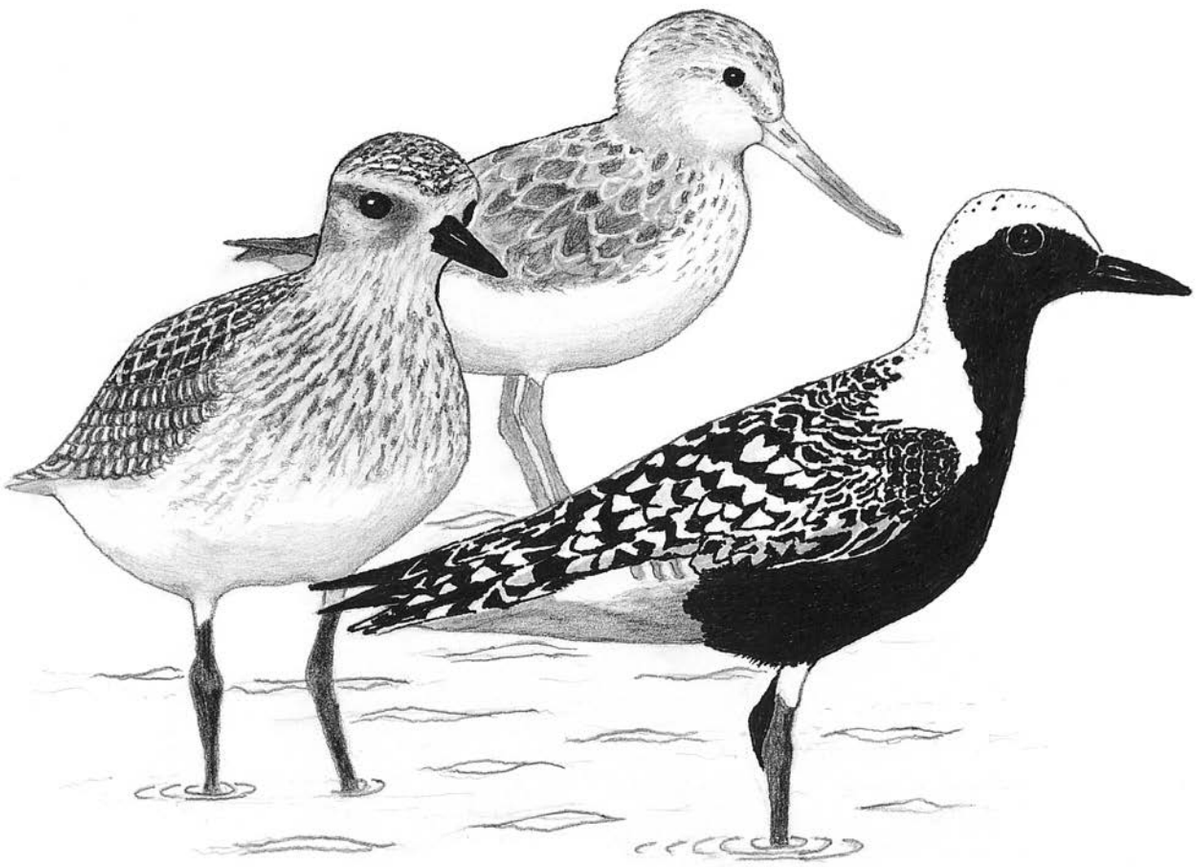
Stilt

The Journal for the East Asian-Australasian Flyway



AWSG
Australasian Wader Studies Group

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Stilt

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MISSION STATEMENT

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

OBJECTIVES

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

MEMBERSHIP OF THE AUSTRALASIAN WADER STUDIES GROUP

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

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

EDITORIAL

It is with great pleasure and some trepidation that I accept the baton from Rosalind Jessop and commence my term as the next editor of *Stilt*. I would like to thank Roz for her efforts over the past three years. I have found it immensely interesting to read through the editorials from previous issues. It is clear from these that *Stilt* has progressed enormously in breadth of content and quality during the 30-odd years of its existence. In reading through these I have come to appreciate the incredible efforts of the previous editors (and contributors) and I feel it is fitting to acknowledge those editors here: Peter Curry (issues 1-4), Peter Dann (issues 5-8), Eric Woehler (issues 9-13), David Thomas (issue 14), Jeff Campbell (issues 15-27), Mike Weston (issues 28-31), David Milton (issues 32-44), Ken Rogers (issues 45-50) and Rosalind Jessop (issues 51/52-58). Through their hard work and expertise, they have taken the journal from strength to strength since its inception in Spring 1981. As a result, *Stilt* has become one of the most important tools for disseminating wader research across the East Asian-Australasian Flyway.

This year, 2011, is the International Year of Biodiversity. There is some irony in this label given that waders are experiencing unprecedented declines across the flyway. Loss of intertidal habitat is thought to the be greatest threat to migratory waders. Monitoring of important staging sites in the Yellow Sea coupled with monitoring in Australia has revealed large-scale declines in species like Red Knot and Great Knot as a result of reclamation projects. It is important now, more than ever, that *Stilt* continue its publication of wader research from all parts of the flyway, in order to inform policy decisions for the management of wader habitat and populations. In this vein, you will see a call for donations toward the plight of the Spoon-billed Sandpiper. I encourage readers to dig deep and contribute toward this desperate cause.

Stilt 59 has received more submissions for publication than can be accommodated in the issue. Thus, a number of manuscripts have been held over until the next issue. This bodes well for future issues as it indicates increasing readership and importance of wader research. However, it also indicates that future submissions prior to an upcoming issue may not necessarily get published in that issue. Furthermore, I intend to make full use of the peer-review process for all original research meaning that there may be longer waiting times for publication than has been standard in the past. Contributors should view this as a positive step toward increasing the impact of their research and the overall quality of *Stilt*.

The next issue of *Stilt* will have instructions to authors included. These are partly a re-instatement of instructions that were published in issues 33-38 and prior to that as "Advice to Contributors" in issues 29-32. The new instructions will be more comprehensive than earlier versions. Contributors intending to submit manuscripts are encouraged to read these instructions carefully and follow the guidelines therein, to help reduce editing time and email exchange relating to formatting and content errors. Instructions to authors will be made available on the website in the near future.

Finally, I would like to thank all the authors whose contributions have made *Stilt* 59 an interesting start to the 2011 wader year. There are several positive contributions on waders in Indonesia; two separate papers indicating a potential changes in status of Black-winged Stilt and Spotted Redshank, one revealing an important stopover site on southward migration for Red Knot and one providing improved information on wintering populations in southern Sumatra. The achievements to date of shorebird banding at an important shorebird research site, Chongming Dongtan, is provided by Chendong Tang and colleagues. Graeme Fulton gives a helpful overview of the new checklist to Birds of Korea. And closer to home, Clive Minton and colleagues provide a comprehensive update on the results obtained through wader banding and flagging activities here in Australia. I hope you enjoy this, the first issue of 2011 and I welcome feedback from readers on any aspect of *Stilt*.

Birgita Hansen

NEWS FROM THE CHAIR

The last year has been one of consolidation and steady progress by AWSG in the face of continuing habitat loss in east Asian staging areas and a new minority Australian government that is not prepared to recognise or admit that populations of the majority of waders in the Flyway are declining. Federal funding to wader-related projects and international forums have declined substantially since the change of government in 2007. This has been reflected in a dramatic reduction in the level of funding AWSG has received for on-going activities. The same situation is occurring more broadly as the government has changed its conservation priorities away from areas such as threatened species to focus on broader habitat concerns. Both Birds Australia (BA) and AWSG have been trying to develop new ways to broaden the funding base for projects. There has been some success, with AWSG being awarded two grants from Woodside to fund research in North-West Australia. AWSG will also be involved in an Australian Research Council-funded project to examine Flyway-wide trends in abundance of waders and the extent of their habitats. This project is led by Drs Richard Fuller, Howard Wilson and Hugh Possingham from the University of Queensland and will run for three years. The long term AWSG count data will be important in this assessment and we hope that our extensive banding database can also be analysed within the project for trends in wader survival.

Elsewhere in the Flyway, the news continues to be bleak. The plight of wader habitats at critical staging sites continues to worsen. In the last year, the results of studies involving AWSG members, Chris Hassel, Adrian Boyle and Danny Rogers have been published reporting their findings of new threats to Red Knot from port developments in Bohai Bay, eastern China. This knowledge is important, but how to influence the regional Chinese administration to protect the remaining intertidal habitat is unclear and extremely difficult for a foreign NGO such as AWSG. Our best option in the short-term will be to put pressure on the Australian government to take a more active role in lobbying the appropriate Chinese government departments. Even this will

be a slow process and probably beyond the time that the intertidal habitats in Bohai Bay have left.

The last year has seen several changes to the roles within the AWSG committee, including Ken Gosbell standing down as chair after four years of hard work. I would like to thank Ken on behalf of members for his tireless efforts, both locally and internationally to raise awareness of the plight of wader populations in our flyway. Along the way, Ken has increased the profile of AWSG as a respected NGO with a broad range of technical skills that can be applied to wader and habitat conservation. Ken will continue on in his role as chair of the Shorebird Working Group within the East Asian-Australasian Flyway Partnership. This is an important regional forum and the outcomes from the recent meeting in Cambodia suggest that the Partnership is finally starting to develop new projects and collaborations that will contribute to effective wader conservation.

After 10 months as chair, I am still coming to grips with the machinations and processes of dealing with the BA administration. As a special interest group of Birds Australia, AWSG keep all our funds within the BA accounts. Birds Australia are the incorporated body that takes responsibility for all contracts or grants awarded to AWSG. AWSG are probably the most active special interest group under the BA umbrella and we have several contracts with the federal and state governments as well as mining companies. Our treasurer, Brian Speechley, is constantly frustrated with the slow service we receive from BA when raising invoices or making payments. Some creditors have to wait months for payment, including volunteers seeking reimbursement of costs for field work. After five years as treasurer, Brian has succumbed to his frustration and will stand down as treasurer. So we are looking for a member who can use spreadsheets who would be willing to take over from Brian. Please contact me for more information. The role is not very time-consuming and only requires basic numeracy skills and being well-organised.

Other changes that have occurred in the last 10 months have included Ann Lindsey stepping down as Conservation Officer and Dr Joan Dawes taking over the reins. Ann has worked hard for the last six years in her role advocating for improved conservation and preservation of wader habitats in Australia and elsewhere in the Flyway. The conservation officer is constantly faced with the depressing evidence of the low value Australian society place on our natural environment. Our economic system requires increasing consumption of natural resources to maintain or improve our standards of living. This inevitably leads to a conflict between the needs of people and the environment, especially as the human population increases. Ann has done an excellent job of juggling her time between lobbying against pressing local and national developments. She has now decided to focus her energies in the Hunter River region where the most important populations of waders in NSW hold on in the face of ever-expanding port development. We welcome Joan, who is a recently retired professional scientist and previously our NSW conservation officer. Joan has a great understanding of governments and their processes that I hope will translate into improved influence in development decision-making.

You will notice that there have been changes at the top in our journal, *Stilt*. The editor of *Stilt*, Roz Jessop, has resigned and Dr Birgita Hansen has agreed to take over. This issue is the first under Birgita's editorship. I know she has many good ideas to help raise the profile of *Stilt* in the scientific community (see her editorial below). Small journals all over the world, such as *Stilt,* struggle to survive in the face of increased competition from higher profile commercial journals. Competition for scientific manuscripts is fierce and professional scientists are pressured to submit their science to journals with the widest readership. How *Stilt* fits into this mixture has evolved over time. It has led to *Stilt* being recognised nationally as a legitimate scientific journal. This has raised its impact and helped attract new submissions as its readership broadens. Access to issues of *Stilt* on the AWSG website has also contributed greatly to broaden the readership. Papers in *Stilt* are becoming increasingly cited in the mainstream scientific literature. This can only improve the standing and influence AWSG is having within the science community and more broadly.

Any volunteer-based organisation can only be effective through the efforts of its members. I encourage all members to step up and become more involved in the Group. Already, many members contribute to the success of the Group. However, the majority of the work usually falls on the same small group – usually the committee. There are plenty of opportunities to become involved, such as joining our popular NW Australia expeditions, helping improve public education and knowledge of waders and their habitats, writing letters and lobbying governments or helping with data entry and correspondence. People with more advanced skills can immerse themselves in any number of aspects of wader ecology by analysing subsets of the mountain of data AWSG has collected since the late 1970s. Please consider contacting me to give a hand. The results can be very rewarding and usually fun!

David Milton
Chair

TREASURER'S REPORT FOR 2010

Total payments exceeded receipts by $24,554 during 2010, however this included an excess of contracted expenditure over contract income of $25,353 due to contracts in progress at the start of the year.The non-contract surplus was $799 for the year.

The balance of $46,277 carried forward at 31st December 2010 includes commitments for future expenditure on contracts of $8,288. General (non-contract) accumulated funds were $37,989 at year-end.

Membership Statistics for 2010:

The membership at the end of the year was:	**2010**	**2009**
Australia/New Zealand	235	228
Overseas (excl. NZ)	28	27
Institutions	14	15
Complimentary	56	58
Total	**333**	**328**

This summary of receipts and payments for the past year is not an audited statement. It has been prepared for the information of AWSG members from records of transactions provided by Birds Australia which relate to the Australasian Wader Studies Group.

The AWSG is a Special Interest Group of Birds Australia and members who wish to see the audited accounts of Birds Australia should refer to the Concise Financial Report included in the Birds Australia Annual Report 2010.

Brian Speechley
Treasurer

Australasian Wader Studies Group
Receipts and Payments
1 January 2010 - 31 December 2010

RECEIPTS			PAYMENTS		
Item	**2010 $**	**2009 $**	**Item**	**2010 $**	**2009 $**
Balance brought forward	70,830.77	82,322.59	Stationery/Printing	3,077.33	4,406.94
			Advertising & promotion	0.00	1,512.00
Subscriptions	7,996.01	8,436.37	Postage/Courier	751.59	2,043.29
Contracts - Federal Govt.	0.00	17,727.27	Consultants/Contracts	37,889.77	40,430.39
Contracts - State Govts.	8,000.00	8,181.82	Field expenses	1,869.73	2,250.00
Contracts - Other	15,000.00	22,500.00	Conferences/Meetings	414.48	3,247.45
Sales	-120.00	0.00	Phone/Fax	190.00	51.82
Conferences	0.00	0.00	Equipment (consumable)	0.00	0.00
Grants and Donations	1,210.00	1,467.00	Travel & accommodation	11,446.97	14,362.39
			Admin fee (BA)	1,000.00	1,500.00
			Depreciation	0.00	0.00
Total income	32,086.01	58,312.46	Total expenses	56,639.87	69,804.28
			Balance carried forward	**46,276.91**	**70,830.77**
	102,916.78	**140,635.05**		**102,916.78**	**140,635.05**

A CALL TO HELP SAVE THE ENIGMATIC SPOON-BILLED SANDPIPER

The Spoon-billed Sandpiper *Eurynorhynchus pygmeus* is one of the world's strangest looking birds and certainly the most unusual wader. The species is listed by IUCN as Critically Endangered on the basis of an extremely small population, estimated at 120-200 hundred pairs, and due to an annual decline of 27%. This means that it is at an extremely high risk of extinction in the next few years. Hunting and habitat loss on the non-breeding grounds, combined with the loss of important intertidal feeding areas during its migration, have all contributed to this precipitous decline.

At the last East Asian-Australasian Flyway Partnership Meeting in December 2010, a report on the International Action Plan for the Spoon-billed Sandpiper was delivered on behalf of BirdLife International and the Convention for the Conservation of Migratory Species (CMS). Along with actions related to habitat protection, site management, awareness raising and education particularly in the non-breeding grounds, the possibility of a establishing a captive breeding program was explored. The Wildfowl and Wetlands Trust (WWT) in conjunction with RSPB, BTO, Birdlife International and Birds Russia have now embarked on an ambitious breeding program. This will entail extensive field operations in Chukotka, Russia, in the forthcoming summer of 2011. Ongoing husbandry will be carried out through WWT facilities in the United Kingdom. The cost of this program is very high and, while it is being funded in the short term by RSPB and WWT, the EAAF Partnership has invited Partners to provide financial assistance to enable ongoing support and the success of this program.

Although this species is not one that we see in Australasia it is, nevertheless, the most iconic wader species in our flyway. Its current critical conservation situation should be of concern to every shorebird lover wherever they live. Moreover, the problems faced by this species are common to many of the shorebirds that migrate through our flyway. In many ways this is a flagship species that is demonstrating to the world the significant issues that are faced by these long distance migrants.

As a key member of the Partnership, the AWSG wishes to provide support to this program, and the broader conservation of this species by protecting critical habitat and addressing the threats of hunting, identified as the main causes of decline. The AWSG invites members to provide financial assistance toward these critically urgent conservation actions.

Donations may be made by cheque, payable to Birds Australia and forwarded to Suite 2-05, 60 Leicester Street, Carlton, Victoria 3053, Australia or by credit card by phone 1300 730 075 or +61 3 9347 0757 or by returning the form on the next page (please **do not** make your donation online at the Birds Australia website). Please specify the Spoon-billed Sandpiper fund when making your donation.

Line drawing on next page courtesy of E. Koblik.

Photo courtesy of Pavel Tomkovich.

Mr/Mrs/Ms/Miss/Dr _____

Address _____

_____ Postcode ____

Phone (H) _____ (W) _____

Email _____

I would like to make a donation of:

|__| $30 |__| $ 50 |__| $100 |__| $250 other $ |_____|

I enclose a cheque/money order payable to Birds Australia, or

Please debit my: |__| Visa |__| MasterCard

(We cannot accept Amex or Diners Club cards)

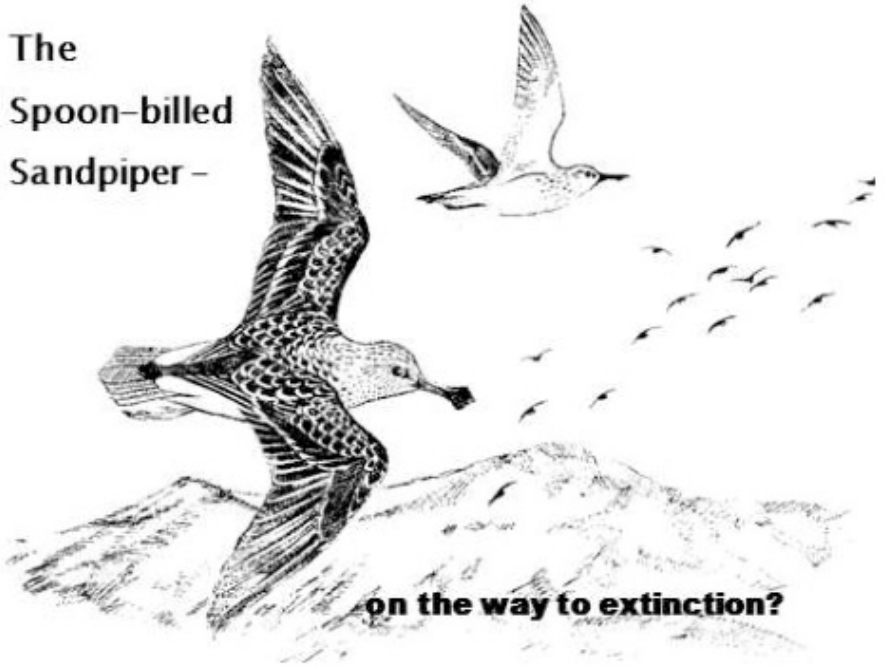
Card number: __ __ __ __ / __ __ __ __/ __ __ __ __/ __ __ __ __

Expiry date: _____ / _____

Cardholder name: _____

Signature: _____

Donations over $2 are tax-deductible, a receipt will be forwarded.



THE MIGRATION OF EASTERN CURLEW *NUMENIUS MADAGASCARIENSIS* TO AND FROM AUSTRALIA

CLIVE MINTON[1], ROSALIND JESSOP[2], PETER COLLINS[3] AND ROGER STANDEN[4]

[1]*165 Dalgetty Road, Beaumaris, Victoria 3193, Australia.*
Email: mintons@ozemail.com.au
[2]*Phillip Island Nature Park, PO Box 97, Cowes, Victoria 3922, Australia*
[3]*214 Doveton Crescent Soldiers Hill, Victoria 3350, Australia*
[4]*11 Hamlet Street, Bendigo, Victoria 3550, Australia*

The migration of Eastern Curlew *Numenius madagascariensis* is described on the basis of an analysis of 13 banding recoveries and 143 leg flag sightings obtained from 1,311 birds caught in Australia during the last 35 years. Migration from Australia to the breeding grounds in Siberia is on a narrow front with the principal staging areas being in Taiwan, in the northern Chinese and South Korean parts of the Yellow Sea and in southern Japan. The first birds reach these areas in the second week of March after a direct flight from Australia or with only brief stopovers on the way. Recoveries in the breeding area occur from early May. The return migration appears also to contain a long trans-oceanic flight, from the Asian mainland to the northern coasts of Australia, with adult birds mainly arriving back in their non-breeding areas from late July to mid-September. It is recommended that further telemetry studies be undertaken to facilitate a fuller understanding of the migration of Eastern Curlew.

INTRODUCTION

The Eastern Curlew *Numenius madagascariensis* is the largest of the 214 species of waders in the world. It is one of 35 species of long distance migrants which breed in the Northern Hemisphere, from Japan and China northwards to the arctic regions of Siberia and Alaska, and regularly spend the non-breeding season in Australia.

Eastern Curlew breed in northeast China, south-eastern Siberia and the Kamchatka Peninsula (Higgins and Davies 1996, P. Tomkovich personal communication; see Figure 1). Eggs are normally laid in May, probably early May in north-east China/south east Siberia (Ueta and Antonov 2000) and late May in Kamchatka (Gerasimov *et al*. 1997). Young hatch in late May and June and fledge from mid-June onwards. Failed breeders are thus potentially able to assemble for the return southward migration in June. Birds migrate through east Asia on both northward and southward migrations with the majority of the estimated East Asian - Australasian flyway population spending the non-breeding season in Australia (Watkins 1993).

The total population of Eastern Curlew was estimated by Watkins (1993) at 21,000 but a recent revision has increased this to 38,000, with 28,000 of these being in Australia (Bamford *et al*. 2008). The distribution within Australia is widespread with the largest concentrations (over 1,000) being reported by Bamford *et al*. (2008) at Hervey Bay and Moreton Bay (Queensland), Corner Inlet and Western Port (Victoria) and Roebuck Bay (north-west Western Australia). Although a recent paper, Bamford *et al*. (2008) mainly utilises data from the 1990s. More recent data suggests a decline in Eastern Curlew population of up to 40% from those numbers reported there (Gosbell and Clemens 2006, Reid and Park 2003, Rogers *et al*. 2008, and Queensland Wader Study Group unpublished data). To illustrate this decline, Corner Inlet averaged 1,246 for 1982–2009, but the 2005–2010 average is only 821 (Shorebird 2020 unpublished data). This highlights the need to better understand the migration patterns of this bird.

No comprehensive analysis of Eastern Curlew migration has been published. Only four banding recoveries were available to Higgins and Davies (1996). Three recent papers have covered specific aspects of Eastern Curlew movements. An analysis of Australasian Wader Studies Group (AWSG) count data by Wilson (2000) showed that there is significant northward movement within Australia of birds, presumably immatures, which remain in Australia during the austral winter. Driscoll and Ueta (2002) detailed the results of a three-year program in which satellite transmitters were attached to adult Eastern Curlew prior to their northward migration. Although few of the birds were tracked to the breeding grounds the migration path through Asia was outlined and the long non-stop flight capability of some birds was demonstrated. Ueta *et al*. (2002) reported on aspects of southward migration based on the results from satellite transmitters placed on 12 adult Eastern Curlew in two different breeding areas in south-eastern and eastern Siberia. Birds from both locations headed to the Yellow Sea after leaving the breeding areas. However only two transmitters functioned long enough to track birds to the Southern Hemisphere.

Improved catching techniques (well camouflaged cannon nets) and colour leg flagging of Eastern Curlew mean that there are now sufficient additional recoveries and flag sightings to re-examine the migratory movements of this species. This is the main objective of this paper. Knowledge of migration paths and key stopover areas is necessary for assessing likely impacts of habitat changes in the Flyway and for determining conservation needs.

METHODS

All birds were cannon-netted at day-time high tide roosts. Biometric and wing moult details were collected and recorded in the standard manner (Minton and Serra 2001). Since 1991, nearly all birds have had a darvic leg-flag placed on the right tibia: orange flags on birds banded in Victoria, green flags on birds banded in south-eastern Queensland,

Figure 1. Eastern Curlew breeding region (after Bamford *et al.* 2008).

and yellow flags on birds banded in north-western Australia. From 1993 onwards, an additional leg flag has been placed on the left tibia of birds caught in Victoria and north-west Australia to make a flagged bird more obvious.

Birds were aged using plumage criteria and primary moult data (Hayman *et al*. 1986, Barter 1990, Higgins and Davies 1996, Victorian Wader Study Group [VWSG] unpublished data). Juvenile birds and those in their first year could be identified with near certainty but other immature birds in their second and third years were not always separable from adults. The attempt to refine ageing characters has been restricted by small numbers of first year birds captured and subsequently retrapped, meaning that we seldom had the opportunity to examine known-age immatures. Also the age at which birds first return north to their breeding grounds, and therefore become part of the migrating population, is still uncertain. Count and austral winter recapture data suggests that full northward migration may not occur until the birds are at least four years old (VWSG unpublished data; Rogers *et al* 2006a).

Banding recoveries and flag sightings are subject to various known but unquantifiable biases and these need to be recognised when using such data to delineate migration routes and stopover locations. The distribution of the human population throughout areas visited by marked birds is a key factor. So also are the activities of that population. For example recoveries are more likely to occur in locations where hunters operate or other banders are active. Flag

sightings are strongly dependent on the distribution of bird watchers or other ornithological fieldworkers.

The definitions of terms used in this paper are:

a) Recovery. The report of a bird away from its banding location where the metal band number is known and therefore the individual bird can be identified.
b) Retrap. The recapture of a banded bird by the original bander at, or close to, its original banding location.
c) Flag sighting. The observation of a bird carrying one or more coloured plastic leg flags, which indicate the area (but not the date) where the bird was originally marked.

Usually a recovery is a unique event, each referring to a different bird. However repeat flag sightings may be made of the same bird, especially if it remains at a particular location e.g. a stopover site during migration. As there is no way of differentiating between individuals it is not possible to quantify the total number of birds sighted.

Birds seen outside Australia between March and early May are classed as being on northward migration and late June to October are classed as being on southern migration.

Weight gains prior to migration can be a useful indicator of the likely distance to be travelled by a bird on the next leg of its migration. The marked sexual dimorphism of Eastern Curlew (Barter 1990, Rogers 1995) means that weights of male and female birds need to be considered separately. Almost complete separation of the sexes is possible using bill length criteria, and if other parameters are also utilised then almost 100 percent separation can be achieved. Weights are reported as mean and standard deviation. Weights reported come from the biometric data collected when birds were banded.

RESULTS

The numbers of Eastern Curlew banded, retrapped, recovered, flagged and subsequently resighted (up to end September 2009) are given in Table 1. Most of the NSW banding was carried out in the 1970s, that in Victoria and northwest Australia since 1980 and still continuing, and in Queensland in the 1990s.

Banding recoveries

Of the 1311 Eastern Curlew banded in Australia only 13 have so far been reported recovered overseas – a recovery rate of nearly one percent. This is low for a such a large species, particularly one which is still hunted in some areas as illustrated by a recent (2006) recovery of a bird 'shot for sport/food' in Russia (Australian Bird and Bat Banding Scheme 2009).

The 13 recoveries have a good geographical coverage both in banding location and recovery site (Table 2 and Figure 2). Seven were recovered on the breeding grounds, six in south-eastern Siberia and one in northern China. Four other birds were recovered on northward migration – two in Papua New Guinea, one in China, and one in Japan. One bird was recovered in Japan on southward migration and no date is available for the bird recovered in South Korea.

Leg flag sightings

The 968 leg-flagged birds produced 84 flag sightings overseas and a further 59 flag sightings within Australia (Table 3 and Figures 3 and 4). The overseas flag reporting rate of 8.0 % is eight times higher than for the overseas recovery rate of metal bands. Within Australia, 59 flag sightings were made away from the original flagging areas, compared with no banding recoveries.

The location of overseas sightings of leg-flagged birds differs from the location of banding recoveries. In particular there are only three sightings of flagged birds on the

Table 1. Numbers of Eastern Curlew banded and flagged in Australia and retrapped, recovered or subsequently sighted in Australia and overseas. Australian flag sightings do not include birds resighted at the banding site. Data included to the end of September 2009.

Capture location	Bird numbers					
	Banded	Retrapped (locally)	Recovered (overseas)	Flagged in Australia	Overseas flag sightings	Australian flag sightings
Vic	822	65	7	552	48	50
NSW	40	0	2	0	0	0
Qld	233	3	3	206	21	1
WA	216	10	1	210	15	8
Total	**1,311**	**78**	**13**	**968**	**84**	**59**

Table 2. Recovery (overseas) locations of Eastern Curlew banded in Australia. Data included to the end of September 2009.

Banding location	Recovery numbers					
	South-eastern Russia	South Korea	Japan	China	Papua New Guinea	Total
Vic.	4	0	2	1	0	7
NSW	0	1	0	0	1	2
Qld	1	0	0	1	1	3
WA	1	0	0	0	0	1
Total	**6**	**1**	**2**	**2**	**2**	**13**

Figure 2: Eastern Curlew overseas recoveries of birds banded in Australia.

breeding grounds. In the migration seasons, Japan (with 37 sightings) features strongly, followed by South Korea (25 sightings), Mainland China and Taiwan (12 and seven sightings, respectively). It is also notable that all of the 12 flag sightings of Eastern Curlew marked in northwest Australia seen during migration were in Korea and China, with none in Japan.

Seventy-four of the 84 overseas flag sightings refer to birds seen during northward migration.

Fifty of the 59 flag sightings representing movements within Australia were of birds flagged in Victoria. In contrast to the flag sightings in Asia, the majority of sightings in Australia during the migration seasons are of birds on southward migration (47 versus only six during the northward migration period) with six seen in the non-migration period of the Australian summer. Five of these six northward sightings, all in south-east Queensland, occurred in late April or early May.

Eight sightings of birds flagged in north-west Australia were at Carnarvon, WA, 1080 km south-west of the banding site. These sightings were between 11th July and 7th October.

Six interstate sightings of Victorian-flagged Eastern Curlew and one of a Queensland-flagged Eastern Curlew were made outside the migration period. Of the six Victorian-flagged birds, two were seen in Tasmania in December and early February, two were seen in Queensland (Moreton Bay) in January and two were seen in South Australia in December (one as far west as the Yorke Peninsula). The Queensland-flagged bird was seen at Newcastle, NSW, in early January.

Northward migration

Counts and observations of departing migrants in Australia suggest that the typical date of the first major northward departures from both Victoria and north-west Western Australia is around the 7th March. A rapid decline in numbers occurs after this date, especially in Victoria, and most adults birds have left before the end of March (Minton 1993).

The four banding recoveries of birds on northward migration, where the recovery date is known, range from 22nd March in Japan to the rather late date of 18th April in Papua New Guinea (a NSW banded bird).

The much higher numbers of sightings of leg-flagged birds gives a greater insight into the main northern migration period. The median date for 18 sightings in Japan of Victorian-flagged birds was 19th March and was 31st March for 15 Victorian-flagged birds sighted in South Korea (Figure 5a).

The fastest known northward movement occurred in 2003 when, on 9th March, a newly arrived Eastern Curlew carrying what was reported as a shiny new orange leg flag on each tibia was seen in Taiwan. This was almost certainly one of 36 Eastern Curlew caught in Corner Inlet, southeastern Victoria, on 27th February, only 11 days previously (VWSG unpublished data). Five or six of these days are likely to have been used for the 7,400 km flight so that this bird probably left Corner Inlet on 3rd or 4th March, assuming a non-stop flight.

Eastern Curlew from Queensland have also been recorded in Japan on early dates (Figure 5b). However the median date for which the 14 Queensland-flagged birds were seen there was 14th April. The median date for the sightings in Taiwan was however much earlier, on 3rd April (Figure 5b).

The nine flagged birds from north-west Australia, which were subsequently seen on northward migration in Asia also, show timing more similar to that of Queensland birds with a

Table 3. Sighting locations of Eastern Curlew flagged in Australia. Australian flag sightings do not include birds resighted at the banding site. Data included to the end of September 2009.

	Sighting numbers										
Flagging locations	**South Korea**	**Russia**	**Japan**	**China – mainland**	**Taiwan (China)**	**WA**	**Qld**	**NSW**	**SA**	**Tas**	**Total**
Vic.	15	1	22	7	3		33	13	2	2	98
Qld	2		15		4			1			22
WA	8	2		5		8					23
Total	**25**	**3**	**37**	**12**	**7**	**8**	**33**	**14**	**2**	**2**	**143**

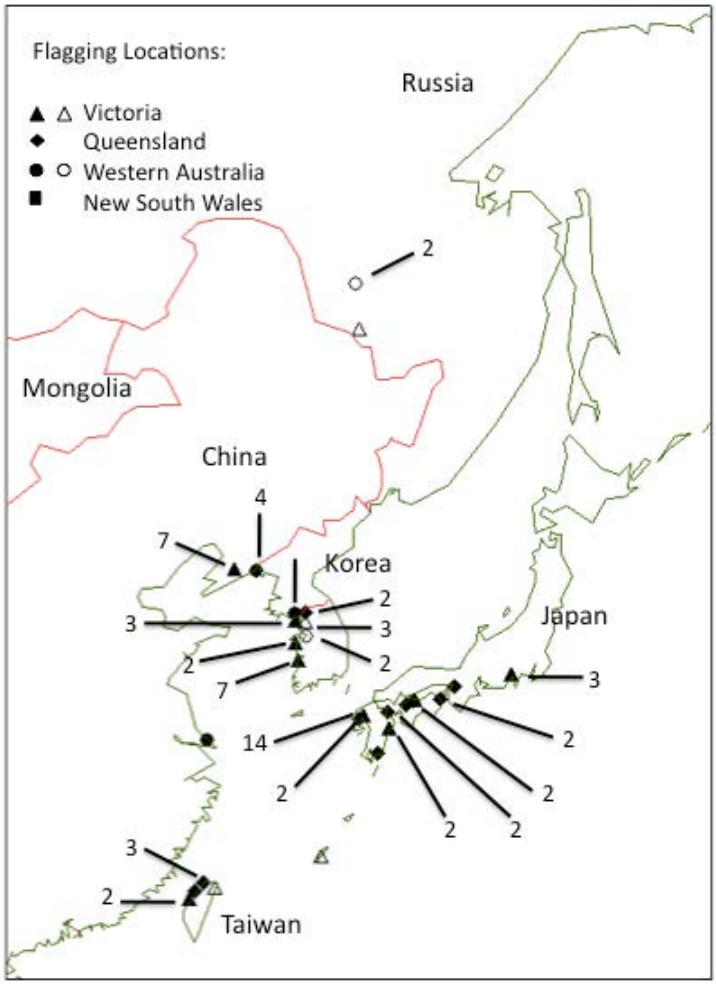


Figure 3. Eastern Curlew flag sightings outside Australia. Each symbol refers to a single sighting except where adjacent numbers reflect multiple sightings. Solid symbols relate to northward migration, empty symbols relate to southward or non-migration sightings.

median date of 14th April for South Korean sightings and 20th April for Chinese sightings (Figure 5c).

Breeding grounds and southward migration

Four Victorian-banded Eastern Curlew recovered on the breeding grounds were reported on 4th May in north-east China and between 22nd April and 5th May in south-east Siberia. The three other breeding grounds' reports (one each from Victoria, Queensland and north-west Australia) also occurred in May though the exact date was not specified.

Research using satellite transmitters showed that the first birds left the Amur River Region breeding grounds in early June and all had moved out by the end of that month (Ueta et al. 2002).

The return migration is first noticeable in Australia by an increase in numbers in both northern Australia and south-

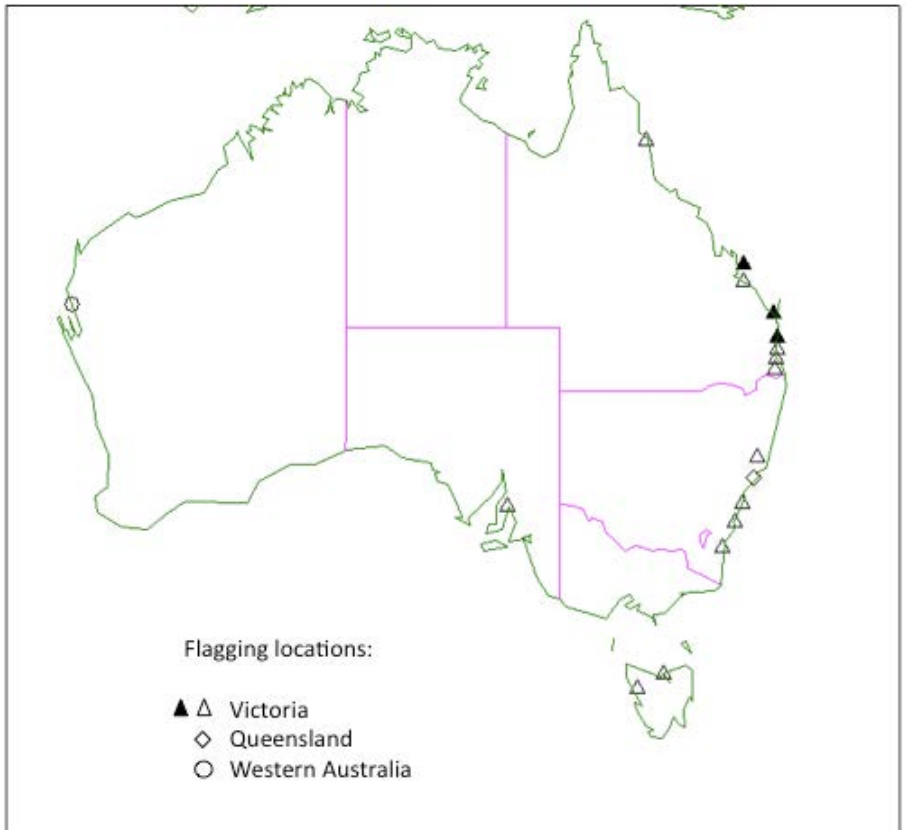


Figure 4: Eastern Curlew flag sightings within Australia. Each symbol refers to a single sighting. Solid symbols relate to northward migration, empty symbols relate to southward or non-migration sightings.

east Australia in late July, and particularly, during the first two weeks of August. Numbers however, have peaked in north-west Australia by mid-September (D. Rogers personal communication.) but continue to increase until early November in Victoria (VWSG and AWSG unpublished data).

There are no banding recoveries and only a small number of overseas flag sightings to assist the process of estimating more accurately the southward migration period for birds returning to each non-breeding area in Australia. Four Victorian-flagged birds were noted at widely separate locations and times commencing with Okinawa (16th July), through South Korea (28th and 30th July) to a very late bird still in Taiwan on 25th October. Two Western Australian-flagged Eastern Curlew were still in South Korea on the 13th and 30th of September. No Queensland-flagged birds have been seen on southward migration.

Sightings of Victorian flagged birds throughout coastal Queensland and NSW give some indication of the timing of the latter stages of the southward migration. The earliest of 26 reports in Queensland was 24th July and the last date was 5th October. The median was 14th August. Thirteen birds seen in NSW were reported at similarly separated dates between 21st July and 8th October, with a median date of 1st September. An additional seven sightings of Chinese-flagged birds were recorded in Queensland (two in July, one in September and four between 28th October and 27th December), presumably after migration was completed.

Retraps

There have been 65 recaptures in Victoria of Victorian banded Eastern Curlew with a median time between banding and recapture of 3.3 years All except one were at, or close to, the same location where they had been banded (40 recaptured at the site, 16 less than 20 km away and two 23km away). The exception was a bird banded at Yallock Creek, Western Port, in February and recaptured near Foster, Corner Inlet, 87 kilometres southeast in July of the same year. However this was a bird with a satellite transmitter attached which had failed to migrate into the northern hemisphere and may have therefore exhibited an abnormal movement.

The elapsed times between banding and recapture for 65 birds banded and recaptured show a wide spread. The pattern is affected by the intermittent opportunities to catch birds. Even at the two main sites, Yallock Creek/The Gurdies and Inverloch, catches were not possible every year. The oldest bird was over 22 years old. Nine birds were ten years old or more.

Departure weights

The mean weights of adult Eastern Curlew caught in Victoria outside the migration season (i.e. October to December when they are in primary moult and when weights remain fairly constant) were 714 g for males and 806 g for females (derived from Rogers 1995). The mean weights of adults in breeding plumage from a total catch of 58 birds on

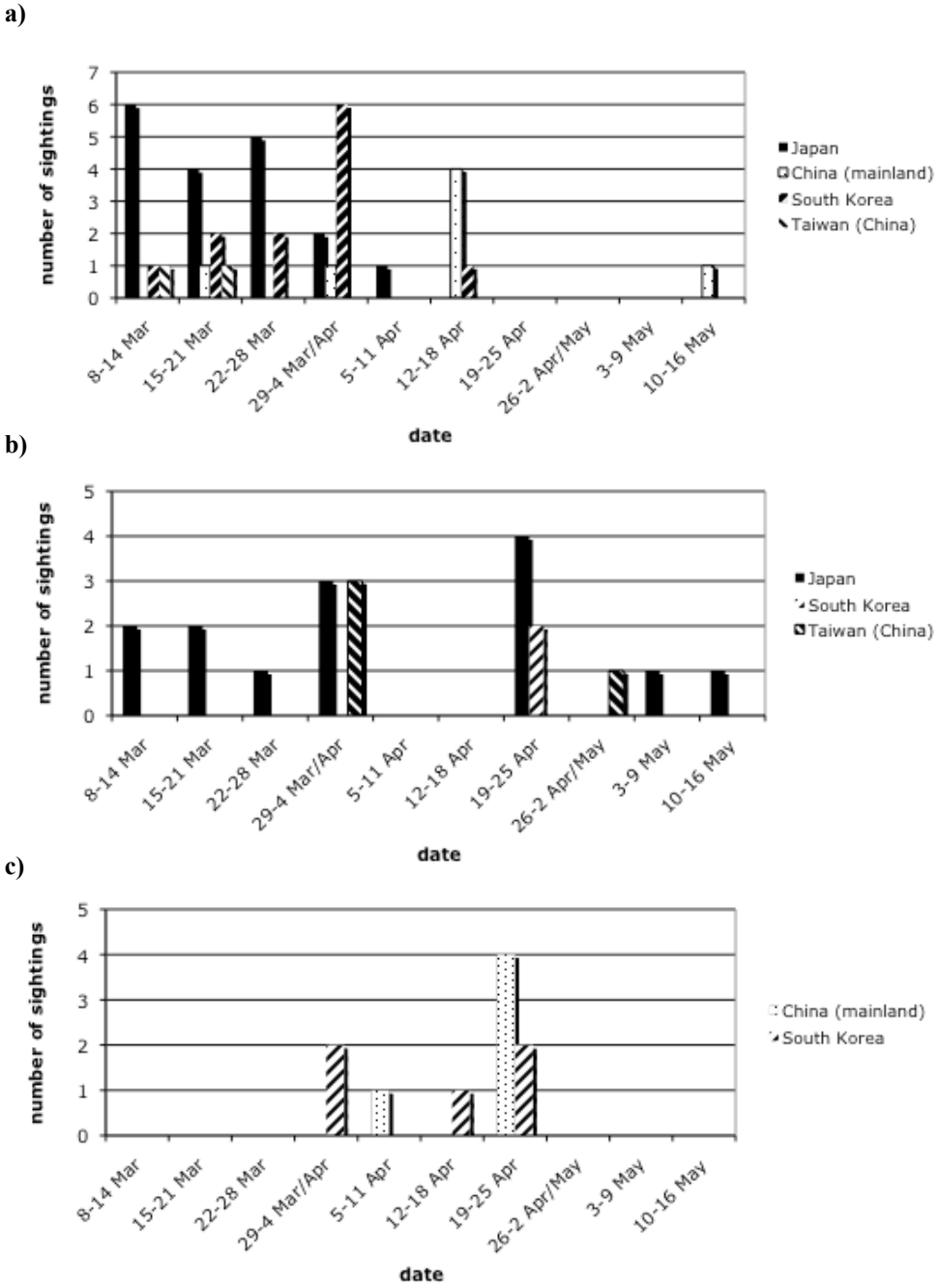


Figure 5: Dates of overseas sightings for Eastern Curlew on northern migration.
(a) Victorian flagged birds (39 sightings).
(b) Queensland flagged birds (20 sightings).
(c) Western Australian flagged birds (10 sightings).

22nd February 1999 were 1,039 ± 56 g for males (n = 22) and 1,245 ± 55 g for females (n = 23) (VWSG unpublished data).

At this date, some two to three weeks before the average northward departure date, birds were already carrying an addition of 46 percent (males) to 54 percent (females) to the mass recorded in the October to December period. On the assumption that mass will continue to increase by around 1 percent per day up until the departure date (based on having already gained around 50 percent in mass in not more than 50 days) it is probable that birds departed with an average mass increase of around 60 to 70 percent, i.e. with an average departure mass of 1,180g in males and 1,330g in females. These suggested departure weights seem reasonable in the light of additional data from a later catch on 27 February 2003. In this catch 13 males averaged 1,130 ± 98 g and 21 females 1,266 ± 67g (VWSG unpublished data).

DISCUSSION

Breeding areas

The recovery data presented here, and the satellite telemetry results reported by Driscoll (2000), both suggest that Eastern Curlew over-wintering in Australia breed in south-eastern Siberia, especially around the Amur River, and in Manchuria. This region is considered to be the stronghold of the Eastern Curlew breeding population (P. Tomkovich personal communication). Eastern Curlew also breed in lesser numbers further north in Yakutia (Lena River) and the Kamchatka Peninsula. As yet there is no evidence that these latter populations include Australian birds, but this may merely reflect the lack of observations made in these very sparsely populated regions.

Stopovers

Stopovers of Eastern Curlew on northward migration seem mainly to be in Japan, South Korea, northern China (Yellow Sea) and Taiwan. To arrive in Japan in early March (19th March median arrival date) after leaving Victoria most likely on or after the 7th March suggests a rapid traverse of around 8000 kilometres and most likely means that most individuals make this flight non-stop (Barter 2002). Flight range calculations on the basis of departure weights (Davidson 1984) also show that the Eastern Curlew of Western Port and Corner Inlet in Victoria (where the departure-mass data were collected) are in theory capable of reaching such target destinations as southern Japan (8200 km), western South Korea (8600 km) or the northern coast of the Yellow Sea (9000 km) in a single non-stop flight. Flights to these destinations would take about 5-7 days but would depend on weather, particularly wind, conditions during the flight. The five satellite transmitter-carrying Eastern Curlew, which penetrated to the breeding grounds, also supported the view that destinations such as the Philippines, Taiwan, China and Japan could be reached, at least from Moreton Bay, in what was a single continuous flight (Driscoll 2000). A further indication of the overall speed of northward movement, which can be achieved by some individuals, comes from one of the satellite-equipped birds, which reached the Vladivostok area of Russia by 30th March (Driscoll 2000, Driscoll and Ueta 2002).

However, there is evidence both from recoveries and from satellite transmitter work (Graham *et al*. 1999, Driscoll 2002) that some birds from Australia may make an intermediate stop in the Irian Jaya/Papua New Guinea region before reaching the Asian mainland coastline and Japan.

The relative paucity of flag sightings in China should not be taken as an indication that few Eastern Curlew call in there on migration. In the main period when Eastern Curlew were banded and flagged in Australia in the mid 1990's and early 2000's there were relatively few sightings in China. Until the last five years, in most species of waders there were hardly any flag sightings in China, except in Hong Kong, even though the majority of the populations pass through there (Minton *et al*. 2006b). Several explanations for the dearth of sightings are offered. The first is explained by the vastness of the intertidal habitats available to waders, particularly around the Yellow Sea, and the historical lack of field observers and suitable optical equipment. Secondly, it is also related to the very early passage of Eastern Curlews that makes it difficult to make flag sightings in March and early April due to the cold that (1) makes the birds fluff up and often conceal their flags and (2) means few people are out watching shorebirds (D. Rogers personal communication).

Count data certainly indicates that the Chinese part of the Yellow Sea is the major migratory stopover region for Eastern Curlew with an estimated 25,000 birds passing through there on northward migration each year (Barter 2002).

It is interesting that all overseas sightings of Eastern Curlew flagged in north-west Australia have so far been in South Korea and China. This pattern differs from birds that are flagged in eastern Australia suggesting potentially different stopover sites from the two sources. This pattern occurs in other species including Bar-tailed Godwit (Minton *et al*. 2006b) and Grey-tailed Tattler (Branson *et al*. 2010) but the volume of data is too small to confidently speculate on the relative breeding sites from the two sources of birds.

Timing of northward migration

Victorian Eastern Curlew appear to be the first to leave in numbers on northward migration, relative to those from north west Australia, in the first and second weeks of March, and they seem to reach the Japan and South Korean migratory stopover areas some two or three weeks ahead, on average, of birds from Queensland and north west Australia. It is logical that the Victorian birds, with the furthest distance to migrate, should depart first but perhaps slightly surprising that they should reach such northern latitudes ahead of their counterparts from non-breeding areas in the northern half of Australia. However a parallel situation exists in several other waders species, including Curlew Sandpipers (Minton *et al*. 2006a) where orange-flagged Curlew Sandpipers from Victoria are consistently seen at the Mai Po Marshes in Hong Kong 7 to 10 days earlier on northward migration than yellow-flagged Curlew Sandpipers from north west Australia.

Arrival at the breeding grounds is early relative to other Northern Hemisphere migrant waders visiting Australia – not surprising considering the relatively southern location of the Eastern Curlew's breeding areas compared with most of the other migratory waders that breed further north where it remains frozen and unsuitable as a breeding site for longer.

Birds probably start to arrive on the Amur River breeding grounds in the latter part of April and all probably reach there by mid May. Counts in the northern Yellow Sea (Barter 2002) indicate a decline in numbers from late April, although many are still present in early May. Similarly, at Saemangeum (eastern Yellow Sea), the Eastern Curlew reaches peak numbers (thousands) by early to mid April with relatively few birds found in May (hundreds) (Rogers *et al*. 2006b, and subsequent unpublished data from the Saemangeum Shorebird Monitoring Project). The 10,000 km journey to the breeding grounds from Victoria thus is expected to take 6-8 weeks, and the journey from Moreton Bay, Queensland (8000 km), and from Roebuck Bay, north-western Australia (7500 km), about two weeks less, i.e. 5-6

weeks. This supports the view that Eastern Curlew from non-breeding areas in Moreton Bay, Queensland, on average depart later than those from Victoria to reach these intermediate stopover locations some two weeks later than Victorian birds.

Most overseas sightings (72 of 78) were of birds on northward migration, a common pattern amongst Australian-flagged waders (Minton *et al*. 2006b). Possible reasons for this difference are that Eastern Curlew on northern migration may stage for longer in northern Asia because it is their final coastal feeding opportunity before going inland to the breeding grounds, and because they may need to wait on suitable weather conditions (e.g. if they reach departure weight early, there is no point in migrating to breeding grounds that are still frozen).

Victorian-flagged birds seen in Queensland during the expected northern migration are more likely to represent immature birds moving northward within Australia for the winter (Wilson 2000) than adult birds on their way up to the breeding areas. The overall pattern suggests that on northward migration birds starting their journey in Victoria exit Australia without landing on the northern coasts.

Timing of southward migration

The southward migration of the Eastern Curlew from the breeding grounds back to non-breeding areas in Australia is less well documented. Given that the first significant arrivals occur in Australia in late July, with major arrivals in the first two weeks of August, the first birds must set off southwards from their breeding grounds in late June, with many following in early July.

On southward migration many birds appear to make a landfall in a variety of locations along the Queensland east coast.

The relative paucity of flag sightings and the complete absence of recoveries during southward migration suggests that, as with many other species, some Eastern Curlew may make a long trans-oceanic flight from locations at or near their breeding grounds back to the northern coasts of Australia. Apart from one sighting in Taiwan, on an exceptionally late date of 25th October, there is no evidence from flagging that birds use places anywhere south of South Korea and Japan as stopover locations. The lack of sightings of birds on southern migration contrasts to the northern story possibly because birds have more flexibility about when they need to leave and how far they need to fly. Further, because southern migration is more staggered than northward migration (failed breeders, successful breeders and juveniles migrating at different times), there are fewer birds at any one time at particular staging sites, so fewer flags will be seen in a single scan.

However count data (Barter 2002) shows that many Eastern Curlew use the northern part of the Yellow Sea in China as an important staging area on southward migration before a likely direct flight to Australia. The birds carrying satellite transmitters also showed a strong movement to the Yellow Sea before their main southward migration leg (Ueta *et al*. 2002). From there one bird then flew direct to central Indonesia and another to New Guinea before their transmitters expired. This is consistent with migration movements of Whimbrel, which have recently been found to also make large non-stop flights initially, followed by smaller shifts toward their ultimate destination (Watts *et al*. 2008). Extremely long direct flights to the coast of northern Australia are made in some of the other larger species on southward migration thus reducing or eliminating stopovers in many parts of Asia which are used on northward migration (Minton *et al*. 2006b).

The pattern of flag sightings on the Queensland coast during August/early September suggests that arriving birds may make their landfall at a range of places along the eastern coastline. However the pattern of sightings could also be the result of Eastern Curlew originally stopping in northern Queensland and then completing their migration down the east coast in a series of smaller movements. Certainly it seems likely that the NSW coastal records in August and September refer to birds that are moving southwards back to Victoria in small stages, rather than birds that have made an initial landfall there after a trans-oceanic flight.

A high proportion of adult Eastern Curlew probably reach their ultimate destination, non-breeding areas in Australia, in August with some continuing into September. However, successful breeders, which may have remained longer on the breeding grounds, and juvenile birds probably, continue to arrive throughout September and October (Jones 1984).

Non-stop flight

Using the flight range formula of Davidson (1984), assuming still air conditions and a flight speed of 70 km/h, it can be calculated that Eastern Curlew reaching the predicted average departure weights have sufficient fuel to fly 9200 km (males) to 9600 km (females). The Summers and Waltner (1979) flight range formula gives slightly greater estimated achievable flight ranges, of 9600 km (males) and 10,100 km (females).

In practice, birds can encounter both favourable and unfavourable wind conditions during a migratory flight, perhaps even both during the same flight. If they were able to utilise any tail wind components during this leg of the migration then their range would be greater than this, and conversely if head winds predominated they would fall short of their target. It is likely that Eastern Curlew exploit tailwinds when possible. This argument is supported by observations of a northward departure of Victorian birds after the passage of a cold front and the onset of strong south-westerly winds (Graham *et al*. 1999). One satellite-equipped bird was recorded as achieving an average ground speed of 85 km/h in its journey from Victoria when tracked in mid flight over northern Queensland (Graham *et al*. 1999). This compares with the probable typical air speed of a migrating Eastern Curlew of around 70 km/h and an average achieved ground speed of around 50 km/h for several Eastern Curlew moving from south-east Queensland into Asia (Driscoll 2000).

It is probable therefore that under reasonable weather conditions many Eastern Curlew will be able to reach southern Japan or the Yellow Sea shores of South Korea and China either in a single flight from Victoria or, perhaps for some, with a very short period spent at stopovers. This

would account for the early arrival dates (second week March) of some flagged birds in both southern Japan and South Korea, as well as in Taiwan.

Site faithfulness

As with most of the migratory waders, Eastern Curlew seem to exhibit strong site faithfulness, returning to the same place each year and remaining in the same general area throughout the six to eight month period of the non-breeding season they are in Australia.

The interstate flag sightings of Australian-banded birds outside the migration period can be explained either by birds having changed their non-breeding area or having been marked when already on migration within Australia. Two Victorian- flagged birds subsequently seen in Tasmania in December and early February could fall into this latter category as could the Queensland-flagged bird seen at Newcastle. However the two Victorian-flagged birds seen in Moreton Bay and the two seen in South Australia seem more likely to refer to birds that have changed their non-breeding area. Based on the proven flight capability of Eastern Curlew and most other wader species, it would seem most likely that birds moving to or from South Australian non-breeding areas would fly directly across inland Australia rather than fly round the much longer coastal route via Victoria. Hence they are unlikely to have been banded in Victoria whilst on migration.

Overall, the relative lack of flag sightings elsewhere in Australia during the non-breeding season and the high number of local retraps (Table 1) indicate that most individual Eastern Curlew return to the same non-breeding area each year, and remain in it throughout the non-breeding season.

Survival

Eastern Curlew would appear to be a long-lived wader, judging by the extended ages of retraps. The figures suggest that survival rates are high, as might be expected for such a large bird. However, no analysis of survival rates has been made. The recapture of some 9 % of Eastern Curlew banded in Victoria (Table 1) also supports this hypothesis, this being a surprisingly high recapture rate for an infrequently caught species, but perhaps also reflecting the high site fidelity exhibited. Despite the apparent good survival, the population appears to be declining and considering the apparent low annual production of young birds and the estimated minimum age of four years at which Eastern Curlew are capable of returning to their breeding grounds to reproduce, this becomes quite concerning for the species.

Research tools

The previous satellite telemetry experiments provided much useful information. However, a significant proportion of the birds may have been affected by the carrying of a transmitter (its weight, its wind resistance, and/or discomfort of the harness), because only five out of the 37 birds equipped with a transmitter in Australia actually achieved the full northward migration to the breeding grounds. Satellite telemetry products are continually being improved with current products significantly lower in weight than the 26 grams previously used, as demonstrated by a successful Whimbrel study using a transmitter of less than 10grams (Watts *et al*. 2008). Light-sensor geolocators of about 1 gram are available (Branson *et al*. 2010) but these have the disadvantage that a bird needs to be recaptured in order to retrieve the data. Nevertheless in the relatively closed and limited populations of Eastern Curlew at each study location in the non-breeding areas recapture of sufficient bird's geolocators in the season following the migration back to the breeding grounds may be practical providing enough data loggers are deployed. All these techniques can be potentially applied to furthering our understanding of Eastern Curlew movements

The future

Based on available banding recoveries, flag sightings and count data, Eastern Curlew spending the non-breeding season in Australia seem to migrate in a narrow band, between Taiwan and southern Japan, to their main staging areas in the northern parts of the Yellow Sea (China and South Korea) and thence to their breeding grounds in south-east Siberia. However, there are still several important unknowns about this migration.

Current data suggests that both northwards and southwards migration contain one extremely long near-continuous flight stage, supplemented by smaller stages of movement to complete the journeys. The greatest unknown in relation to Eastern Curlew migration in the East Asian-Australasian Flyway is how many small steps are made outside the main Australian-Asian flight, knowledge that would best come from geolocators or satellite telemetry.

Also, identification and/or confirmation of the relative importance of stopover areas are needed to trigger, or support existing efforts for conservation of these sites.

Another important unknown is the non-breeding area/s of Eastern Curlew, that breed in Kamchatka and southern Yakutia.

Recoveries and flag sightings are influenced by the distribution of observers and therefore may not be representative of the full picture. A really detailed understanding of the migratory flight strategy of the Eastern Curlew can only come from deployment of satellite transmitters or other forms of position indicators such as geolocators. Such methods, especially if deployed in all three current Eastern Curlew study areas in Australia, Queensland, Victoria and north-west Australia, may well reveal presently unproven key stopover areas (e.g. Irian Jaya), may well indicate some differences in the breeding areas of birds from the three different parts of Australia, and may more clearly show what strategic combination of long movements/short movements is employed on each of the migrations (northward and southward). It could also show the range of variation between individual birds.

Whilst conventional banding and flagging operations of Eastern Curlew will continue it is the intention of AWSG/VWSG to seek funding to enable further work using tracking devices in order to more fully understand the migration strategy of the Eastern Curlew.

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RECOVERIES AND FLAG SIGHTINGS OF WADERS WHICH SPEND THE NON-BREEDING SEASON IN AUSTRALIA

CLIVE MINTON[1], JOHANNES WAHL[2], HEATHER GIBBS[3], ROSALIND JESSOP[4], CHRIS HASSELL[5] AND ADRIAN BOYLE[5]

[1]*165 Dalgetty Rd, Beaumaris, Victoria 3193, Australia. mintons@ozemail.com.au*
[2]*Steinfurter Str. 55, D-48149 Muenster, Germany.*
[3]*P.O. Box 2110, Lygon St North, East Brunswick, Victoria 3057, Australia.*
[4]*Phillip Island Nature Park, PO Box 97, Cowes, Victoria 3922, Australia.*
[5]*PO Box 3089, Broome, Western Australia 6725, Australia.*

Recoveries and flag sightings relating to migratory waders which visit Australia are analysed. The 882 overseas recoveries from 316,000 birds banded in Australia is equivalent to a recovery rate of 0.28%. The reporting rate for leg flags seen overseas is 10% - 36 times greater (19,164 sightings from 187,000 waders flagged in Australia). This total includes engraved leg flags and individual flag and colour band combinations, which are becoming increasingly important generators of information (1439 sightings of 815 different individuals overseas). Maps and tables showing all reported movements greater than 200 km are presented. Migration routes, stopover sites and breeding areas are synthesized, to the extent to which the data on each species allows. The major further contribution to understanding the migration strategy of each species which geolocators and satellite transmitters can provide is emphasized. Understanding migratory movements is an important prerequisite to accurately targeting conservation efforts in the East Asian – Australasian Flyway.

INTRODUCTION

An assessment of what had been learned from banding and flagging waders in Australia, using data gathered up to the end of 2003, was presented at the Australasian Wader Studies Ggroup (AWSG) conference in Canberra, Australian Capital Territory, in December 2003. It was subsequently published in the Proceedings (Minton 2005). Maps showing all recoveries and flag sightings of waders which visit Australia, using data up to mid 2006, were published in the celebration issue of Stilt (Minton *et al.* 2006). Conclusions were drawn on migratory pathways, stopover locations and breeding destinations for 26 species of migratory waders.

Banding and flagging of waders, particularly in north-west Australia and south-east Australia, has continued at a high level in recent years, and a considerable volume of new information on wader movements has been generated. This is especially so because large-scale individual marking within Australia commenced in late 2004, initially using engraved leg flags but, since 2007, also via flag and colour-band combinations. Furthermore there has been a huge expansion of wader marking in mainland China, particularly at Chongming Dao, near Shanghai, in the south-west of the Yellow Sea. This has resulted in a large increase in the number of overseas-marked birds reported in Australia, especially sightings of flagged birds.

A number of papers have been published recently analyzing, in detail, the migration patterns of individual species (Bar-tailed Godwit – Wilson *et al.* 2007, Grey-tailed Tattler and Terek Sandpiper – Branson *et al.* 2010, Eastern Curlew – Minton *et al.* 2011). There have also been smaller articles on movements of individually-marked birds, such as those on Red Knot visiting Bohai Bay (Rogers *et al.* 2010), on Ruddy Turnstone (Minton *et al.* 2010a,b) and on Bar-tailed Godwit (Minton *et al.* 2010c).

It is now timely to update the previous publications on banding and flagging achievements and the maps illustrating migratory movements. Recovery and flag sighting data, up to the end of August 2010, is given for each species for which overseas movements of marked birds, either into or out from Australia, have been reported. This is an additional 6½ years of information compared with the initial presentation (Minton 2005). Maps showing marking and reporting locations are also included, using data available to October 2009. These thus include three or more years of data since the earlier paper (Minton *et al.* 2006).

Up-to-date migration data is particularly important at the present time when major population decreases, thought to be due to habitat loss at staging sites, are being recorded for nearly half the major migratory species in the East Asian – Australasian Flyway (Delaney and Scott 2006, Bamford *et al.* 2008). Conservation needs and actions can only be formulated if there is a sound foundation of scientific information. The AWSG population monitoring programme is revealing major reductions in the numbers of many species of migratory waders. The migration data generated by banding and flagging will assist in determining where conservation actions should be directed.

METHODS

An estimate of the numbers of migratory waders banded and flagged up to August 2010 in Australia was obtained by updating the 2003 data (Minton 2005) with information provided by the main active groups – the Victorian Wader Study Group (VWSG) (Victorian coast, the south-east coast of South Australia, and King Island, Tasmania), the AWSG (north-west Australia and the Northern Territory) and the Queensland Wader Study Group (Moreton Bay). Information on recoveries of Australian-banded birds and controls in Australia of waders banded overseas was provided by the Australian Bird and Bat Banding Scheme.

The number of sightings of plain leg flags and birds individually marked with engraved flags or flag/colour band

combinations were obtained from the AWSG Leg Flag Database, funded by the Australian Government and developed and operated by Heather Gibbs. Those birds which are individually identifiable are technically "recoveries". In the initial table showing overall totals they are grouped with the flagging data to facilitate comparisons with past published data. But in the individual species accounts they are shown separately as they are a rapidly growing category providing "recovery" information at a very much faster rate than it accrues from reports of metal bands. In these tables, individually identifiable birds are counted only once per between-country movement (repeat sightings, even in different years, are not counted in the totals); however, plain flag sightings totals may include repeat sightings of the same individual(s).

The plotting of the maps (by JW) was carried out in the same way as in the earlier paper (Minton *et al.* 2006). The main focus of the analysis is on overseas movements, but movements within Australia greater than 200 km are also shown. Lines join the marking and finding location, but these are not necessarily the routes actually flown by the individual birds.

It should be borne in mind that, because recoveries and flag-sighting reports are dependent on people finding and reporting birds, apparent movement patterns are significantly affected by the distribution and habits of people. Thus few reports will accrue from remote areas even though they may be extensively used on migration by many birds. One advantage of geolocators and satellite transmitters, which are increasingly being deployed on waders, is that they give information on a bird's movement which is not biased by the distribution of observers.

RESULTS

Banding, flagging, recovery and flag sighting data – to August 2010 – for migratory waders which visit Australia are given in Table 1.

There have now been approximately 316,000 migratory waders banded in Australia, resulting in 882 recoveries overseas. This represents an average recovery rate of 0.28%, though there are marked variations between species.

The number of flagged birds has now grown to *c.*187,000 and there has been a massive increase in reported sightings overseas (to 19,164). The sighting rate is 10.2%, about 35 times the recovery rate. It is not surprising therefore that our knowledge of migration has increased so rapidly in recent years as leg flagging, and the search for and reporting of flagged birds, has become so universal.

Recoveries in Australia of waders banded overseas (166) have also grown but the big increase is in the number of overseas flagged birds seen here (3895), particularly birds marked at Chongming Dao in China.

Each of the 28 wader species for which overseas movement data exists is covered individually below. A table summarizing movements, by country, is given for each together with a map showing movements. Two additional migratory species showing significant movements within Australia are also covered, but no map is included.

Pacific Golden Plover *Pluvialis fulva*

Data only accumulates very slowly on this little-banded species (Table 2). The extra records for the last three years further support the northward migration path through the Chinese region and Japan and haven't added to the Alaska/Pacific records (Figure 1).

Table 1. Banding, flagging, recovery and flag sighting totals for migratory waders visiting Australia

	To end 2003*	**To August 2010**
Banded in Australia	254,000	316,000
Recoveries overseas	534 (0.21%)	882 (0.28%)
Flagged in Australia	126,000	187,000[+]
Sighted overseas	3,903 (3.1%)	19,164[+] (10%)
Banded overseas, recovered in Australia	150[#]	214[#]
Flagged overseas, sighted in Australia	225	3,895[+]

[+] These totals include all sightings of individually identifiable birds from 2004 onwards.
[#] These totals include the 48 sightings of individually identifiable birds up to end 2003.
* As published in Minton 2005.

Table 2. Pacific Golden Plover - number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	**Vanuatu**	**Hong Kong (China)**	**China (mainland)**	**Japan**	**USA**	**Total**
Recoveries / controls							
From Australia to…	1	1		1			3
To Australia from…						1	1
Sightings - plain flags							
From Australia to…	2		1		1		4
To Australia from…				1			1
Total	3	1	1	2	1	1	9

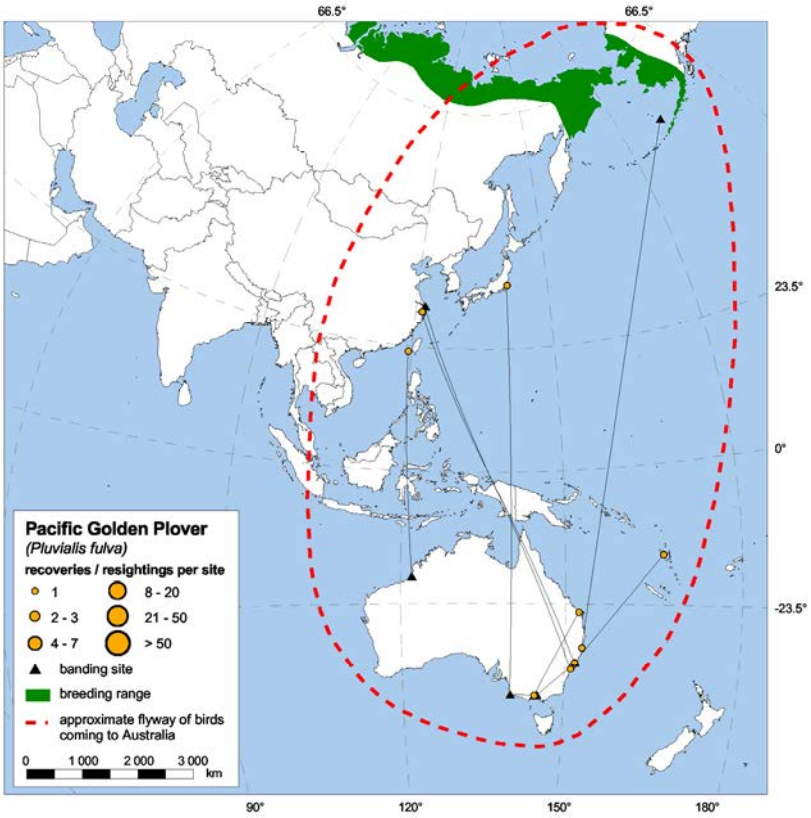

Figure 1. Pacific Golden Plover.

Grey Plover *Pluvialis squatarola*

The number of records has grown significantly over the last three years, mainly with flag-sightings of birds moving between Australia and China (both directions) and to South Korea. No new countries have been added (Table 3). The migratory path through Asia still appears to be narrower than for many other waders with records concentrated in the Yellow Sea and Japan (Figure 2). There are still no reports from further north to indicate the origin in the Russian arctic of the Grey Plover which come to Australia in the non-breeding season.

Double-banded Plover *Charadrius bicinctus*

The well-established pattern of birds from the South Island of New Zealand coming to south-eastern Australia for the winter has not changed (Figure 3). With marking levels of this species in both countries now lower than when intensive studies took place in both in the 1980s, new records are accumulating only slowly (Table 4). Overall there have been 51 birds marked in Australia later found in New Zealand and 46 which have been recorded making the journey in the opposite direction.

Lesser Sand Plover *Charadrius mongolus*

Lesser Sand Plover show a wider spread of reporting locations in Asia than Greater Sand Plover, although the number of records is smaller (28 vs. 261). Reports range from Thailand and Vietnam in the west to Japan/Korea/Sakhalin (Russia) in the east (Figure 4, Table 5). This suggests that the Lesser Sand Plover which visit Australia come from several of the widely dispersed breeding areas, with more than one sub-species probably being involved. There is only one record so far from Russia, close to (but not in) one of the eastern breeding areas.

Table 3. Grey Plover – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	China (mainland)	S Korea	Japan	Total
Recoveries / controls					
From Australia to…		1			1
Sightings - known individuals					
To Australia from…		2			2
Sightings - plain flags					
From Australia to…	1	9	9	20	39
To Australia from…		9	1		10
Total	1	21	10	20	52

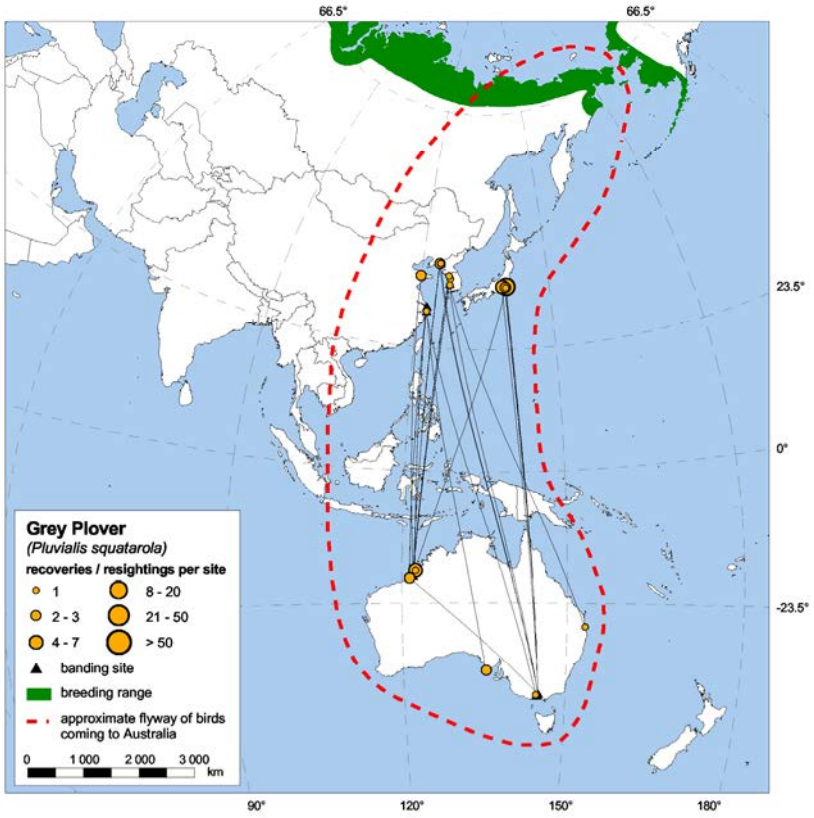

Figure 2. Grey Plover.

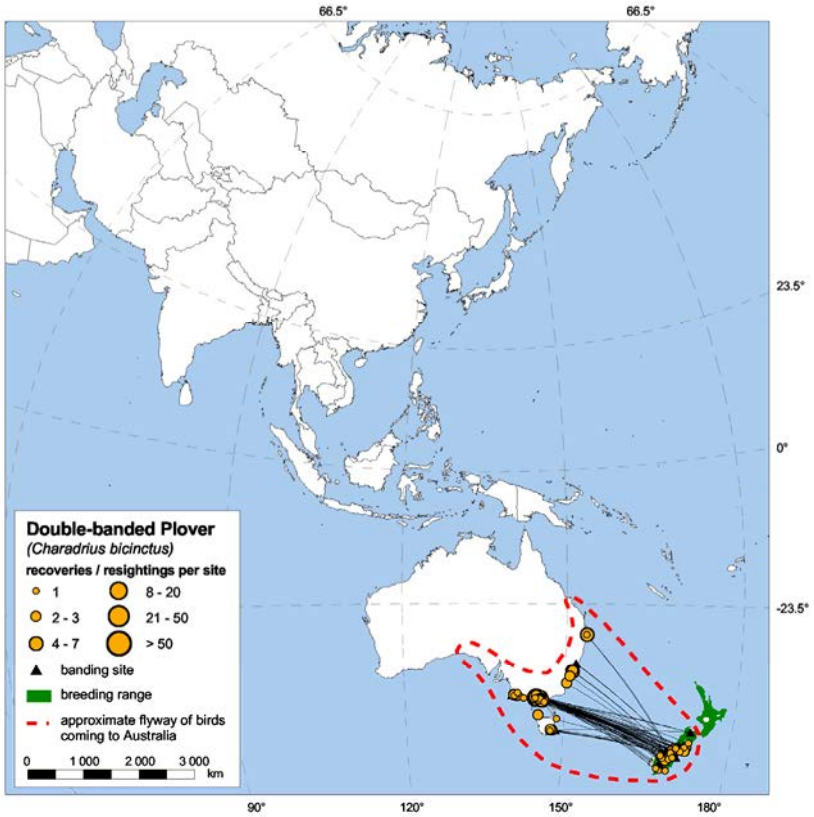

Figure 3. Double-banded Plover.

Table 4. Double-banded Plover – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	New Zealand	Total
Recoveries / controls			
From Australia to…		31	**31**
To Australia from…		13	**13**
Sightings - known individuals			
To Australia from…		30	**30**
Sightings - plain flags			
From Australia to…	2	20	**22**
To Australia from…		3	**3**
Total	**2**	**97**	**99**

Table 5. Lesser Sand Plover – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Philippines	Thailand	Vietnam	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls											
From Australia to…	1	1					1			1	**4**
Sightings - known individuals											
From Australia to…							1				**1**
To Australia from…						1					**1**
Sightings - plain flags											
From Australia to…	16		1	1	3	4	1	2	5		**33**
To Australia from…						3	1		1		**5**
Total	**17**	**1**	**1**	**1**	**3**	**8**	**4**	**2**	**6**	**1**	**44**

Greater Sand Plover *Charadrius leschenaultii*

Flag-sighting records have been accumulating rapidly for Greater Sand Plover, with many movements between Australia and Taiwan. Hong Kong also features strongly for sightings of Australian-flagged birds (Figure 5, Table 6). The advent of major banding at Chongming Dao, south-west coast of the Yellow Sea, has extended the eastward boundary of the migration path with 71 birds from there now having been seen in Australia. This species has a markedly north-west oriented migration with birds passing through Asia between Vietnam and Chongming Dao. There are still no records from anywhere near the probable breeding grounds. Hopefully the geolocators recently deployed on Greater Sand Plover at Roebuck Bay, Broome, will enable the breeding grounds to be identified.

Latham's Snipe *Gallinago hardwickii*

Again there has been no recent change in the situation, with few Latham's Snipe caught in Australia in recent years (Figure 6, Table 7). There has only ever been one recovery or resighting of an Australia-marked Latham's Snipe, but there have been six recoveries in Australia of Latham's Snipe marked in Japan.

Swinhoe's Snipe *Gallinago megala*

There has been no change on the previous situation, with just two recoveries in The Philippines of birds banded in the Northern Territory (Figure 7, Table 8). However more have been banded and flagged in north-west Australia in the last year and these may generate further information.

Black-tailed Godwit *Limosa limosa*

Although relatively few (about 800) of this species have been marked in Australia there has been a good accumulation of overseas movement records, particularly in recent years via flag sightings (Figure 8, Table 9). Flag-sighting seems to be particularly important in this species, with only two of the 104 movement records being recoveries/controls. This may be because of the Black-tailed Godwit's habit of wading around in rice fields with the tibia, on which the flags are placed, being above water level. Also, flag spotters in north-west Australia have been particularly efficient at seeing Black-tailed Godwit originally flagged at Chongming Dao and in Japan. Taiwan and all coasts of the Yellow Sea seem to be the most favoured areas for migratory stopovers. The three records in Indonesia are interesting. Most Australian waders overfly that area without stopping, on both their northward and southward migrations.

Bar-tailed Godwit *Limosa lapponica*

This species is one of the most widely studied and banded in the Flyway – from the breeding areas in Siberia and Alaska to the non-breeding areas in Australia and New Zealand. In recent years much new data has been generated from the extensive catching and flagging at Chongming Dao and from intensive flag searching at other locations around the Yellow Sea (particularly in South Korea), in Japan and in Taiwan. There are now a massive 6705 overseas movement records relating to Australia (Figure 9, Table 10).

Migration strategies deduced from an analysis of recoveries and flag sightings (Wilson *et al.* 2007) have

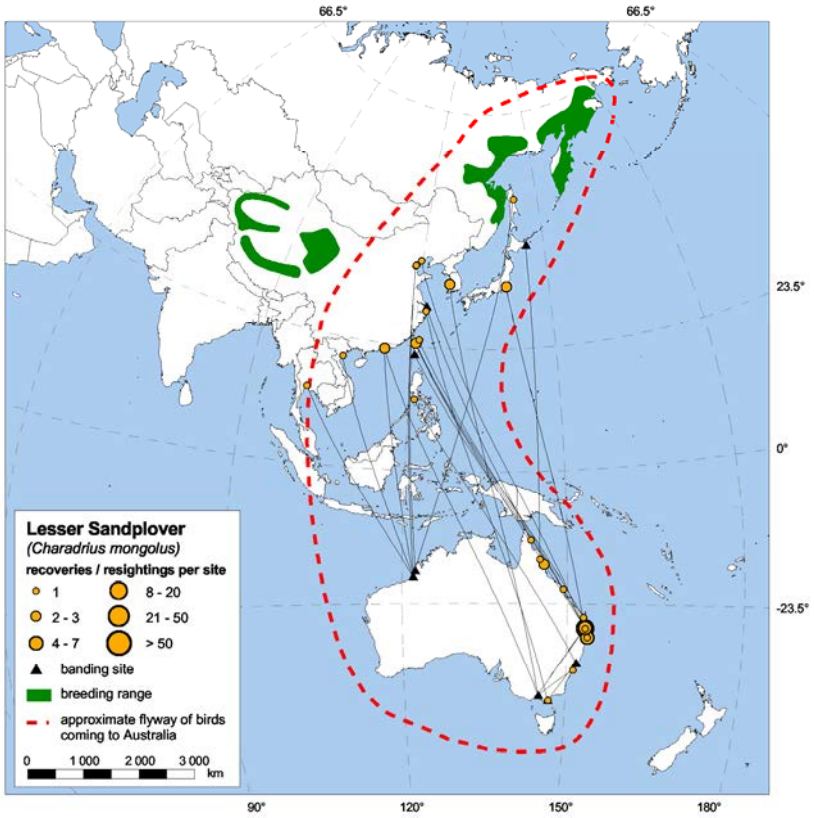

Figure 4. Lesser Sand Plover.

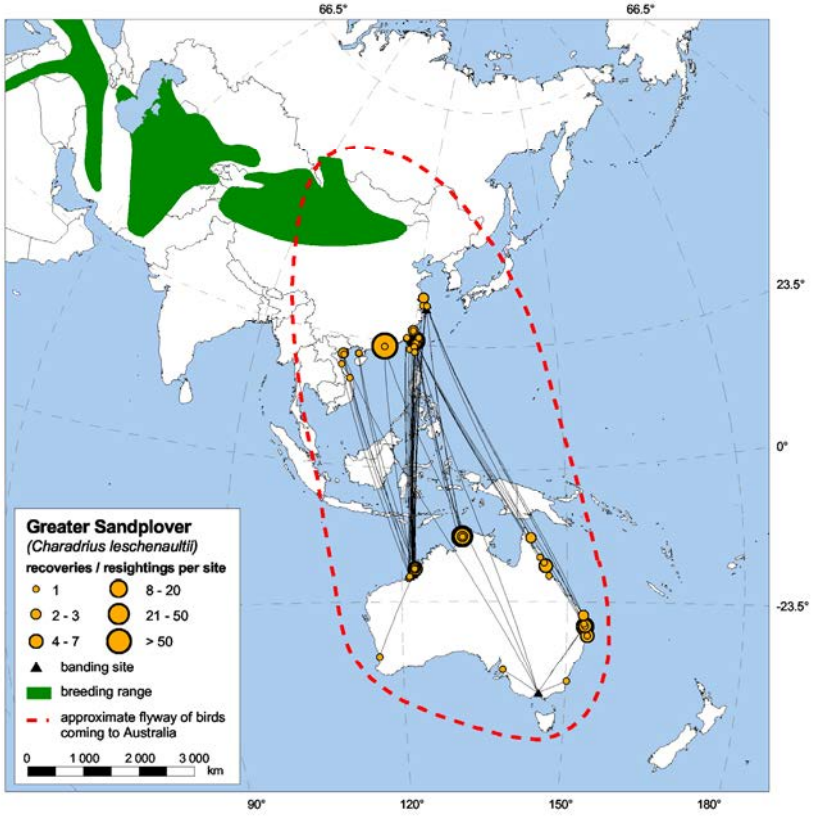

Figure 5. Greater Sand Plover.

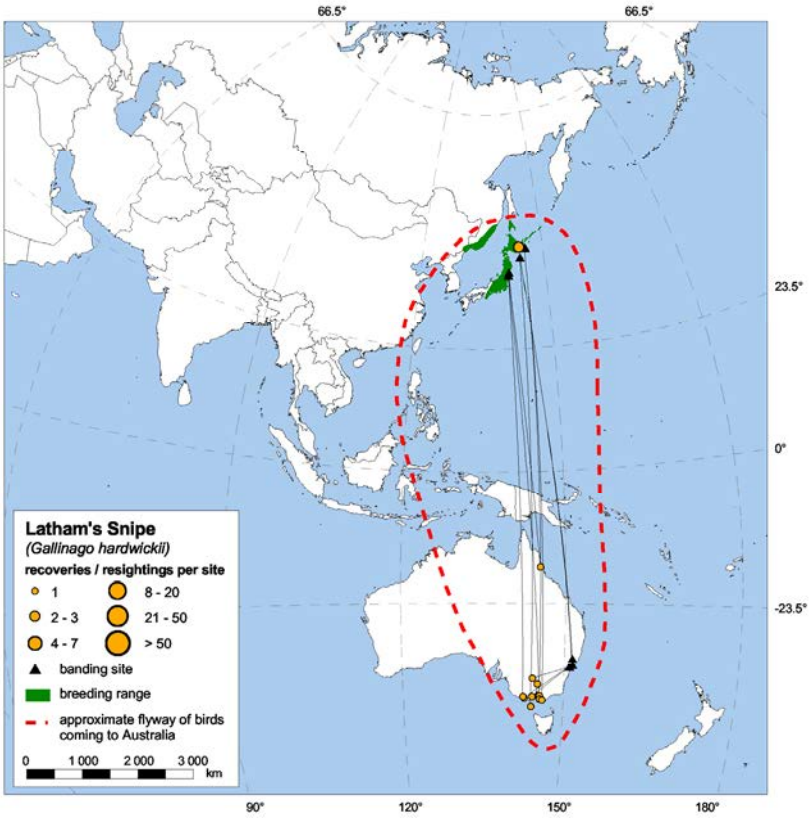

Figure 6. Latham's Snipe

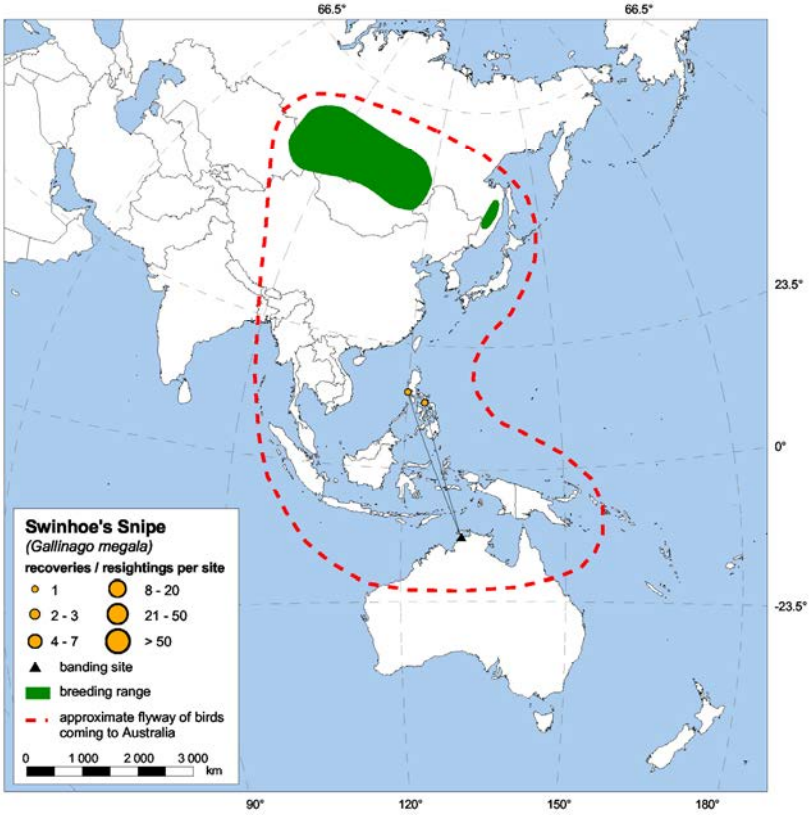

Figure 7. Swinhoe's Snipe

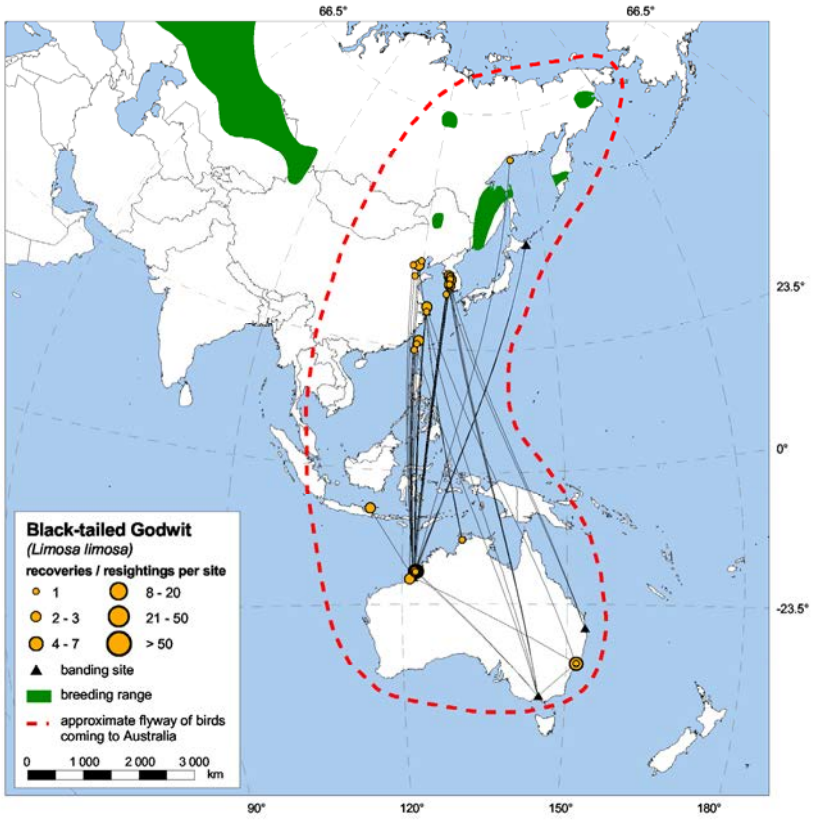

Figure 8. Black-tailed Godwit

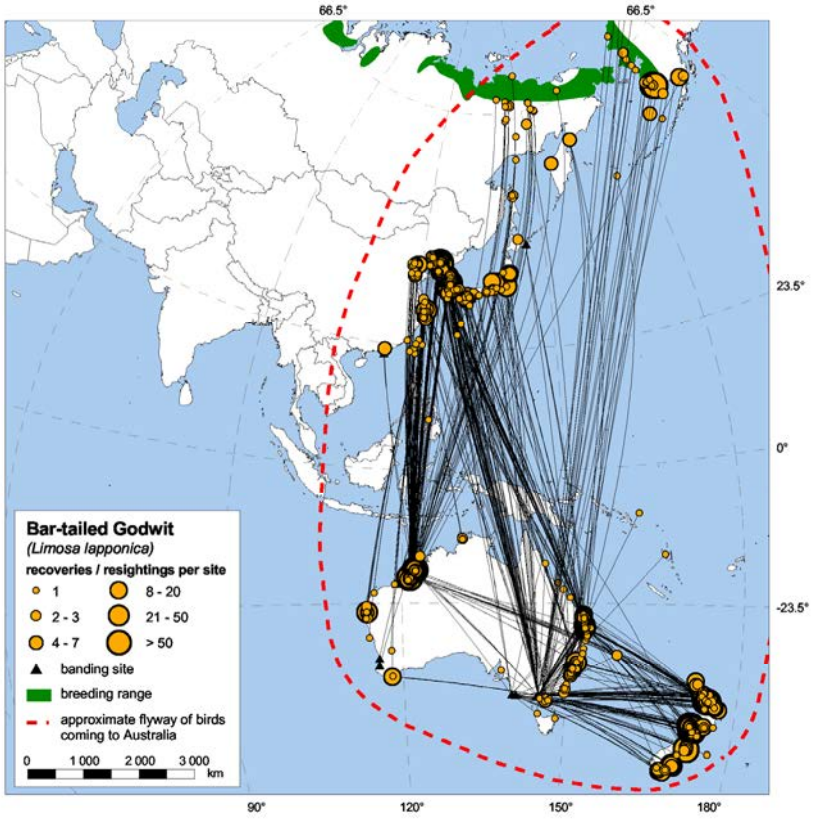

Figure 9. Bar-tailed Godwit

Table 6. Greater Sand Plover – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Vietnam	Hong Kong (China)	Taiwan (China)	China (mainland)	Total
Recoveries / controls						
From Australia to…		4		**1**	3	**8**
To Australia from…				**1**	1	**2**
Sightings - known individuals						
From Australia to…	5		1	**3**		**9**
To Australia from…				**5**		**5**
Sightings - plain flags						
From Australia to…	17	2	65	**59**	8	**151**
To Australia from…			1	**33**	71	**105**
Total	**22**	**6**	**67**	**102**	**83**	**280**

Table 7. Latham's Snipe – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Japan	Total
Recoveries / controls			
From Australia to…	3	1	**4**
To Australia from…		6	**6**
Total	**3**	**7**	**10**

Table 8. Swinhoe's Snipe – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Philippines	Total
Recoveries / controls		
From Australia to…	2	**2**
Total	**2**	**2**

Table 9. Black-tailed Godwit – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Indonesia	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls									
From Australia to…								1	**1**
Sightings - known individuals									
From Australia to…					1	4			**5**
To Australia from…					1				**1**
Sightings - plain flags									
From Australia to…	9	3		8	7	20			**47**
To Australia from…			1		31		17		**49**
Total	**9**	**3**	**1**	**8**	**40**	**24**	**17**	**1**	**103**

subsequently been confirmed by satellite telemetry on both the *baueri* and the *menzbieri* subspecies (Gill *et al.* 2009).

Bar-tailed Godwit carry out the majority of their migrations in long non-stop flights, with just minor adjustments of position at the Yellow Sea stopover on northward migration (both subspecies), on their breeding grounds in Siberia (*menzbieri*), prior to southward migration across the Pacific from Alaska (*baueri*), and after reaching the coasts of Australia (and New Zealand) following their trans-Pacific journey (*baueri*).

There is an almost complete separation of the subspecies in the non-breeding areas with *baueri* in eastern Australia and New Zealand and *menzbieri* in north-west Australia. However there have recently been two sightings in Alaska of Bar-tailed Godwit marked in north-west Australia.

New data on the well established strong cross-Tasman movement of immature Bar-tailed Godwit is accumulating rapidly following the introduction of engraved leg flags on Bar-tailed Godwit in Victoria (Minton *et al.* 2010c).

Little Curlew *Numenius minutus*

There have been no overseas recoveries or flag sightings (hence no map). However, within the north-west Australian marking areas several movements of a little over 200 km have been recorded. One bird banded at Roebuck Plains, near Broome, was recaptured in a subsequent year at Anna Plains, adjacent to 80 Mile Beach (Table 11). A whole bevy of Little Curlew with engraved flags put on near Broome were seen only a few weeks later at 80 Mile Beach or on the adjacent grasslands. This species appears to be highly mobile in its non-breeding areas in Australia, a requirement presumably necessitated by the ephemeral nature of good feeding areas.

Whimbrel *Numenius phaeopus*

Continued modest levels of catching of this species, especially in north-west Australia and in China, have led to a significant increase in the number of colour-marked birds

Table 10. Bar-tailed Godwit – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	New Zealand	Vanuatu	Solomon Is	Philippines	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	N Korea	Japan	Russia	USA	Total
Recoveries / controls														
From Australia to…	9	11	1	1	1			66	3		1	23	5	**121**
To Australia from…						1		10					1	**12**
Sightings - known individuals														
From Australia to…	50	49					1	114	24	1	7		2	**248**
To Australia from…		24						12					5	**41**
Sightings - plain flags														
From Australia to…	341	2827				8	10	724	917	19	139	11	586	**5582**
To Australia from…		38						1000	10		18			**1066**
Total	**400**	**2949**	**1**	**1**	**1**	**9**	**11**	**1926**	**954**	**20**	**165**	**34**	**599**	**7070**

Table 11. Little Curlew – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Total
Recoveries / controls		
From Australia to…	1	**1**
Sightings - known individuals		
From Australia to…	8	**8**
Total	**9**	**9**

reported (Figure 10, Table 12). There is an easterly bias in the migration route with four records relating to Kamchatka, a real hot spot for migrating Whimbrel.

Eastern Curlew *Numenius madagascariensis*

Recoveries and flag-sightings continue to accrue on this long-lived species even though the main marking activity in Australia occurred 15 to 20 years ago. There have now been a total of 87 Australian-marked birds reported overseas and seven Chinese-flagged birds seen in Australia (Figure 11, Table 13).

Recent records confirm that the migration path is relatively narrow with most migration records being in the Yellow Sea (28 Korea and 17 China) and southern Japan (39). There have been six recoveries and three flag sightings on the south-east Siberian breeding grounds. This high proportion is probably because these southern breeding areas are relatively accessibile to observers, compared with the arctic regions used by most other waders.

Terek Sandpiper *Xenus cinereus*

There has been a large growth recently in the number of flag sightings, particularly Australian-flagged birds in South Korea and Chongming Dao-flagged birds found in north-west Australia (Figure 12, Table 14). This species seems to occur quite widely on the Asian mainland during migration with a particular emphasis on the Yellow Sea area, with lesser numbers in Hong Kong and Taiwan. 201 total overseas movement records have now accrued. These include several recoveries in Russia, with three being in the eastern portion of the breeding range.

Common Sandpiper *Actitis hypoleucos*

The only report remains a colour-marked Common Sandpiper from north-west Australia which was subsequently seen in Singapore. Few are marked anywhere in the Flyway (Figure 13, Table 15).

Grey-tailed Tattler *Tringa brevipes*

Recent data has further confirmed the major role of Japan as a stopover location on migration for Grey-tailed Tattler (Figure 14, Table 16). There is a particularly strong link between there and the Grey-tailed Tattler which spend the non-breeding season in Queensland.

Overall there is a fairly wide spread of records in Asia during the migration season and an apparent pattern of a broad northward movement from their non-breeding areas in Australia. Taiwan features extremely strongly (192 records) and this, compared with relatively low number of records in the Yellow Sea region, suggests Grey-tailed Tattlers particularly favour offshore islands such as Taiwan and Japan as stopover locations. There are now four reports from Siberia, three being in or close to the breeding areas.

Common Greenshank *Tringa nebularia*

The number of records since the last paper has almost doubled, though there is still a total of only 31 overseas movements involving Australia (Figure 15, Table 17). Amazingly there have still been no overseas recoveries of Australian-banded Greenshank.

The biggest change has resulted from the banding at Chongming Dao in China, with 21 flag sightings and controls in Australia now from that location. The Chinese coast and Taiwan seem to be the main locations used for migratory stopovers. There are no reports yet from anywhere in Russia to indicate the likely breeding grounds of the Greenshank which come to Australia.

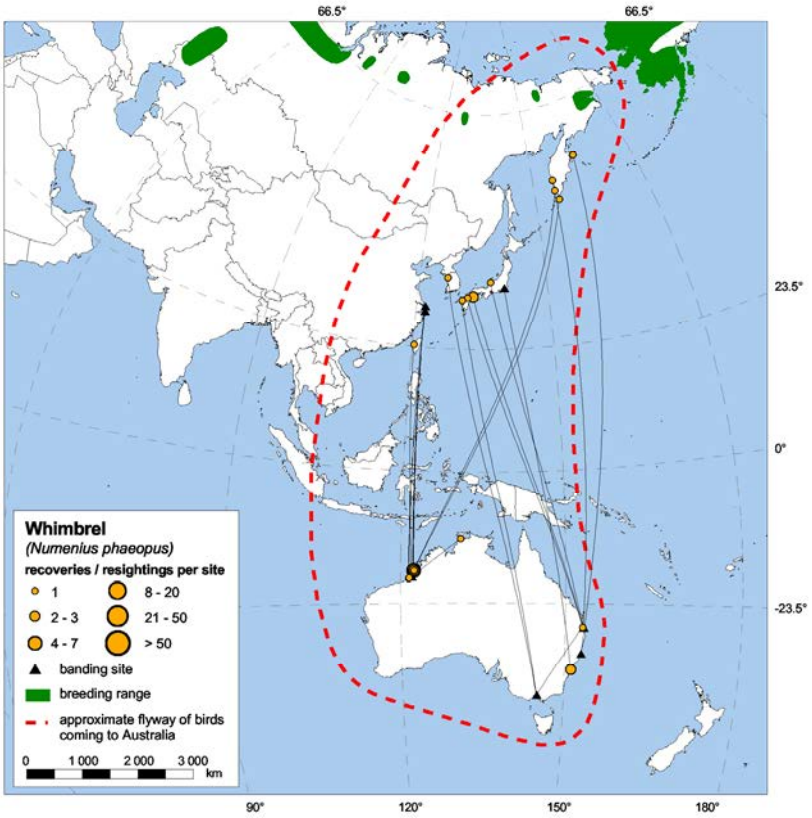

Figure 10. Whimbrel

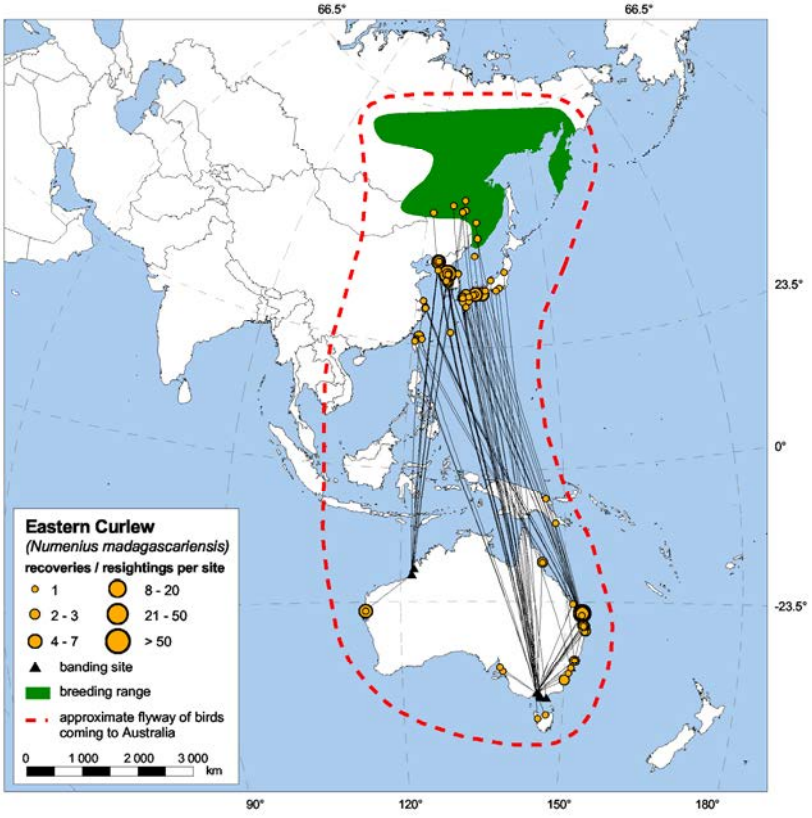

Figure 11. Eastern Curlew

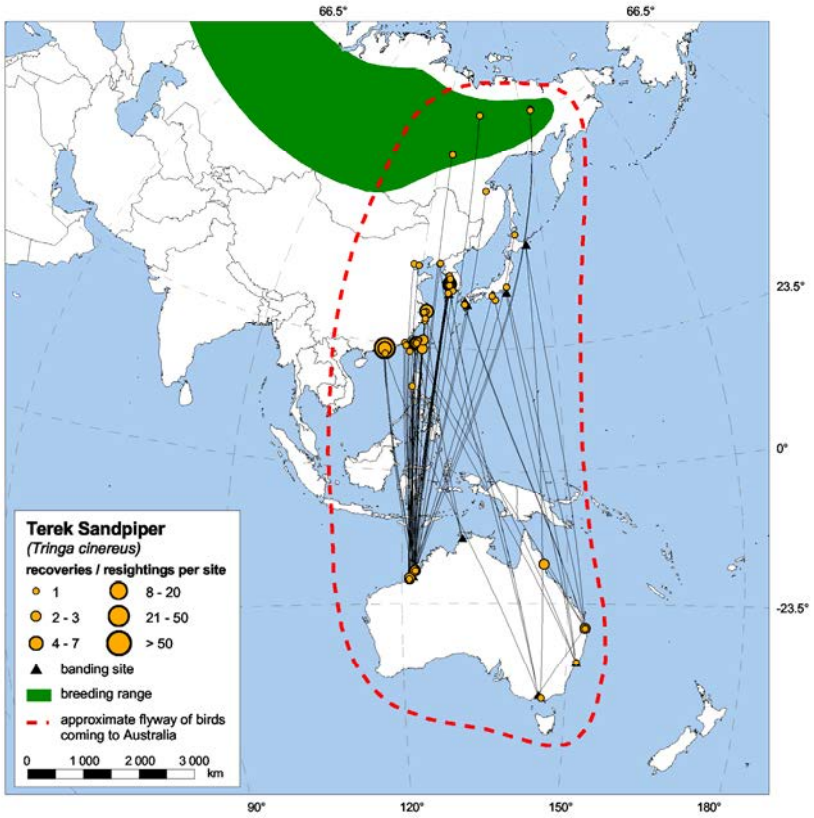

Figure 12. Terek Sandpiper

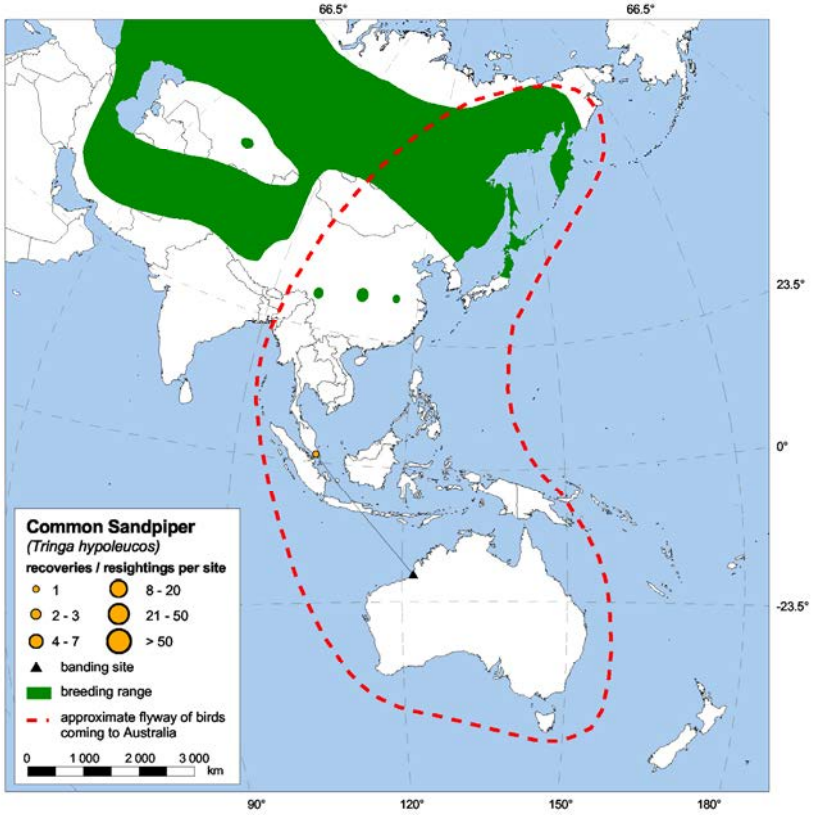

Figure 13. Common Sandpiper

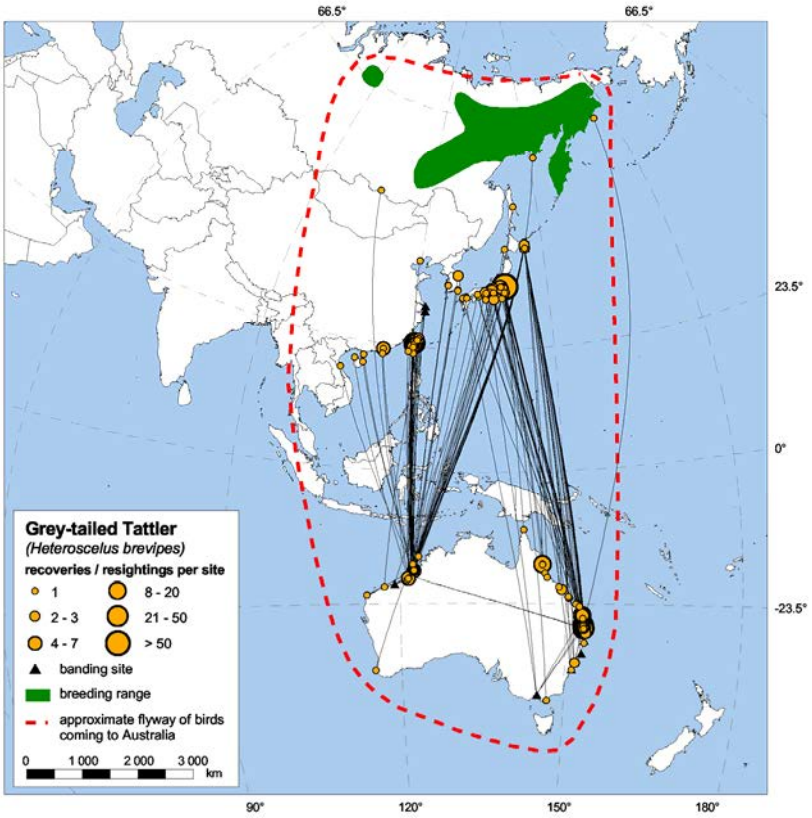

Figure 14. Grey-tailed Tattler

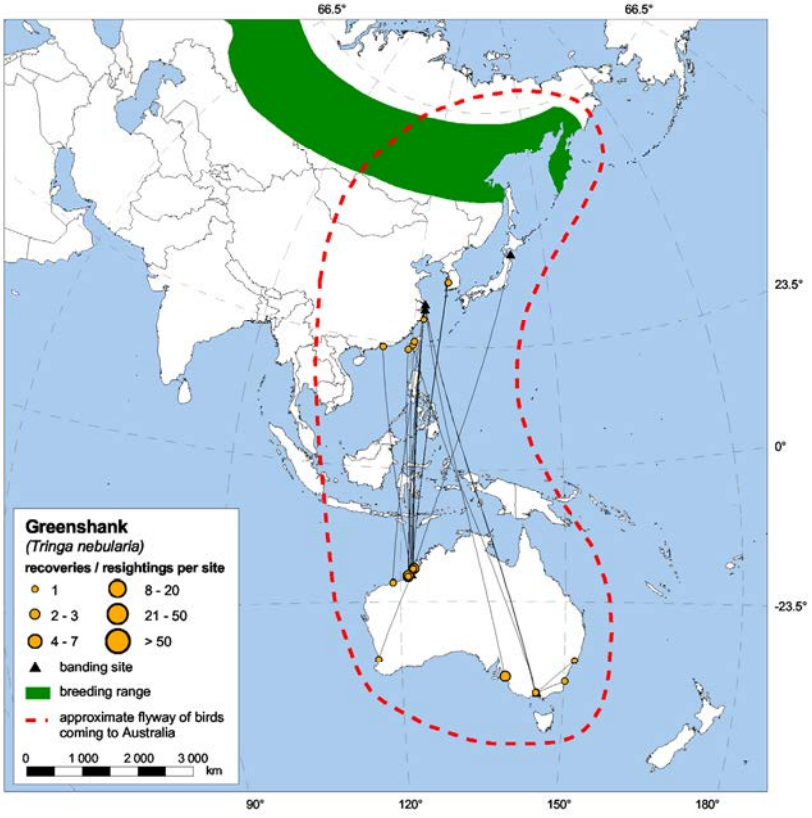

Figure 15. Common Greenshank

Table 12. Whimbrel – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls							
From Australia to…						4	**4**
Sightings - known individuals							
From Australia to…		1					**1**
To Australia from…			1				**1**
Sightings - plain flags							
From Australia to…	2	1		3	4		**10**
To Australia from…			20		2		**22**
Total	**2**	**2**	**21**	**3**	**6**	**4**	**38**

Table 13. Eastern Curlew – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	PNG	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls								
From Australia to…		2		2	1	2	6	**13**
Sightings - known individuals								
From Australia to…				1	1			**2**
Sightings - plain flags								
From Australia to…	62		7	14	26	37	3	**149**
To Australia from…				7				**7**
Total	**62**	**2**	**7**	**24**	**28**	**39**	**9**	**171**

Table 14. Terek Sandpiper – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Philippines	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls									
From Australia to…		1	1	3	10	3	1	6	**25**
To Australia from…			1		1	2	3		**7**
Sightings - known individuals									
From Australia to…				4		1	1		**6**
Sightings - plain flags									
From Australia to…	3		48	13	6	45	1		**116**
To Australia from…				5	33	7	2		**47**
Total	**3**	**1**	**50**	**25**	**50**	**58**	**8**	**6**	**201**

Table 15. Common Sandpiper – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Singapore	Total
Sightings - plain flags		
From Australia to…	1	**1**
Total	**1**	**1**

Marsh Sandpiper *Tringa stagnatilis*

Few Marsh Sandpiper are caught in Australia and there are only four overseas reports of these birds. Three were in Bohai Bay, Yellow Sea, which suggests this may be a hot-spot for this species. Pleasingly one was a recovery well north in Russia, though to the east of the breeding grounds. It is surprising that no Marsh Sandpiper banded or flagged overseas have been reported within Australia (Figure 16, Table 18).

Common Redshank *Tringa totanus*

There are six records of yellow-flagged Redshank seen in Hong Kong (Figure 17, Table 19). Since just five Redshank have been flagged in north-west Australia, compared to many flagged in Hong Kong (with the white-over-yellow flag combination), it is possible that some or all of these sightings relate to local birds where the white flag was lost or was not visible. However, the table of data and a map are still included in this paper. As this species is uncommon in Australia, a thorough analysis of its migratory movements would require data from other countries such as Indonesia, Thailand, Singapore, Japan and China (including Hong Kong and Taiwan).

Ruddy Turnstone *Arenaria interpres*

Ruddy Turnstone have been a particular focus of banding and colour-marking in south-eastern Australia in the last few years and the volume of movement data, particularly from flagged and engraved-flagged birds, has increased rapidly (Figure 18, Table 20). Of the 511 total records 156 relate to

Table 16. Grey-tailed Tattler – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Vietnam	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls									
From Australia to…	1	1	1	6	3		10	3	**25**
To Australia from…				3	1		7		**11**
Sightings - known individuals									
From Australia to…	1			7		2	6		**16**
To Australia from…				2					**2**
Sightings - plain flags									
From Australia to…	8		8	149	1	8	110	1	**285**
To Australia from…				23	15		258		**296**
Total	**10**	**1**	**9**	**190**	**20**	**10**	**391**	**4**	**635**

Table 17. Common Greenshank – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Total
Recoveries / controls							
To Australia from…				1		1	**2**
Sightings - known individuals							
To Australia from…				1			**1**
Sightings - plain flags							
From Australia to…	3	2	2	1	2		**10**
To Australia from…				17			**17**
Total	**3**	**2**	**2**	**20**	**2**	**1**	**30**

Table 18. Marsh Sandpiper – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	China (mainland)	Russia	Total
Recoveries / controls				
From Australia to…	1		1	**2**
Sightings - plain flags				
From Australia to…	2	3		**5**
Total	**3**	**3**	**1**	**7**

Table 19. Common Redshank – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Hong Kong (China)	Total
Sightings - plain flags		
From Australia to…	6	**6**
Total	**6**	**6**

movements between Australia and Taiwan. The link with New Zealand (44 records) has also been shown to be stronger than previously thought, with many birds passing through Australia regularly on their way to their non-breeding areas in New Zealand (including several records relating to the very south end of New Zealand, near Invercargill). A recovery in Guam, out in the Pacific due south of Japan, is the first Australian-marked bird showing a Pacific element to its migration route. However one of the birds fitted with a geolocator made its return from the Siberian breeding grounds via south-west Alaska and the Gilbert Islands (Kiribati) in the western central Pacific (Minton *et al.* 2010b).

It is not clear why Taiwan is so favoured as a migratory stopover site for Ruddy Turnstone on both northward and southward migration. It is not just the result of the intensive flag-sighting effort there as all four geolocator-carrying Turnstone which were subsequently recaptured had used it as a stopover on northward migration.

There have been two recoveries of birds from north-west Australia in Russia close to the breeding grounds. The geolocator birds, from south-east Australia, also seem to have gone to breed in the Yakutia region on the north coast of Siberia.

An even fuller picture of Ruddy Turnstone migration should emerge during the next year as some of the many geolocators currently deployed on Ruddy Turnstone are retrieved and downloaded.

Asian Dowitcher *Limnodromus semipalmatus*

There have been only just over 100 Asian Dowitcher marked in Australia but they have produced eight overseas reports (Figure 19, Table 21). The most interesting was the sighting of a flagged bird breeding in Mongolia, in the centre of this species' discontinuous breeding range. The remainder relate to birds staging in Taiwan and the Yellow Sea. So far there have been no reports within Australia of Asian Dowitcher marked overseas.

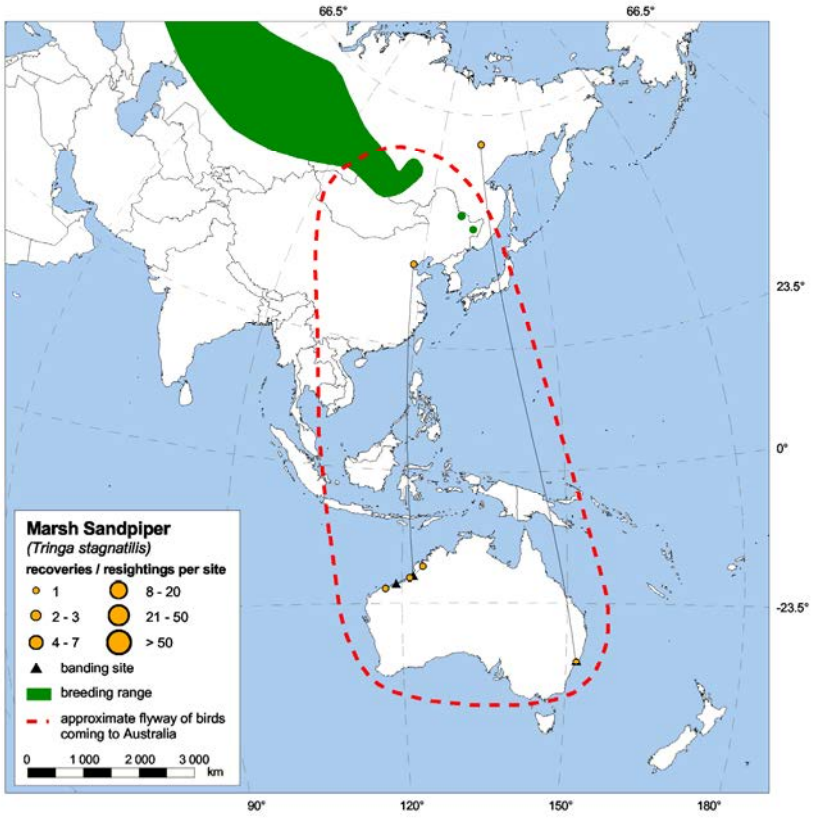

Figure 16. Marsh Sandpiper

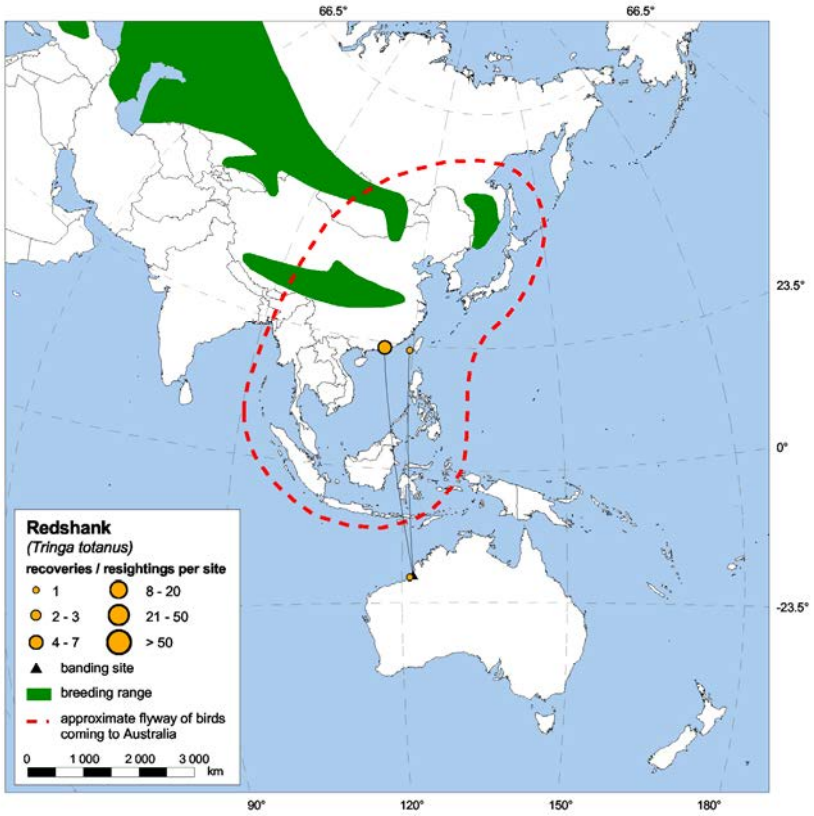

Figure 17. Common Redshank

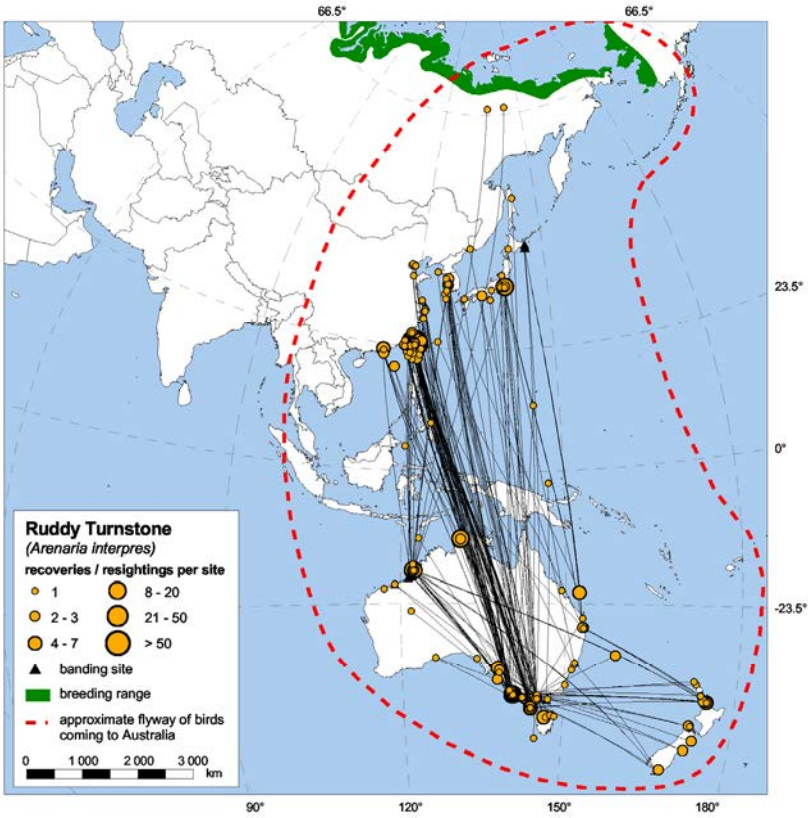

Figure 18. Ruddy Turnstone

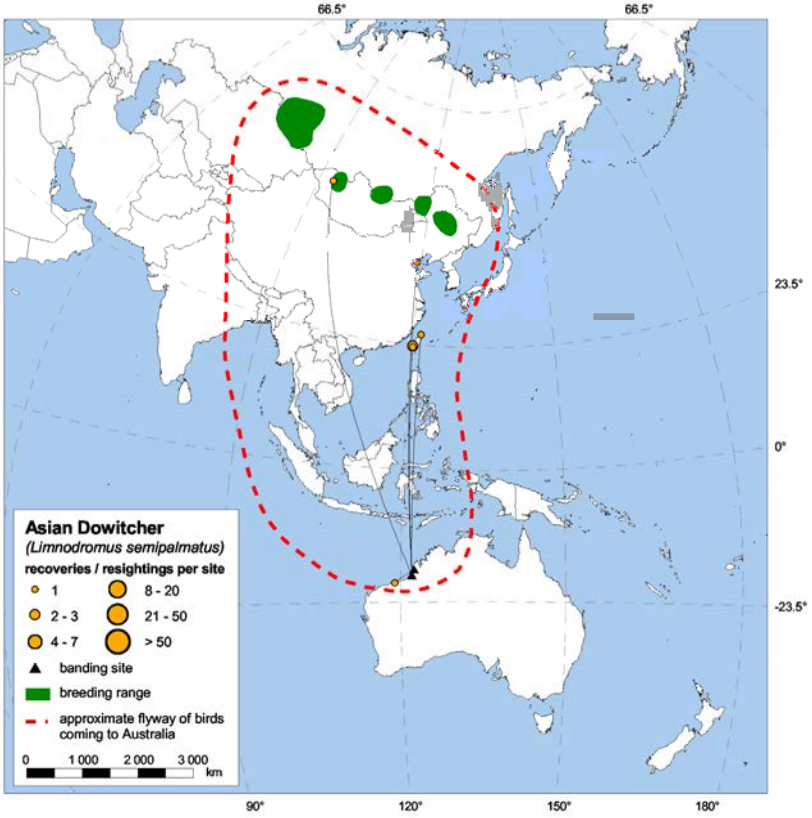

Figure 19. Asian Dowitcher

Table 20. Ruddy Turnstone – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	New Zealand	PNG	Philippines	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Guam	Japan	Russia	Total
Recoveries / controls												
From Australia to…	7	1	1	1		3	3	1	1	2	4	**24**
To Australia from…		1				1				2		**4**
Sightings - known individuals												
From Australia to…	21				3	44	8	2		6		**84**
To Australia from…		3										**3**
Sightings - plain flags												
From Australia to…	153	32		1	13	99	12	17		25		**352**
To Australia from…		5				9	15	2		11		**42**
Total	**181**	**42**	**1**	**2**	**16**	**156**	**38**	**22**	**1**	**46**	**4**	**509**

Table 21. Asian Dowitcher – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Taiwan (China)	China (mainland)	Mongolia	Total
Recoveries / controls					
From Australia to…	1				**1**
Sightings - known individuals					
From Australia to…		1			**1**
Sightings - plain flags					
From Australia to…		4	1	1	**6**
Total	**1**	**5**	**1**	**1**	**8**

Great Knot *Calidris tenuirostris*

A large amount of new data has accumulated in the last five years, particularly from the introduction of large scale banding at Chongming Dao and the extensive use of engraved leg flags there and in north-west Australia (Figure 20, Table 22). A total of 3443 overseas movements relating to Australia have now accrued.

Great Knot focus strongly on the whole of the Yellow Sea as their main stopover area on northward migration. Yalu Jiang, at the north end of the Yellow Sea, and Saemangeum in South Korea (until it was reclaimed), were particularly favoured staging sites. Bohai Bay is also used. Many Great Knot make their first brief landfall at Chongming Dao in the Yangtze estuary at the south-western end of the Yellow Sea. Records in Hong Kong, Taiwan and southern Japan are probably birds which failed to reach their intended destination in a single 5500–7000 km flight from the north coast of Australia. Flag sightings and recoveries suggest that a single further flight from the Yellow Sea takes birds to, or close to, the breeding areas in north-west Siberia.

The southward migration strategy is less clear. Many birds stop off on the coast on the southern side of the Sea of Okhotsk. It is possible that these make a direct flight of 8000 km back to northern Australia. Others stage in both the Korean and Chinese parts of the Yellow Sea before returning to Australia. Determination of the full details of southward migration will probably require the use of geolocators or satellite transmitters.

Red Knot *Calidris canutus*

The Red Knot is another species which has received intensive attention. This is especially so in recent years when it has become apparent that massive declines have occurred in the population in the Flyway. A total of 7442 movements linking Australia and overseas have occurred, as well as 720 shorter movements within Australia (Figure 21, Table 23).

In many ways movements of Red Knot are similar to Bar-tailed Godwit with a high concentration of movement records relating to the Yellow Sea, a strong link between Australia and New Zealand, and two subspecies involved. However in the case of the Red Knot both subspecies breed in Siberia – *rogersi* in Chukotka and *piersmai* in the New Siberian Islands. Also there is much more overlap in the non-breeding areas of the two subspecies, although *piersmai* dominate in north-west Australia and *rogersi* in eastern Australia (and New Zealand) (Rogers *et al.* 2010).

A particularly strong feature of data generated in recent years has been the number of first-year Red Knot marked in north-west Australia in the June to August period which have subsequently been sighted in New Zealand. Much further data has also been collected on the strong movement to New Zealand of Red Knot juveniles which spend their first year in south-east Australia before moving across the Tasman Sea at the beginning of their second year to become New Zealand "citizens".

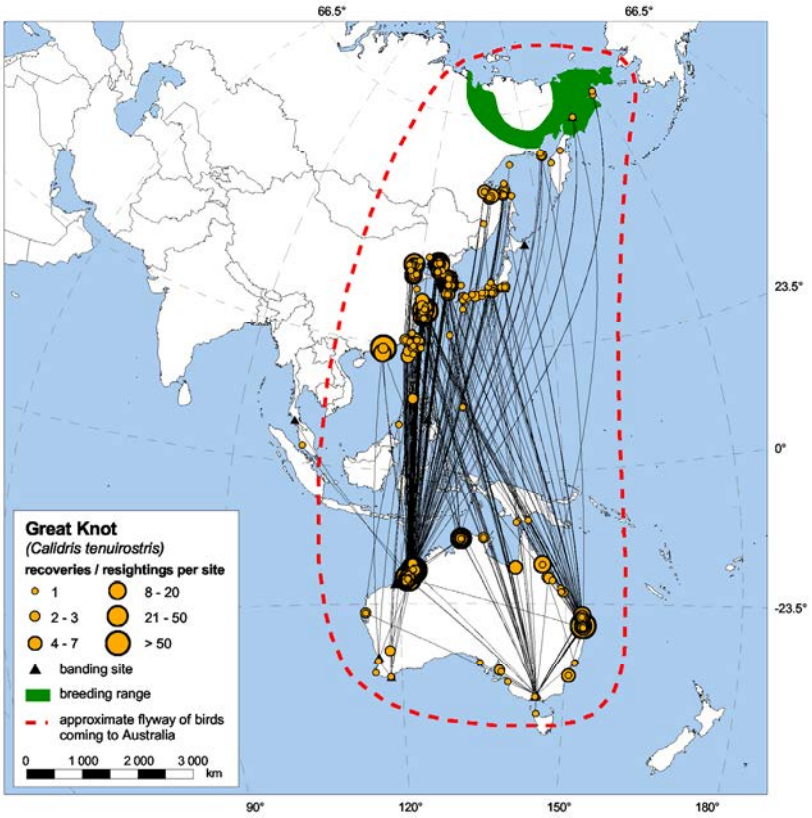

Figure 20. Great Knot

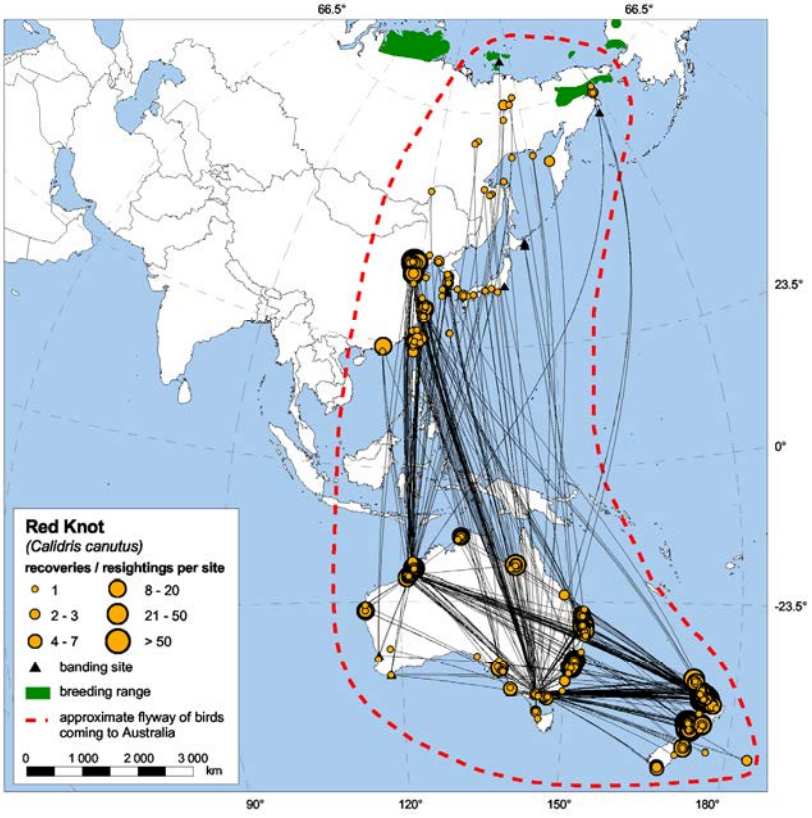

Figure 21. Red Knot

Table 22. Great Knot – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	PNG	Philippines	Malaysia	Thailand	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	N Korea	Japan	Russia	Total
Recoveries / controls													
From Australia to…	8	2	4				1	236	2	1		51	**305**
To Australia from…								24	4			3	**31**
Sightings - known individuals													
From Australia to…	180					16	19	158	52	1			**426**
To Australia from…								14					**14**
Sightings - plain flags													
From Australia to…	135	1		1		91	85	460	453	4	38	37	**1305**
To Australia from…					2			1609	49		20		**1680**
Total	**323**	**3**	**4**	**1**	**2**	**107**	**105**	**2501**	**560**	**6**	**58**	**91**	**3761**

Table 23. Red Knot – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	New Zealand	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls									
From Australia to…	14	79	1	1	43	1		17	**156**
To Australia from…		7	3		1	1	1	2	**15**
Sightings - known individuals									
From Australia to…	102	34		2	193	1			**332**
To Australia from…		10			5				**15**
Sightings - plain flags									
From Australia to…	605	5088	20	46	1631	19	12	11	**7432**
To Australia from…		100	1		98		2		**201**
Total	**721**	**5318**	**25**	**49**	**1971**	**22**	**15**	**30**	**8151**

Sanderling *Calidris alba*

This species has a rather more easterly migration path than other Australian waders with Japan being the strongest focus (Figure 22, Table 24). However Taiwan and the coasts of the Yellow Sea are also important stopover areas. After stopping in these areas the next major staging site on northward migration seems to be at the northern end of Sakhalin in eastern Siberia. This, and Japan, are also extensively used on southward migration. The lack of reports (only three) in areas between Japan/the Asian mainland and the northern Australian coast suggests Sanderling may make this 5–6000 km journey without stopping.

There has so far been only one record in, or near, the northern Siberian breeding grounds.

Red-necked Stint Calidris ruficollis

This is the most ubiquitous wader in the Flyway with birds marked and subsequently reported at a wide range of locations (Figure 23, Table 25). The biggest concentration of records of Australian birds is along the whole of the Chinese coast and throughout Japan. Northern Sakhalin in eastern Siberia is also widely used as a stopover location on both northward and southward migrations. Some birds however stray far to the west, particularly on southward migration, with flag sightings reported from Thailand, Malaysia and even the Andaman Islands (India). Another notable feature is the number of records relating to Indonesia (78). Clearly the Red-necked Stint, being smaller than most waders, does not always have the capability to fly non-stop between the Chinese mainland and Australia and therefore makes more stopovers than other waders.

There have been a total of 120 records relating to Russia – far more than for any other species. Some of these have been on the breeding grounds right along the north coast of Siberia. There is no suggestion of a north/south migration pattern – the most north easterly record (north-east Chukotka) relates to a breeding adult marked there which was subsequently recaptured in the far west of Australia, in Perth.

Long-toed Stint *Calidris subminuta*

This tiny wader, weighing 20% less than a Red-necked Stint, only occurs in small numbers, mainly in western and northern Australia. A flagged bird from one of the inland lagoons near Broome was subsequently reported on migration in part of Malaysia (Figure 24, Table 26).

Pectoral Sandpiper *Calidris melanotos*

Although this species breeds across a wide range of northern Siberia most birds are thought to migrate across the Bering Straits to spend the non-breeding season in the Americas. A small sprinkling reach Australia and one flagged in Victoria was subsequently seen near Sydney in New South Wales (Table 27). No map is shown.

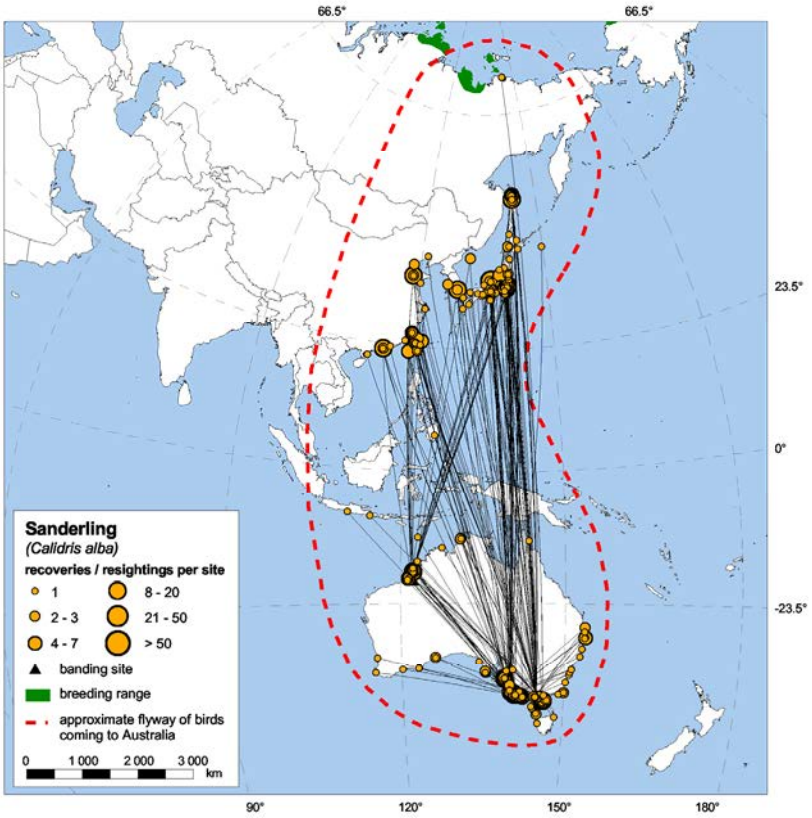

Figure 22. Sanderling

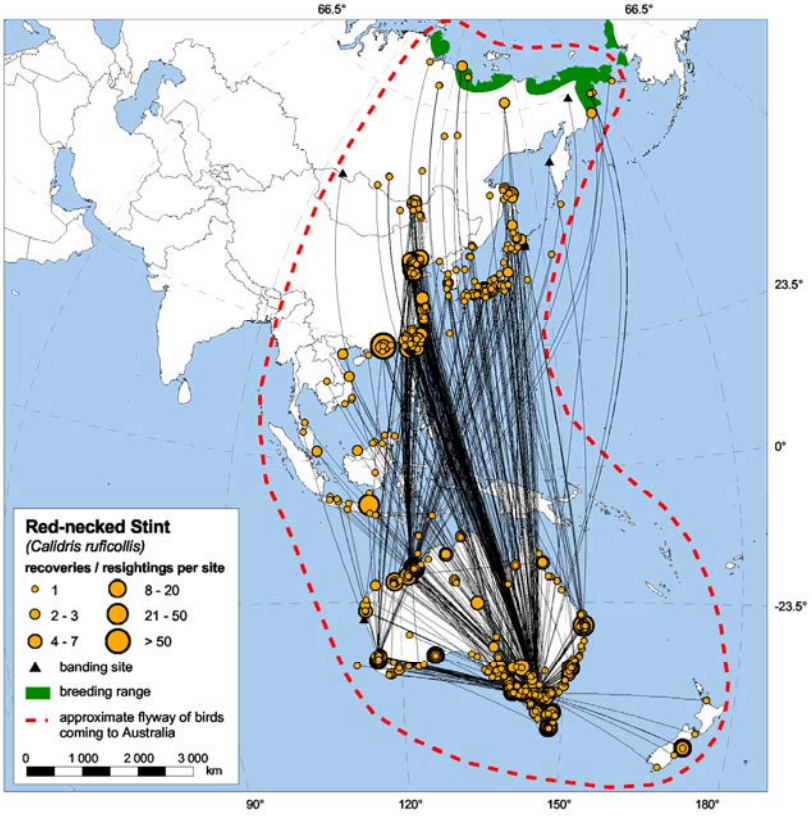

Figure 23. Red-necked Stint

Table 24. Sanderling – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Indonesia	Philippines	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls										
From Australia to…	47		1		3	4		7	23	**85**
To Australia from…						1		1		**2**
Sightings - known individuals										
From Australia to…						4		2		**6**
Sightings - plain flags										
From Australia to…	440	2		27	39	65	79	236	88	**976**
To Australia from…						5				**5**
Total	**487**	**2**	**1**	**27**	**42**	**79**	**79**	**246**	**111**	**1074**

Table 25. Red-necked Stint – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	New Zealand	East Timor	Indonesia	Brunei	Andaman Islands (India)	Malaysia	Thailand	Vietnam	Hong Kong (China)	Taiwan (China)	China (mainland)	Mongolia	S Korea	Japan	Russia	Total
Recoveries / controls																	
From Australia to…	118			5			1	1	5	1	4	42	1		3	18	**199**
To Australia from…										2	1	3			5	2	**13**
Sightings - plain flags																	
From Australia to…	1176	30	1	73	4	2	7	2	2	342	154	760	30	25	102	93	**2803**
To Australia from…											5	21		2	15	7	**50**
Total	**1294**	**30**	**1**	**78**	**4**	**2**	**8**	**3**	**7**	**345**	**164**	**826**	**31**	**27**	**125**	**120**	**3065**

Table 26. Long-toed Stint – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Malaysia	Total
Sightings - plain flags		
From Australia to…	1	**1**
Total	**1**	**1**

Table 27. Pectoral Sandpiper – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Total
Sightings - plain flags		
From Australia to…	1	**1**
Total	**1**	**1**

Sharp-tailed Sandpiper *Calidris acuminata*

The most important new movements data generated in the last five years has been the link between Alaska and Australia (Figure 25, Table 28). There are now five sightings in south-east Australia of birds banded as juveniles on the shores of south-west Alaska. This surprising southward migration route for some of the young birds from the Siberian breeding grounds has been known for some time but it is nice to have direct evidence. Weight data collected in Alaska suggests that these birds make a direct flight across the Pacific to Australia, just like Bar-tailed Godwit going to New Zealand and Australia from Alaska (Gill *et al.* 2009).

Taiwan and the Chinese side of the Yellow Sea seem to be important stopover sites, on northward migration particularly. No Australian-marked birds have been reported from mainland Japan. There are three recoveries close to the breeding grounds in the north of the Yakutia region of Siberia.

Curlew Sandpiper *Calidris ferruginea*

Although Curlew Sandpipers have a wide breeding range across the north of Siberia, similar to the Red-necked Stint, the two species have noticeably different migration paths. On northward migration Curlew Sandpipers seem to be almost all on the Chinese coast (from Hong Kong to the west side of the Yellow Sea) and in Taiwan, until they turn inland to cross China and Siberia to their arctic breeding grounds. South Korea (1 record) and Japan (6 records) are clearly to the east of the main migration route (Figure 26, Table 29).

On southward migration many Curlew Sandpipers use a more westerly route with single Australian-marked birds being reported in southern India and Sri Lanka, as well as

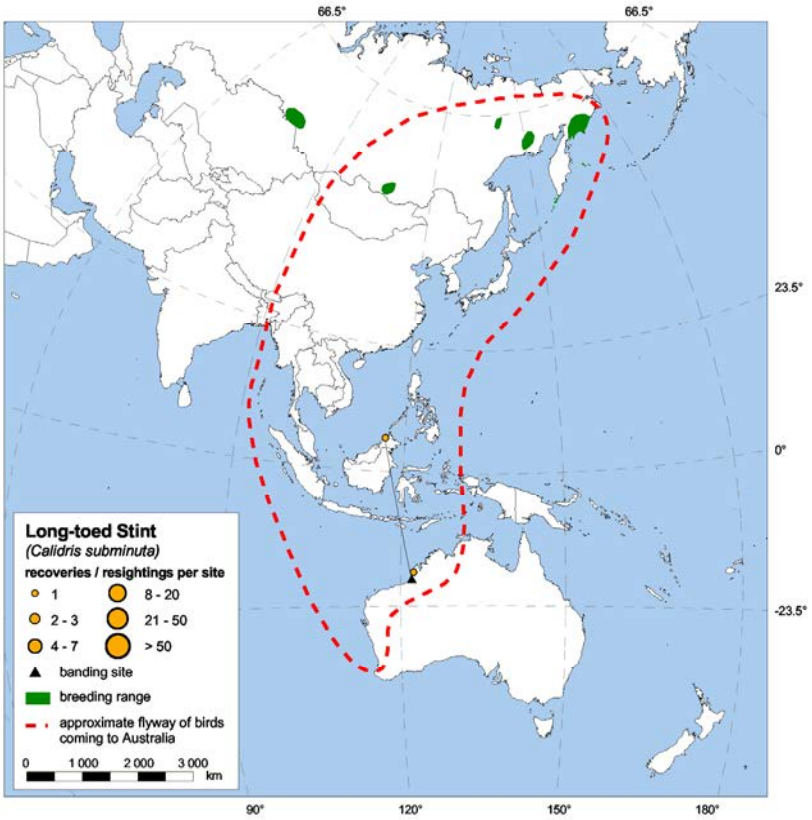

Figure 24. Long-toed Stint

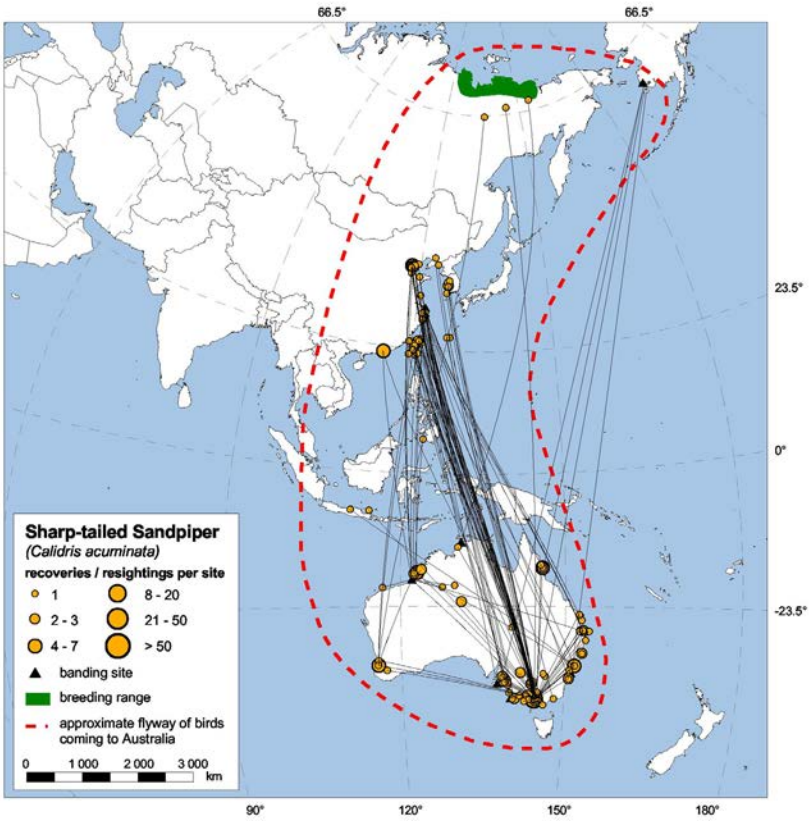

Figure 25. Sharp-tailed Sandpiper

Table 28. Sharp-tailed Sandpiper – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	Indonesia	Philippines	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	USA	Total
Recoveries / controls											
From Australia to…	3	1	1		1	8			3		**17**
Sightings - known individuals											
From Australia to…	1										**1**
To Australia from…						1					**1**
Sightings - plain flags											
From Australia to…	85	1		7	26	42	9	3			**173**
To Australia from…					3	36				5	**44**
Total	**89**	**2**	**1**	**7**	**30**	**87**	**9**	**3**	**3**	**5**	**236**

Table 29. Curlew Sandpiper – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Australia	New Zealand	Indonesia	Sri Lanka	India	Singapore	Malaysia	Thailand	Vietnam	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls																
From Australia to…	69		5		1			2	4	14	3	33			11	**142**
To Australia from…		2				1		1	1	7	7	2			3	**24**
Sightings - known individuals																
From Australia to…	6									5	5	26				**42**
Sightings - plain flags																
From Australia to…	723		35	1			3	5	1	638	168	381	1	3	2	**1961**
To Australia from…		1	1							10	2	10		3		**27**
Total	**798**	**3**	**41**	**1**	**1**	**1**	**3**	**8**	**6**	**674**	**185**	**452**	**1**	**6**	**16**	**2196**

several in Thailand and Malaysia. Quite a number (41 records) also use the western parts of Indonesia.

There have been 16 records linking Russia and Australia, with several referring to birds seen on the breeding grounds. The furthest west of these (90°E) was a bird banded in south-east Australia. The only north-west Australian Curlew Sandpiper found on the breeding grounds was recently reported (2009).

Broad-billed Sandpiper *Limicola falcinellus*

All except two of the 38 records relate to birds moving between north-west Australia and Asia/Russia (Figure 27, Table 30). There is quite a wide spread of migratory stopover locations, from Hong Kong to northern Japan. There has been one report from Russia of a bird on migration through northern Sakhalin but none from anywhere near the breeding grounds.

Oriental Pratincole *Glareola maldivarum*

Although vast hordes (up to 2.8 million) of Oriental Pratincole occasionally occur in north-west Australia (Sitters *et al.* 2004) only small numbers have been banded and flagged. It is therefore particularly fortunate that a bird probably flagged during the spectacular event at Anna Plains/80 Mile Beach in February 2004 was subsequently seen at a breeding location in Taiwan (Figure 28, Table 31).

DISCUSSION

The massive contribution made by leg flagging to the knowledge of wader movements is now extremely apparent, with 17,707 overseas plain flag sightings and 815 individually-marked birds sighted (1,439 reports), compared to 882 recoveries of Australian-marked birds. A more balanced picture of migration in the whole Flyway is also now being obtained because of the large-scale wader banding and flagging which has occurred over the last seven years at Chongming Dao, and elsewhere in China. Large-scale wader catching has also started relatively recently in Thailand and Indonesia, and there are ongoing marking programs still operating in Japan, Taiwan, Hong Kong and New Zealand.

The increasing use of engraved leg flags and individual flag/colour band combinations is also improving the quality of information collected. A prime example of this is the intensive study of Red Knot in the Bohai Bay area of the Yellow Sea in China where sightings of marked birds, together with breeding plumage data, have enabled the distribution of the two races of this species in the non-breeding areas to be estimated (Rogers *et al.* 2010). The Red Knot data is also being used in representations to government and conservation bodies in China, and elsewhere, concerning the major threat to migratory waders caused by the huge ongoing reclamation projects all around the Yellow Sea.

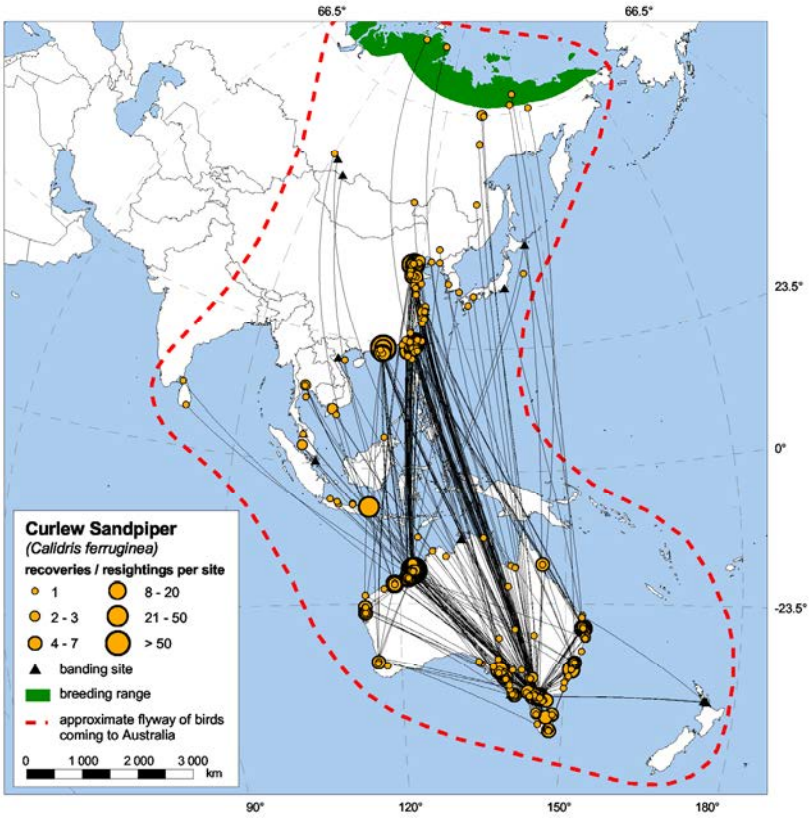

Figure 26. Curlew Sandpiper

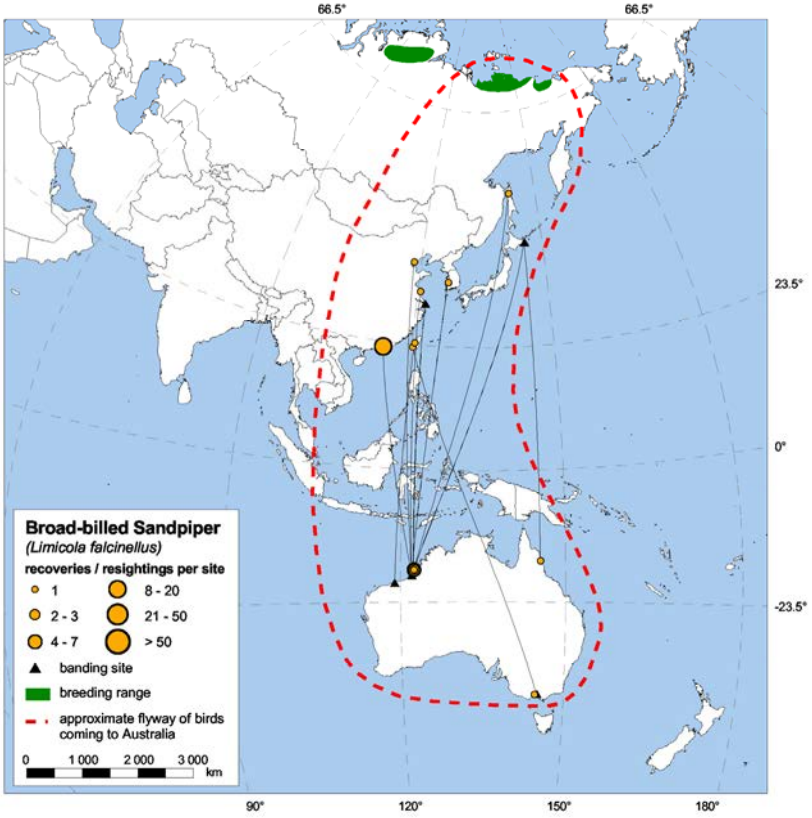

Figure 27. Broad-billed Sandpiper

Table 30. Broad-billed Sandpiper – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Hong Kong (China)	Taiwan (China)	China (mainland)	S Korea	Japan	Russia	Total
Recoveries / controls							
From Australia to…		1				1	**2**
Sightings - plain flags							
From Australia to…	16	1	2	2			**21**
To Australia from…			9		6		**15**
Total	**16**	**2**	**11**	**2**	**6**	**1**	**38**

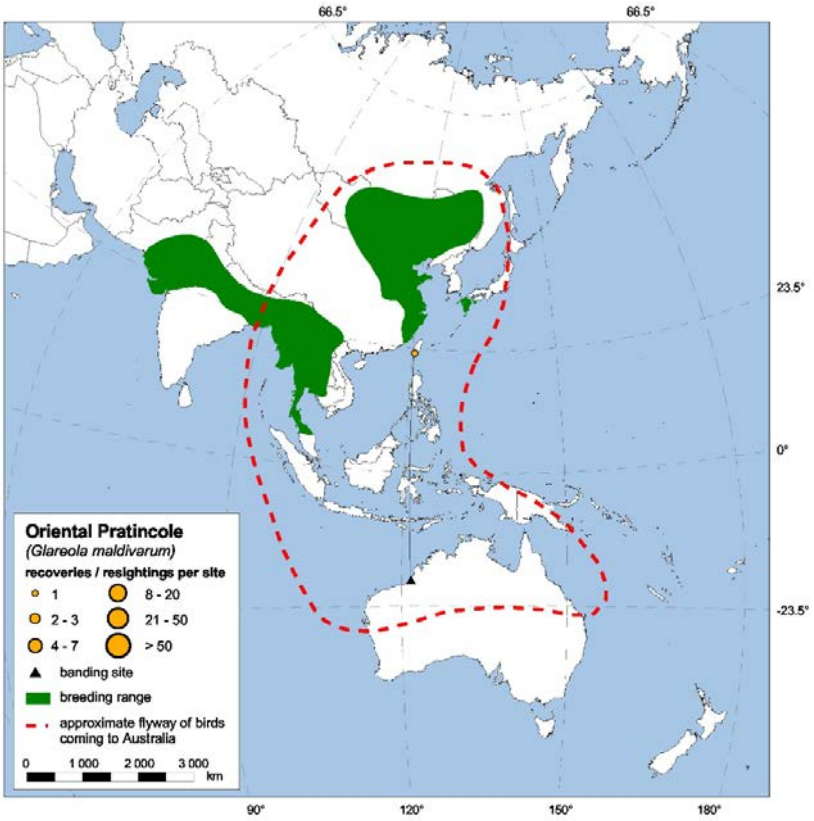

Figure 28. Oriental Pratincole.

Table 31. Oriental Pratincole – number of recoveries and leg-flag sightings of birds moving to and from Australia.

	Hong Kong (China)	Total
Recoveries / controls		
From Australia to…	1	**1**
Total	**1**	**1**

The migration analyses confirm earlier knowledge that most of the migratory waders which visit Australia make their main stopovers in China, especially in the Yellow Sea. Long non-stop movements to cover the majority of the journey appear to be the norm. Some of the larger waders seem to need only one major stopover but the medium and smaller sized species require at least two stops. Shorter movements may be made to adjust location in the stopover regions and also at the end of journeys as birds near their arctic breeding areas or Australian non-breeding areas.

Bar-tailed Godwit (trans-Pacific from Alaska on southward migration) and Double-banded Plover (across the Tasman to and from New Zealand) are the only two species which complete their main migration without a stopover.

No two species have the same migration route and many use different paths and strategies for the northward and southward journeys, sometimes markedly so. The Alaskan-breeding Bar-tailed Godwit travel northward from eastern Australia (and New Zealand) with a major stopover in the Yellow Sea. However on southward migration they fly directly across the Pacific. Curlew Sandpiper travel northward through China, but many return southward via a more westerly route, extending as far as India/Sri Lanka.

Migration routes are narrow in some species (Eastern Curlew, Grey Plover, Greater Sand Plover) but broad in

others (Red-necked Stint, Lesser Sand Plover). Some migrations have a generally north/south pattern of movement (e.g. Grey-tailed Tattler) whilst others show more apparent crossovers of migratory paths (e.g. Red-necked Stint).

Presumably each species has gradually evolved its optimum migration strategy which will have been dependent on changes in available breeding and non-breeding areas since the last Ice Age. With migration routes and stopover locations fine tuned over a prolonged period it is vital that these are not prejudiced by marked changes caused by human activities such as the loss of feeding habitat at stopover sites (e.g. due to reclamation of intertidal flats in the Yellow Sea). This appears to already have occurred with many species in the East Asian – Australasian Flyway showing marked population declines in the last 20 years (Gosbell and Clemens 2006). The banding and flagging data generated over the past 30 years on waders which spend the non-breeding season in Australia clearly indicates the importance of the Asian coast, particularly the Yellow Sea in China and Korea, as a key stopover location for most species on northward migration and for many on southward migration. It is essential that the loss of migratory stopover habitat in Asia be slowed. Continued banding, flagging and resighting efforts provide a fundamental understanding of species' migrations on which to base conservation actions.

ACKNOWLEDGEMENTS

Most banding and flagging fieldwork involves large teams of people, especially when the principal catching technique is cannon-netting. The arduous physical effort, long hours, and sometimes extreme weather conditions are just some of the challenges which participants have to contend with. Without this huge input by banders, over more than 30 years, the data on which this paper is based would not have been generated.

Every overseas recovery and flag sighting generated involves a "third party". These may be other banders, flag observers, wader study groups, individual researchers, bird watchers, photographers, hunters or members of the public who just happen to come across a marked bird. All are thanked for their efforts in collecting information on marked birds and, especially, for reporting them.

The role of sorting and storing this information, and regurgitating when required, is critical and thanks are due to the Australian government for funding the Flag Database Coordinator (through AWSG) and the Australian Bird and Bat Banding Office. Many many overseas persons and Banding Schemes facilitated the flow of flag sightings and recoveries/controls from outside Australia and these are all greatly thanked. Ken Gosbell kindly commented on a draft of the manuscript.

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SHOREBIRD BANDING AT CHONGMING DONGTAN, EAST CHINA: AN OVERVIEW

CHENDONG TANG, WENJIE XUE, QIANG MA, XUESONG FENG
Shanghai Chongming Dongtan National Nature Reserve, 202183, Chongming, Shanghai, China
Email: mq81_cn@163.com

We review the shorebird banding at Chongming Dongtan, an important stopover site for shorebirds in east China along the East Asian-Australasian Flyway. More than 30,000 shorebirds of 45 species have been banded and nearly 30,000 shorebirds have been marked with colour leg flags at Chongming Dongtan. Great Knot was the most abundant bird with more than 9,000 birds being banded. Since 2006, engraved leg flags were placed on 1,408 birds. A total of 359 birds of 20 species were recaptured during shorebird banding at Chongming Dongtan. More than half of this total were Great Knot and more than 70% were originally banded in north-west Australia. This suggests that there is a close migratory connection between the shorebirds in north-west Australia and at Chongming Dongtan. Shorebird banding at Chongming Dongtan provided data for understanding the shorebird migration and stopover ecology along the East Asian-Australasian Flyway.

INTRODUCTION

Chongming Dongtan is an important stopover site for migratory shorebirds along the East Asian-Australasian Flyway. Located in the south Yellow Sea region, Chongming Dongtan is more than 5,000 km from the non-breeding grounds of shorebirds in Australia and 3,000-6,000 km from the breeding grounds of shorebirds in Alaska and Siberia (Xu and Zhao 2005). More than 250,000 shorebirds stage at Chongming Dongtan for fuelling and rest during migration (Barter *et al*. 1997).

In order to understand this migration, shorebird banding has been conducted at Chongming Dongtan since the 1980s. Here we review the shorebird banding at Chongming Dongtan. We classified the shorebird banding at Chongming Dongtan into two stages: 1986-1996 and 2002-2009.

METHODS

Study site

Chongming Dongtan (E121°50'-122°05' / N31°25'-31°38', Figure 1) is located at the east end of Chongming Island in the Yangtze River estuary. The total area is 241.55 km^2, with tidal flats encompassing 145.77 km^2. The annual average temperature is 15.3°C, the average temperature in the hottest month (July /August) is 26.8°C and in the coldest month (January/February) 3.0°C. The average annual rainfall is

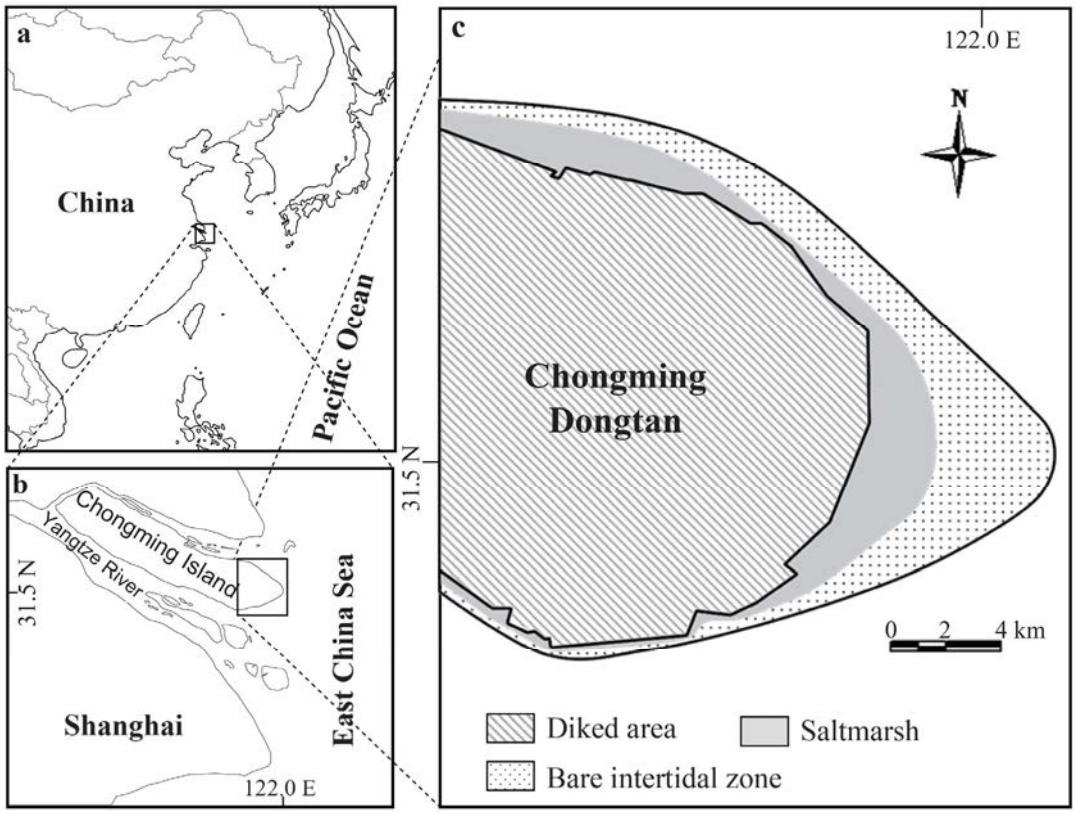

Figure 1. Map of Chongming Dongtan (c) and its location in China (a) and in the Yangtze River estuary (b). From Gan *et al*. 2010.

1022.1 mm (Xu and Zhao 2005).

The Chongming Dongtan Nature Reserve was established in 1998. It became part of the East Asian-Australasian Flyway Site Network in 1999, was designated as a Wetland of International Importance (Ramsar site) in 2000 and promoted to a Chinese National Nature Reserve in 2005.

Shorebird capture and banding

Shorebird banding was conducted during northward migration (from March 20th to May 20th) and southward migration (from August 1st to October 20th). The main periods of shorebird banding at Chongming Dongtan are listed in Table 1.

Generally, the banding lasted from late March to late May during northward migration, and from early August to late October during southward migration. According to the bird counts in the reserve over the past decades, shorebird banding covered the entire migratory periods of shorebirds at Chongming Dongtan. Shorebirds were captured by two local hunters. Decoys and bamboo whistles were used to attract shorebirds close to the catching area and captured using traditional clap nets (Ge *et al.* 2006, Choi 2009). All the captured birds were placed into portable cages and transferred to the banding sites, about 200-500 m away, to conduct shorebird banding.

Captured shorebirds were fitted with numbered metal bands issued by the National Bird Banding Center of China on the left tibia, and black and white colour leg flags on the right tibia. Shorebirds were aged according to the state of wear of primaries and the patterns of inner mediate coverts (Prater *et al.* 1987). The body weight, length of wing, bill, head and bill, and tarsus were measured.

RESULTS

Total number and species of shorebirds banded

The shorebird banding can be classified into two stages – 1986-1996 and 2002 to present. During 1986-1996 due to the lack of people and financial support, small numbers of shorebirds were banded (Table 2). A total of 1158 birds of 31 species were banded during this period. From 2002 to present, shorebird banding was organized by the Chongming Dongtan Nature Reserve. The staff at the reserve, researchers, and volunteers took part in banding work. Until the end of 2009, a total of 29,698 birds of 43 species were banded, including 28,398 birds attached with color leg-flags (Table 3).

In 1986-1996, the most abundant shorebird banded at Chongming Dongtan was the Great Knot, followed by the Red-necked Stint and Dunlin. These three species made up about 50% of the total number of shorebirds. Since 2002, more than 1,000 individuals of nine species were banded. These include Great Knot, Dunlin, Terek Sandpiper, Long-toed Stint, Whimbrel, Bar-tailed Godwit, Red-necked Stint, Sharp-tailed Sandpiper and Common Greenshank (Table 3). Great Knot was the most abundant bird with 9,371 birds (32% of total) banded during 2002-2009.

The species and number of shorebirds banded during northward and southward migration between 2002 and 2009 is presented in Figure 2. The number of species banded was higher during southward than northward migration. In contrast, the individual number of banded shorebirds was higher during northward than southward migration.

Numbers and species fitted with engraved leg flags

Since 2006, engraved leg flags were attached to a total of 1,408 birds. Most of these were Great Knot (636 birds) and Red Knot (223 birds) (Table 4).

Recaptures

A total of 359 birds of 20 species were recaptured during shorebird banding at Chongming Dongtan (Table 5). More than half of this total were Great Knot and more than 70% of the total were birds originally banded in north-west Australia and carrying yellow leg flags.

DISCUSSION

Bird banding is one of most effective methods for the study of bird migration. Banding large numbers of birds over many years can provide valuable data on migration routes and important stopover sites (Minton 2003). More than 30,000 shorebirds of 45 species have been banded at Chongming Dongtan since the 1980s. This has provided important data for understanding the shorebird migration and stopover ecology along the East Asian-Australasian Flyway.

Great Knot, Bar-tailed Godwit, Red Knot and 20 other shorebird species staging at Chongming Dongtan are connected with seven countries, including Australia and New Zealand. This indicates that Chongming Dongtan is an important stopover site along the East Asia-Australasian wader migration route. Among the recaptured birds, Great Knot has the most recovery records. More than 70% of the recoveries in Chongming Dongtan came from north-west Australia. This suggests that there is a close migratory connection between the shorebirds in north-west Australia

Table 1. The main banding periods at Chongming Dongtan

Banding periods	Events
In 1986	The Chongming Banding Station was established and shorebird banding commenced.
In 1996	Waterbird identification and banding training courses, organised by Chinese and Australian governments, held at Chongming Dongtan
From 1996-2001	Shorebird banding suspended.
Since 2002	Shorebird banding re-started and organized by the Chongming Dongtan Nature Reserve.
Since 2003	Leg-flags -- white over black -- were used in shorebird banding
Since 2006	The colour combination of leg-flags was changed from white over black to black over white. Engraved leg flags were used in shorebird banding.

Table 2. Numbers of shorebirds banded at Chongming Dongtan during 1986-1996. See Table 3 for the scientific name of the species.

Species	1986	1987	1988	1989	1990	1992	1994	1995	1996	Total
Great Knot		27	52	111					144	334
Red-necked Stint		2	82	42					2	128
Dunlin	12	27	34	32					11	116
Bar-tailed Godwit	2	6	28	15				1	35	87
Terek Sandpiper		20	40	1				1	5	67
Common Redshank		2	7	20					24	53
Common Greenshank	21	3	19	3				3	1	50
Sharp-tailed Sandpiper		4	10	21					13	48
Greater Sand Plover			34						1	35
Grey Plover	2		8	9					14	33
Red Knot		2	2	12	1	1	1		13	32
Kentish Plover	1	1	17	9					4	32
Grey-tailed Tattler		2	28							30
Spotted Redshank	5	1	13						1	20
Broad-billed Sandpiper		4	4					5		13
Whimbrel	1	4	7							12
Pacific Golden Plover		2	8					1		11
Wood Sandpiper			5						6	11
Curlew Sandpiper		5	5							10
Marsh Sandpiper									10	10
Ruddy Turnstone		3	3							6
Eastern Curlew				1			1		2	4
Eurasian Curlew									3	3
Little Curlew									3	3
Black-tailed Godwit			2							2
Spoon-billed Sandpiper			1	1						2
Nordmann's Greenshank			1						1	2
Asian Dowitcher			1							1
Solitary Snipe			1							1
Common Sandpiper			1							1
Sanderling									1	1
Total	44	115	413	277	1	1	2	11	294	1158

and Chongming Dongtan (Hui *et al.* 2009). Thus, any environmental change at Chongming Dongtan may affect the wader population in north-west Australia. The population decline of migratory shorebirds in Australia could be linked to the loss and degradation of habitats in the Yellow Sea regions including Chongming Dongtan (Rogers *et al.* 2009).

Two Red Knot subspecies occur in the East Asian-Australasian Flyway, *Calidris canutus piersmai* wintering in north-west Australia and the *Calidris canutus rogersi* wintering in east Australia and New Zealand (Battley 2005). Bird recapture indicates that both subspecies stage at Chongming Dongtan during migration. The same situation occurs in Bar-tailed Godwit. Both subspecies, *Limosa lapponica menzbieri* from north-west Australia and *Limosa lapponica baueri* from east Australia and New Zealand (Wilson *et al.* 2007, Gill *et al.* 2005), chose Chongming Dongtan as the stopover site during north migration. Although recent satellite tracking study has indicated that the Bar-tailed Godwit may skip Chongming Dongtan during northward migration (Gill *et al.* 2005), Chongming Dongtan might be important stopover site for the weak birds, especially when the weather is unsuitable for migratory flights.

ACKNOWLEDGEMENTS

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Table 3. Numbers of shorebirds banded during 2002-2009

Species	Scientific name	Number
Great Knot	*Calidris tenuirostris*	9371
Dunlin	*Calidris alpina*	2533
Terek Sandpiper	*Xenus cinereus*	2227
Long-toed Stint	*Calidris subminuta*	2098
Whimbrel	*Numenius phaeopus*	1786
Bar-tailed Godwit	*Limosa lapponica*	1692
Red-necked Stint	*Calidris ruficollis*	1635
Sharp-tailed Sandpiper	*Calidris acuminata*	1235
Common Greenshank	*Tringa nebularia*	1062
Red Knot	*Calidris canutus*	985
Common Redshank	*Tringa totanus*	803
Greater Sand Plover	*Charadrius leschenaultii*	619
Wood Sandpiper	*Tringa glareola*	566
Broad-billed Sandpiper	*Limicola falcinellus*	336
Grey-tailed Tattler	*Tringa brevipes*	316
Black-tailed Godwit	*Limosa limosa*	276
Grey Plover	*Pluvialis squatarola*	253
Kentish Plover	*Charadrius alexandrinus*	235
Lesser Sand Plover	*Charadrius mongolus*	202
Turnstone	*Arenaria interpres*	188
Marsh Sandpiper	*Tringa stagnatilis*	167
Curlew Sandpiper	*Calidris ferruginea*	155
Common Sandpiper	*Actitis hypoleucos*	154
Spotted Redshank	*Tringa erythropus*	146
Eastern Curlew	*Numenius madagascariensis*	144
Pacific Golden Plover	*Pluvialis fulva*	129
Sanderling	*Calidris alba*	116
Eurasian Curlew	*Numenius arquata*	67
Common Snipe	*Gallinago gallinago*	51
Little Ringed Plover	*Charadrius dubius*	31
Nordmann's Greenshank	*Tringa guttifer*	29
Asian Dowitcher	*Limnodromus semipalmatus*	23
Oriental Pratincole	*Glareola maldivarum*	16
Little Curlew	*Numenius minutus*	12
Green Sandpiper	*Tringa ochropus*	9
Red-necked Phalarope	*Phalaropus lobatus*	8
Ruff	*Philomachus pugnax*	8
Temminck's Stint	*Calidris temminckii*	5
Swinhoe's Snipe	*Gallinago megala*	4
Black-winged Stilt	*Himantopus himantopus*	2
Long-billed Dowitcher	*Limnodromus scolopaceus*	2
Grey-headed Lapwing	*Vanellus cinereus*	1
Spoon-billed Sandpiper	*Eurynorhynchus pygmeus*	1
Total		29698

Table 4. Engraved leg flags used at Chongming Dongtan during northward (N) and southward (S) migration.

Species	2006 N	2006 S	2007 N	2009 S	Total
Great Knot	178	109	278	0	636
Red Knot	120	0	103	0	223
Common Greenshank	27	93	10	0	130
Bar-tailed Godwit	10	19	137	0	166
Black-tailed Godwit	0	38	10	0	48
Whimbrel	83	60	0	0	143
Grey Plover	0	0	26	0	26
Dunlin	0	0	0	36	36
Total	489	319	564	36	1408

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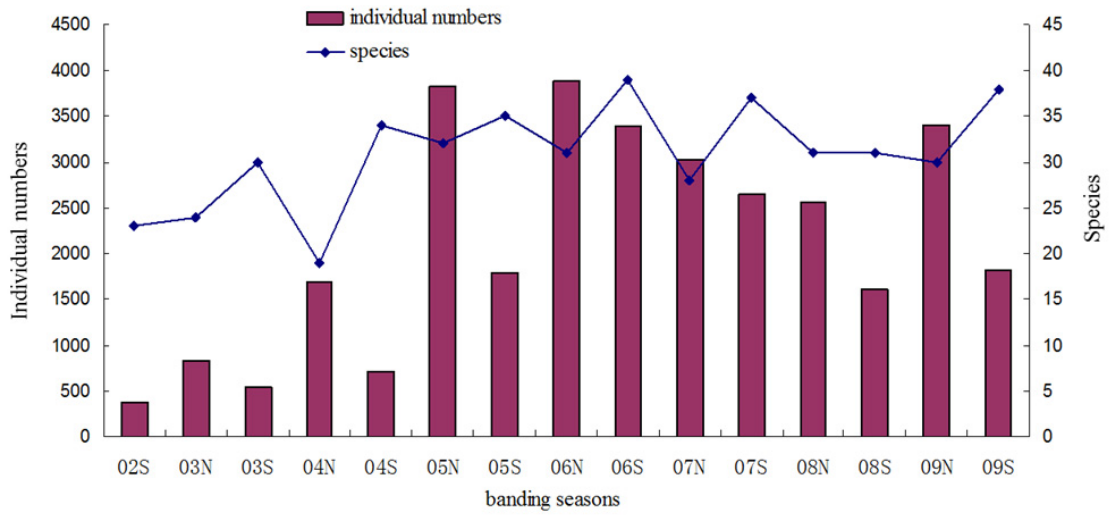

Figure 2. Species and individual numbers of shorebirds banded at Chongming Dongtan during northward (N) and southward (S) migration in 2002-2009.

Table 5. Shorebird recapture during 2002-2009 at Chongming Dongtan.

	AU	NZ	JP	PH	ML	TW	HK	CM	Total
Great Knot	178	1	2	1				28	210
Bar-tailed Godwit	35	1						4	40
Red Knot	12	16	2					1	31
Red-necked Stint	8								8
Terek Sandpiper	8		2		1			5	16
Curlew Sandpiper	5								5
Lesser Sand Plover	1		2						3
Greater Sand Plover	1						1	1	3
Sharp-tailed Sandpiper	2					1		2	5
Eurasian Curlew	1								1
Grey Plover	1								1
Whimbrel						1			1
Dunlin						2		24	26
Common Greenshank								1	1
Black-tailed Godwit	1								1
Long-toed Stint								3	3
Sanderling	1								1
Broad-billed Sandpiper	1								1
Grey-tailed Tattler								1	1
Ruddy Turnstone	1								1
Total	256	18	8	1	1	4	1	70	359

Au: Australia; NZ: New Zealand; JP: Japan; PH: Philippine; ML: Malaysia; TW: Taiwan, China; HK: Hong Kong, China; CM: Chongming Dongtan, China. Birds captured in the same season and in the same year at Chongming Dongtan are not included.

FURTHER RECORDS ON BLACK-WINGED STILT *HIMANTOPUS HIMANTOPUS* IN SUMATRA, INDONESIA

MUHAMMAD IQBAL[1] & GIYANTO[2]

[1]*KPB-SOS, Jalan Tanjung api-api km 9 Komplek P & K Blok E 1 Palembang 30152, Indonesia; kpbsos26@yahoo.com.*
[2]*Jl. Bunga Wijaya no. 66, Padang Bulan Selayang, Medan 20131, Sumatera Utara, Indonesia. gigi_giyanto@yahoo.com*

Keywords: Black-winged Stilt, Sumatra, Indonesia

Recent observations of Black-winged Stilt *Himantopus himantopus* during October 2009 to March 2010 in Sumatra suggest that the bird may be a regular winter visitor rather than a vagrant. The occurrence of breeding adult *Himantopus himantopus* accompanying juveniles in Bagan Serdang suggests that the species is a regular visitor and possibly breeds in Sumatra.

INTRODUCTION

The Black-winged Stilt, *Himantopus himantopus*, is divided into five subspecies, and is sometimes considered to constitute three to five separate species (Pierce 1996). These include the nominate race *himantopus* of Europe, Africa and Asia; *leucocephalus*, from Australia; *mexicanus*, the Black-necked Stilt of Central and South America; *melanurus*, the White-backed Stilt of central South America and *knudseni*, the Hawaiian Stilt of Hawaii (Pierce 1996). Sonobe & Usui (1993) and Robson (2005a) distinguish Black-winged Stilt *H. himantopus* as a separate species from White-headed Stilt *H. leucocephalus*, although most other authors (e.g. Cramp & Simmons 1983, Hayman *et al.* 1986, Inskipp *et al.* 1996, Pierce 1996) treat *leucocephalus* as a subspecies of *H. himantopus*. More information on the distribution of this species (or subspecies) is required before any firm conclusions can be made regarding its range (Lopez & Mundkur 1997).

Most Indonesian references treat Australian White-headed Stilt *H. leucocephalus* as a full species (e.g. Andrew 1992, Behleer *et al.* 2001, Mackinnon *et al.* 1998, Sukmantoro *et al.* 2007, White & Bruce 1986). We follow this treatment here. In addition to the taxonomic considerations, we think an advantage of treating *H. himantopus* and *H. himantopus* separately is that it will result in more careful monitoring and improved population estimates for use in the reviews of global and local shorebird populations developed by Wetlands International (Bamford *et al.* 2008, Delaney & Scott 2006). In the remainder of this paper, we therefore use the following terminology: Black-winged Stilts from the Eurasian (sub)species *H. h. himantopus* are referred to as "*H. himantopus*", characterized by pure white to dusky grey hindneck. White-headed Stilts from the (sub)species *H. h. leucocephalus* are referred to as "*H. leucophalus*", characterized, in adult plumages, by a bold black ridge of feathers on the hindneck.

H. himantopus is vagrant visitor in Indonesia. There are three only known records of *H. himantopus* from Indonesia – two from northern Sumatra and one from Kalimantan Borneo (Robson 2005b; Mann 2008; Iqbal *et al.* 2010). The records from northern Sumatra include juveniles. The occurrence of juveniles of *H. himantopus* in Northern Sumatra suggests that the species may have bred in Jeulingke (Banda Aceh) or a nearby area. *H. leucocephalus* breed regularly in Southern Sumatra (Iqbal 2008, Iqbal *et al.* 2009). Further observations are needed to determine whether both species breed in Northern Sumatra. If both species nest in the same places with limited or no hybridisation, then they should be considered separate species. In this paper, we summarize further reports of *H. himantopus* in Sumatra after Iqbal *et al.* (2010).

METHODS

A survey of waterbirds at some wetlands (east coast of Southern Sumatra, Northern Sumatra and middle east coast of Sumatra) was conducted during October 2009 to March 2010. During this survey, incidental observations of *H. himantopus* in Sumatra were made (Figure 1). The birds were counted using binoculars and identified using field guides (Hayman *et al.* 1986; Sonobe & Usui 1993; Mackinnon *et al.* 1998). In addition to records reported in Iqbal *et al.* (2010), observations of Black-winged Stilt were made at two sites in Sumatra (Figure 1). These were Bagan Serdang, Pantai Labu sub-district, Deli Serdang District of North Sumatra province and in Tanjung Sereh Banyuasin river South Sumatra province.

RESULTS

The following records provide details on *H. himantopus* at two locations in Sumatra after Iqbal *et al*. (2010).

Bagan Serdang

Bagan Serdang ($03^{0}42'03"$N and $98^{0}50'05"$E) is located in Bagan Serdang village, Pantai Labu sub-district, Deli Serdang District of North Sumatra province. .

On 4th October 2009 a mixed flock of 42 stilts was observed at Bagan Serdang in fish pond habitat (Figure 2). Approximately 10 breeding adults and several juveniles of *H. himantopus* were recorded (Figure 3). Five adults *H. leucocephalus* and several juvenile stilts were also observed feeding with an adult *H. himantopus*. The exact number of *H. himantopus* and *H. leucocephalus* juveniles could not be determined because it is difficult to distinguish juveniles of each the species.

Figure 1. Locations of records of *H. himantopus* in Sumatra. Filled stars show the locations of new records and open stars show previous records (Iqbal *et al*. 2010).

On 21st February 2010, a *H. himantopus* male in breeding plumage was observed in Bagan Serdang (Figure 4), with one adult and two juvenile *H. leucocephalus*. Male breeding *H. himantopus* has a head and neck typically all white, compared with *H. leucocephalus*, which has a "mane" on back of neck and an otherwise white head. The female adult of *H. himantopus* can be easily identified from male by having browner mantle and scapulars (Hayman *et al.* 1986, Sonobe & Usui 1993, Mackinnon *et al.* 1998). On 27th March 2010, one *H. himantopus* and two *H. leucocephalus* were observed again in same location as the individual seen on 21st February 2010.

Figure 2. A mixed flock of *H. himantopus* and *H. leucocephalus*. Photo taken on 4 October 2009 in Bagan Serdang (© Giyanto).

Figure 3. A breeding female and juvenile *H. himantopus*. Photo taken on 4 October 2009 in Bagan Percut (© Giyanto).

Figure 4. A male *H. himantopus* in breeding plumage. Photo taken on 21 February 2010 in Bagan Serdang (© Giyanto).

Tanjung Sereh

Tanjung Sereh ($02^0$25'2"S and $104^0$45'1"E) is located in Banyuasin river, South Sumatra Province. . There is only one observation in Tanjung Sereh of *H. himantopus*, where one adult and one juvenile were observed on 25th January 2010.

DISCUSSION

The *H. himantopus* has previously recorded in Sumatra in October 2007 and January 2009 (Iqbal *et al.* 2010). This and the more recent records, reported here, suggest that the bird may be a regular winter visitor in northern Sumatra.

The single observation of *H. himantopus* in Tanjung Sereh is the first record for this species in southern Sumatra. In addition, it is also second record of *H. himantopus* south of the equator in Indonesia, the first being from Lake Jempang, South Kalimantan (Robson 2005b). Recent further records of the *H. himantopus* in Sumatra during October 2009 to March 2010 suggest that the recent status of this species in Sumatra is one of a possible regular visitor rather than a vagrant. These records also suggest a possible expansion of the currently known wintering range of this species. Alternatively, *H. himantopus* may have been recognised in Indonesia only recently, owing to recent growth in interest in ornithology and relevant field guides in the region.

The occurrence of breeding adult *H. himantopus* and *H. leucocephalus* with juveniles in Bagan Serdang suggest that they possibly breed in Sumatra. However, we have not yet found nests, eggs or chicks, which could confirm its

breeding status. The possibility of breeding interactions between the two species is interesting. The taxomonic status of *H. himantopus* is still debatable in terms of whether the species should be treated as two full species, rather than subspecies. More work in the future is needed to observe the interaction between both species in same locations, in order to determine whether hybridization occurs and whether they should be considered separate species.

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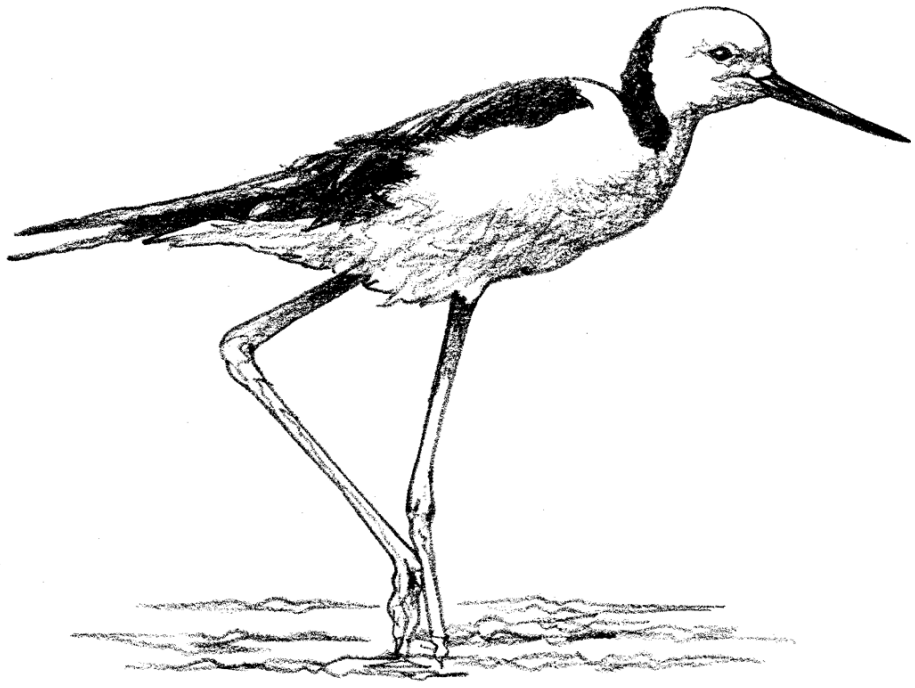

FIRST RECORDS OF SPOTTED REDSHANKS *(TRINGA ERYTHROPUS)* IN NORTHERN SUMATRA, INDONESIA

ANDREW C. CROSSLAND[1] & ARI W. SITORUS[2]

[1] *No.3 The Lagoon, Seafield Lagoon, Brooklands, Christchurch 8083, New Zealand.*
E-mail: Andrew.Crossland@ccc.govt.nz

[2] *Jalan M. Abbas/Semnanjung No. 26, Tanjung Balai Asahan, Sumatera-Utara, Indonesia.*

Within the East Asian-Australasian Flyway, the bulk of the Spotted Redshank (*Tringa erythropus*) population winters from central China to Vietnam (Sonobe & Usui 1993, Bamford *et al*. 2008). Small numbers migrate as far south as Peninsula Malaysia (Wells 1999), but the species rarely crosses the Straits of Malacca to reach the Greater Sundas (Crossland *et al.* 2006). It has been recorded three times in Sumatra (Iqbal *et al.* 2009) but has not yet been recorded elsewhere in Indonesia (Sukmantoro *et al.* 2008). The previous verified records include eight birds at Lebak Pampangan on 9 October 1988; three at Lebak Teluk Tomang on 31 March 1989 (Verheught *et al.* 1993) and three at Telok Galas River on 31 October 2008 (Iqbal *et al.* 2009). All three records were in South Sumatra Province - the first two on freshwater habitats, the third on coastal inter-tidal mudflats. Here we provide details of two further Spotted Redshank records, both from North Sumatra Province some 800+ km north-west of the area where the previous sightings have been made (see Figure 1).

During September and October 2010 we surveyed the central east coastline of North Sumatra Province. We visited 40 coastal wetlands and counted over 60,000 waterbirds (Crossland & Sitorus *in prep*). We found Spotted Redshank at two locations.

Our first sighting was of two birds in residual breeding plumage at Pantai Kuala (3°31'N, 99°13'E), Serdang-Bedagai District, on 28 September 2010. These birds were feeding on inter-tidal mudflats at mid tide and loosely associating with a large group of Black-tailed Godwit (*Limosa limosa*) and Common Redshank (*Tringa totanus)*. They were easily identified by extensive black feathering on head, neck, breast, belly and flanks, as well as an absence of the broad white trailing edge to the wing found in Common Redshank.

Our second sighting was of a single bird on 2 October 2010 at Pantai Sejara (3°15'N, 99°32'E) in Batu Bara District. This individual was also moulting out of breeding plumage but retained black feathering on breast and belly with mottled neck and flanks. It was observed feeding at low tide amongst a large congregation of *c*.9,600 waders of 21

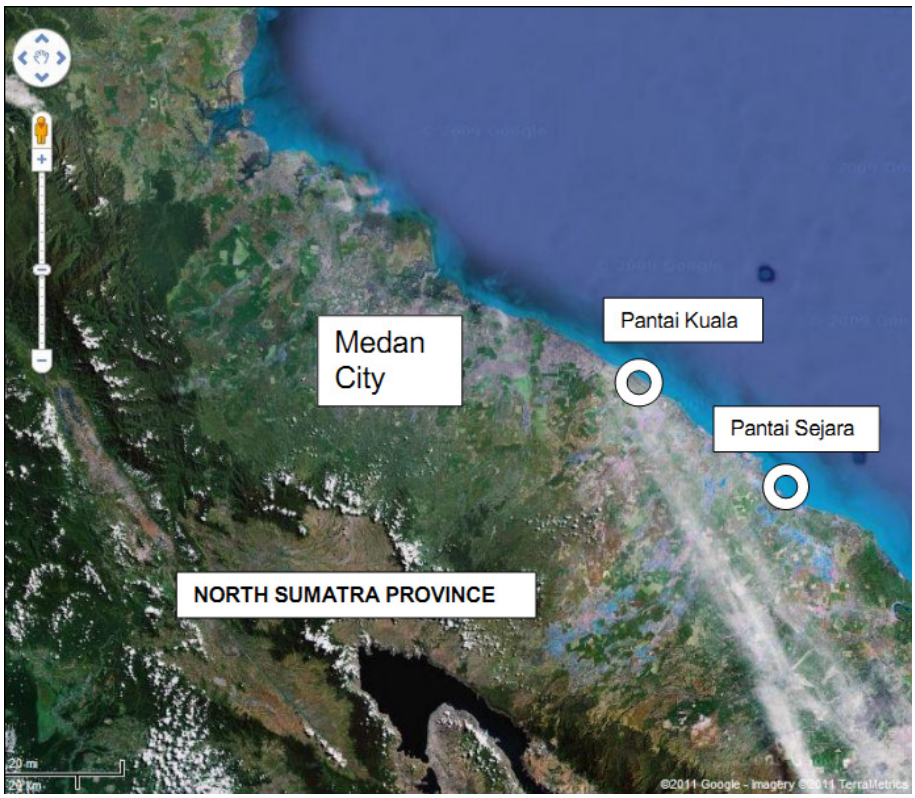

Figure 1. Locations where Spotted Redshank have been observed in Northern Sumatra

species. It foraged landward of the main flock, near the outer edge of mangroves amongst scattered Common Redshank, Asian Dowitcher (*Limnodromus seimpalmatus*), Whimbrel (*Numenius phaeopus*), Terek Sandpiper (*Xenus cinereus*) and Lesser Sand Plover (*Charadrius mongolus*).

These sightings comprise the fourth and fifth records of Spotted Redshank for both Sumatra and for Indonesia. Since the mid 1980s, wader flocks totalling hundreds of thousands of birds have been scrutinised on the Sumatran east coast by various researchers (Silvius 1986, 1988, Verheught *et al.* 1983, 1990, Crossland *et al.* 2006, 2009, Iqbal *et al.* 2010). The fact that Spotted Redshank have been recorded just five times (totalling 17 individuals) confirms its status is either a vagrant or a very scarce migrant to Sumatra (Crossland *et al.* 2006).

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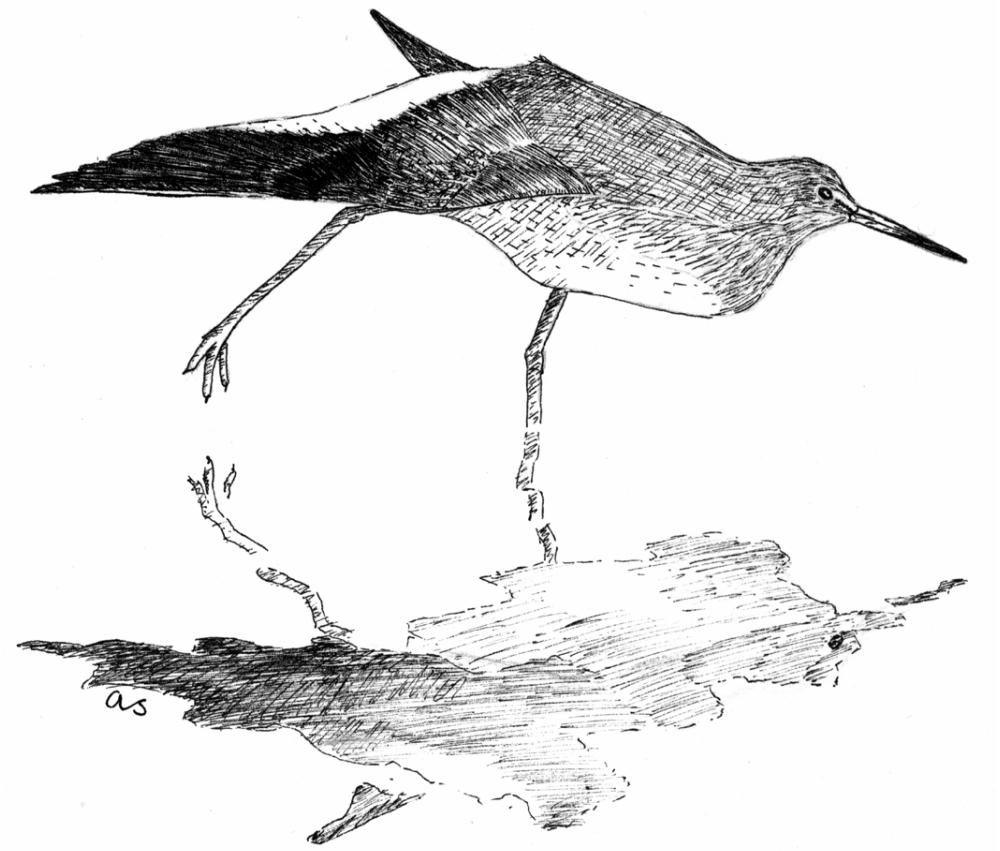

RED KNOT *(CALIDRIS CANUTUS)* ON SOUTHWARD MIGRATION THROUGH NORTHERN SUMATRA - DISCOVERY OF IMPORTANT STAGING SITES AND EVIDENCE OF LINKS WITH CHINA AND NORTH-WEST AUSTRALIA

ANDREW C. CROSSLAND[1] & ARI W. SITORUS[2]

[1] *No.3 The Lagoon, Seafield Lagoon, Brooklands, Christchurch 8083, New Zealand.*
E-mail: Andrew.Crossland@ccc.govt.nz

[2] *Jalan M. Abbas/Semnanjung No. 26, Tanjung Balai Asahan, Sumatera-Utara, Indonesia.*

INTRODUCTION

The Red Knot (*Calidris canutus*) is a long distant migrant with an East Asian-Australasian Flyway population estimated at 220,000 birds (Delaney & Scott 2006), although recent census data indicate that this is a large over-estimate and total numbers are in fact *c.*105,000 (Rogers *et al.* 2010). During the non-breeding period some 93% of the combined flyway population is thought to occur in Australia and New Zealand, with much smaller numbers elsewhere (Bamford *et al.* 2008).

Red Knots are generally uncommon in South-East Asia (Lane 1987, Robson 2000, Strange 2000, 2001). They are capable of flying non-stop from the Yellow Sea to north-western Australia and their southward migration route is thought to largely bypass the South-East Asian region by flying over the western Pacific Ocean (Higgins & Davies 1996, Minton *et al.* 2006, Bamford *et al.* 2008). On northward migration, New Zealand birds are thought to pass through the Gulf of Carpentaria, while southern Australian birds seem to over-fly northern Australia and fly directly to the East Asian coast (Bamford *et al.* 2008). Red Knot use only a small number of staging sites during both migration periods (Bamford *et al.* 2008).

Within Indonesia, the Red Knot is a scarce passage migrant (MacKinnon & Phillipps 1993, Jepson & Ounsted 1997, Strange 2001, Crossland *et al*. 2006), with the only sizeable concentrations confirmed from North Sumatra Province and suspected in West Papua (Crossland & Sinambela 2009). The total Indonesian wintering population is estimated at 5000 birds (Bamford *et al*. 2008), but no important non-breeding or staging sites have been identified to date. Until now, most Sumatran reports of Red Knot have been of birds on northward migration (Crossland *et al.* 2006, Crossland & Sinambela 2009). Northward migrating birds observed in breeding plumage at Bagan Percut in North Sumatra Province have been identified as the *piersmai* sub-species (AC *pers. obs.*).

Published observations of birds on southward migration have been limited to 70 birds at the Banyuasin Delta, South Sumatra Province, on 1 August 1988 (Verheught *et al.* 1990), 13 at Bagan Percut, North Sumatra Province on 27 September 2005 and 58 at Pantai Labu, North Sumatra Province, on 2 October 2005 (Crossland & Sinambela 2009). An additional record is of <100 birds observed on the Banyuasin Peninsula, South Sumatra Province in November 2008 (M. Iqbal *pers. comm.*). The apparent scarcity on southward migration seemed consistent with a non-stop migration from China to Australia (Crossland & Sinambela 2009). However, in this paper we report on unprecedented numbers of Red Knot observed at several North Sumatran coastal wetlands during southward migration in October 2010.

METHODS

During September and October 2010 (the southward migration period) we surveyed waterbirds along the east coast of North Sumatra Province - concentrating on the central coastline between Bagan Serdang (3°42' N, 98°50'E) in the north and the Asahan River-mouth (3°01' N, 99°52' E) in the south (Crossland & Sitorus *in prep*). We made accurate counts of Red Knot at all sites where they occurred and searched for leg flags. Birds were observed at either high tide roosts or while feeding at low tide. Counts were made with 10x42 and 10x50 binoculars and with a 25x60 spotting scope. Survey methods followed those recommended in Howes & Bakewell (1989).

RESULTS

We counted over 60,000 waders and waterbirds on 40 wetlands on the east coast of North Sumatra Province (Crossland & Sitorus *in prep*). Red Knot were encountered at seven sites with a combined total of 3,504 birds (Figure 1; Table 1). This total is considerably higher than numbers recorded on the same coastline on previous visits during the southward migration period in September-October 2005 and August-September 2006 (Crossland & Sinambela 2009), and on a non-breeding visit in January 2009 (Iqbal *et al.* 2010).

Bagan Serdang was the only site where firm sand/mud allowed approach and close viewing of roosting flocks of Red Knot. Elsewhere, substrates were too soft to allow close approach and an abundance of snakes made wading through knee-deep mud somewhat hazardous. The 894 birds at Bagan Serdang were carefully scrutinised and three colour-flagged Red Knot identified (Table 2). Two of these had yellow flags and had been banded sometime since 1992 in NW Australia. The other bird had a blue/yellow flag from Bohai Bay in China and had been banded in either 2009 or 2010 (AWSG leg flag records, per C. Minton).

DISCUSSION

Given that concentrations of Red Knot have not been detected on previous southward migration surveys of this coastline, during September-October 2005 and August-September 2006 (Crossland & Sinambela 2009), there is a

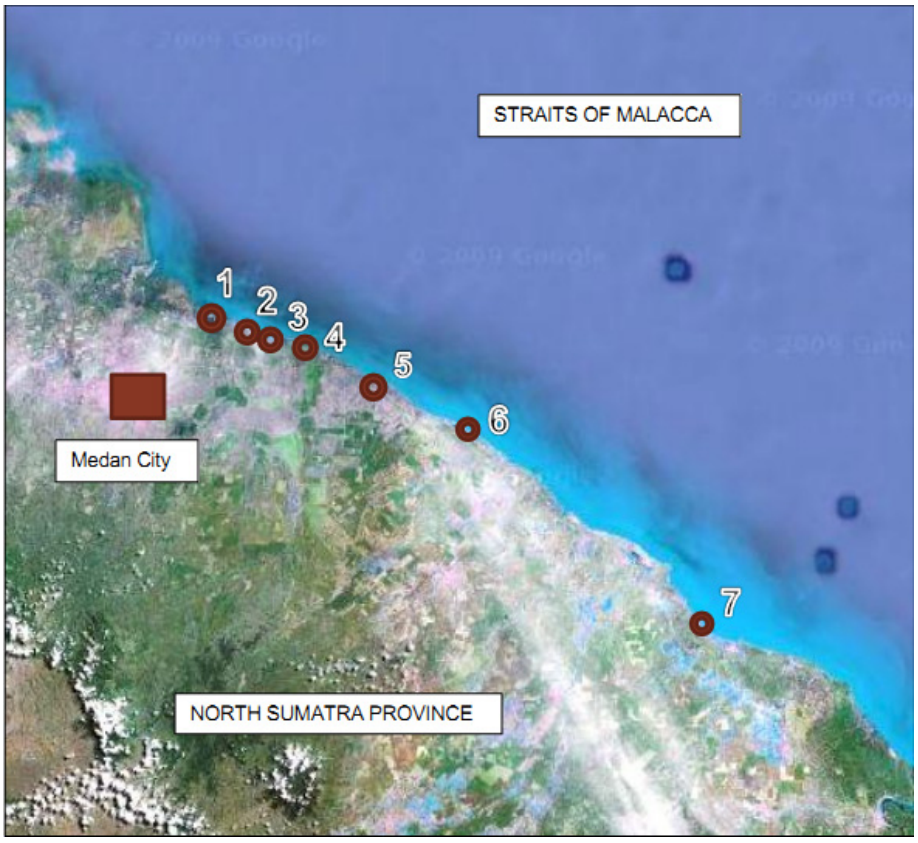

Figure 1. Sites holding Red Knot, North Sumatra east coast, September-October 2010.

Table 1. Counts of Red Knot in North Sumatra Province September-October 2010

Date	Location	Latitude / Longitude	Number of Red Knot
28/9/10	Pantai Kuala	3 º 31'N, 99 º 13'E	4
8/10/10	Pantai Sejara	3 º 15'N, 99 º 32'E	28
13/10/10	Pantai Sri Mersing	3 º 38'N, 99 º 00'E	1
14/10/10	Pantai Labu Baru	3 º 40'N, 98 º 54'E	2434
14/10/10	Pantai Labu West	3 º 40'N, 98 º 53'E	139
14/10/10	Pantai Ancol Indah	3 º 41'N, 98 º 53'E	4
14/10/10	Bagan Serdang	3 º 42'N, 98 º 50'E	894
Total			3504

Table 2. Details of leg-flagged Red Knot at Bagan Serdang, 14 October 2010

Flag details	Banding location	Distance
yellow on left tibia	NW Australia	approx. 3578 km
yellow on right tibia	NW Australia	approx. 3578 km
blue over yellow on right tibia	Bohai Bay, China	approx. 4301 km

possibility that the relatively large numbers recorded in October 2010 may be an aberration. Birds may have fallen out of migration from a route further east or perhaps there was a change in migration strategy for birds departing degraded habitats in the Yellow Sea, suggestive of insufficient fat reserves to enable birds to reach Australia on a single flight. Another possibility is that the influx of birds into Sumatra involved large numbers of juveniles, as a result of successful reproduction in the 2010 breeding season (C. Minton *pers. coms.*). These juveniles may be less successful than adults at reaching northern Australia in a single flight. Unfortunately, plumage data was not collected during the survey, preventing a calculation of adult/juvenile ratios.

Red Knot are concentrated at a small number of sites

The combined total of 3,504 Red Knot equates to over 70% of the estimated total Indonesian winter population of 5,000 (Bamford *et al.* 2008). This number is much higher than previously recorded anywhere in Sumatra (Van Marle & Voous 1988, Crossland *et al.* 2006, Iqbal *et al.* 2010) and was quite unexpected given that all previous records of sizeable Red Knot congregations have been made during the northward migration period (Crossland & Sinambela 2009).

Red Knot seem to be concentrated at a very small number of locations – a total of seven out of the 40 coastal wetlands visited. The vast majority of birds (3467 or 98.9%)

were located at just three sites - Bagan Serdang, Pantai Labu Baru and Pantai Labu West. These three sites were previously identified as localities favoured by Red Knot on northward migration (Crossland & Sinambela 2009), suggesting that the species uses the same sites on both northward and southward passage. Whilst Red Knot were numerically the dominant wader species at both Bagan Serdang and Pantai Labu Baru, they were found to only occur in low numbers or not at all at other sites containing thousands of waders only a few kilometres to the east and west (Crossland & Sitorus *in prep*). This further suggests that Red Knot are concentrating at only these few sites.

Internationally important numbers

The 4 km of shoreline linking high-tide roosts at Pantai Labu Baru, Pantai Labu West and Pantai Ancol Indah comprises a continuous band of inter-tidal mudflats. Collectively, these roosts held 2,577 Red Knot on 14 October 2010. This equates to 1.17% of the estimated flyway population as estimated by Bamford *et al.* (2008) or 2.45% as estimated by Rogers *et al.* (2010). The Pantai Labu Baru, Pantai Labu West and Pantai Ancol Indah area is the only site in Indonesia currently known to exceed the 1% international importance threshold of 2,200 birds. Bagan Serdang with 894 Red Knot on 14 October 2010, falls short of the 1% threshold but it does meet the staging threshold criteria - currently set at 550 birds (Bamford *et al.* 2008). These two localities appear to be only sites in Indonesia currently known to meet International Importance criteria for Red Knot as no other sites were identified in recent reviews by Bamford *et al. (*2008) and Li *et al. (*2009).

CONCLUSION

The presence of 3,504 Red Knot on the east coast of North Sumatra Province and observations of both Chinese and Australian flagged birds confirms a southward migration route through the Straits of Malacca region. This adds to evidence from nearby Peninsula Malaysia where 482 Red Knot were recorded during the southward migration and non-breeding periods in 2004-2005 (Li *et al.* 2006). Rogers *et al*. (2010) suggested a great circle northward migration route between Australia and the Yellow Sea which runs through the Straits of Malacca, roughly parallel with both the Sumatran and Malaysian coastlines (both orientated NW to SE). Data presented in this paper suggests that this great circle route is also utilised on southward migration.

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NOTES ON THE WINTERING WADERS IN NOVEMBER 2009 ALONG THE EAST COAST OF LAMPUNG PROVINCE, SOUTHERNMOST SUMATRA, INDONESIA

MUHAMMAD IQBAL[1], AHMAD RIDWAN[1] & HERMAN[1]

[1]*KPB-SOS, Jalan Tanjung api-api km 9 Komplek P & K Blok E 1 Palembang 30152, Indonesia; kpbsos26@yahoo.com.*

Keywords: Wintering waders, Lampung Province, Indonesia

A survey of the wader population was carried out during November 2009 on the east coast of Lampung Province, southernmost Sumatra, Indonesia. A total of 1,147 waders were counted of seven species. Asian Dowitcher was the most abundant species with up to 54% of the total count, followed by Black-tailed Godwit 31%, Bar-tailed Godwit 8.8%, Oriental Pratincole 2.1%, Common Sandpiper 0.7%, Eastern Curlew 0.4% and Eurasian Curlew 0.3%. This number of shorebirds is lower than that in the east coast of South Sumatra province, bordering Lampung province in southern part of Sumatra. Further study on the composition of wader numbers along the east coast of Lampung Province is needed, particularly in relation to mangrove forest availability and habitat loss caused by fishponds.

INTRODUCTION

Large numbers of waders have been recorded on the mudflats of Southern Sumatra (Silvius 1988, Danielsen & Skov 1989, Danielsen & Verheugt 1990, Verheugt *et al.* 1990, Verheugt *et al.* 1993). Unfortunately, most records are from South Sumatra Province and information on waders in Lampung Province in southernmost Sumatra is still lacking. It is suspected that the east coast of Lampung Province has potential habitat for migratory waders during the non-breeding season. The discovery of breeding Javan Plover *Charadrius javanicus* in June 2007 at Penet (Penet River) shows the east coast of Lampung Province's importance for waders (Kennerley *et al.* 2008).

During November 2009, a survey of waders was conducted on the east coast of Lampung Province. A total of 1,147 waders were counted of seven species. The occurrence of species and population numbers are discussed here. This survey provides some information about the composition of the wader populations during the non-breeding season on parts of the Sumatran coast.

METHODS

The east coast along Lampung Province was visited using small boats with 40hp outboard motors during November 2009. Waders were counted on the mudflats during low tide. Counting ended before high tide as birds starting flying to roost in the mangroves or inland plains. We found that the most effective method was to count from the boat as it was driven along the mudflat edge.

Standard site description and waterbird count forms (Asian Waterbird Census form) designed and tested by Wetlands International were used for the surveys. Site descriptions enabled data to be collected on types of wetlands, vegetation, uses of and threats to wetlands. Waterbird count forms provided a standard list of all waterbirds, against which numbers could be tallied.

Study Area

The east coast of Lampung Province is located in southern Sumatra. Many areas have been converted to medium-large scale fish and prawn ponds (Yudha 2007). However, good mangrove forest still occurs behind the mudflat, especially in Way Kambas National Park. The survey sites are from Mesuji (4^0 09' 14.8"S & 105^0 50' 26.50"E), in the north to Labuhan Maringgai (5^0 17' 48.16"S & 105^0 51' 47.72"E) in the south along approximately 200 km of coastline and include the following sites; Mesuji River (4^0 09' 14.8"S & 105^0 50' 26.50"E), Rotan River (4^0 23' 54.86"S & 105^0 52' 06.20"E), Seputih River (4^0 31' 16.91"S & 105^0 54' 13.81"E), Sekopong Bay (4^0 56' 44.12"S & 105^0 55' 32.61"E), Penet River (5^0 05' 48.37"S & 105^0 52' 10.93"E) and Labuhan Maringgai (5^0 17' 48.16"S & 105^0 51' 47.72"E) (see Figure 1).

RESULTS

Table 1 provides details of count sites, number of species and number of waders recorded on 29 November 2009. The sequence and nomenclature of each species follow Sukmantoro *et al.* (2007) as used in the Indonesian bird list.

Species accounts

Common Sandpiper *Actitis hypoleucos* was recorded at three sites during the survey but is possibly more widespread at each site in small numbers. In Lampung Province, Common Sandpiper is recorded regularly in Way Kambas National Park (Parrot & Andrew 1996).

Two Eurasian Curlew *Numenius arquata* were observed at Teladas and one was sighted in Sekopong Bay. Marle & Voous (1988) do not list Eurasian Curlew as occurring in Lampung Province, but Parrot and Andrew (1996) have recorded it as common in Way Kambas National Park.

Three Eastern Curlew *Numenius madagascariensis* were observed on the Seputih River and two in Sekopong Bay. In Lampung Province, Marle and Voous (1988) recorded Eastern Curlew in January and February 1979 from Way Kambas National Park, and it is listed as scarce in Way Kambas National Park by Parrot and Andrew (1996).

Approximately 350 Black-tailed Godwit *Limosa limosa* were recorded in Sekopong Bay. In Lampung Province, Marle and Voous (1988) recorded Black-tailed Godwit on

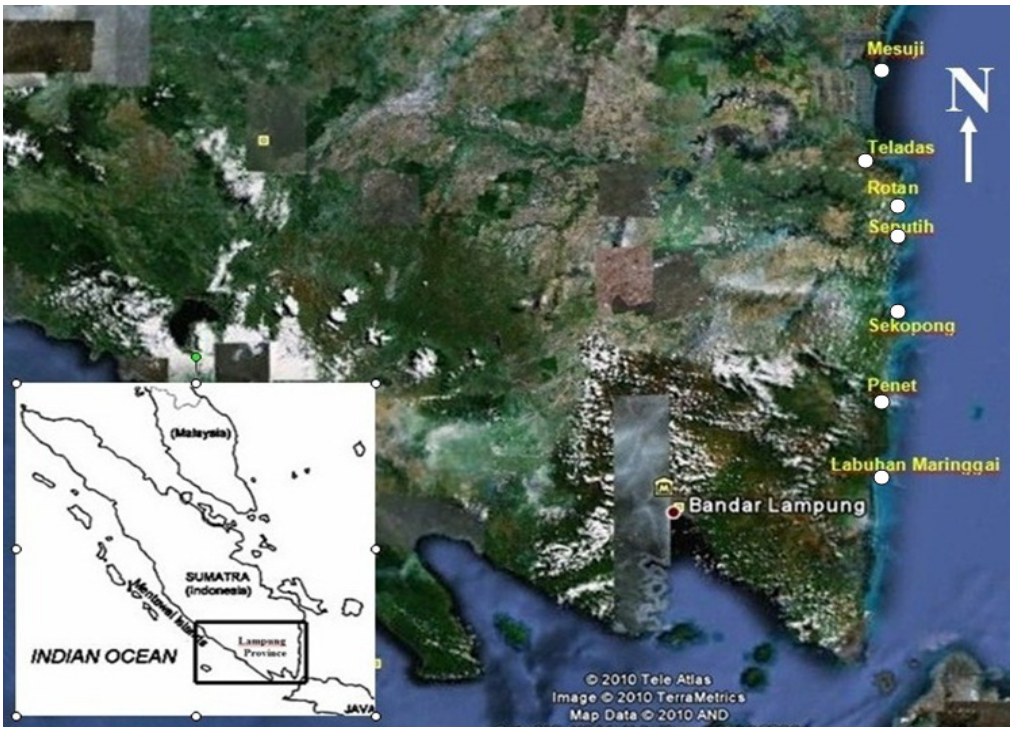

Figure 1. Sites counted (white dots) during the wader survey of the east coast of Lampung Province, Indonesia.

Table 1. Waders counted on the east coast of Lampung Province, 29 November 2009.

SPECIES	SITES							TOTAL	PERCENTAGE
	1	2	3	4	5	6	7		
Common Sandpiper			1		2		5	8	0.7
Eurasian Curlew		2			1			3	0.3
Eastern Curlew				3	2			5	0.4
Black-tailed Godwit					350			350	31
Bar-tailed Godwit					100			100	8.8
Asian Dowitcher					625			625	54
Oriental Pratincole							25	25	2.1
Unidentified	2		25	3		1		31	2.7
TOTAL	**2**	**2**	**26**	**6**	**1,080**	**1**	**30**	**1,147**	**100%**

Notes: 1 = Mesuji River, 2 = Teladas River, 3 = Rotan River, 4 = Seputih River (part of Way Kambas National Park), 5 = Sekopong Bay (part of Way Kambas National Park), 6 = Penet River (part of Way Kambas National Park), and 7 = Labuhan Maringgai

January-February 1979 from Way Kambas National Park, and it listed as scarce in Way Kambas National Park by Parrot and Andrew (1996).

A total of 100 Bar-tailed Godwit *Limosa lapponica* were observed in Sekopong Bay. Bar-tailed Godwit has been recorded previously (specific date and number of birds not provided) during January and February in Way Kambas National Park (Marle & Voous 1988). Parrot and Andrew (1996) also reported dense mixed flocks of up to 864 Bar-tailed Godwit and Asian Dowitcher on 2 December 1988.

Approximately 625 Asian Dowitcher *Limnodromus semipalmatus* were counted in Sekopong Bay. In Lampung Province, Asian Dowitcher was recorded during January and February (specific date and number of birds not provided) in Way Kambas National Park (Marle & Voous 1988). Parrot and Andrew (1996) estimated that about 800 dowitchers were present during December to February in the Way Kambas National Park. One bird was observed on the shore just north of the Seputih River estuary on February 1988 (Lambert 1988). The number of Asian Dowitchers recorded in Sekopong Bay on 29 November 2009 was the second highest for Lampung Province after Parrot and Andrew (1996).

A total of 25 Oriental Pratincole *Glareola maldivarum* were counted at Labuhan Maringgai. A large number of Oriental Pratincole was reported from Lampung Province without location details (Marle & Voous 1988). Parrot & Andrew (1996) recorded them as scarce in Way Kambas National Park.

DISCUSSION

A total of 1,147 waders of seven species (Asian Dowitcher, Black-tailed Godwit, Bar-tailed Godwit, Oriental Pratincole, Common Sandpiper, Eastern Curlew and Eurasian Curlew) were counted along the coast of Lampung Province on 29 November 2009. Asian Dowitcher was the most abundant species with approximately 625 birds or 54% of the total count, followed by Black-tailed Godwit with approximately 350 (31%), 100 Bar-tailed Godwit (8.8%), 31 unidentified

waders (2.7%), 25 Oriental Pratincole (2.1%), eight Common Sandpiper (0.7%), five Eastern Curlew (0.4%) and three Eurasian Curlew (0.3%).

The largest count in this survey was in Sekopong Bay where a total of 1,080 waders were recorded (see Figure 2). Sekopong Bay, which is part of Way Kambas National Park, has a good mangrove forest and mudflat. A mixed flock of 864 waders previously counted in Sekopong Bay (Parrot & Andrew 1996) is the largest single count of waders in Lampung Province recorded prior to this survey. Although the number of birds recorded in this study is lower than recent wader counts from North Sumatra and South Sumatra Provinces (Silvius 1988, Danielsen & Skov 1989, Danielsen & Verheugt 1990, Verheugt *et al.* 1990, Verheugt *et al.* 1993, Crossland *et al.* 2009, Iqbal *et al.* 2010), this does not suggest a reduction in the importance of the east coast of Lampung Province as a feeding ground for migratory non-breeding waders in Sumatra.

Parrot & Andrew (1988) estimated 800 dowitchers were present during December to February in Way Kambas National Park. This estimation is the largest number of waders on the east coast of Lampung Province (Marle & Voous 1988, Parrot & Andrew 1988). The waders recorded during this survey are consistent with previous records on the east coast of Lampung Province (Marle & Voous 1988, Lambert 1988, Parrot & Andrew 1988, Holmes 1996). The number of waders along the east coast of Lampung Province is lower than wader numbers on the east coast of North Sumatra Province and Southern Sumatra Province. This is possibly due to the loss of mangrove forest for fishponds (Yudha 2007). However, it is very early to conclude that wader numbers along the east coast of Lampung Province are lower than Northern and South Sumatra Provinces. Further surveys are needed to study composition of wader numbers along the east coast of Lampung Province, especially with relation to mangrove forest availability and habitat loss caused by fishponds.

ACKNOWLEDGMENTS

We would like to thank an anonymous reviewer for comments on an earlier draft of this manuscript. Fieldwork on this survey was part of the Milky Stork *Mycteria cinerea* population assessment in Sumatra, supported by Rufford Small Grant (RSG) with additional fund from WCS RFP (Wildlife Conservation Society Research Fellowship Programme) and equipment grant from Idea Wild. We would like to thank Rufford Small Grant Secretariat (Josh Cole and Jane Rufford), WCS RFP secretariat (William Banham, Ph.D., Kate Mastro, Lynn Duda and Dr. Nick Brickle), and Idea Wild (Dr. Wally van Sickle, Henry Stephen, Anne Marie and Sean Kelly). Thanks also to Yus Rusila Noor (Wetland International), Dr. Christian Goenner, Dr. Mike Crosby (Birdlife International) and Dr. Dewi Prawiradilaga (LIPI-Indonesia) for giving recommendation for implementing this project. Finally, we would like to thank Pak Jon from Pasir River, our driver who supported us very well during fieldwork in Lampung Province.

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Figure 2. A flock of Black-tailed and Bar-tailed Godwit, and Asian Dowitcher in Sekopong Bay on 29 November 2009.

BOOK REVIEW

GRAHAM R. FULTON
School of Natural Sciences, Edith Cowan University, Joondalup Western Australia, Australia, 6027
E-mail grahamf2001@yahoo.com.au

CHECKLIST OF THE BIRDS OF KOREA

Author: The Ornithological Society of Korea 2009
Publisher: The Ornithological Society of Korea, Seoul
Pp. 133, ISBN 978-89-5708-176-1
Price: On application to the Society.

The Checklist of the birds of Korea is published by The Ornithological Society of Korea, who also the publish Korea's ornithological flagship journal The Korean Journal of Ornithology (ISSN 1225-9179). This journal was first published (Issue 1 – Volume 1) in December 1994. The society is generally regarded as the premier ornithological society in The Republic of South Korea (hereafter Korea). The same society hosted the International Symposium on Migratory Birds in 2004, of which papers from its proceedings are often cited in Stilt (The Ornithological Society of Korea 2004).

This book presents the first official checklist of Korean birds (North and South) based on records from the Bird Record Committee, formed in 2005 and then headed by Prof. Koo Tae-hoe (family name is followed by given names in Korea) and other dedicated members since. Its aim as with all official checklists is to standardize the nomenclature and taxonomy of the birds of Korea, to complement and build upon a history of previous records of Korean birds and to act as a catalyst for further research and reviews on Korea's birds (Lee 2009).

The book is divided into the usual formal parts expected in a checklist and is predominately written in the Korean language (Hangeul): to a much lesser extent English and Latin is used for scientific names. The Korean preface is duplicated in English. The contents and explanation of the layout are given in Korean and are followed by a list of bird families found in the checklist given in Korean and in English, and in the same phylogenetic order as followed through the core of the book. The checklist itself takes up 75 of the book's 133 pages, which includes supplementary listings at the end. The species in the checklist are given with Korean and English common names, and Latin names. The explanatory notes associated with each taxonomic group including species are in Korean, although most of the in-text citations are in English. A thorough bibliography follows and in three language sections gives Korean, English and Japanese citations. The English citation list is the largest. It is necessary to give references in Korean and Japanese, because these were published in those languages, not in English. These are followed by three indexes: Korean common names, English common names and scientific names in Latin.

Due to the large amount of Korean text that is not duplicated in English the book's audience can be safely regarded as primarily Korean. As the first formal checklist it will allow Korean authors to be more consistent in nomenclature, particularly with the English common names. In the past an *ad-hoc* system of following various English texts was used to source the English name, which often led to using the Latin name adjoining it in that text. The checklist, among other things, allows for greater consistency of bird names in the Korean literature – benefiting the author and the reader. The necessary use of English in the checklist, citations and the English index enable English readers to follow the list, but without gaining clear understandings of the reasons adopted for the phylogeny. The duplication of the preface in English allows English readers to gain some historical and geographical context.

The obvious strength of the book is that it fills the unoccupied niche as the first official checklist of Korean birds and allows for standardization and encourages debate. Writing in Korean allows the book to reach a broader Korean audience, because most Korean researchers have a 'good enough' grasp of English and many are proficient in English. Its greatest weakness, from my perspective, is the lack of explanatory English. If the checklist had been made more assessable to English-only readers this would have catalyzed a broader audience and cultivated a greater scientific debate. Nevertheless, it meets its primary objectives in complementing historical records that began tenuously in the nineteenth century when Henry Tristram published eight birds collected by Lieutenant Gunn, of the H.M.S. *Flying Fish* on survey of the Korean coastline (Tristram 1885). Since then additions to the knowledge on Korean birds has increased sporadically by mostly Japanese and Koreans researchers. Later more additions were made by the American ornithologist Oliver Austin who published a review of the avifauna of the whole peninsula, but with data mostly referring to the southern half (Austin 1948, Tomek 1999). Since 1950 when the Korean War began communication between North Korea (The Democratic People's Republic of Korea) and South Korea has been extremely minimal. However the work of the Polish avian-systematist Teresa Tomek and colleagues, who regularly visited North Korea since 1986, is included in the book aiding the current understanding of the whole Korean Peninsula (see Tomek 1999, 2002). Building on these and other studies in one volume aids the secondary objectives of the checklist – to promote and facilitate further research.

The book is well organized into its relevant sections, an achievement made more laudable because it is written in two and sometimes three languages per section. The layout is logical and easy to follow even for those who cannot read Korean. The layout certainly advances the book making it quick to move back and forth between sections. The English citations are clear and authors have commendably avoided using abbreviations, which are frustrating to match with correct journal names when dealing with obscure references and because abbreviations are not consistent (Calver and Bryant 2008). The book is a checklist and therefore does not contain maps and other supplementary material nor should it. The front and back cover, and frontispiece show the endangered Black-faced Spoonbill *Platalea minor* (IUCN 2010).

I recommend this book to Korean readers as a useful and practical first checklist and to a lesser extent to non-Korean

readers for the same reasons. This is particularly so for avian/ecological researchers and their students who are working in or publishing in Korea. No doubt conservation managers and administrators would benefit from the standardization of names too.

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I thank The Ornithological Society of Korea for supplying the book.

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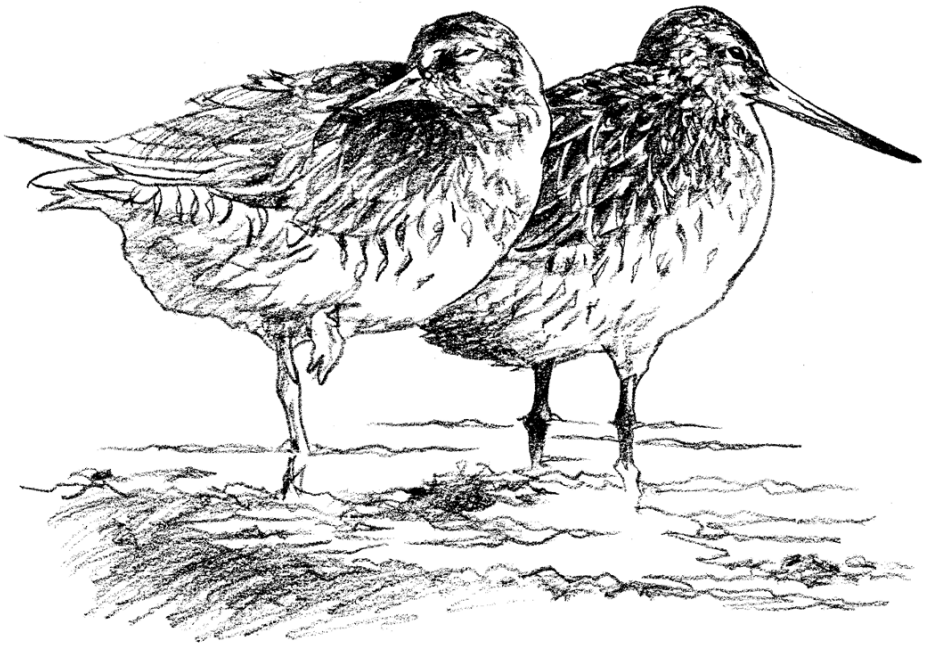

NORTH-WEST AUSTRALIA WADER AND TERN EXPEDITION REPORT 19TH FEBRUARY TO 12TH MARCH 2011

CLIVE MINTON[1], ROSALIND JESSOP[2], CHRIS HASSELL[3] AND MAUREEN CHRISTIE[4]

[1]*165 Dalgetty Rd, Beaumaris, Victoria 3193, Australia. mintons@ozemail.com.au*
[2]*Phillip Island Nature Park, PO Box 97, Cowes, Victoria 3922, Australia.*
[3]*PO Box 3089, Broome, Western Australia 6725, Australia.*
[4]*Carpenter Rocks, South Australia 5291, Australia.*

INTRODUCTION

The 2011 visit to north-west Australia was considered by participants to be the 'best ever' Expedition. This description has often been used in the past, justifiably, but in 2011 the happiness and enjoyment of the team, its cohesiveness and efficiency and the catching results achieved were uniformly excellent. This was particularly notable given that half of the 30 participants had never previously taken part in a NWA Expedition and that the quite frequent rain in the first two weeks, and later the heat/humidity, made working conditions at times rather difficult.

Each annual Expedition turns out to be different from the previous one, with new challenges from the birds, the weather and the overall logistics of having a large team living and working in the field continuously for three weeks. It was with some reservations that we moved the 2010/11 Expedition to the February/March period (because several key people were unavailable in the usual November/December period). However, although we had one cyclone pass close by (only Category 1!), and another threatened, we only had one significant rainstorm at an inconvenient time when we were catching in the field. To our surprise, temperatures were much cooler than in November, partly because of the cloud cover but also because it was a particularly cool February. Equally, fears that our catching and data collection might not be adequate proved groundless, with the birds being more settled and easier to catch, except on the extremely high tides at the beginning of our visit. As predicted, no catches were made on these early high tides due to birds leaving the beaches to roost on pools behind the mangroves. As a consequence the team moved from Roebuck Bay to 80 Mile Beach a day earlier than originally planned.

This report follows a similar format to that of other recent NWA Expedition Reports. Catch highlights are provided followed by data tables.

MAIN ACHIEVEMENTS

Catching

The roosting pattern of waders on the north shores of Roebuck Bay, Broome, followed a markedly different pattern to that encountered on previous visits. Almost all the birds were gathered into two huge 5-10,000+ flocks at the extreme eastern and western ends (Boiler Point and Quarry Beach, respectively). Intervening beaches had no birds roosting on them until the last day or two of the visit.

The catching program commenced rather unsuccessfully. The first catch was a consolation catch of nine Pied Oystercatchers on Quarry Beach, when all the grey waders vacated the area completely, of their own volition, just after the tide edge reached the beach. An attempt at Boiler Point the next day was completely unsuccessful, with most birds departing inland to roost at the slightest provocation during twinkling. The team then moved to 80 Mile Beach.

A catch was made on each of the 10 field days at 80 Mile Beach, including on the exceptionally high tide on the first day which forced us to drive the cars from the beach up onto the dunes at the peak of the tide! The tide on the previous day was predicted to be the fourth highest tide of the year but its height and effects were enhanced by the huge on-shore swell following the passage of an off-shore cyclone. Much of the outer dune along the beach was eroded leaving a two-three metre sand cliff along large parts of the beach.

The small-mesh three-cannon nets were used (instead of the usual four-cannon large-mesh nets) throughout our period at 80 Mile Beach. These enabled us to set the nets below the predicted level of high tide because we could empty them so quickly. Therefore, we were able to take advantage of the camouflage provided by the sponges, bracket coral, shells and other rubbish washed up on the tide line in the aftermath of the cyclone. The small-mesh nets also have the advantage of going out fully even when completely camouflaged with sand or shell grit. Thus, for almost the first time at 80 Mile Beach, waders were not aware of, or wary of, the net area. In addition, by setting below high tide, we were never stranded high and dry as has occurred at times in the past when a predicted tide level has not been reached.

Catching success at Broome was much better during the last week of the Expedition although catching failed on two days. Once this was due to inadequate recce information and the second time it was because of the untimely arrival of a high circling frigatebird. However the four catches which were made were all quite large and the species content was excellent.

As usual we didn't always catch what we were targeting on a particular day. On the first occasion we tried to catch White-winged Black Terns at 80 Mile Beach we instead finished up with our best catch of Terek Sandpiper and Grey-tailed Tattler! Fortunately Maureen managed to retrieve the departing KBS film crew who hadn't wanted to film terns

but who were desperate to film Terek Sandpiper being banded and measured. At Broome, on the last day, we resisted pressures from the KNN film crew and blood sample avian disease researcher Sora Estrella to catch Bar-tailed Godwit and Great Knot in favour of targeting Grey-tailed Tattler and other medium-sized waders. What did we catch? Great Knot (265) and Bar-tailed Godwit (56) dominated the 491 birds caught!

Some of the highlights of the catching program are given below.

a) The total number of birds caught was 3,490, which included 3,179 waders (17 species) and 311 terns (5 species).

b) The 3,490 birds were caught in 15 cannon-net catches, giving a slightly higher than normal average catch size of 233 (range 8-531; Table 1). Ten of the catches were in the manageable size range of 100 - 400 birds.

c) Great Knot (1,166) topped the list of birds caught (Table 2). Great Knot seemed to be more numerous than in recent years probably because they had such excellent breeding success in 2009, followed by another good year in 2010. Five hundred and eighty-six Greater Sand Plovers were caught, the largest catch being 267 birds. No overheating problems were experienced at any time with this, or any other species, due to the precautions taken to keep birds cool during the short period they were in the net and by getting shade erected over keeping cages very quickly (or setting them up in advance).

A pleasing total was 210 Red Knot. In other recent years the Expedition has struggled to obtain adequate samples of this species. The higher and more widespread population, especially at 80 Mile Beach, may be the result of the excellent breeding success experienced in 2009.

Red-necked Stint and Curlew Sandpiper were much less numerous than usual, particularly on 80 Mile Beach. Perhaps they had gone inland to feed at the vast array of ephemeral wetlands now present in Central Australia? A reasonable total (432) was eventually obtained for Red-necked Stint but only 82 Curlew Sandpipers were caught even though they appeared to have had another successful breeding year in 2010.

A nice total of 28 Broad-billed Sandpipers was caught, all at Roebuck Bay.

d) The most unexpected catch was 276 White-winged Black Terns, out of a total of 491 birds, on 4th March at 80 Mile Beach. A total of 40,000 White-winged Black Terns had been counted roosting on about a 10km section of beach approximately 40km south of the Anna Plains beach access. Only 89 White-winged Black Terns have previously been banded in Australia (per David Drynan). Two hundred and thirty-one have previously been banded in China (per Hongxing Jiang) mostly caught as a by-catch during wader banding. It is likely therefore that this catch of 276 is the largest ever made of this species anywhere in the world. A separate short paper will be prepared analyzing the biometric and moult data.

White-winged Black Terns breed across a wide range of the Northern Hemisphere, between 35 and 55 degrees north, from northern Italy in the west to Sakhalin Island in eastern Siberia. There do not appear

Table 1. NWA 2011 expedition catch totals

Catches	Location	New	Re-trap	Total	
20/02/2011	Broome	6	3	9	
Sub-total		***6***	***3***	***9***	
23/02/2011	80 Mile Beach	192	10	202	including 1 tern
24/02/2011	80 Mile Beach	158	3	161	
25/02/2011	80 Mile Beach	131	6	137	including 9 terns
26/03/2011	80 Mile Beach	248	6	254	including 1 tern
27/03/2011	80 Mile Beach	85	0	85	
27/03/2011	80 Mile Beach	2	0	2	by hand
28/03/2011	80 Mile Beach	8	0	8	
1/03/2011	80 Mile Beach	98	4	102	
2/03/2011	80 Mile Beach	185	8	193	
3/03/2011	80 Mile Beach	284	6	290	
4/03/2011	80 Mile Beach	487	4	491	including 279 terns
Sub-total		***1878***	***47***	***1925***	
6/03/2011	Broome	251	104	355	
8/03/2011	Broome	187	87	274	including 17 terns
10/03/2011	Broome	359	172	531	
11/03/2011	Broome	275	121	396	including 1 tern
Sub-total		***1072***	***484***	***1556***	
TOTAL		**2956**	**534**	**3490**	

Table 2. NWA 2011 Expedition - wader and tern catch details

Species	Catch Totals				
	New	***Retrap***	***Total***	***Juveniles***	% juv
Bar-tailed Godwit	335	30	365	78	*21*
Black-tailed Godwit	0	1	1	0	
Broad-billed Sandpiper	24	5	29	17	*59*
Bush Stone Curlew	2	0	2	2	
Curlew Sandpiper	63	19	82	20	*24*
Great Knot	978	188	1166	279	*24*
Greater Sand Plover	440	146	586	100	*17*
Grey Plover	4	0	4	1	
Grey-tailed Tattler	122	8	130	41	*32*
Lesser Sand Plover	4	0	4	2	
Pied Oystercatcher	6	3	9	0	
Red Knot	197	13	210	34	*16*
Red-necked Stint	315	117	432	80	*19*
Ruddy Turnstone	3	1	4	1	
Sanderling	3	0	3	1	
Terek Sandpiper	149	2	151	38	*25*
Whimbrel	1	0	1	0	
TOTAL WADERS	**2646**	**533**	**3179**		
Gull-billed Tern	6	0	6	0	
Crested Tern	5	0	5	1	
Lesser Crested Tern	3	0	3	0	
Little Tern	20	1	21	2	
White-winged Black Tern	276	0	276	12	*4*
TOTAL TERNS	**310**	**1**	**311**		
TOTAL	**2956**	**534**	**3490**		

to be any previous long-distance recoveries and the extent of the southward migration in the East Asian/Australasian Flyway may not have been fully recognised previously. We hope that these birds produce a flag-sighting on their migrations through Asia in the future.

John Stoate, the owner of Anna Plains Station, very kindly took us on two major reccies to the areas of Anna Plains Station adjacent to the parts of 80 Mile Beach where the White-winged Black Terns were found roosting. These revealed huge concentrations of birds feeding on the wing on grasshoppers over certain areas of the grassy plains. This year the grass was longer than at any time in recent decades due to the regular rain which has occurred throughout January and February, totaling more than twice the average annual rainfall. The vast quantities of grasshoppers and small locusts present had not yet progressed to the flying stage but were so thick that low-flying terns easily flushed them into the air for capture.

This count of White-winged Black Tern now adds a fourth species to the list of those having a significant proportion of the East Asian/Australasian Flyway population present at times, and apparently dependent on, the grasslands at Anna Plains Station. The other three species are Oriental Plover, Oriental Pratincole and Little Curlew. Because of the high vegetation this year these species were only present in low numbers (20 Oriental Plover, 800 Oriental Pratincole, 100 Little Curlew). Populations of these species were presumably at inland locations or other more suitable habitats in northern Australia.

e) Overall 1,925 birds were caught at 80 Mile Beach (Table 3). This is the highest total in the last four years and is possibly the highest ever during a three-week Expedition. This total included two Bush Stone-curlew chicks about-to-fledge, caught at night near the airfield.

Recaptures and Controls

A record total of 11 foreign-banded waders were captured. From China there were eight Great Knot, one Red Knot and one Bar-tailed Godwit. There was also a Great Knot from Korea carrying an Australian band indicating it had previously been recaptured in north-west Australia. It had originally been banded in Korea in 1997. Banding details of all these birds are currently being sought and these controls will be processed by the Australian Bird and Bat Banding Office in due course. This high proportion of Chinese-banded birds is a reflection of the hugely successful wader banding which has been carried out at Chongming Dao, Bohai and other locations along the Chinese coast in recent years.

Table 3. Comparison of catches during the 2006-2011 Expeditions

Catches	Year	New	Re-trap	Total
Broome (first period)	2006	857	174	1031
	2007	985	223	1208
	2008	807	184	991
	2009	1374	208	1582
	2011	***6***	***3***	***9***
80 Mile Beach	2006	1619	55	1674
	2007	1690	95	1785
	2008	1215	62	1277
	2009	604	28	632
	2011	***1878***	***47***	***1925***
Broome (second period)	2006	1120	176	1296
	2007	861	192	1053
	2008	567	88	655
	2009	1172	296	2068
	2011	***1072***	***484***	***1556***
TOTAL	**2006**	**3596**	**405**	**4001**
	2007	**3536**	**510**	**4046**
	2008	**2589**	**334**	**2923**
	2009	**3150**	**532**	**4282**
	2011	**2956**	**534**	**3490**

Recapture rates (31%) were again good at Roebuck Bay, with 487 in 1,565 birds caught (Table 1). The rate was particularly high (43%) in the large catch of 267 Greater Sand Plover on 10th March, in the 191 catch of Red-necked Stint (38%) on 9th March, and on the Great Knot catches (35%).

There were again some very old individuals in the 532 recaptures of previously banded birds made during the Expedition (Table 4). Bar-tailed Godwit, Great Knot and (perhaps surprisingly) Greater Sand Plover always seem to dominate our longevity tables, with individuals occasionally reaching an age of 20 years or more. This year a Bar-tailed Godwit and a Great Knot which were at least 23 years old were recaptured. The record for NWA is a 29 year-old Bar-tailed Godwit.

It is interesting that five of the Great Knot recaptured on 6 March had been originally banded in the same catch on 29 August 1998. This was the "famous" catch of 2,042 birds at Camp Site Beach which contained 1,001 Great Knot (our highest ever catch for this species).

Proportion of Juveniles

It appears to have been a second successive season of above average breeding success for the wader populations which spend the non-breeding season in north-west Australia (Table 5). This year the best overall performance in relation to the average of the last 12 years, was for Bar-tailed Godwit (21% juveniles, compared with a 9.8% average). This confirms the field observations of Chris Hassell and others, of unprecedented numbers of juvenile Bar-tailed Godwits arriving in Roebuck Bay in October 2010.

Importantly it was another good breeding season for Great Knot (24% juveniles, following the 44% of the previous year and compared with the 12.5% long-term average).

The only species with relatively poor breeding success was Greater Sand Plover (17% juveniles compared with a 24.5% average).

Wader populations should be significantly helped by these two successive good breeding seasons in the Arctic in 2009 and 2010. Unfortunately one must now expect a relatively poor breeding outcome from 2011's breeding efforts!

Geolocators

Twenty-nine geolocators were put onto Greater Sand Plovers at Roebuck Bay during the last week of the Expedition. In addition, two Greater Sand Plovers were caught carrying geolocators put on in March 2010 (one BAS Mk.12 model and one Swiss Ornithological Institute unit). This brings to eight the number so far retrieved from the 30 applied in March 2010. Twenty-two of these have been seen back in Roebuck Bay subsequent to their northward migration, so just over a third of these have so far been retrieved. Unfortunately the technical performance of the geolocators has been very poor. So far, all the BAS Mk.12 geolocators had lost battery power after six weeks and therefore only the journey to the breeding grounds was recorded. All the SOI units failed completely because of corrosion.

The units put on this year were 19 BAS Mk.10B geolocators and 10 experimental Migwad 1 geolocators. The BAS Mk.10B units are more robust and better protected than

Table 4. Oldest Recaptures during NWA 2011

Species	Date banded	Banding location	Age at banding	Retrap date	Retrap location	Minimum age at retrap
Bar-tailed Godwit	4/04/1994	80 Mile Beach	2+	4/03/2011	80 Mile Beach	19+
Bar-tailed Godwit	2/04/1996	80 Mile Beach	3+	25/02/2011	80 Mile Beach	18+
Bar-tailed Godwit	9/04/1990	Roebuck Bay	2+	11/03/2011	Roebuck Bay	23+
Bar-tailed Godwit	20/07/1996	Roebuck Bay	3	6/03/2011	Roebuck Bay	18
Bar-tailed Godwit	12/10/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Great Knot	31/03/1990	Roebuck Bay	2+	6/03/2011	Roebuck Bay	23+
Great Knot	9/09/1992	Roebuck Bay	3+	11/03/2011	Roebuck Bay	21+
Great Knot	3/03/1996	Roebuck Bay	2+	6/03/2011	Roebuck Bay	17+
Great Knot	5/03/1996	Roebuck Bay	2+	11/03/2011	Roebuck Bay	17+
Great Knot	29/08/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Great Knot	29/08/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Great Knot	29/08/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Great Knot	29/08/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Great Knot	29/08/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Great Knot	24/09/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Greater Sand Plover	6/04/1994	80 Mile Beach	2+	23/0212011	80 Mile Beach	19+
Greater Sand Plover	25/08/1998	80 Mile Beach	2	26/02/2011	80 Mile Beach	14
Greater Sand Plover	16/03/1994	Roebuck Bay	2+	10/03/2011	Roebuck Bay	19+
Greater Sand Plover	11/04/1996	Roebuck Bay	2+	10/03/2011	Roebuck Bay	17+
Greater Sand Plover	24/09/1998	Roebuck Bay	1	8/03/2011	Roebuck Bay	13
Grey-tailed Tattler	26/07/1998	Roebuck Bay	1	8/03/2011	Roebuck Bay	14
Red Knot	17/03/1996	Roebuck Bay	3+	6/03/2011	Roebuck Bay	18+
Red Knot	28/10/1998	Roebuck Bay	3+	6/03/2011	Roebuck Bay	15+
Red-necked Stint	10/04/1996	Roebuck Bay	1	8/03/2011	Roebuck Bay	16
Red-necked Stint	24/09/1998	Roebuck Bay	3+	10/03/2011	Roebuck Bay	15+

Table 5. Percentage of juveniles in NWA 2011 cannon-net catches.

Species	Total catch	% juv.	Average % juv. 98/99 to 09/10	Assessment of 2011` breeding success
Great Knot	1166	24	12.5	Very good
Bar-tailed Godwit	365	21	9.8	Excellent
Red Knot	210	16	19.9	Average
Curlew Sandpiper	82	24	18.9	Good
Red-necked Stint	432	19	21.4	Average
Grey-tailed Tattler	130	32	20.2	Very good
Terek Sandpiper	151	25	14.4	Very good
Greater Sand Plover	586	17	24.5	Poor

the previous Mk.12 units and will hopefully enable the full migration routes and range of breeding destinations of the Greater Sand Plovers to be determined. The new Migwad 1 geolocators are rather smaller than the BAS Mk.10 units and have been provided free for testing by a new (U.K.) supplier.

A small team of people will visit Broome from 9-20 September 2011 to help the local Broome team retrieve some of these geolocators from Greater Sand Plovers, as happened in September 2010.

Flag sightings

A great many sightings of waders leg-flagged elsewhere (either overseas or in other Australian locations) were made during the expedition. The highlight was a Red Knot flagged on its breeding grounds in Chukotka, in the far northeast of Siberia. This is direct confirmation that some individuals of the *rogersi* subspecies spend the non-breeding season in north-west Australia (the majority go to eastern Australia and New Zealand).

Many sightings were also made of birds individually marked with engraved leg flags or colour band combinations. Quite a few of these involved birds originally marked at Roebuck Bay, Broome, that had subsequently moved to 80 Mile Beach. In some species - especially Red Knot – such movements are more frequent than they were previously thought to be.

OTHER MATTERS

Participants

The 2011 team contained 19 participants from Australia and 11 from overseas, as detailed below. In addition the two

Broome Bird Observatory wardens took part in several catches, both at Broome and at 80 Mile Beach. It was extremely pleasing to see how extraordinarily well this mixed nationality group blended together and learned from each other and from the overall Expedition experience.

19 Australia (9 VIC, 5 WA, 2 NSW, 1 SA, 1 ACT, 1 NT)
2 Thailand
2 Netherlands
2 New Zealand
2 Hong Kong
1 China (mainland)
1 Taiwan
1 Japan

Itinerary

Because of the early move to 80 Mile Beach more catching days were spent there (10) than at Broome (8). The prolonged period at 80 Mile Beach was particularly successful and enjoyable and demonstrated that it is possible to catch there on a much wider range of tide heights than at Broome (from extreme spring high tides right down to neap tides).

Finances

The Expedition has not yet received all its projected income or made all the expected expenditures but at present it appears likely that the overall result will be a net loss. This is because charges were set two years ago, and not increased this year, and because some unbudgeted expenditures were incurred.

This shortfall will be covered by reserves accumulated from small surpluses achieved on previous Expeditions. A final financial outcome statement will be prepared later in the year when all income and expenditure matters have been finalized.

Next Expedition

The success of the 2011 Expedition has made it difficult to decide whether to revert to the November/early December period for the next Expedition or whether to again try the February/early March period. The various pros and cons of each have been evaluated by the expedition leaders and some regular participants and a decision has been made that the next Expedition will again be in the late February/early March period. The specific dates will be Saturday, February 18 to Saturday, March 11. The tides will not be as extreme as this year and we can conveniently be at 80 Mile Beach for all of the highest ones. It is hoped that many NWA 2011 Expedition participants will return again. Please indicate your interest and likely availability as soon as possible.

ACKNOWLEDGEMENTS

As always an Expedition depends on the help and assistance and generosity of a wide range of people.

Key amongst these are Broome Bird Observatory (and its Wardens, Glenn Ewers and Sarah Katz) and the owners of Anna Plains Station (John, David and Helen Stoate) who provided the essential bases and accommodation for the Expedition over its three week duration. At Anna Plains we were not able to use the usual house (a new employee and his family now live there) but instead used a range of accommodation in and around John Stoate's own house. This proved extremely suitable, facilitating even greater team harmony – and much more frequent than usual dips in the adjacent swimming pool! We thank them also for the freedom to roam at will over the 450,000 ha. station which abuts a 100km. length of 80 Mile Beach.

Thanks are also due to the Broome Port and Harbour Authority (Vic Justice) and to Nyamba BuruYawuru Ltd for permission to catch on the shores between the port and Broome town.

As usual the financial viability of the Expedition was greatly assisted by many people providing their personal vehicles for use during the Expedition (Maureen Christie, Prue Wright, Chris Hassell, Maurice O'Connor, John Renowden, Joop van Eerbeek/Mo Verhoeven, Frank O'Connor). The W.A. Department of Conservation also very generously loaned a vehicle and trailer and provided $5000 to cover the Australian costs of the participant from mainland China and to help with other Expedition costs. Chris Hassell, George Swann, AQIS and BBO kindly loaned trailers too.

Finally huge thanks are due to the whole team for its incredibly hard work throughout the full three-week period. Everyone contributed enormously but we have to single out for particular mention Chris Hassell for leading all the fieldwork activities, Maureen Christie and Helen MacArthur for organizing and supervising the menus, food purchases and catering, and to Adrian Boyle for his incredibly energetic assistance of everyone and everything during the banding and processing operations.

Vignettes:
Rob Mancini, p52, p62
Andrew Silcocks, p54

Back Issues:
Most volumes of *Stilt* are available as back issues. Please contact the Secretary for details of costs and availability.

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

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