaurants. The remainder were consumed by the hunters.

Hunter demography and income

Typically, hunters were 46-55 year old men with a low level of education, who had been taught their skills, whilst young, by older family members.

Hunters' personal income ranged from 1,420-3,733 Yuan/year, of which hunting provided 100-500 Yuan. The average personal income on Chongming Dao in 1993 was 1,858 Yuan/year. Those with higher incomes (eg. fishermen, shop owners) obtained less from hunting than those with lower incomes (eg. farmers).

Hunter conservation attitudes and education

Hunters consider that waders are a natural resource, like fish and plants. Hunting has been undertaken for many years and they did not believe that the activity would result in a decline in numbers. They suggested that reclamation is a more likely cause of falling numbers.

Provision of conservation information resulted in:
the 20% of hunters with reasonable income and good education (generally young people) accepting the argument and saying that they would cease hunting when income from other sources increased,
the 40% with reasonable income and poor education (generally older people), finding the conservation argument difficult to understand but saying they would abandon hunting when jobs with good income became available, and
the remaining 40% with low income levels and poor education still not accepting the need for conservation and not believing that the government had the right to stop them hunting. They planned to continue hunting as it provided a substantial part of their annual income.

Conclusions

It was concluded that hunting activity had reduced between 1991 and 1992, and that this reduction would continue in the future because:
the improving economy was providing higher paying jobs that did not require supplementing with hunting income,
reduction in family sizes would lead to less younger people being taught hunting skills,
continuing reclamation would reduce the available hunting habitat.

BIOMETRICS, MOULT, AGE STRUCTURE AND SUBSPECIES OF BROAD-BILLED SANDPIPER *LIMICOLA FALCINELLUS* WINTERING AT GREAT VEDARANYAM SWAMP, IN SOUTH-EAST INDIA

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ABSTRACT

This paper provides information on the population, moult, biometrics and subspecies of Broad-billed sandpiper spending the non-breeding season at the Great Vedaranyam Swamp (GVS) on the south-east coast of India, based on birds captured for banding between 1985 and 1991. Two subspecies *falcinellus* and *sibirica* are known to winter. The weight during the departure period was higher than the during the wintering period, but much lower to that recorded on the Australian wintering grounds. However, the weight during the arrival time was much closer to that of Kazakhstan birds during the autumn passage.

INTRODUCTION:

Among the two subspecies of Broad-billed Sandpiper *Limicola falcinellus*, the breeding range of eastern race *sibirica* is imperfectly known, but the wintering range is well known. The breeding range of the western nominate race *falcinellus* is well known, and the wintering range is not known well (Cramp & Simmons 1983). Ali & Ripley (1983) mentioned that due to overlap in measurements and the lack of conspicuous distinguishable characters between these two races, the distribution pattern of the two races on the Indian sub-continent is ambiguous. However, they reported that the nominate race commonly spends the non-breeding period along the west coast (Makran and Sind coasts) and assumed that the race occurring to the east (West Bengal coast and Bangladesh) could be *sibirica*. This paper attempts to provide information on subspecies recognition of the population wintering in Great Vedaranyam Swamp, based on the moult pattern in first year birds, and to compare its occurrence with that of related species using the same flyway.

The analysis is based on bird ringing data obtained from 196 birds handled for ringing, between 1985 to 1992. In this paper the moult pattern, measurements, age details, and weight changes of this species are discussed in detail and compared with Australian wintering ground.

STUDY AREA

The GVS stretches for about 50 km from east to west, parallel to the Palk Strait and separated from it by a sand bank. Its north to south dimensions vary from about 10 km at its broadest point (in the east), to about 8 km in the central part and 6 km at its western portion. In total it has an area of about 349 km^2. The swamp also contains mangroves in the western third. It is a continuous sheet of brackish or saline water up to the tips of its northern boundary during the monsoon, and also during the seasonal windy period in April and May. During very dry periods, the whole swamp dries up, but for the two permanent waterbodies known as Mullipallam Creek in the west and the Siruthalaikadu Creek in the east. These creeks each have a permanent opening in to the sea and they are separated from each other by a stretch of land throughout the year, except for the monsoon period. The water depth of the two creeks varies from about 60 cm to 200 cm according to the seasons. During the monsoon a few irrigation channels of the River Cauvery drain into the swamp. The swamp is dotted with small islets. See also Sampath and Krishnamurthy (1989).

METHODS

The birds were caught with mesh nets and nooses, the traditional methods followed by the professional bird trappers of coastal regions. Birds caught were ringed, aged, measured, weighed and examined for moult before release.

Birds were aged as "adults" and "first-years" based on the characters described in Prater *et al* (1977). "Adult" refers to birds older than first-years and this category included second-year birds from the first of August onwards. The terms "first-year" refers to birds hatched in the same year. Subsequently wintering refers to the non-breeding period (i.e. the northern hemisphere winter).

Moult scoring followed Snow (1967). Wing, bill and tarsus were measured to the nearest millimeter, and birds were weighed to the nearest gram.

RESULTS

Age Composition

As a considerable number of birds were aged for the three seasons of 1989-90, 1990-91, 1991-92, proportions of different age classes were calculated for these seasons only. Among the three seasons the proportion of first year birds was higher in 1989-90. In the remaining two seasons the proportion of young birds was nearly 40%.

Moult

One of the earliest captures was of two adults on 24 August 1991 with the lowest primary score "3"; three inner primaries had just started growing. The other adult caught on the same day was had a moult score of "23". A few adults caught during September were not scored for moult. All the adults caught during October had advanced moult scores (32-49). Adults completed the primary moult between December and early January. Very few adults moulted up to the end of January.

Although one first year bird had started the primary moult from the seventh primary on 13 October, most of them commenced moult from late December to early January, which is the completion period for the adult primary moult. The first year birds renew their outer 3-6 primaries before leaving for their breeding ground in the first half of April. Out of the 32 first year birds observed in primary moult, 62% of them renewed the outer four primaries, 23% and 12 % of them renewed the outer three and five primaries respectively. One first year bird was observed with six renewed outer primaries.

Two adults caught during the last week of February were undergoing a second moult by renewing the outer three primaries, they were probably second year birds.

Biometrics

The measurements of wing, bill and tarsus are within the range of the measurements given by other authors, namely Cramp and Simmons (1983), Ali and Ripley (1983), Fry (1989) and Gavrilov (1995)(see Table 1).

Weight changes

There was no significant variation in the monthly mean weight of adults and first years except in the months of December and March, during which period adults weighed 1g more than the young birds. The monthly mean weight at the time of arrival was 36g for both the adults and first-year birds. The mean weight decreases after the arrival and was lowest in December and January (32.7g). The mean weight of first-year birds was 2.5g higher than the adult weight in November. The maximum mean weight of 42.1 and 41.1g were recorded for the adults and first year birds during March respectively. However, the heaviest bird observed was 55g during the last week of March. This is much lower than that observed in Australia (68g) in early April by Fry (1986). However, the mean weight observed by Gavrilov (1995) during the autumn passage (July to September) in Kazakhstan in various years (34-41g for adults and 31-37 for juveniles) which was much closer to the arrival time weight at GVS.

Fidelity to wintering sites

At least some site fidelity exists in this species, as demonstrated by the retrap data. Six individuals were retrapped in subsequent years with time intervals between capture and recapture of one to four years.

DISCUSSION

The measurements of wing length, bill and tarsus of Broad-billed Sandpiper wintering at GVS are within the range of the measurements given by other authors from various places. There is no significant variation between adult and first year birds, as was observed by Fry (1986) in Australia. However, there is a great difference in the timing of primary moult between the Australian and South Indian wintering grounds, in the latter locality the moult was completed between late December and early January. The period of primary moult is at least two months earlier in Australia where it occurs in March/April (Fry 1986), but this timing coincides with that given in Cramp and Simmons (1983). Renewal of outer primaries in first-year birds is also evident from this study which varies from three to six primaries. Cramp and Simmons (1983) stated that the first year birds of the western Siberian race *falcinellus* wintering in India renew 3-4 outer primaries and the eastern Siberian race *sibirica*, 4-5 outer primaries in Indonesia. The renewal of 3-6 outer primaries observed during the study also suggests the occurrence of both western (*falcinellus*)

Table 1. Measurements (mm) of Broad-billed Sandpiper

		Range	Mean	SD	N
Wing	Adult	103-115	107.4	3.8	68
	First Year	102-115	107.0	4.5	71
Bill	Adult	27-37	32.3	3.0	101
	First Year	26-37	32.1	2.1	96
Tarsus	Adult	20-24	21.8	0.9	100
	First Year	19-23	21.7	1.5	96

and eastern (*sibirica*) Siberian races in winter in south-east India. Most first year birds were observed to renew four outer primaries, which was similar to the observation made in Australia by Fry (1986) on the *sibirica* race. This also supports the contention that the *sibrica* race occurs in south-east India.

Although the two races are indistinguishable by measurements, the possibility of occurrence of both the races in south-east India is high. The autumn migration of this species through Kazakhstan had been described in detail by Gavrilov *et al*. (1995), which could be mostly the western Siberian race *falcinellus*. It is also known through ringing recoveries that a portion of the wintering population of Little Stint *Calidris minuta*, Curlew Sandpiper *Calidris ferruginea* and Grey Plover *Pluvialis squatarola* at GVS passes through Kazakhstan during autumn. Hence, the nominate race *falcinellus* occurring in Kazakhstan could occur at GVS too. Similarly, it is predicted by Ali and Ripley (1983) that the Broad-billed Sandpiper occurring at the West Bengal coast could be the same eastern race *sibirica* that occurs in Burma. Occurrence of *sibirica* at GVS is possible, because the occurrence of the occurrence of other eastern species that commonly occur in the East Asia-Australasian Flyway such as Large Sand Plover *Charadrius leschenaultii*, Great Knot *Calidris tenuirostris*, and the eastern subspecies of Red Knot *Calidris canuta rogersi* , in south-east India is confirmed (Balachandran *in press*). This is also supported by the recovery of GVS-ringed Broad-billed Sandpiper in eastern China.

Birds wintering in GVS weighed much less than those wintering in Australia, which is probably due to the variation in distances being covered during their return journey. This kind of variation in weights between the two wintering sites was also observed in two other waders; Large Sand Plover and Red Knot (Balachandran *in press*). As Kazakhstan is one of the staging sites for the waders wintering in GVS (proved by recoveries) the variations of mean weight (higher, lower, same) indicate that this species can stage in other sites before reaching GVS.

ACKNOWLEDGMENTS

This study was carried out as a part of the Bombay Natural History Society's (BNHS) Bird Migration Study supported by U.S. Fish & Wildlife Service under a grant from PL-480 funds No. 14-16-0009-87-02 released through Department of Environment, Wildlife and Forests, Government of India. We gratefully acknowledge the permission given to work in the area by the Tamil Nadu Forest Department. We wish to express our sincere thanks to Mr. J. C. Daniel, the then Director of BNHS for his guidance and Dr. A. R. Rahmani the Director of BNHS for going through this manuscript.

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THE CONTINUUM OF MIGRATORY WADERS IN SOUTH-EAST ASIA, AUSTRALIA AND NEW ZEALAND: AN ANALYSIS.

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ABSTRACT
Diversity and association indices are used in the analysis of 547 sets of coastal census data from south-east Asia, Australia and New Zealand. There is a continuum with the most diverse populations occurring in the tropics. An association index used for the first time shows distinct population groups in New Zealand, southern Australia and coastal eastern Australia. Unlike most natural communities this continuum is sustained by migration. Distribution patterns of individual species are analysed in terms of proportional changes within census populations from different regions. Some aspects of migration are considered in the light of the analysis. Possible causes of the continuum are discussed and the role of resident waders in the distribution patterns of migratory waders are considered.

INTRODUCTION

A continuum describes a situation where there is a progressive change in a community or a series of over lapping communities within a set distance (Kershaw 1964). The area under review, stretches several thousand kilometres from the coast of Vietnam and southern China to Tasmania and New Zealand. This area plays an important part in the life cycle of several million waders that breed in northern and central Asia.

Lane (1987a) gives a general account of the waders distribution in the Asian and Australasian regions. Watkins (1993) has given a detailed analysis of the numbers and distribution of waders in Australia and discusses their conservation. Alcorn *et al.* (1994) gives an account of the seasonal movements fluctuations in numbers and habitat interactions for waders mostly in southern and eastern Australia. The distribution of waders in New Zealand is described by Sagar (1992a).

What does not seem to have been attempted is an analysis of the full range of published census data . Most of this has been produced in the last fifteen years, in response to concerns about the conservation of migratory waders, a very vulnerable group of birds. Some of the censuses are very extensive; the total count for all coastal censuses from New Zealand, Australia and South East Asia stands at over five million.

Ecological indices allow a comprehensive summarization of complex population data. Alcorn *el al* . (1994) have used such methods to examine the interaction of waders and habitat. Crawford (1979a, 1979b, 1980) has used indices to analyse habitat and seasonal effects for waders and waterfowl in the Darwin area, Northern Territory Australia. In this present study, the analysis starts by reducing all census to a comparatively few meaningful index values, these then form the basis of further calculations. Some of the methods used here are employed for the first time, these include a district - wide scoring system and an association index derived from it.

Other indices used are species richness and the little-used Simpsons (evenness) diversity index. The concept of diversity is not simple, as its indices values are controlled by two factors, species richness and evenness (Hill 1973, Kempton1979). Evenness relates to the numerical proportionality of species to each another. These factors may fluctuate independently of each other, so it is possible for a community to have a high species count and a comparatively low diversity. This occurs when the population is large but numerically dominated by one or two species, thus producing a significant lack of evenness.
4.

CENSUS DATA

The basis for the analysis for this study is 545 published and 2 unpublished censuses results. Of these 39 were used in a limited way because they either involved surveys of entire large Asian countries or are from migration staging areas along the northern border of the area under review. Unless otherwise stated, calculations involved the remaining 508 censuses.

Only censuses carried out between August to April were considered, this roughly corresponds to the beginning and end of the migratory waders non-breeding period. When selecting censuses careful consideration had to be given to the processes followed in the original data collection and their presentation. It was assumed, unless it had been otherwise stated, that censuses carried out in the same sites had involved different observers who followed different procedures each time. As a consequence each census was treated as a separate entity and no attempt was made to directly compare one census with another. In most cases there was no published account of the area from which the data was collected but much could be deduced from the species list (Crawford 1972, Alcorn *et al.* 1994). All data was from wet coastal habitat so the recording of Ruddy Turnstone *Arenaria interpres* indicates open sandy or muddy beaches and flat reefs, Bar tailed Godwit *limosa* *lapponica* tidal mud flats and Marsh Sandpiper *Tringa stagnatilis* saline and fresh water lagoons and marsh behind the beach. Only four of the thirty five districts from which most of the data was derived did not register all three indicator species. Marsh Sandpiper is rare in New Zealand and Tasmania and it was from some of the districts in these areas that it went unrecorded.

Unidentified birds were not counted as part of a census and all data was rejected if there was signs that this was causing a bias. Significant bias was considered to have occurred in the following situations:

1. the data from two or more common species were combined, or:
2. failure in recording the less common species, so that a shortened species list is presented. The lists of residential waders was also considered here.

In all cases individual censuses were compared with others from the same region in a search for possible anomalies. Little reliance was placed on isolated censuses which could not be verified by other data. All censuses are regarded as estimates and the aim here was to keep the margin of error to a minimum.

A small amount of data from bird banding operations were used. This source of data could not be fully utilised because of census size criteria. The data from aerial surveys were not used because of limits to the accuracy.

Census results ranged from a few hundred to over eighty thousand birds. Such variations causes analytical problems, so three techniques were used to mitigate this difficulty.

1. The minimum census size was set at 1800 birds. There is a relationship between the number of species and size of the sample from the population. Plotting the rate at which new species are added to a list against sample size produces a curve characteristic of the community. Data from Alcorn *el al.* (1994), Harvey & Elkin (1991) and Crawford (1997) indicated that 1800 birds was the point at which this curve flattened out. On a few occasions small censuses from the same area were combined so as to meet the size criteria. Some large sets of data were divided, if the necessary information had been made available.
2. Censuses of about the same size were grouped together for analysis, this was only used in calculations involving species richness.
3. The use of ratios, these were simple percentages and more complex types which are discussed in the next section.

INDICES

Several indices are used in the analysis of these data. Simple concepts such as numbers of species per census (species richness) do not require explanation. However in practical terms species richness is the least reliable of the indices used here. Failure of observers to report rare species can cause problems for analysis and for this reason none is attempted, other than the presentation of regional means.

Simpson (1949) proposed a diversity index, the modified formula of which is:

$$D = \frac{N\,(N-1)}{\sum ni\ (ni-1)}$$

Where ni is the number of the ith species in the population sample and N is the total number of birds in the census. The index is a complex ratio which is little influenced by sample size unless the census is small. The index describes the effects of the evenness component of diversity, with the species count having little effect. This can be seen by ranking the species in the census from the most to the least numerous as shown in Figure 1. The two examples are from Mackay, Queensland (Hewish 1990) and the Derwent Estuary, Tasmania (Patterson 1986). The Derwent census has a D value of 2 .06 and for Mackay, 7 .19. The key factor are the species ranked forth to eighth, the greater their representation in terms of numbers in the sample the greater the index value. The index is insensitive to rare species. In the Mackay sample the rarer types (ranked from 9 th to 17 th) made up 8.7% of the sample (only the first 13 are shown here). When only the nine most common species were used in the calculations the index value was 0.8% higher, compared with when all 17 species were included . The minimum theoretical value for the Simpsons index is 1.0 when only one species is present. The maximum theoretical value occurs when all species are present in equal numbers. For a sample of twenty five species the maximum is approximately 25.5.

Much of the data comes from 35 distinct districts and the information from these areas was used to derive a diversity index which I have called the sum of scores. Like all diversity indices it values are controlled by both the species count and evenness. It was developed in an attempt to overcome the high variance which is usual in shore bird censuses. The scoring system is derived from log 2 X series which matches the ranked species distribution pattern seen in many censuses (Figure 1) To calculate a district score there had to be a minimum of four sets of census data, obtained over a period of at least two years. It was also used to analyse data from scatted census from some of the larger Asian countries, here the scores were calculated as for districts.

The steps in calculation are: (1) Convert the numbers for each species to a percentage of the census total (this needs to be done for the birds in each census), (2) The percentage values for each species are then summed across all census, (3) The mean percentage values are then calculated by dividing the sum for each species by the number of censuses, (4) The mean percentages are then scored as follows:

THE MEAN PERCENT AS PER SPECIES	SCORE
< 0.5 recorded only once	0.125
< 0.5 record more than once	0.25
0.5 to 1	0.5
1.1 to 2	1
2.1 to 4	2
4.1 to 8	3
8.1 to 16	4
16.1 to 32	5
32.1 to 64	6
> 64	7

(5) The scores for each species are then summed to give the sum of scores.

There is a large variation in the amount of data coming from different districts. Most of this effect is mitigated by the use of the ratios. The larger more comprehensive sets of district data are likely to contain more rarities, as is suggested in Table 1. These may add up to 1.5 to some districts scores, this is not considered significant in this study where score values range from 8.75 to 49.0. District sum of scores are rounded to the nearest integer.

Association indices measure the degree of similarity between two population samples. Only the district data was used for such comparisons. Two indices with the necessary ratio type qualities were considered, the Sorensens (1948) and the Minimum Percentage index (Southwood 1978). Neither were considered entirely suitable, so an association index was developed which has features of both these indices and incorporates the concept of the sum of scores. The formula is:

$$\text{association} = \frac{2 \sum \text{minimum scores} \times 100}{\sum A + \sum B}$$

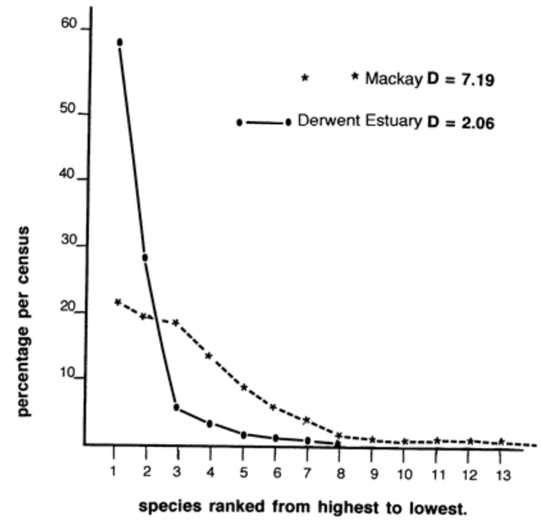

Figure 1. Ranked distribution within two sets of census data. The two sets of census data are from the Derwent Estuary 1983 (Patterson 1986) and the Mackay area 1989 (Hewish 1990) The total number of birds (N) counted in each census was 6061 and 5546 respectively. Species are ranked in terms of the proportion they make up in the census samples. The Red-necked Stint is the first ranked species in the Derwent data making up 59% of the census. For Mackay the Lesser Sandplover was the most abundant species at 23%. The Mackay census contains 17 species only the relative abundance of the first 13 are shown here.

where $\sum A$ and $\sum B$ are the sum of scores for the two districts being compared. The minimum scores are calculated as in the simplified example shown below:

SPECIES	SCORES PER DISTRICT		MINIMUM SCORES
	DISTRICT A	DISTRICT B	
k	0.25	3	0. 25
l	5	4	4
m	3	3	3
n	0	6	0
Totals	8.25	16.0	7.25

Table 1. Species richness values within regions. Mean species richness is calculated from the number of species recorded per census. The mean number of species within each census size group, is followed by the number of censuses, in brackets, from which the data was obtained. Southern Australia is defined as all areas south of the Hunter River Estuary (33°S).

	SPECIES PER CENSUS			
CENSUS SIZE	2000 to 3000	4000 to 5000	5000 to 6000	over 10,000
REGIONS				
New Zealand	7.7 (12)	7.3 (10)	9.0 (6)	10.4 (33)
Southern Australia	10.6 (30)	11.4 (18)	10.6 (7)	16.0 (74)
Northern Australia	16.3 (18)	19.8 (6)	17.1 (14)	17.4 (41)
South-east Asia	20.2 (17)	20.5 (8)	21.6 (8)	24.6 (8)

Here the association value is 59.79. When two sets of census data are identical the index value will be 100, when they are totally dissimilar the value will be zero. It is not necessary to multiply the ratio by 100, this was left out when doing statistical calculations.

Distance Measurements

In the analyses distance was measured in terms of degrees of latitude and longitude . For calculations using latitude, involving the entire area under review, the line of 46°S was used as the zero base line (this defines the southern boundary). When calculations only involved Australia and Asia 43°S was used. A consequence of this is that in a variable that increases towards the north there will be a tendency for a positive correlation with latitude. If the trend in the variable is in the opposite direction the correlation will be negative. There were some problems with calculations involving longitude because the districts tend to lie on a south-east to north-west axis. As will be shown, there is a significant longitude related effect between southern Australia and New Zealand , this was examined using methods other than correlations. Correlations involving longitude were carried out for Australia and Asia using 153°E as the zero base line. No correction was made to allow for the curvature of the earth.

RESULTS

Data Sources

The following is a list of the published census data, the results are derived from this material. ***New Zealand:*** McKenzie (1965), Oates (1995) ,Veitch (1978), Munro (1971), Barlow (1987), Sagar (1984, 1985, 1986 ,1987, 1988, 1990, 1992b,1993). ***Australia and New Guinea:*** Kendell & van Gessel (1972), Amiet (1957), Crawford (1975, 1997), Dann (1980,1994), Dann *et al*. (1994), Close & McCrie (1986), Hewish (1986,1987,1989, 1990), Thomas (1968, 1970), Driscoll (1993), Baker (1988), Minton (1982a, 1982b,1987,1993), Minton & Watkins (1989), Minton & Jessop (1994), Minton & Martindale (1982), Fallaw & Hayward (1996), Lord (1993), Martindale (1981,1982), Heron (1980), Klapste (1975), Cornelius (1988), Lane (1987b, 1988), Lane & Jessop (1985), Schulz (1995), Jaensch (1984,1987,1988), Jaensch & Barter (1988), Jaensch & Vervest (1990), Thompson (1990), Garnett (1986), Guard (1981), Harris (1994, 1995, 1996, 1997), Ashby (1991), Congrave & Congrave (1982), Campbell (1992), Barter *et al*. (1988), Houston & Mitchell (1997), Singor (1997), Naismith (1992), Patterson (1981, 1986), Woodall & Watson (1988), Loyn (1978), QOS(1972), Anon. (1981,1992, 1995). ***Asia:*** Silvius (1987, 1988), Silvius *et al.* (1987), Lim Kim Sheng (1994), Parish & Wells (1984), Edwards & Polshek (1987), Balzer (1990), Medway & Nesbett (1965), Nesbett (1964), Perennou *et al* . (1990), Perennou & Mundkur (1991, 1992), Scott & Rose (1989). van de Van (1988) ,Wang Hui (1992), Custodio (1993), Ruttanadakul (1993), Yus Rusila Noor (1994), Vowles & Vowles (1982), Lane & Mundkur (1990), Magsalay (1991), Magsalay *et al*. (1990), Pederson *et al.* (1996), Howes (1987), Harvey & Elkin (1991), Scott & Howes (1989), and Mundkur (1993).

Unpublished data from Queensland has been provided by Mrs H. B. Gill (Cairns) and Mr P. Driscoll & Mr P. O'Neil (Shoalwater Bay).

Species Richness and Population Size

Not all species richness data could be used here because of the differences in the census sample size. Four sets of census material, all well represent in the regions are shown in Table 1.The results suggest that the means of species richness within the census data almost doubles from south to north.

Wilkins (1993) showed that populations of migratory waders were larger in northern Australia than in the south, though there are large important population centres in parts of southern Australia, as also occurs in New Zealand. It is unclear how the population of south-east Asia compares with that of Australia. Certainly the wader numbers are large in the Asian region.

The Simpsons (evenness) Index.

In Table 2 the Simpsons index values shows a similar pattern to that of species richness. A series of t-tests (two-tailed) showed that the differences between all means shown in Table 2, were highly significant ($P< 0.01$). As with species richness the main differences were between regions. No New Zealand census had an index value greater than 3.0 and in Australia 4 out of 238 census from south of the Hunter Estuary (33°S) had an index value greater than 4.0. What is shown here is that southern censuses have a lower evenness pattern with the ranked distribution tending to be exponential (Figure 1).

Table 2. Means of Simpsons (evenness) index Values for regions. Here the concerns about the effect of sample size do not apply and the means are calculated without regard to census size.

REGIONS	MEANS	NUMBER OF CENSUS
New Zealand	1.69	77
Southern Australia	2.92	238
Northern Australia	4.36	123
South-east Asia	5.61	70

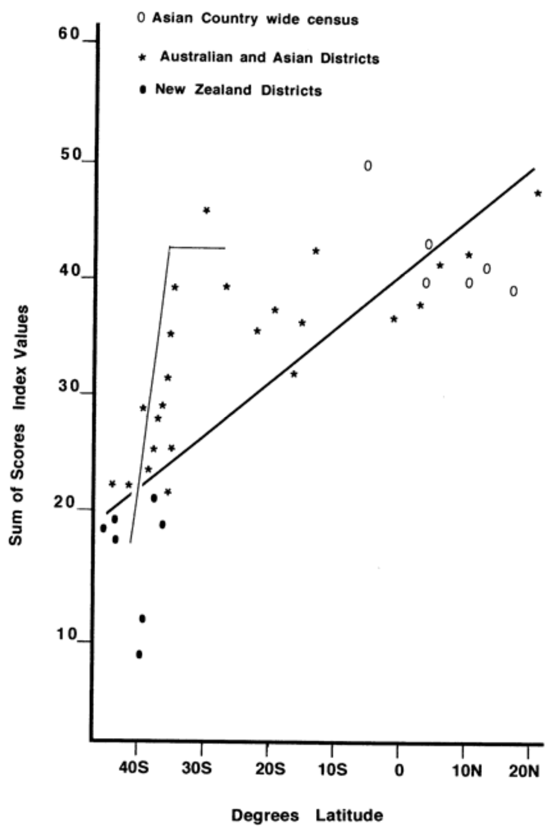

Figure 2. District and state-wide sum of scores.
The district sum of scores and their degree latitude (rounded to the nearest whole degree) are as follows New Zealand Southland (46°S), Canterbury (43°S), Nelson (41°S), Bay of Plenty (38°S), Waikato (38°S), Auckland (36°S), Far North (35°S), Southern Australia South-east Tasmania (43°S), Northern Tasmania (41°S), Corner Inlet (39°S), Western Port Bay (38°S), Port Phillip Bay (37°S), South-eastern South Australia (36°S), Albany area (35°S), Swan W.A. (34°S), Gulf St Vincent (35°S), Shoalhaven Estuary (36°S), Botany Bay, Paramatta River (34°S), Hunter Estuary (33°S), Northern Australia Clarence Estuary area (30°S), Morton Bay area (27°S), Mackay area(21°S), Cairns area (16°S), South-east Gulf of Carpentaria (16°S), Broome, Port Headland area (19°S), Darwin (12°S). Papua New Guinea Central Province (9°S). South East Asia East coast Sumatra (1°S), Palau Bruit Sarawak (2°N), Singapore Island (4°N), Coastal Brunei (4°N), Selangor area Peninsula Malaysia (6°N), Pattani Bay Thailand (7°N), Olango Island The Philippines (10°N), Red River Delta Vietnam (20°N). Asian State wide Sum of Scores (these do not include district census data) Indonisa (6°S) Sabah, Sarawak States Malaysia (3°N). Peninsula Malaysian, east and west coast (4°N), The Philippines (9°N) Thailand (11°N), Vietnam (16°N). The index value for Cairns was calculated with additional unpublished data from Mrs H. B. Gill who carried out census in the area from 1964 to 1970.

The lowest Simpsons index value was 1.003 for a census from Waikato, New Zealand. The highest index value was 11.46 from the Pulau Bruit area, Sarawak. Further calculations showed that there was a significant positive correlation between Simpsons index values and latitude, both within Australia ($r = 0.420$, $df = 354$, $P<0.01$) and for Australia and Asia ($r = 0.610$, $df = 424$, $P < 0.01$).

The sum of scores

The sum of scores diversity index values have a relationship with latitude as shown in Figure 2. The index values are shown for 35 districts, with additional data from scattered censuses from five Asian countries also included. All district sum of scores in Australia and Asia are indicated by the same symbol, the most northerly district in Australia is Darwin at approximately 12°S. A regression analysis of scores against latitude was highly significant ($F = 56.68$, $d f = 34$, $P<0.001$). Though the sum of scores can be fitted to a straight line which suggests a progressive change, south to north, an alternative pattern is a step-wise increase with the largest and possibly the only step occurring at the interface between northern and southern Australia (on the east coast between Corner Inlet 39°S and the Clarence Estuary 30°S). There was no correlation between the sum of scores and longitude in Australia and south east Asia. The index value tends to be lower in New Zealand than parts of Australia at the same latitude, the differences are significant ($t = 4.89$, $df = 15$, $P < 0.05$).

Association index

With diversity indices it is possible for two areas to have the same index values but to have an entirely different range of species. Association indices describe the relationship between the species mix in different population samples.

Figure 3 shows the pattern of association index values for 35 districts. Values greater than 70 indicate a strong link between the two censuses being compared with each other. There are three distinct blocks of districts which are bound together by strong to moderate association linkages, these are New Zealand, southern Australia and the east coast of Australia.

Variations within the New Zealand block of districts is mainly due to the local distribution of Red Knot *Calidrius canutus*. This species is normally very common at New Zealand sites but it occurs in smaller numbers in the Bay of Plenty and Waikato areas, as a result the index values between these districts and other locations tend to be lower than would otherwise be the case. The small number of Red Knot in some of the Waikato censuses has led to the unusual situation for a coastal area. Some censuses contained over four thousand birds but the census were made up almost entirely of the Bar-tailed Godwit *Limosa laponica*. Nowhere else does a single species so dominate coastal sites to such a degree.

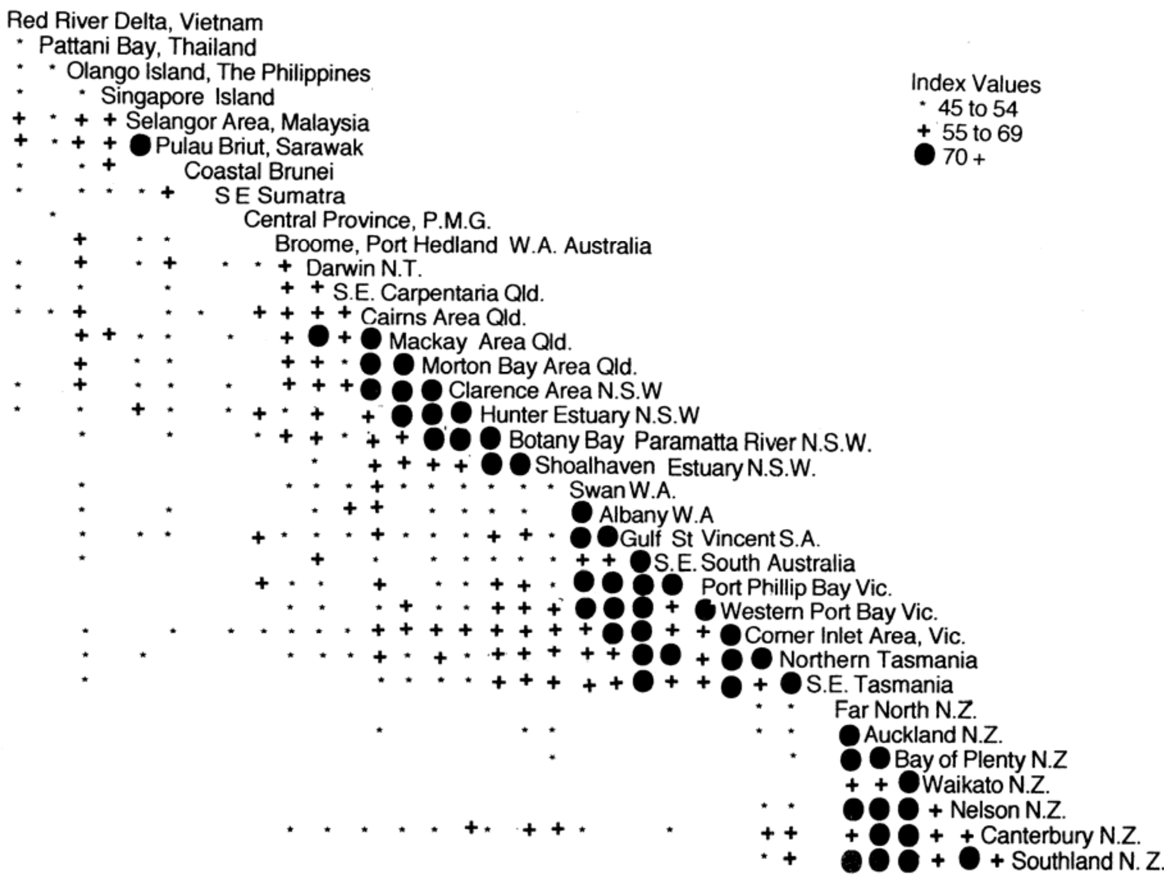

Figure 3. Association index values between districts. The results are show here for the association index values between 35 districts. The districts are arranged from north to south. Values greater than 70 indicate a close association between the district sum of scores being compared. Values less than 45 (left blank) show a weak similarity between the species lists being compared. All sum of scores showed some association the lowest value was 4.0 between Waikato, New Zealand and Pattani Bay, Thailand.

The southern Australian block (Figure 3) is influenced by the presence of large numbers of Red-necked Stint *C. ruficolis* and Curlew Sandpiper *C. ferruginea* in all censuses, with other species playing a less significant role.

The east coast Australian block of index values have a high association due to a variety of species. This area is particularly interesting because there is a distinct gradient change in all the diversity indices values which becomes most evident between Corner Inlet in Victoria and the Clarence and Richmond Estuaries in northern New South Wales (Figure 2). This is also reflected in the association index value changes along the coast. New Zealand is at the latitudes that correspond from the central coast of New South Wales to about two degrees south of Tasmania and yet there is no sign of the latitude related changes that occur on the Australia side of the Tasman Sea. Corner Inlet and northern Tasmanian districts show some moderate to weak association links with some New Zealand districts because of the presence of somewhat higher proportions of Red Knot and Bar-tailed Godwit in the census samples from the Australian side.

The association values for districts along the north coast of Australia and New Guinea shows only moderate links which seems to be a consequence of the generally higher diversity of the wader population. The Great Knot *C. tenurirostris* helps in the formation of index links between the four districts between Cairns and Port Hedland (Figure 3).

In south-east Asia only one close link was found, this was between the Selangor area, Peninsular Malaysia and Pulau Bruit area, Sarawak which has an index value of 73. The Asian data used here includes 70 sets of district census material, with a total count of over 378,000 birds. The lack of any clear pattern of the association index, coupled with high diversity (Figure 2), suggests a situation far more complex than that found in Australia and New Zealand.

An analysis was carried out on the relationship between association index values and latitude and longitude. The expectation is that as distance increases in any one direction, association index values will fall giving a negative correlation. This is subject to sampling the same type of habitat. In the Australian districts there was no correlation with changes in longitude and association index values. For changes in latitude by association values there was a highly significant correlation (r= -0.548, df = 169, P< 0.01). This suggests that districts in the same latitude tend to have a similar mix of species. If an observer was to move north or south of a given latitude by a few degrees, they could expect to find significant alterations in the mix of species within coastal districts. A similar analysis were also carried out on the association index values for south-east Asia, New Guinea and northern Australia (the latter being used in both calculations).

Here the results were different, with both changes in latitude and longitude correlated negatively with association index values (r= -0.374, and r= -0.379, respectively with df = 64, P< 0.01). This indicated that variations in the values could be explained by changes in distance regardless of the direction taken.

The flyway: staging areas and association index values.

Some indication of the changes in association index values along the north-south migration flyway are shown in Figure 3. Additional information from staging areas on the borders of south east Asia are presented in Table3. The Red River Delta in northern Vietnam is included here (Figure 3), as well as Taiwan and the Seyang Salt Work in southern China. These three areas may be important refueling sites for migrating waders. Additional data which forms the basis for this analysis is from Mundkur (1993), Yuan-Hong Chuang (1992), van der Van (1988), Scott & Rose (1989), Perennou *et al.* (1990), Peronnou & Mundkur (1992), Wang Hui (1992) and Pederson *et al.* (1996).

The top part of Table 3. shows the association index values between the three staging areas. The high association index value between the Sheyang and Taiwan (86) is due in part to the presence of Dunlin *C. alpina* which accounts from 30 to 40 percent in the censuses. Data from the Red River Delta indicates that the Dunlin accounts for about 3% of the population in that district. This species is regarded as rare to the south though it can be easily mistaken in winter plumage, for the more common Curlew Sandpiper *C. ferruginea*.

Table 3 also shows the regional index values. These are means obtained from the lists of district association index values which are calculated with the data from each district and each staging area. These values are lower than might have been expected, given that the staging areas seem to contribute to the population mix in areas to the south. The differences between the three staging areas and all the south-east Asian districts are as great as that between southern Australia and New Zealand. Despite the geographical nearness of Taiwan and Olango Island in the Philippines the index value is 47 indicating a comparatively weak association.

There are three factors that may collectively explain the lower than expected association links between the staging areas and other regions.

1. The staging areas are within the main population centres of species like Dunlin which tend to numerically dominate some censuses.
2. Individual birds in passage may spend only a brief period in a staging area so that their species becomes under represented in the censuses.
3. Migration does not take the form of broad waves of

Table 3. Association index values for the Red River Delta, Vietnam, The Seyang Salt Works, Jiangsu Province, China and Taiwan and the regional means for all areas to the south. This table shows the index values for the three migration staging areas of Red River Delta, Seyang and Taiwan. The association index value are rounded to the nearest integer. The regional mean index values are calculated from the southern district by northern staging area association values. The maximum possible value is 100 when the census samples being compared are identical. The lowest value is zero when the population samples are totally dissimilar.

STAGING AREAS	Red River Delta	Seyang Salt Works	Taiwan
Seyang Salt Works	-	-	86
Red River Delta	-	50	52
REGIONS			
South-east Asia	53.6	37.4	43.6
North-west Australia	45.2	36.6	35.3
North-east Australia	44.0	34.8	36.2
South-east Australia	37.5	33.5	35.7
South coast Australia	34.0	31.6	35.7
North Island NZ	9.2	12.7	15.3
South Island NZ	13.0	15.3	20.0

birds moving north and south but a series of channels each carrying its own mix of species. These channels may converge or diverge resulting in a complex relationship between staging areas and non-breeding regions.

In Australia there are small differences between the regional association values (Table 3). North-west Australia, because of its geographical position, has the closest link with the Red River Delta in Vietnam .The overall mean index values for northern and southern Australia is 38.8 and 34.4 respectively but a t-test showed a significant difference between these means ($t = 3.20$, $df = 55$, $P<0.05$). This suggests a slight gradient across Australia in association linkages with the staging area.

Though the association index values in New Zealand are low (Table 3) there appears to be a longitudinal related effect. The Red River Delta is the most westerly of the three staging areas and has the lowest index values. In terms of longitude, Taiwan is closest to New Zealand and has the highest comparative values. A t-test should show that the means association index values for the Red River and Taiwan with all the New Zealand districts was not significant but the t value is sufficiently high enough to warrant further investigation ($t = 2.02$, $df = 12$, $0.05 < P < 0.1$). The species which have the most influence in this situation are Golden Plover *Pluvialis dominica*, Sharp-tailed Sandpiper *Calidris accuminata* and Ruddy Turnstone *Arenaria interpres*. In the three staging areas and New Zealand these species make up only a small component of the censuses. They only have an effect because the common species in one region are uncommon in the other.

The association index values shown in Figure 3 for Olango Island in the Philippines and the Australian districts suggest a stronger linkage than occurs between the other south-east Asian districts and Australia. An analysis of association index values carried out in the same way as for the staging areas above, showed that these differences were statistically significant ($P < 0.01$). The species that most influence this linkage were Red-necked Stint *C. ruficolis*, Curlew Sandpiper *C. feruginea* and Grey-tailed Tattler *Heteroscelus brevipes*.

Species distribution patterns

The distribution patterns of twenty eight species were examined using the mean percentage values that were used previously in the calculations of the sum of scores. The species were selected on the basis that they accounted for 4% or better in at least two districts. Two species that qualified, the Spotted Redshank *Tringa erythropus* and Dunlin *C. alpina*, were not considered further, because of their limited range; neither are common south of Vietnam. In the case of country wide data, the latitude was taken as the mid-point of the Asian country coast line. The results are regarded as approximate but they allow species to be placed into groups on the bases of correlation results. Species that increase proportionally in the census samples, with increasing northward latitude had a positive correlation. Species which have the opposite tendencies, becoming more common towards the south, had a negative correlation with latitude. The groups and the correlation results are shown in Table 4.

Species placed in group A (Table 4) are not common in any part of Australia and New Zealand and correlations were not attempted because of their limited distribution. Six other species were placed into other groups on the basis of their distribution patterns, even though no significant correlation could be demonstrated. In the case of Wood Sandpiper *T. glareola* it accounted for 2% or better in eight of the fifteen districts and country wide census in Asia. In Australia it made up less than 1% in all districts and is a rare species in New Zealand. A similar pattern was found for Marsh Sandpiper *T. stagnatilis.* Four other uncorrelated species were placed in groups based on similar considerations.

The mean percentage values for each species were then used to calculate the proportion of the group within each region (Table 5). The proportion of each group is expressed as a percentage. The nature of the ratio ensures that as the proportion of one group falls the proportion of another will automatically increase. Table 5 also shows that each group tends to predominate in different regions. About a third of the palearctic waders in south-east Asia censuses belong to species groups A and B. Group C was well represented in the tropics but decreases in the south, while group D becomes more common in southern Australia. Group E which makes up a significant proportion on the south-east coast of Australia, becomes proportionally dominant further east in New Zealand. The general trend is for a simplification of the community structure from north to south. These results show a strong agreement with the patterns seen for diversity (Figure 2) and association index values (Figure 3).

Resident waders

A full discussion of the resident wader species is beyond the scope of this paper. Some aspects of these local breeding species are considered here in the light of their possible interaction with the migratory visitors. As with the Palaearctic species only coastal data are considered.

In southern regions the resident wader population is large with a diverse range of species. They decrease in terms of both species and numbers from south to north. In south-east Asia they often form a scarce group within the wader-water communities. An analysis using the ratio of

Table 4. Groups of species and distribution correlations. Twenty six species are grouped her in relation to their distribution patterns as shown by their mean percentages as per census data. The sign "+" = correlates with degrees latitude and therefore accounts for a greater proportion of the census population in the north. The sign " # " = correlates negatively, making a larger proportion in the south. No correlation was attempted with group A species because their population centres are north of Australia.

GROUP A	
	Little Ringed Plover *Charadrius dubius*
	Kentish Plover *Charadius alexandrinus*
	Eurasian Curlew *Numenius aquata*
	Redshank *Tringa totanus*
	Long-toed Stint *Calidris subminuta*
GROUP B	
	+ Common Sandpiper *Actitis hypoleucos*
	Wood Sandpiper *Tringa glareola*
	Marsh Sandpiper *Tringa stagnatilis*
	+ Broad-billed Sandpiper *Limicola falcinellus*
	+ Terek Sandpiper *Xenus cinereus*
GROUP C	
	+ Whimbrel *Numenius phaeopus*
	+ Great Sandplover *Charadius leschenaultii*
	+ Lesser Sandplover *Charadius mongolus*
	Grey-tailed Tattler *Heteroscelus brevipes*
	Black-tailed Godwit *Limosa limosa*
	+ Greater Knot *Calidris tenuirostris*
	+ Greenshank *Tringa nebularia*
GROUP D	
	Grey Plover *Pluvialis squatarola*
	# Red-necked Stint *Calidris ruficolis*
	# Curlew Sandpiper *Calidris ferruginea*
	# Eastern Curlew *Numenius madagscarensis*
	# Sharp-tailed Sandpiper *Calidris accuminata*
GROUP E	
	Golden Plover *Pluvialis dominica*
	# Ruddy Turnstone *Arenaria interpres*
	# Red Knot *Calidris canutus*
	# Bar-tailed Godwit *Limosa lapponica*

resident waders to total wader per census within Australia and another for the entire area under review showed significant negative correlations with changes in latitude (both $P<0.01$).

If the resident species data is combined with the rest of the wader data and the indices recalculated, the net effect is a significant narrowing of the difference between the tropics and temperate regions which have been shown to exist for migratory waders by themselves. The possible implications of this are discussed at the end of the paper.

DISCUSSION

Often population analysis has assumed that migratory wader populations were sedentary, when in fact they are highly mobile. This raises the question as to whether the migration of birds through south-east Asia and northern Australia on their way to and from southern Australia and New Zealand, effected the censuses in the tropics to the extent that the results of this study are compromised.

The effects of migratory passage within south-east Asia, Australia and New Zealand was examined with the aid of regular long term censuses from Brunei (Havey & Elkin (1991) and Darwin (Crawford 1997). The effects on diversity as shown by the sum of scores was tested by calculating the index values for the periods of December to February, August to October and March to April. The last two periods correspond to the time when migration activity is at its greatest. The differences between the December to February scores and those of the other two periods gives an indication of the passage movement effect in these districts. The largest difference was a decrease of 3.25 (8%) following the south bound migration period in Darwin in 1971. There were occasions when the index value was higher during the December to February period, up to 2.0 (6%). This was due to the greater evenness in the census population. It

Table 5. The proportions of groups of species in coastal regions. The south-east Asian region has been divided into censuses north and south of the equator. Northern Australia is divided into north-western (Port Hedland to the Gulf of Carpentria) and north-eastern (Cairns to the Clarence Estuary). Similarly, southern Australia has become south-eastern (Hunter Estuary to Corner Inlet) and south coast (Western Port Bay to Swan, WA). The percentage values are rounded to whole numbers. Values less than 0.5% are indicated by a star * .

	South-east Asia		Coastal Australia				New Zealand
	N of Equator	S of Equator	North-west	North-east	South-east	South	
Groups							
A	16	24	*	*	*	*	0
B	19	18	4	2	1	*	*
C	29	27	41	35	9	5	*
D	24	15	34	25	48	85	1
E	9	13	20	36	42	10	99
Others	3	3	1	2	*	*	*
Total %	100	100	100	100	100	100	100

seems that migration does not significantly influence the results shown in Figure 2. The association index is a derivative of the sum of scores and the impact of migration on this index could be similarly insignificant.

It can be demonstrated that large flocks of migratory waders passing through an area like the Seyang Salt Works in southern China can cause significant fluctuations in Simpsons index values over a period of a few days. This can be deduced from the census data in Wang Hui (1992). There also a trend for the variance of Simpsons index values to decrease with southern latitude but this effect may be the result of the simplification if the community in southern areas (Table 5). Migratory flocks can both increase or decrease the Simpsons index value in a census, depending on the mix of species. The index results shown in Table 2 do not seem to have been significantly effected by migration.

With regards to species richness (Table 1) most species which make up the census population in southern Australia and New Zealand are found in the tropical regions for most of the year. The exception is the Sharp-tailed Sandpiper *C. accuminata* (Lane 1987a). Calculations with species richness for the censuses in Brunei and Darwin suggest that southern migrants add two or three to the species counted in these areas, not enough to explain the results shown in Table 1.

In conclusion migration has a small effect, but this is insufficient to explain the differences shown to occur between regions (Tables 1 and 2, Figures 2 and 3). There would be a much greater effect if migrating birds were stopping every few kilometres, current evidence suggests that they are able to fly non-stop, distances like those between Australia and southern China (Thomas 1987, Barter & Wang 1990).

A full analysis of migration requires a different approach to the methods used here though the results in Table 3 and Figure 3 show how individual staging areas may influence populations in other regions.

The results in Tables 4 and 5 seem to confirm the finding that diversity decreases, towards the south, along the continuum. It also suggests that for some groups of species, the southern areas are of greater importance (Table 4).

Clues as to how the migratory wader continuum came into existence are given by the pattern of the distribution for non-waders in Asia. Every year, several million passerines and waterfowl migrate to and from their breeding grounds in central and northern Asia. Many of the non-wader species winter in the southern temperate zone and northern tropics. Some cross the equator and a very few reach northern Australia. Such a distribution pattern may have existed for migratory waders in the geological past. The evolution of a highly efficient flight performance has enabled this group to exploit habitats as far south as the land masses will allow but the centre of high diversity has remained in the tropics (Figure 2). In some animal and plant communities exponential type, species ranked distribution curves (Figure 1) are a sign of recent establishment or imbalance. This pattern is shown for the Derwent census and is the usual pattern for New Zealand and most of temperate Australia (Table 2).

The motivation for a southward expansion of range is probably the result of intra and inter species competition for suitable feeding habitat. It is not possible to determine the part played by habitat at this stage. Some species seem to be able to utilise their preferred habitat at all latitudes. Others such as the Eurasian Curlew *N. aquata* may be confined to Asia, as unlike some Group A species (Table 4) it is yet to be certainly recorded in Australia or New Zealand.

Geographical features such as the Timor, Arafura and Tasman seas and probably the mountains of New Guinea have contributed to the continuum because though they act as barriers, few species have been completely contained by them. There also seems to be a continuum effect between northern and southern Australia with a marked zone of overlap on the east coast (Figures 2 and 3, Table 5). There may be a similar situation on the west coast of Australia but there is insufficient published information. The differences between the south-west of Western Australia and the Broome, Port Hedland area are as distinctive as any seen between widely separated districts along the east coast.

A further consideration is the distribution of the indigenous waders which have large and diverse communities, centred in southern Australia and New Zealand. Do these species compete with some migratory waders for high quality coastal habitat and in so doing, partly exclude some species of visiting waders from the southern regions. Total exclusion does not seem possible with such highly mobile birds, that are not having to maintain breeding territories. Lack (1968) has stated that the feeding characteristic of migratory species tends to be less specialised than non-migrants. This has resulted from the need of the migratory species to utilise more that one type of habitat during their life cycle. In the case of the resident waders it is likely that they are better adapted to local conditions. Signs of this are found in extreme habitats, such as high salinity (Crawford 1975) or in cold wet windy environments like the south and west coasts of Tasmania (Schulz 1993a,b, Schulz & Menkhorst 1984). In these situations the numbers of indigenous birds exceeded palearctic visitors, a situation that rarely occurred elsewhere during the southern summer. If some of the indigenous species are able to compete directly with some migratory waders than the latter are more likely to be adversely effected.

When diversity indices are calculated for entire wader population there is a closing of the gap in values between temperate and tropical regions compared with similar calculations just using Palearctic species. This may be regarded as indirect support for the concept of partial exclusion. Habitat quality and diversity are usually linked. If the southern regions were supporting the same mix of migratory species as the tropics, as well as the large, diverse indigenous population the limits set by the carrying capacity of the habitat could be exceeded. This question must remain open, as further investigation requires a study of the feeding behaviour of likely competitors.

The extent of the continuum pattern of the migratory waders has perhaps not been recognised in the past because of limited data and the tendency for major differences to occur between and not within regions. An added difficulty has been the poorly defined distribution patterns of waders. Every year, hundreds if not thousands of palearctic waders wander far from their own species population centres. This adds an aesthetic interest to the study of this group but it also produces problems for analysis. There is the temptation to over-value rarities. The historical reasons for the continuum seem likely to remain the subject of speculation. Of greater concern should be any future changes in the pattern due to human activity.

ACKNOWLEDGMENTS

I started to write this review and analysis fifteen years ago but abandoned the work due to a lack of data. Progress has been made possible due to the efforts of mostly unnamed observers who have taken part in national wader counts and similar projects over the last decade and a half. I would also like to acknowledge the assistants at various stages of Dr. B. C. Longstaff, Dr. D.R. Wells, Mr C. R. Veitch, Dr. G. M. Storr, Dr. G. Holmes, Mr R. Jaensch and Mr D. Watkins. I also thank Mrs H. B. Gill , Mr P. O Neil and Mr. P Driscoll for giving me access to their unpublished data.

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* Editors Note: Yes, these page numbers are correct, according to the volume in question!

THREE SIGNIFICANT TERN FLOCKS IN NORTH QUEENSLAND, AUSTRALIA, RECORDED DURING WADER SURVEYS.

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This note reports three significant observations of tern flocks, which were made during wader surveys that I have undertaken for the Queensland Department of Environment.

Common Terns

On 21 November 1995 I was conducting a coastal wader survey, along with S. Pell, W. Lawler and D. O'Connor. I noticed a large flock of flying birds. Their position was about one kilometre inshore from our boat, and they eventually landed on a spit close to the mouth of Euri Creek (19º57'S, 148º10'E). Hoping that they were waders we altered course and we were initially disappointed when they resolved to be terns. We landed in order to observe the flock at closer quarters.

Although it was a mixed flock, some 90% of the terns were Common Terns *Sterna hirundo* and an accurate count of the species tallied 706 individuals. Common Terns are paradoxically uncommon and are usually seen singly or in small groups (Nielsen 1996). Higgins & Davies (1996) state that the species is "Sparsely scattered from Cairns, south to Rockhampton." Their account suggests that the Euri Creek flock would be the highest accurate count of *S. hirundo* recorded in Queensland, as the largest number they list is for Reef Point (map reference not given): 650+ on 4 December 1991.

Most local birdwatchers are aware that the best opportunity of seeing this species in North Queensland is at the Bowen Yatch Club (20º3'S, 148º14'E) where they perch on the moorings (J. Wren per. comm.). It now seems that the reason for this is that these birds are remnants from the main population at Euri Creek. The site is difficult to access physically and poses great problems for monitoring. Whether the spit holds good numbers of Common Terns throughout the summer, or if it is an annual and important staging area for the species is still speculative although local indications suggests that this is the case.

White-winged Black Terns

While surveying Cromarty Wetlands near Giru (19º30'S, 147º5'E) for freshwater waders on 16 March 1996 (with D. Harrison), we were amazed at the sight of a huge flock of White-winged Black Terns *Childonias leaucopterus* feeding over the marsh. An initial attempt to accurately count the swirling birds using the hand held counter was abandoned due to frustration and "thumb fatigue!" At this point less than half the flock had been tallied and the number on the counter stood at 1687, so the total number of birds in the flock easily numbered 3000.

Several days later, a Queensland National Parks and Wildlife Officer reported seeing thousands of White-winged Black Terns feeding at the Cromarty Wetlands (P. Minton pers. comm.). Only a few weeks after the initial sighting P. Minton and W. Warnett observed that the numbers were much reduced to a few flocks of 50 to 100 birds (M. Warnett pers. comm.).

Only three entries of White-winged Black Terns of over 2000 birds are listed in Higgins & Davies (1996): 15000 at Port Hedland, WA (1982); 6000 at Eighty Mile Beach, WA (1989); and up to 2600 at Armstrong Plains, Qld (1985). A former skipper of the Great Barrier Reef Marine Parks patrol vessel "Sirenia" had observed thousands White-winged Black Terns relatively close to Giru at Cape Bowling Green (19º18'S, 147º23'E) over several years and was of the opinion that this site was a major staging area for the species during migration (D. Cameron pers. comm.). ANCA (1996) also lists the cape as the arrival and departure point for 2000-3000 White-winged Black Terns.

Little Terns

During the survey at Cape Bowling Green, another observation of significance was the numbers of Little Terns sighted. Two separate flocks totaled 385 birds. Regarding populations, a survey of eastern Australia in Dec. 1989 recorded a total breeding population of 310-319 pairs. In Queensland, 3187 birds were recorded including 56 breeding pairs (Higgins & Davies 1996). Unfortunately, tide and time constraints and the research emphasis on waders did not allow us to spend any more time on the terns to discover whether they were nesting. As before, at this stage the frequency of occupancy and the importance of the site for this species is open to conjecture.

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CAPE BOWLING GREEN, NORTH QUEENSLAND; A SITE OF SIGNIFICANCE FOR GODWITS.

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The spit at Cape Bowling Green, near Giru (19º18'S, 147º23'E), is a rich habitat and an important wildlife refuge. It is somewhat remote and only accessed at a premium, even for the Queensland Department of Environment.

During a survey of the spit on 13 December 1996, Ranger P. Centurino and I counted over 7000 mixed shorebirds including 2058 Black-tailed Godwits *Limosa limosa*. According to Watkins (1993) this would be the highest number counted in Queensland outside their national strongholds in the south eastern Gulf of Carpentaria (49400 bird counted). The number of *L. limosa* found also qualify as a site of international significance for the species: the estimated Flyway population is 162000, with 1% (the criteria for international importance) being 1620. Of lesser importance but still of significance was the count of 2103 Bar-tailed Godwits *Limosa lapponica*. According to Watkins (1993) this makes the spit a site of national importance for the species, which has a Flyway population estimate of 165000 (1%=1650).

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OBSERVATION OF ATTEMPTED RAPTOR PREDATION ON MIGRANT WADERS IN NORTHERN NEW SOUTH WALES.

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Raptor predation plays a significant role in the population dynamics and behaviour of wading birds in the northern hemisphere (Page & Whitacre 1975, Townshend 1984, Kus *et al*. 1984, Whitfield 1985). However there are very few documented accounts of raptor predation on wading birds in Australia (Marchant & Higgins 1993). Schulz (1987) discussed the anti-predator responses of Hooded Plover *Thinornis rubricollis* when approached by raptors and also observed a Peregrine Falcon *Falco peregrinus* capture a Hooded Plover (Schulz 1992).

Raptors, particularly Whistling Kites *Haliastur sphenurus*, Brahminy Kites *H. indus* and White-bellied Sea Eagles *Haliaeetus leucogaster* commonly traverse wader feeding grounds and roosts, however, rarely do they make concerted attempts to capture waders. This note reports observations of repeated predations attempts by an Australian Hobby *Falco longipennis* on firstly a Grey-tailed Tattler *Heteroscelus brevipes* and then an Eastern Curlew *Numenius madagascariensis* in September 1993.

The attacks were made while birds were roosting during high tide at Chickiba Lake. Chickiba Lake is a human made roost utilised by up to 500 individuals of 14 species of migrant wader. The lake is situated in the Richmond River estuary, northern New South Wales, Australia. The roost is about 150 metres long by 50 metres wide, with a one metre high berm situated on the western edge. Waders generally roost between or on the berm and the lake shore.

Around high tide on 17 September 1993 an Australian Hobby approached a roosting flock of waders at high speed from behind the berm. As the flock took flight over the water the Hobby made an attempt to capture a Grey-tailed Tattler. The response of the Tattler was to drop into the water thus avoiding the Hobby. After a brief period in the water (one to two seconds) the Tattler took flight, only to be pursued once again. The Hobby made two further attempts at the Tattler which used the same avoidance technique on each occasion.

As the Hobby was pursuing the Tattler a resident Whistling Kite came to investigate, causing Eastern Curlews, Whimbrels *N. phaeopus* and Bar-tailed Godwits *Limosa lapponica* to take flight across the lake. The passage of this flock over the water apparently disoriented the Hobby enabling the Tattler to escape. The Hobby then focused its attention on an Eastern Curlew. The response of the Curlew was to drop into the water. A confrontation then developed between the Hobby and the Whistling Kite, enabling the Eastern Curlew to escape after a brief period (one to two seconds) in the water.

The fact that both species of wader used the same technique to avoid predation suggests that it may be a universal method of avoidance and may explain the observation of waders taking flight over water when disturbed by raptors.

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AN OBSERVATION OF WADER MIGRATION IN A TROPICAL STORM

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The east coast of Peninsular Malaysia is not usually considered to be of major importance for migratory waders, particularly in comparison to the west coast. This note reports on the observation of two flocks of small waders apparently migrating south along the east coast of Peninsular Malaysia in very poor weather.

The following observations were made during a visit to Rantau Abang (about 140 km north of Kuantan), in the State of Terengganu, Peninsular Malaysia, in August 1996 (see Finlay & Turner 1994).

At about 14:00 on 22 August 1996, a heavy thunderstorm swept over the beach. Everyone was forced to cover as the torrential downpour, and the lighting, persisted for over half an hour. We had taken shelter in a resturaunt on the beach. It was from this point that we noticed a flock of small waders, which were impossible to identify, flying south in the worst of the storm. They flew about 200 m offshore, and only a few metres above the sea. A second flock was seen about ten minutes later, behaving in a similar fashion in similar weather. Each flock consisted of about 50 birds. I assume these flocks were migrating because of the timing and direction of the movement.

Migrating waders must endure bad weather, but it surprised me that they continued in such bad weather even though there were kilometres of deserted beaches (due to the rain) that would have served amply as a resting point.

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AN OBSERVATION OF THE BEACH THICK-KNEE (*Esacus magnirostris*) ATTEMPTING TO FORAGE ON A PIPI (*Donax deltoides*)

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The East Asian-Australasian Flyway population of the Beach Thick-Knee (*Esacus magnirostris*) has been estimated at approximately 1000 individuals and is in some state of decline (Watkins 1990; Garnett 1993). The Beach Thick-Knee occurs in low densities over the northern part of Australia from Onslow in Western Australia to Nambucca Heads on the New South Wales mid-north coast (Garnett 1992, 1993; Marchant & Higgins 1993). The Beach Thick-Knee is regarded as endangered in New South Wales and very little research has been undertaken on their ecology (Garnett 1993; Marchant & Higgins 1993). Beach Thick-Knees forage on large intertidal mudflats, sandflats, and sandspits exposed at low tide; on open beaches or near river-mouths (Garnett 1993; Marchant & Higgins 1993). Such areas in northern New South Wales are often inhabited or regularly used by humans. Human disturbance is one reason associated with the Beach Thick-Knees decline (Garnett 1992). Marchant and Higgins (1993) report Beach Thick-Knees foraging on crabs (Soldier Crab *Mictyris longicarpus* and *Thalamita sp.*) and other marine invertebrates but there is no published literature concerning Beach Thick-Knees foraging on Pipi's (*Donax deltoides*). The foraging behaviour reputedly involves the Thick-knee hammering the prey with its bill before swallowing. However, crabs are often not hammered against the substrate, but rather held in the throat with the bird walking a few paces before swallowing (Marchant & Higgins 1993). In this note, I report an observation of an adult Beach Thick-Knee attempting to forage on a Pipi.

At 16:58 on the 8 June 1997, whilst undertaking Pied Oystercatcher (*Haematopus longirostris*) surveys near Evans Head in northern New South Wales, a single solitary Beach Thick-Knee was observed attempting to forage on a Pipi. The observation was made at the entrance to Salty Lagoon some three kilometers north of Evans Head. The bird was observed from a four-wheel drive vehicle for approximately three minutes, during this time the bird repeatedly attempted to open the Pipi by hammering it into the soft sand in a similar fashion to Pied Oystercatchers. The bird was located above the high tide zone and appeared to be seeking refuge from vehicles by residing in close proximity to the heavily eroded sand dune. The foraging behaviour of the bird was noted as unusual and I then proceeded to continue the Pied Oystercatcher counts. On the return trip, some 10 minutes later, the bird was noted to be in almost the identical location and was still attempting to open the Pipi by hammering it with its bill. A series of head bobbing movements was noted whilst observing the bird on this occasion before it dropped the Pipi (probably as a result of my close proximity). When the vehicle retreated, the bird picked the Pipi back up and continued as before. At the time we departed, some 23 minutes after the initial observation, the bird had not succeeded to open the Pipi. Conditions at the time included a 15 kmh^{-1} south-east wind, 30 % cloud cover, one metre windswell, and it was just prior to dusk. This observation raises a number of questions; do Beach Thick-Knees forage on Pipi's, if so is it a regular or rare occurrence? It was also noted that a pair of

Pied Oystercatchers were present nearby and raises the suggestion of the Beach Thick-Knee acquiring the Pipi from them. Another observation made whilst traversing beaches on that day was a number of recreational Pipi collectors, and did any of these collectors leave excess Pipi's lying on the sand surface, thus presenting the bird an opportunity to forage on it.

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NOTES ON THE BLACK-FRONTED PLOVER: AN UNDESCRIBED CALL AND AN UNUSUAL HABITAT.

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The Black-fronted Dotterel *Elseyornis melanops* is found throughout most regions in Australia, but despite this widespread range, many aspects of its behaviour and ecology have been poorly studied. In contrast, in New Zealand, where the species has recently become established after colonizing the South Island in the early 1950s, it has been the subject of much more intensive study (Marchant & Higgins 1993). Here we present two previously unpublished observations on the species.

Undescribed Call.

On 6 September 1997, at Torquay, Victoria, one of us (JMP) flushed a single Black-fronted Dotterel from a puddle of rainwater. The bird first ran, then flew about 10 metres to the muddy shoreline of a nearby freshwater pond. In doing so, it appears to have entered the territory of another Black-fronted Dotterel, which had been standing at the edge of the water at the southern end of the pond. Almost immediately, the 'resident' Dotterel flew towards the intruder, landing about five metres away. It then approached the trespassing Dotterel, running in a hunched, forward-leaning posture. As it ran, the bird uttered a long call consisting of a slow, low-pitched but clearly audible 'putt-putt-putt-putt' call which sounded like a stalling engine. This call was quite different to the higher-pitched 'pit-pit' contact and alarm calls usually made by the species (Marchant & Higgins 1993). Every metre or so the bird stopped briefly and bobbed its head, while still calling. The intruder then flew away, closely pursued by the other Dotterel. They flew erratically, and included many twists and turns as the interloper tried to evade the attentions of its pursuer. The chase extended for more than 100 metres, including over some nearby houses, and then both birds returned to their original positions. No further interactions were seen to take place.

The aggressive territorial interaction between these two Dotterels was generally similar to agonistic encounters previously described, although the pursuit flight was possibly longer than is usually observed (Marchant & Higgins 1993). However, the 'putt-putt' call was quite different to the buzzing call which is usually associated with threat behaviour during territorial boundary disputes (Phillips 1980) and the repeated chipping calls made during agonistic encounters (Child & Child 1984). This call appears to be undescribed.

Unusual Habitat.

On 8 September 1997 one of us (MAW) was conducting a regular search for Hooded Plovers *Thinornis rubricollis* on a sandy beach exposed to the ocean between Harmers Haven and Cape Patterson, near Wonthaggi, on the southern coast of Victoria. At about 17:00, a Black-fronted Dotterel was flushed from the upper level of the beach, where it was feeding on the open sand. After it fed on the sand for several minutes, it then ran onto an adjacent partly-exposed intertidal rock platform and continued to feed. It waded through shallow water as it foraged, but did not feed in any shallow rock-pools. The bird was flushed from the rock platform as the observer left the area, and it returned to the sandy beach.

Black-fronted Dotterels are usually associated with muddy margins of terrestrial freshwater wetlands, and infrequently occur around brackish or saline wetlands (Marchant & Higgins 1993). The species rarely occurs on coastal shores, where there are a few records in sheltered, low energy environments, including estuaries, exposed intertidal mudflats and sheltered beaches (Smith 1964, 1966; Haines 1969; McGarvie & Templeton 1974; Schulz 1990). A reference to Black-fronted Dotterels utilizing 'intertidal pools' mentioned in Marchant & Higgins (1993) should actually refer to 'interdunal pools' (Storr 1987). The species has never been recorded on ocean beaches in New Zealand (Marchant & Higgins 1993), but sometimes appears to inhabit open sandy or shingle beaches on King Island in Bass Strait (Green & McGarvie 1971; McGarvie & Templeton 1974; Schulz 1990). The habitat described here is superficially similar to one such record on King I., where Dotterels were seen among seaweed on a shingle beach which was protected from the swell by an offshore rocky platform (Schulz & Kristensen 1990). However, the rock platform described here did not protect the beach from the effects of the waves, which were breaking over the platform and washing heavily onto the beach.

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SIGHTINGS OF LEG-FLAGGED WADERS FROM VICTORIA, AUSTRALIA; REPORT NUMBER 5.

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An orange plastic leg-flag has been placed on the right tibia of most migrant and some resident waders banded in Victoria since 1990. Altogether some 20,000 birds have been marked in this way.

Lists of sightings of orange-flagged birds away from the banding areas have been published in past VWSG Bulletins (and in *The Stilt).* This is the fifth such list and mostly covers sightings reported in the year to 30 June 1997. Special thanks for reporting sightings are due to Geoff Carey and Paul Leader (Hong Kong), Minoru Kashiwagi (Japan) and the New Zealand Banding Office and Adrian Riegen (New Zealand).

The following tables give details of the sightings of leg-flagged birds. The first column is the date, the second column is the location of the sighting and the third column are the observers that made the sighting.

Lesser Sand Plover

240396	Manly Foreshore, Moreton Bay, Qld.	B. Lane, T Tarrant, N. Moores

This is the second year in which a Victorian-flagged Lesser Sand Plover has been seen in Moreton Bay at the time of northward migration.

Greater Sand Plover

22.3.96	Wynnum, Moreton Bay, Qld	A. Keates
12.10.96	Manly Foreshore, Moreton Bay, Qld.	M. Hayward
26.10.96	Manly Foreshore, Moreton Bay, Qld.	T. Tarrant, A & C. Keates
13.11.96	Tuross Estuary, NSW	M. Crowley

Further indications of a coastal migration route for this species. There have now been seven sightings from only nine flagged birds!

Ruddy Turnstone

23.2.97	Karaka, Manukau Harbour, NZ 37^0 5’S 174^0 50’E	P. Cuming, B. Wooley *et al*.

This is the first movement of a Ruddy Turnstone between Victoria and New Zealand.

Eastern Curlew

6.4.95	Kamo River, Saijo, Ekime, Japan 33^0 55N 133^0 10’E	Japan Migration Research Centre
25.10.96	Lan-uang His, Ilan, Taiwan. 24^0 42N 121^0 50’E	Taiwan Banding Centre
19-21.3.97	Sone, Kitakyushu, Fukuoaka, Japan 33^0 49N 130^0 58’E	Kazuo Samoto
19.3.97	Sone, Kitakyushu, Fukuoaka, Japan 33^0 49N 130^0 58’E	Kazuo Samoto
22.3.97	Imazu, Fukuoaka, Japan 33^0 36N 130^0 15’E	Okabe
26.3.97	Higashi-Yoga, Saga, Japan 33^0 11N 130^0 16’E	Masayoshi Takeishi
26.12.96	Penrice Saltfields, St Kilda, SA	W. Syson

The bird in Taiwan was on a rather late date for a presumed return to Victoria. A nice collection of five sightings in Japan. The bird in South Australia had obviously changed its non-breeding area.

Terek Sandpiper

11.4.97	Mai Po Nature Reserve, Hong Kong 22^0 29N 114^0 19'E	R. Meermans
29.10.96	Manly Harbour, Moreton bay, Queensland	A. and C. Keates

These are the first sightings of orange-flagged Terek Sandpipers. Only eight have been marked with leg-flags in Victoria.

Bar-tailed Godwit

20.4.96 to 5.5.96	Yatsu, Narashino-shi, Japan 35^0 41N 140^0 0'E	Harutaka Takubo
20.4.96 to 15.5.96	Yatsu, Narashino-shi, Japan 35^0 41N 140^0 0'E	Yatsu Nature Observers
20.4.96	Shin-hama, Ichikawa-shi, Chiba, Japan. 35^0 40N 139^0 55'E	Tsutomu Ishikawa
21.4.96	Arao-shi, Kumamoto, Japan 32^0 58N 130^0 26'E	Kazumori Yamamoto
27.4.96	Watera, Miyagi, Japan	Hiroshi Ikeno
28.4.96	Yatsu, Narashino-shi, Japan 35^0 41N 140^0 0'E	Ryuji Iijima
7.5.96	Edogawa Canal, Ichikawa-shi, Japan 35^0 42N 139^0 56'E	Kenichi Kaneko
11.5.96	Yatsu, Narashino-shi, Japan 35^0 41N 140^0 0'E	Harutaka Takubo
19.5.96	Tori-no-umi, Watari-machi, Japan 38^0 02N 140^0 57'E	Masataka Iguchi
26.5.96	Edogawa Canal, Ichikawa-shi, Japan 33^0 59N 133^0 27'E	Nobuyoshi Ishii
28.4.97	Watari, Miyagi, Japan 38^0 02N 140^0 55'E	Hiroshi Ikena
2.5.97	Yatsu, Chiba, Japan. 35^0 40N 140^0 00'E	Tomoo Hirayama
11.5.97	Yatsu, Chiba, Japan 35^0 40N 140^0 00'E	Simba Chan
17-18.5.97	Watari, Miyagi, Japan 38^0 02N 140^0 55'E	Hiroshi Ikeno
9.11.96	Miranda, Firth of Thames, NZ	K. Woodley
15.12.96	Karaka, Manukau Harbour, NZ	T. Habraken
25.4.97	Mankyung Estuary, Korea 36^0 52N 126^0 43'E	Jin Young Park
26.10.96	Manly Harbour, Moreton Bay, Qld	A. and C. Keates

A wonderful crop of 15 sightings in Japan (only one previously). Also the first sighting in Korea.

Red Knot

30.9.96, 26.10.96, 27.10.96, 15.12.96	Kidd's, Karaka, Manukau Harbour, NZ (2 birds)	T. Habraken, C. Minton, R Clough
23.10.96, 29.10.96, 12.11.96, 17.10.96	Mangere, Manukau Harbour, NZ	T. Habraken, C. Minton, R Clough
17.10.96	Clarke's Bay, Manukau Harbour, NZ	T. Habraken
3.11.96	Tapora, North Kaipara, NZ	N. Green
17.11.96	Miranda, Firth of Thames, NZ	T. Habraken
20-22.9.96	Kooragang I., Stockton, NSW	D. Geering
--.02.97	Price Saltfields, SA	per D. Paton

As usual New Zealand features extremely strongly in Red Knot leg-flag sightings. The bird in South Australia has obviously changes it's non-breeding area.

Great Knot

7.9.96	Yatsu, Chiba, Japan 35^0 10N 140^0 0'E	Yasuo Suzuki
15.9.96	Broome, WA	J. Fallaw, B. Hayward

This is the first indication of a link between Victorian and north west Australian Great Knot. The sighting from Japan is also a first.

Sharp-tailed Sandpiper

16.12.96	Mystic Park, northern Victoria	P. Maher

Sharp-tailed Sandpipers regularly use different non-breeding areas in different years.

Red-necked Stint

24.5.97	Hsu-Tsuo Kang, Tauyuan, Taiwan 25^0 7'N 121^0 9'E	Taiwan Banding Scheme
26.5.97	Nan-kang, Hsinchu, Taiwan 24^0 36'N 120^0 42'E	Taiwan Banding Scheme
1.6.97	Lu-erk-men, Taiwan 23^0 1'N 120^0 6'E	Taiwan Banding Scheme
6.5.96	Matsubase-Machi, Japan 32^0 36'N 130^0 39'E	Kunihiko Watanabe
10.5.96	Nagatsu, Ehime, Japan 33^0 59'N 133^0 28E	Junji Kawada
1.8.96	Tokachi, Hokkaido, Japan (2 birds)	Hitoshi Ochi
20.8.96	Onohara, Kagawa, Japan	Hitoshi Yokoyama
26.7.96	Pankowka, Rosja, Irkutsk, Russia 51^0 0'N 104^0 30E	Polish Banding Scheme
19.4.96	Mai Po Nature Reserve, Hong Kong 22^0 29N 114^0 19'E	Paul Leader
20.4.96	Mai Po Nature Reserve, Hong Kong 22^0 29N 114^0 19'E	David Melville
23.4.97	Mai Po Nature Reserve, Hong Kong 22^0 29N 114^0 19'E	G. Carey, P. Leader
11.5.97	Mai Po Nature Reserve, Hong Kong 22^0 29N 114^0 19'E	W. K. Li
15.5.97	Beidaihe, Hebei, China 39^0 47N 119^0 27'E	G. Carey
4 to 25.11.96 (5 sightings)	Lake Ellesmere NZ 43^0 43S 122^0 29'E	C. Hill
27.6.97	Anna Plains, 80 Mile Beach, WA	C. Hassell, J. Sparrow, M. Russell
27.12.96	Tullakool Saltworks, NSW	P. Maher
26.9.96	Moruya, NSW	M. Crowley
23.10.96	Maroom, Maryborough, Qld	C. Barnes
15.1.96, 6.10.96, 24.11.96	Cape Portland, Tas.	R. Cooper
1.1.97	Hobart, Tas.	P. Park
9.2.97	Perkins I. northern Tas.	T. Reid
26.12.96	Carpenter Rocks, SA	A. Boyle, I. Stewart
10.1.97, 26.1.97	Lakes NP, Vic.	T. Rolland, C. Minton *et. al*

An excellent array of Red-necked Stint sightings from Russia, China, Hong Kong, Japan, Taiwan and New Zealand.

The sighting in Russia is some 11,000 km from southern Victoria and is well to the west of a direct migration route from the breeding grounds. Previous recoveries have also suggested that some birds carry out a marked westerly loop on their southward migration back to Australia. The sighting in Beidaihe, northern China, is one of very few flag sightings in that country (as opposed to many recoveries of banded birds). It was made by Peter Carey from Hong Kong - the person who also makes many observations in Hong Kong and also prepares the collated list of sightings from there each year.

Some of the sightings in Australia are of birds which had changed their non-breeding locations - an uncommon occurrence. The sighting in June in noth west Australia is puzzling. Either it was a 'greater than normal' northward movement by a first year bird or it was an adult which abandoned its return to the breeding grounds after reaching NW Australia.

<u>Curlew Sandpiper</u>

15.5.97	Beidaihe, Hebei, China 39^{0} 47N 119^{0} 27'E	G. Carey
7.5.97	Szu-Tsao, Tainan, Taiwan 23^{0} 1N 120^{0} 7'E	Taiwan Banding Centre
9.4.96 (2 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey
19.4.96	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	P. Leader
20.4.96 (2 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	P. Leader, P. Kennerley
24.4.96	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	S. McChesney
1.5.96	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	H. Seigel
24.5.96	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	W. Yeung
23.3.97	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
28.3.97 (2 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
30.3.97	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
31.3.97 (4 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
1.4.97 (3 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
8.4.97 (2 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
10.4.97	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
11.4.97	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
13.4.97	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
22.4.97	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
23.4.97 (2 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
26.4.97 (2 birds)	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	G. Carey, P. Leader
27.4.97	Mai Po Nature Reserve, Hong Kong 22^{0} 29N 114^{0} 19'E	R. Lewthwaite
28.4.97	Mai Po Nature Reserve, Hong Kong	R. Lewthwaite

	22^0 29N 114^0 19'E	
30.4.97	Mai Po Nature Reserve, Hong Kong 22^0 29N 114^0 19'E	G. Carey, P. Leader
15.9.96	Broome, WA	C. Hassell
20.9.96 (3 birds)	Kooragang I. Stockton, NSW	D. Geering
22.9.96	Kooragang I. Stockton, NSW	D. Geering
20.12.96	Tullakool Saltworks NSW	P. Maher
6.10.96, 9.10.96	Cape Portland, Tas.	R. Cooper
2.12.96	Cape Portland, Tas.	R. Cooper
9.2.97	Perkins I. northern Tas.	T. Reid

Another good selection of sightings, particularly from Hong Kong. It is interesting that there are quite a few records of birds which have reached Hong Kong on northward migration before the end of March.

Sanderling

21.4.96	Yatsu, Narashino-shi, Japan 35^0 41'N 140^0 00E	Tstomu Ishikawa
28.4.96	Yatsu, Narashino-shi, Japan 35^0 41'N 140^0 00E	Yatsu Nature Observers
4.5.96	Yatsu, Narashino-shi, Japan 35^0 41'N 140^0 00E	Tstomu Ishikawa
18.8.96	Yatsu, Narashino-shi, Japan 35^0 41'N 140^0 00E	Tatsuo Tomioka
24.8.96	Akita, Japan 39^0 21'N 140^0 01E	Hitoshi Sasaki et al
27.8.96 to 1.9.96	Takamotsu, Ishikawa, Japan 36^0 45'N 136^0 42E	Yuji Sasahara
1.9.96 (2 birds)	Ichinomiya River, Chiba, Japan 35^0 23'N 140^0 24E	Yasuo Suzuki
30.9.96	South Ballina, NSW	Bo Totterman
7.10.96 (different bird)	South Ballina, NSW	Bo Totterman
6.11.96 (2 birds)	Sandy Point, Shallow Inlet	S. Taylor, J. Wilson and A. Gutowski

Another excellent series of sightings from Japan. This country dominates overseas reports of this species and is clearly an important stopover for Sanderling on both northward and southward migration.

SIGHTINGS OF WADERS LEG-FLAGGED (YELLOW) IN NORTH WEST AUSTRALIA: LIST NUMBER 4 - AUGUST 1997

Clive Minton[1] & Rosalind Jessop[2]
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INTRODUCTION

Since August 1992, most of the waders banded in noth west Australia have had a single yellow plastic leg-flag fitted to their right tibia. Some 22,000 waders have now been marked in this way. The technique has added greatly to the volume of data generated concerning migration routes and stopover sites of these birds.

Three lists of sightings of leg-flagged birds from noth west Australia have already been published (Minton and Jessop 1995a, 1995b, 1996). This report is the fourth.

All birds would have been banded at one of three main locations in north west Australia:
1. Broome (Roebuck Bay) – 18º0'S, 122º22'E
2. Mile Beach (Anna Plains) – 19º15'S, 121º20'E
3. Port Hedland Saltworks – 20º15'S, 118º55'E

It is not possible to determine which as the same colour flag/leg position was used at each.

List of sightings reported in 1996-7
In the following tables, the first column is the date, the second is the location where sighted and the last column is the observer.

Greater Sandplover

1.4.97	Mai Po, Hong Kong (22º29'N,114º19'E)	Geoff Carey & Paul Leader

Yellow-flagged Large Sandplovers are seen in most years at Mai Po. There are no sight records or recoveries further north than this on the coast of mainland China suggesting that Hong Kong may be towards the northern limit of the migration route to and from the breeding grounds.

Eastern Curlew

21.4.96	Kangwha Island, Korea (37º34'N,126 º23'E)	Jeong-Yeon Yi

This is the first report of an Eastern Curlew away from north west Australia.

Terek Sandpiper

27.5.97	Dongjin Estuary, Korea (35º49'N,126º42'E)	Doug Watkins
11.4.97	Mai Po, Hong Kong (22º29'N,114º19'E)	Geoff Carey & Paul Leader
26.4.97	Mai Po, Hong Kong (22º29'N,114º19'E)	Geoff Carey & Paul Leader
28.4.97	Mai Po, Hong Kong (22º29'N,114º19'E)	R. P. Tipper

Judging by the above reports, and previous recoveries/flag sightings, both Hong Kong and Korea are on the main migration route of Terek Sandpipers from north west Australia.

Blacktailed Godwit

22.4.97	Szu-Tsao, Tainan, Taiwan (23º1'N, 120º7'E)	per Taiwan Banding office

There have now been two overseas sightings of Black-tailed Godwits (the other was in Korea) from only 106 yellow leg-flagged birds.

Bartailed Godwit

8.9.96	Asan Bay, Korea (36º54'N, 126º54'E)	Jin-Young Park
20.10.96	Miranda, Firth of Thames, New Zealand (37º10'S, 175º19'E)	David Lawrie *et al.*
9.11.96	Miranda, Firth of Thames, New Zealand (2 birds)(37º10'S, 175º19'E)	Keith Woodley *et al.*
23.4.97	Mai Po, Hong Kong (22º29'N, 114º19'E)	Geoff Carey & Paul Leader
9.5.97	Happy Island, Hebei Province, China (39º0'N, 119º0'E)	Geoff Carey & Paul Leader
23.5.97	Kanghwa Island, Korea (37º35'N, 126º25'E)	Jeong-Yeon Yi
27.4.97	Kanghwa Island, Korea (37º35'N, 126º25'E)	Ki-Seop Lee
6.5.97	Kanghwa Island, Korea (2 birds)(37º35'N, 126º25'E)	Jin-Young Park
24.4.97	Asan Bay, Korea (36º54'N, 126º4'E)	Jin-Young Park
7.5.97	Asan Bay, Korea (2 birds)(36º54'N, 126º4'E)	Jin-Young Park
4.5.97	Cheonsu Bay, Korea (36º37'N, 126º25'E)	Ki-Seop Lee
11.5.97	Cheonsu Bay, Korea (36º37'N, 126º25'E)	Wan-Ho Im
26.4.97	Mankyung Estuary, Korea (35º52'N, 126º43'E)	Jin-Young Park
27.4.97	Mankyung Estuary, Korea (35º52'N, 126º43'E)	Ok-Sik Jung
9.5.97	Dongjin Estuary, Korea (4 birds)(35º49'N, 126º42'E)	Jin-Young Park

This is the best ever collection of flag sightings of Bar-tailed Godwits from north west Australia. The large number of sightings in Korea (considered to be a minimum of 12 individuals) in late April/early May is due to the fantastic efforts of Jin-Young Park and his colleagues. The west coast of Korea appears to be the next major stopover site for Bar-tailed Godwits after they have made their first stop on the central Chinese coast in late March/early April.

The sightings in New Zealand are unusual (there was a previous record in 1993). Recoveries suggest that the Bar-tailed Godwits visiting New Zealand come from breeding areas further east than those occurring in north west Australia and that the birds from the two areas may even be different subspecies.

Red Knot

18.10.96	Mangere, Manukau Harbour, New Zealand (36º57'S, 174º46'E)	R. Clough
9.11.96	Miranda, Firth of Thames, New Zealand (37º10'S, 175º19'E)	S. & J. Rowe *et al*
22.12.96	Miranda, Firth of Thames, New Zealand (37º10'S, 175º19'E)	Tony Habraken

There has only been one previous sighting of a Red Knot from north west Australia in New Zealand. Recoveries and other flag sightings suggest that the north west Australian Red Knot are largely discreet from those occurring in eastern Australia and New Zealand.

Great Knot

15.5.96	Sanbanze Tidal Flat, Funabashi, Chiba, Japan (35º40'N, 139º59'E)	Tatsuo Tomioka
15-22.5.96	Yatsu Tidal Flat, Chiba, Japan (35º40'N, 140º0'E)	Yatsu Nature Observers
2.4.97	Mai Po, Hong Kong (22º29'N, 114º19'E)	Geoff Carey & Paul Leader
17.8.96	Namyang Bay, Korea (2 birds)(37º5'N, 126º45'E)	Jeong-Yeon Yi
24.4.97	Asan Bay, Korea (36º54'N, 126º54'E) (2 birds)	Jin-Young Park

25.4.97	Mankyung Estuary, Korea (35º52'N, 126º43'E)	Jin-Young Park
26.4.97	Mankyung Estuary, Korea (2 birds)(35º52'N, 126º43'E)	Doug Watkins
21.1.97	Peel Inlet, Mandurah, Western Australia	Marcus Singor

Until this present excellent batch of sightings the rate of observation of leg-flagged Great Knot has been disappointingly low. The records in Korea are the first flag sightings of Great Knot there from north west Australia. It would appear that Korea may be the next major stopping off point for birds after their initial Asian landfall on the central Chinese coast.

There was a previous sighting in the same area in Japan in May 1996. Japan appears to be on the eastern fringe of the main northward migration route of Great Knot.

Rednecked Stint

1.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader
23.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader
1.5.97	Imazu Reclamation, Nakatsu, Oita, Japan (33º34'N, 131º16'E)	Hiroshi Tanaka

A smaller number of sightings than in most years. Hong Kong and Japan are very much on the migration route of Red-necked Stints - the former particularly on northward migration and the latter especially on southward migration.

Curlew Sandpiper

12.5.96	Sago, Tsushima Is., Nagasaki, Japan (34º36'N, 129º21'E)	Satoshi Sugihara
8.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader
11.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader
12.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader
13.4.97	Mai Po, Hong Kong (2 birds)(22º29'N, 119º14'E)	Geoff Carey & Paul Leader
23.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader
26.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader
28.4.97	Mai Po, Hong Kong (22º29'N, 119º14'E)	Geoff Carey & Paul Leader

Another excellent series of sightings from Hong Kong. It is interesting that Curlew Sandpipers from north west Australia do not seem to reach Hong Kong as early as those from Victoria! (see "orange flag" list in this this edition of *Stilt*).

Broadbilled Sandpiper

20.4.97 Mai Po, Hong Kong (22º29'N, 114º19'E) Geoff Carey & Paul Leader

Another sighting from Hong Kong. This is the sixth from north west Australia to be seen at Mai Po.

And a tern !!!

Gull-billed Tern

30.12.96	Lake Gregory, W.A.	John Barkla *et al*

This bird would have been marked at Broome in March 1996. The sighting location is 555 km ESE of Broome. The bird was thought to be of the Australian race *macrotarsa* – both the Australian and Asian (*affinis*) races were caught and flagged in March 1996.

ACKNOWLEDGEMENTS

These extremely valuable reports of leg-flagged birds are only possible because of the careful field observations and systematic recording and reporting by observers. Very grateful thanks are due in particular to Geoff Carey and Paul Leader in Hong Kong, Jin-Young Park in Korea, Minoru Kashiwagi and the Japanese Bird Banding Office and a wide variety of observers, and Adrian Riegen and the New Zealand Banding Office and many individual observers.

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NORTH WEST AUSTRALIA WADER EXPEDITION FOR 1998; 1 AUGUST TO 31 OCTOBER.

The next AWSG expedition to study waders and terns in northwest Australia will take place from 1Aug. to 31 Oct. 1998. As usual, time will be divided between three locations: Roebuck Bay at Broome, 80 Mile Beach and Port Hedland Saltworks.

It is hoped to have a team of 20-25 people in the field throughout this thirteen week period. Help is therefore urgently needed and expressions of interest are welcomed. You don't need to be an experienced wader bander or counter already (you might be by the end of your visit!).

More information can be obtained from the expedition leaders

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ABSTRACTS OF THE PARKS VICTORIA HOODED PLOVER SEMINAR SERIES

The first Hooded Plover seminar series was held at the Portsea National Park Office, Mornington National Park, Victoria, on 26 June 1997. Over 70 delegates attended, and they came from as far away as eastern Victoria and South Australia. They represented a cross-section of interest groups, from volunteers to officers of the Department of Natural Resources and Environment (Victoria).

The aims of the day were:
1. To increase participant's level of understanding of the management needs of the Hooded Plover.
2. To provide an opportunity to share information and ideas.
3. To develop a communication network.
4. To establish priorities for the successful management of the Hooded Plover.
5. To develop an Action Plan for the management of Hooded Plovers in Mornington National Park for the next year.

There were four major talks, and a brief synthesis. The abstracts, in order of presentation, are presented below:

Sharing the Beach, how fair is it? Monitoring and Management of the Hooded Plover within the Mornington Peninsula National Park.

Bernice Dowling, Ranger, Parks Victoria, Mornington Peninsula National Park, PO Box 117, Sorrento 3943.

Hooded Plovers *Thinornis rubricollis* inhabit the ocean beaches of the Mornington Peninsula National Park. A ground nesting bird with flightless young, this species relies on the tidal zone of sandy beaches to feed for two months before fledging. With 2.8 million tourist visits to the National Park annually, this study looks at the impact of recreation on the Hooded Plover.

Two methods are used to assess the impact of visitor numbers on Hooded Plovers. Friends of the Hooded Plover survey the ocean beaches every two weeks during the breeding season and once every four or five weeks when the birds form wintering flocks. During the survey, Friends record all species they observe including dogs and people. While surveying, the Friends walk below the high-tide mark to avoid disturbance to beach nests or runners. In addition, nest searches are conducted where the Friends regularly record Hooded Plovers, particularly where single birds are located. Approaching nests is avoided to mimimise disturbance and to prevent foxes following footprints to the eggs. Observations of nests and recording of a plover sitting (incubating eggs) are made from a distance. Searching is done by experienced observers only. After locating the nest, the site is visited regularly and the most obvious nest fate recorded. The combined efforts have provided 4700 records related to adult plovers, 109 records relating to flightless runners and the results of 143 nest attempts.

This presentation summarises the data collection and identifies practices in coastal management that do not adequately protect breeding areas. The presentation also highlights the positive management undertaken by Parks Victoria and the Friends of the Hooded Plover to increase the hatching success and the survival rate of runners.

Monitoring the Hooded Plover on Phillip Island, Victoria.

Bob Baird, c/- Phillip Island Nature Park, PO Box 97, Cowes, Phillip Island, 3922.

Studies of Hooded Plovers on Phillip Island over the past five breeding seasons have shown that breeding success is very low. This presentation covers details on adult Hooded Plover numbers, breeding sites (current and discontinued), breeding success and terrain at nest sites.

An Experiment: Study of Egg Loss in Hooded Plovers on Phillip Island.

Peter Dann, c/- Phillip Island Nature Park, PO Box 97, Cowes, Phillip Island, 3922.
Bob Baird, c/- Phillip Island Nature Park, PO Box 97, Cowes, Phillip Island, 3922.

Studies of Hooded Plovers on Phillip Island in recent years have shown that breeding success is very low, possibly too low to sustain a stable population unless the birds are relatively long-lived or considerable immigration occurs. One contributing factor to the low breeding success is the high rate of egg loss to predation by foxes, dogs and trampling by sheep (51%).

In 1995, we started an experiment to determine if excluding predators and stock from nest sites would improve hatching success and have a corresponding effect on overall breeding success. We tested three types of exclosures and have developed what we believe to be an optimal design for excluding predators and stock as well as permitting access to the birds. A mesh size of 50x65mm appeared most suitable as smaller mesh sizes caused problems for the birds and larger mesh may have allowed limited access to predators.

Eight enclosures have been deployed to date and hatching success has been substantially increased as a result. So far, overall breeding success has not been improved and it will take several more years before we have sufficient data to reach definite conclusions. The management implications of this experiment will be discussed.

Same place, same time..... same Plover? Colour-banding the Hooded Plover in Victoria.

Michael A. Weston, Department of Zoology, University of Melbourne, Parkville, Vic. 3052.

Hooded Plovers *Thinornis rubricollis* face a variety of perceived threats, everything from disturbance by recreationists to rising sea-levels resulting from the Greenhouse Effect. Relatively little is known about the nature and impact of these threats, and the low population levels and possible population decline in the species means that there is an urgent need for research into these problems. One method applied by this study is capture and marking. Over 100 Plovers have been marked in coastal Victoria (about 25% of the State's current population). In particular, this study is characterised by intense follow-up of marked birds, largely thanks to a network of interested groups and governmental agencies. To date about 1,000 sightings of marked birds has been received. This presentation will discuss the methods employed, and the different kinds of data generated by this technique, with an emphasis on movements. Some preliminary results will be presented in the context of population monitoring and coastal management.

The work described in this presentation is only one component of a multi-faceted research project entitled *"The Hooded Plover: Conservation Biology, Habitat and Disturbance"* A brief summary of some of the other components of the project will be given.

Breeding Success of the Hooded Plover in Victoria. A synthesis of results from Mornington National Park, Phillip Island and the Bellarine Peninsula.

Bernice Dowling, Ranger, Parks Victoria, Mornington Peninsula National Park, PO Box 117, Sorrento 3943.
Bob Baird, c/- Phillip Island Nature Park, PO Box 97, Cowes, Phillip Island, 3922.
Michael A. Weston (Speaker), Department of Zoology, University of Melbourne, Parkville 3052.

Monitoring of Hooded Plover *Thinornis rubricollis* breeding success has been conducted at three sites in Victoria: Mornington Peninsula National Park, Phillip Island and on the Bellarine Peninsula. This presentation synthesizes the breeding results from these areas, which represent some of the areas most highly utilised by recreationists in Victoria. The number of nests has been used as a measure of breeding effort. The results are preliminary but suggest considerable variation in reproductive success within and between areas. Overall, the reproductive success was low, and given that the combined areas represent a substantial proportion of Hooded Plover habitat in the State, there is some cause for concern.

After the above presentations, five workshops were held:

1. Communication
2. Monitoring
3. State-wide Management
4. Mornington Peninsula National Park Action Plan
5. Research requirements

The day ended with a well-attended site inspection of Portsea Back Beach. The day was a resounding success, and all participants and speakers deserve thanks. Bernice Dowling, however, is worthy of special mention, because without her substantial efforts the day would not have been the success it was.

REPORT ON POPULATION MONITORING COUNTS, 1996 AND 1997.

Ken Harris, 59 Strickland Drive Wheelers Hill, Vic. 3150 AUSTRALIA

This report continues the AWSG policy of publishing the results of the National Wader Count Project. Counts are conducted by volunteers in Australia in winter and summer each year. Recent papers submitted to *Stilt* have drawn extensively on published count data, and such analysis is to be encouraged. It is also good to see the publication of historical, previously unpublished, count results (e.g. Crawford 1997) as these could provide a basis for examining population change.

This report includes count data for Winter 1996 and Summer 1997 and Winter 1997. Unfortunately the Summer 1997 data for Queensland and Winter 1997 data for several locations were not returned in time for publication. Since Count data is now published annually, the policy will be to publish the information available to avoid penalizing those that return data promptly. The missing data will be published, or the report will be republished, when all information has been returned.

For Summer 1997 the numbers of migratory waders were very low. The low count was consistent across nearly all species indicating a consistently poor 1996 breeding season. The few species which showed an increase over the previous summer count were Ruddy Turnstone, Red-necked Stint and Pacific Golden Plover. The first two of these showed only modest increases, but after declining over a number of years the Pacific Golden Plover numbers rebounded to treble the total obtained in the previous year.

Count Co-ordinators are asked to make a special effort to return count data promptly, particularly after the Winter counts. This will enable us to print the complete data promptly and avoid taking up valuable space with reprints.

Readers are reminded that the last count report contained some erroneous figures, and that these were corrected in Anon. (1997). Thanks are due to the counters who took the time to check the report for accuracy, and to inform us of the errors.

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Result of the Summer 1996 Wader Count	Cairns	Tnsvlle	Mcky	Gldstn	Moretn Bay	Lockyer Valley	Tweed Est	Richmnd Est	Clrnce Est	Hunter Est	Tuggerah Lakes	Parr Est	Botany Bay	Shlhvn Est	Shallow/ CnrInlet	Wstnpt Bay	East PtPhllp
Latham's Snipe												2					18
Black-tailed Godwit		73	12		843					370							
Bar-tailed Godwit	65	135	761	956	11751		485	162		1300	381	238	533		12334	384	
Little Curlew		7															
Whimbrel	3	118	144	393	1440		48	54		69			47		7	38	
Eastern Curlew	8	208	375	409	3500		131	98		135	2	2	307		1723	1085	
Marsh Sandpiper		1	120	9	129		22	2		131		3					13
Common Greenshank	4	45	60	198	408		83	35		100	22	4			249	133	5
Wood Sandpiper																	2
Terek Sandpiper	46	2		184	19		2	79		94			9			7	
Common Sandpiper		5		1			2										3
Grey-tailed Tattler	25	62	18	496	954		55	94		5	1		147			8	
Wandering Tattler																	
Tattler sp.																	
Ruddy Turnstone		2	6	2	161			41		1	8		44		25	83	
Great Knot	45	1913	747	95	1317			18		32					50		
Red Knot		223			268			3		10					2040		
Sanderling		2						51							150		
Red-necked Stint	210	541	227	1581	1511			45		20	1		143		14415	4041	67
Pectoral Sandpiper																	2
Sharp-tailed Sandpiper		65	260	90	482		3	31					44		3	116	1084
Curlew Sandpiper	25		4	21	5229		11	112		2600		150	68		1275	7056	10
Bush Stone-curlew		7															
Beach Stone-curlew		4	1	8													
Pied Oystercatcher		9	269	152	552		3				2		46		985	306	
Sooty Oystercatcher			5	3	1						2		13		302	1	
Black-winged Stilt		16	40	39	154			25		2	22	336	40				120
Banded Stilt																	
Red-necked Avocet					5					68							
Pacific Golden Plover		21		15	191		18	94		42	8		52			33	
Grey Plover		1	90		51										460		
Red-capped Plover		62		59	485			5					13		44	32	14
Double-banded Plover													1		4	19	
Lesser Sand Plover	52	580	56	450	710		2	22		30			2		62	4	
Greater Sand Plover	68	253	10		229			39							3		
Oriental Plover																	
Black-fronted Dotterel		12	2				6					12	2				5
Hooded Plover															5		
Red-kneed Dotterel			1														
Banded Lapwing																	
Masked Lapwing	35	58	26	15	80		10	2			51	22	2		31	217	264
Long-toed Stint																	
Unidentified small																	
Unidentified medium																	
Unidentified large																	
Spotted Redshank																	
Broad-billed Sandpiper	1																
Ruff/Reeve																	
Oriental Pratincole																	
Asiatic Dowitcher																	
Snipe sp.							2										
Total Number	587	4425	3234	5176	30470	0	883	1012	0	5009	500	769	1513	0	34167	13563	1607
Total Species	13	27	22	21	24	0	16	20	0	17	11	9	18	0	20	17	13

Result of the Summer 1996 Wader Count	Altona	Wrrbee Avalon	BllmeP/ Mud Isl	EDerw Pittw	Marion Bay	Cape Portland	NWCst Tas	SECst SA	West EyrePen	StVinc Gulf	Albany	Swan	80 Mile	Broome	Dwin	TOTAL
Latham's Snipe		20	116													156
Black-tailed Godwit		21											13	20		1352
Bar-tailed Godwit		19	221	84	3		350			847	70	13	45400	9687		86179
Little Curlew																7
Whimbrel				5							3		1	27		2397
Eastern Curlew		11	169	110						103	1		44	28		8449
Marsh Sandpiper	72	80	421							59			10	2		1074
Common Greenshank	63	109	229	44	2		50	17		351	70	3	361	201		2846
Wood Sandpiper		3														5
Terek Sandpiper			1										3120	146		3709
Common Sandpiper		1	3								3			5		23
Grey-tailed Tattler			1			2		8			34		2725	790		5425
Wandering Tattler																
Tattler sp.																0
Ruddy Turnstone		4	38			174	1050	655		195	8		139	348		2984
Great Knot			22							50	450		70315	11265		86319
Red Knot		15	110	1			11			450	200		1380	2802		7513
Sanderling							12	501					10			726
Red-necked Stint	1993	7504	5389	2127	106	1262	2500	2069		1039	3398		3233	2422		55844
Pectoral Sandpiper		5														7
Sharp-tailed Sandpiper	344	3002	679				20	454		1540	6			1		8224
Curlew Sandpiper	2627	3329	174	404		51	550	345		1760	2054		4115	2410		34380
Bush Stone-curlew																
Beach Stone-curlew																13
Pied Oystercatcher		37	46	687	64	28	252	20		22	52		4	65		3601
Sooty Oystercatcher				15	3	21	50	1			4			10		431
Black-winged Stilt	157	340	343							160	2	14				1810
Banded Stilt		140	309							7850						8299
Red-necked Avocet		39								350	202					664
Pacific Golden Plover		31	30			68		33			12		4			652
Grey Plover			191				21			157	58	7	108	81		1225
Red-capped Plover	194	67	224					52		1297	341		167			3056
Double-banded Plover				52	8	64	70									218
Lesser Sand Plover			1			2	5			9			780	670		3437
Greater Sand Plover			2								45		6325	1452		8426
Oriental Plover													2622			2622
Black-fronted Dotterel		11	15	12				5								82
Hooded Plover			1	4	11	16	7									44
Red-kneed Dotterel		3	1													5
Banded Lapwing										34						34
Masked Lapwing	144	282	265	596	51	174		85		64						2474
Long-toed Stint																
Unidentified small	160															160
Unidentified medium																
Unidentified large																
Spotted Redshank																0
Broad-billed Sandpiper													2	12		15
Ruff/Reeve																0
Oriental Pratincole													462			462
Asiatic Dowitcher														2		2
Snipe sp.																2
Total Number	5754	15073	9001	4141	248	1862	4948	4245	0	16337	7013	37	141340	32446	0	345360
Total Species	9	23	26	13	8	12	14	13	0	19	20	4	23	22	0	

Result of the Summer 1997 Wader Count	Cairns	Tnsvlle	Mcky	Gldstn	Moretn Bay	Lockyer Valley	Tweed Est	Richmnd Est	Clrnce Est	Hunter Est	Tuggerah Lakes	Parr Est	Botany Bay	Shlhvn Est	Shallow/ CnrInlet	Wstnpt Bay	East PtPhllp
Latham's Snipe																	5
Black-tailed Godwit									212	350					1		
Bar-tailed Godwit								252	642	1850	40	159	393	450	8519	485	
Little Curlew																	
Whimbrel								53	16	96			38		28	36	
Eastern Curlew								99	87	552	1		378	30	1368	678	
Marsh Sandpiper								3	6	180					5		9
Common Greenshank								64	4	160	18	7		12	301	157	9
Wood Sandpiper																	
Terek Sandpiper								70	7	231						14	
Common Sandpiper								1									2
Grey-tailed Tattler								133	64	21	3				10		
Wandering Tattler																	
Tattler sp.																	
Ruddy Turnstone								51	4	2	16				40	74	
Great Knot								35	360+1	15					50		
Red Knot								1		30					1500		
Sanderling								41							80		
Red-necked Stint								88	8	130			20		14044	6240	3
Pectoral Sandpiper																	3
Sharp-tailed Sandpiper								21	63				8		50	89	200
Curlew Sandpiper								88		1800			16		1005	2336	7
Bush Stone-curlew																	
Beach Stone-curlew																	
Pied Oystercatcher								7	6	4	2		54		934	203	
Sooty Oystercatcher								3			2			2	298	3	
Black-winged Stilt								49	2		6	276	39				50
Banded Stilt																	
Red-necked Avocet																	
Pacific Golden Plover								110	216	220	30	7	34	67	25	64	
Grey Plover															231		
Red-capped Plover									8					17	67	74	23
Double-banded Plover															4	2	2
Lesser Sand Plover								22	42						100	9	
Greater Sand Plover								45	26	23					50		
Oriental Plover																	
Black-fronted Dotterel												14					10
Hooded Plover															2		
Red-kneed Dotterel																	
Banded Lapwing																	
Masked Lapwing								16	5		30	40			42	248	163
Long-toed Stint																	
Unidentified small																	
Unidentified medium																	
Unidentified																	
Spotted Redshank																	
Broad-billed Sandpiper																	
Ruff/Reeve																	
Oriental Pratincole																	
Asiatic Dowitcher																	
Snipe sp.																	
Total Number	0	0	0	0	0	0	0	1252	1418	5664	148	503	980	578	28754	10712	486
Total Species	0	0	0	0	0	0	0	22	19	16	10	6	9	6	24	16	13

Result of the Summer 1997 Wader Count	Altona	Wrrbee Avalon	BllmeP/ Mud Isl	EDerw Pittw	Marion Bay	Cape Portland	NWCst Tas	SECst SA	West EyrePen	StVinc Gulf	Albany	Swan	80 Mile	Broome	Dwin	TOTAL
Latham's Snipe			138													143
Black-tailed Godwit		10											7	100	1200	1880
Bar-tailed Godwit	2	15	168	53	3		37	5			80	5	10098	4739	300	28295
Little Curlew																0
Whimbrel			2	4									4	83		360
Eastern Curlew		2	54	90	2		183				1		25	20		3570
Marsh Sandpiper	87	152	111													553
Common Greenshank	122	154	280	73			27	14			78	12	1		2	1495
Wood Sandpiper		3														3
Terek Sandpiper											1		649	229		1201
Common Sandpiper		1	2								1			10		17
Grey-tailed Tattler						3	6	15			33		400	924		1612
Wandering Tattler																
Tattler sp.																0
Ruddy Turnstone		4	7			49	1920	876			3		64	398	10	3518
Great Knot			15								640	28	14034	6118	3000	23935
Red Knot			36				837				225		177	1114	1500	5420
Sanderling							5	160					4		64	354
Red-necked Stint	1637	8706	6962	1333	450	565	7016	2075			3776	526	369	906		54854
Pectoral Sandpiper		1														4
Sharp-tailed Sandpiper	371	4060	911	8		9	12	1468			11	3				7284
Curlew Sandpiper	1598	2351	1029	320		10	2311	443			478	22	253	321		14388
Bush Stone-curlew																
Beach Stone-curlew															2	2
Pied Oystercatcher		43	74	636	35	40	1430	10			82	20	10	34		3624
Sooty Oystercatcher		1		5		22	383	5			12			17		753
Black-winged Stilt	237	296	303								43	29				1330
Banded Stilt	24	144	7								62					237
Red-necked Avocet		20									519					539
Pacific Golden Plover	42	48	10	49		71	109	118			41					1261
Grey Plover			16				12				145	68	87	60	1	620
Red-capped Plover	28	61	283	117	2	33	163	11			349	84	5			1325
Double-banded Plover	5	11	4			1	154									183
Lesser Sand Plover			26			2	8						61	52		322
Greater Sand Plover			5								100		2718	1060	7	4034
Oriental Plover																0
Black-fronted Dotterel		10	26					3								63
Hooded Plover				4	10	3	37									56
Red-kneed Dotterel																0
Banded Lapwing				2		52	13									67
Masked Lapwing	59	214	533	514		54	26	75								2019
Long-toed Stint																
Unidentified small							220						270	200		690
Unidentified medium																
Unidentified													9000			
Spotted Redshank																0
Broad-billed Sandpiper														7		7
Ruff/Reeve																0
Oriental Pratincole																0
Asiatic Dowitcher														12		12
Snipe sp.																0
Total Number	4212	16307	11002	3208	502	914	14909	5278	0	0	6680	797	38236	16404	6086	175030
Total Species	12	22	24	14	6	14	21	14	0	0	21	10	20	20	10	

HAMLYN PHOTOGRAPHIC GUIDE TO THE WADERS OF THE WORLD
by David Rosair and David Cottridge
1995 Hamlyn (Reed Consumer Books Ltd), London. Pp 175, over 700 colour photographs, no maps, price $75. 22.5x28.75 cm

Hamyln's latest offering in the way of photographic identification guides deals with a group notorious for its identification challenges. The book presents photographs and descriptions of 212 species of waders. Here, we will focus on the content of the book relevant to Australasian users.

Unfortunately, the taxonomy does not follow the latest RAOU checklist, which can be forgiven because both were published in 1995. Importantly, the Plains-wanderer and the Sheathbills have not been forgotten. Waders thought to be extinct are understandably excluded. The exclusion of Cox's Sandpiper (on the basis that it is currently thought to be a hybrid) is a little disappointing to the to the Australian waderologist who, by at least by global standards, has a better chance of seeing one than she/he has of seeing a Dunlin. Surely, it must present an identification challenge?

The text is unreferenced and general, but on the whole it is accurate. It provides details of plumage and a brief summary of habitat, behaviour and movements, and is conveniently located on the page opposite the relevant photographs. The lack of distribution maps is compensated for by a description of the range in the text. While the text is adequate for general identification, complex identification problems (e.g. separation of Red-necked and Little Stints in non-breeding plumages) are glossed over because of a lack of space. To take but that example, there is considerable overlap in the colour and pattern of upperparts feathering in non-breeding plumages and yet this is not mentioned. Instead, other rather spurious characters for separating these species in non-breeding plumage are given and the whole matter is oversimplified. Similar points could be made about the separation of adults in breeding plumage and of juveniles for this and other 'tricky' pairs of *Calidris* waders. For such detailed identification matters, readers would be well advised to refer to specialist identification papers and other more detailed identification books e.g. Dennis Paulson's excellent *Shorebirds of the Pacific Northwest* or even good ol' *Shorebirds* (Hayman *et al*.).

Fortunately, there are no misidentifications to species in the book, a problem which has plagued other Australian photographic books. Nevertheless, the photo captions leave a little to be desired. There are a few errors in labelling e.g. the transposition of breeding/non-breeding plumage for Curlew Sandpiper. But of more concern is a rather inconsistent application of ageing, plumage and sexing classifications. Some sexually dimorphic species are sexed (e.g. Shore Plover) while others are not (e.g. Wrybill). The plumage terms are often rather sloppily applied; the White-rumped Sandpiper and the Red-necked Stint that are labelled as being in juvenile plumage are in fact moulting into first immature non-breeding (=first basic or first-winter) plumage. Indeed, there are some errors in plumage assignment e.g. the Red-necked Stint labelled "moult" is in fresh summer plumage. Racial identity would be useful in at least some cases (e.g. Redshank). Other reviews of the book have expressed dismay at the absence of date and locality data for the photographs, and we agree.

The choice of photographs is generally excellent, only the odd image is of lower quality or dubious value. Curious choices include the Curlew Sandpiper with an unusually straight bill, and the Oriental Plover with an aberrant bill. Some photographs, although aesthetic, have limited identification value. An example of this is the American Golden Plover, where none of the photographs show the crucial character, the rear end structure, which separates the species from Pacific Golden Plover. Instead the photographs show a bird moulting, another with a wing drooped, and two photographs with the tail markedly foreshortened.

The highlight is undoubtedly the impressive collection of photographs. The quality of the photographs is second to none, just consider the difficulties encountered with photographing the cryptic Snipe or the elusive Painted Snipe. Although its size effectively precludes its use on the field, it is a worthy addition to the library of waderphiles, or anyone who appreciates good bird photographs.

David Eades and Michael Weston
Birds Australia National Office, 415 Riversdale Rd, East Hawthorn, Vic., 3123.

[MIKE - IS THE FOLLOWING TABLE PLACED IN THE RIGHT SPOT, IT DID NOT HAVE A HEADING AND DOES NOT APPEAR TO BE REFERED TO IN THE TEXT - ANDREW]

Page no.	Species	Labelled	Correction
68D			D
68E		Adult	Adult breeding
71	NZ Dotteral	Ad non-breeding & breeding	Photos F & G transposed
73C	Great Ringed Plover	Ad non-breeding	has blackish frontal band and breast-band so poss. moulting to breeding? [CHECK]
73E	Great Ringed Plover	Adult	Adult breeding
73L	Little Ringed Plover	Adult	Adult breeding
81E	Kentish Plover	Juv	in non-breeding, ?Ad
91E	Shore Plover [CHECK]	Ad	Ad breeding female [CHECK]
91F, H	Wrybill	Ad breeding	Sex not indicated [CHECK; ?GIVE]
96J	Oriental Plover		Has abberant bill
99K	Bar-tailed Godwit	aDS	Adult male & female [CHECK]
107J	Whimbrel	Ad *variegatus*	jUV [check]
109A	Eastern Curlew	Ad non-breeding	Ad breeding [CHECK]
111H-K	Common Redshank	Ad breeding [CHECK]	Race not indicated [?GIVE IT]
113C	Marsh Sandpiper	Juv	1st imm. non-breeding
113D	Marsh Sandpiper	Unaged	Ad breeding
117K	Wood Sandpiper	Unaged	Ad breeding
121D	Grey-tailed Tattler	Ad	Ad breeding
121H	Wandering Tattler	Ad	Ad breeding
123E	Ruddy Turnstone	Juv	Ad non-breeding [CHECK]
125A	Wilson's Phalarope	Juv	moulting to 1st imm. non-breeding
125B	Wilson's Phalarope	Ad breeding male	1st imm. non-breeding, sex?
125J	Grey Phalarope	1st imm. non-breeding	juv moulting to 1st imm. non-breeding
145D	Lesser Knot	Unaged	Ad breeding
146D	Little Stint	Adult	Ad breding
146I	Red-necked Stint	Unaged, moult [CHECK]	Ad breeding, fresh plumahe
146J	Red-necked Stint	Ad non-breeding	Juv nearly finished moult to 1st imm. non-breeding
152F	White-rumped Sandpiper	Ad non-breeding	Ad non-breeding still with a few ad breeding scapulars [CHECK]
152G	White-rumped Sandpiper	Adult moult	Ad moulting to non-breeding
152H	White-rumped Sandpiper	Juv	JUv starting moult to 1st imm. non-breeding
154C	Pectoral Sandpiper	Unaged	Ad non-breeding
154G	Sharp-tailed Sandpiper	Ad breeding	Juv in fresh plumage
157C &D	Curlew Sandpiper	Ad non-breeding & breeding	Transposed: C=Ad br, D=Ad non-br
157E	Curlew Sandpiper	1st-winter non-breeding	Juvenile
161H	Dunlin	1st-winter non-breeding	Juv nearly finished moult to 1st imm. non-breeding
161J	Dunlin	Juv	Juv moulting to 1st imm. non-breeding
161L	Dunlin	Unaged	Juv moulting to 1st imm. non-breeding
163D	Sanderling	Unaged	Ad non-breeding
163K	Stilt Sandpiper	Unaged	Ad breeding
165 [CHECK]	Buff-breasted Sandpiper	Ad	Ad non-breeding [CHECK]
165I	Ruff	Ad non-breeding, ?sex	Ad breeding female [CHECK]

BIRD SPECIES INDEX

The Stilt: Nos.25-30

Compiled by Hugo Phillipps

PLEASE NOTE: The use of this index for finding references to particular birds in *The Stilt* should be straightforward. Issue numbers are in bold with the relevant page numbers following. References are only to species, not to higher taxa or subspecies. Species are listed alphabetically under both the scientific binomial and the common substantive name. A page reference means that the bird is mentioned on that page, possibly more than once. Names of all Australian birds follow the conventions of RAOU Monograph 2, *The Taxonomy and Species of Birds of Australia and its Territories*, (Christidis & Boles, 1994). The scientific and vernacular names of other (non-Australian) species largely follow *Shorebirds: an identification guide to the waders of the world* (Hayman, Marchant & Prater, 1986). It is a comprehensive index; all obvious and identifiable mentions of species are listed, including trivial ones, but excluding mentions in the previous index. All comments and corrections should be directed to the Compiler.

AUTHOR INDEX

The Stilt**:** Nos.25-30

Compiled by Hugo Phillipps

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Indexes:

Author and species indexes have been published within *The Stilt* to volume 24.

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

ADVICE TO CONTRIBUTORS

The Stilt publishes original papers, technical notes, reports and short communications on the waders ("shorebirds") of the East Asian/Australasian Flyway and relevant Pacific regions. The Editor welcomes any inquiries or questions from potential contributors.

Matters relating to format, style, nomenclature and taxonomy are discussed on the inside back cover of volume 28. Information about the submission procedure are set out on the back cover of volume 29. **The Editor advises all potential contributors to read the *Advice to Contributors* carefully**. Any questions relating to these issues are welcomed, and should be directed to the Editor.

CHECKLIST FOR POTENTIAL CONTRIBUTORS

A number of common problems and errors are made by many contributors, and this section aims to reduce the frequency of these problems. Many regular contributors perpetuate these errors in every contribution they make, and this wastes a large amount of time that the Editorial Team could spend productively on other matters. Before submission contributors must check:

1. that they have read the *Advice to Contributors* (volume 30) and have conformed to all matters of style and format. It is suggested that they also check the style and format in this volume.
2. that they understand and follow the Submission Procedure (volume 29).

More specifically, contributors should ensure:

1. that all Tables and Figures have headings and are referred to in the running text.
2. that all references in the running text are in the reference list and *vice-versa*.
3. that all references are complete, and that every dot and comma is in the correct place.
4. that they do not create their own standard references.
5. that they do not adopt their own matters of style or format.
6. that they use the Latin name for the first mention of a species, excluding the Abstract section where Latin is not used.
7. that the common and Latin names are current (as set out in Christidis & Boles, see *Advice to Contributors* in volume 28).
8. that matters of style and format, marked on the draft returned to the contributor, are incorporated. These changes are not negotiable whereas most other editorial comments are open for discussion.

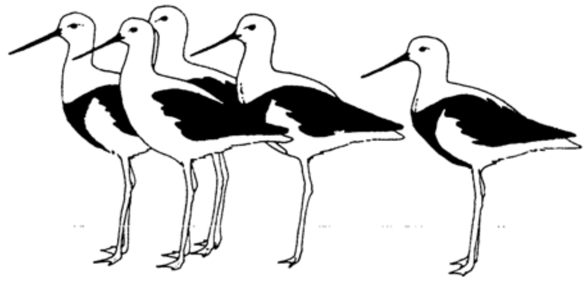
Failure to incorporate these considerations into contributions, especially when they are marked on the first draft but not incorporated into the final draft, will result in delays in publication as the Editorial Team will have to make these corrections. This is especially the case when poor referencing means that the Editor has to refer to the original references to find missing page numbers, titles, publishers, years etc. Unfortunately, contributions that cannot be made on computer disk might also encounter some delays as typing needs to be organised. Either way the Editor will do his best to get material published quickly, and the cooperation of contributors is appreciated. Contributors should note that only the final version of any article should be submitted. Major changes to papers are not acceptable after reviewers and Editors comments have been satisfactorily incorporated.

Computer Formats

We operate Word for Windows (Version 6) and any material submitted on disk must be compatible with this system. If you do not use Word for Windows or Wordperfect please save your files in either of those formats. If your wordprocessor does not allow this, please specify which wordprocessor you use and save a copy of your files as ASCII or text.

Deadlines:

The closing dates for submission of material have been revised. They are 10 February and 10 August 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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