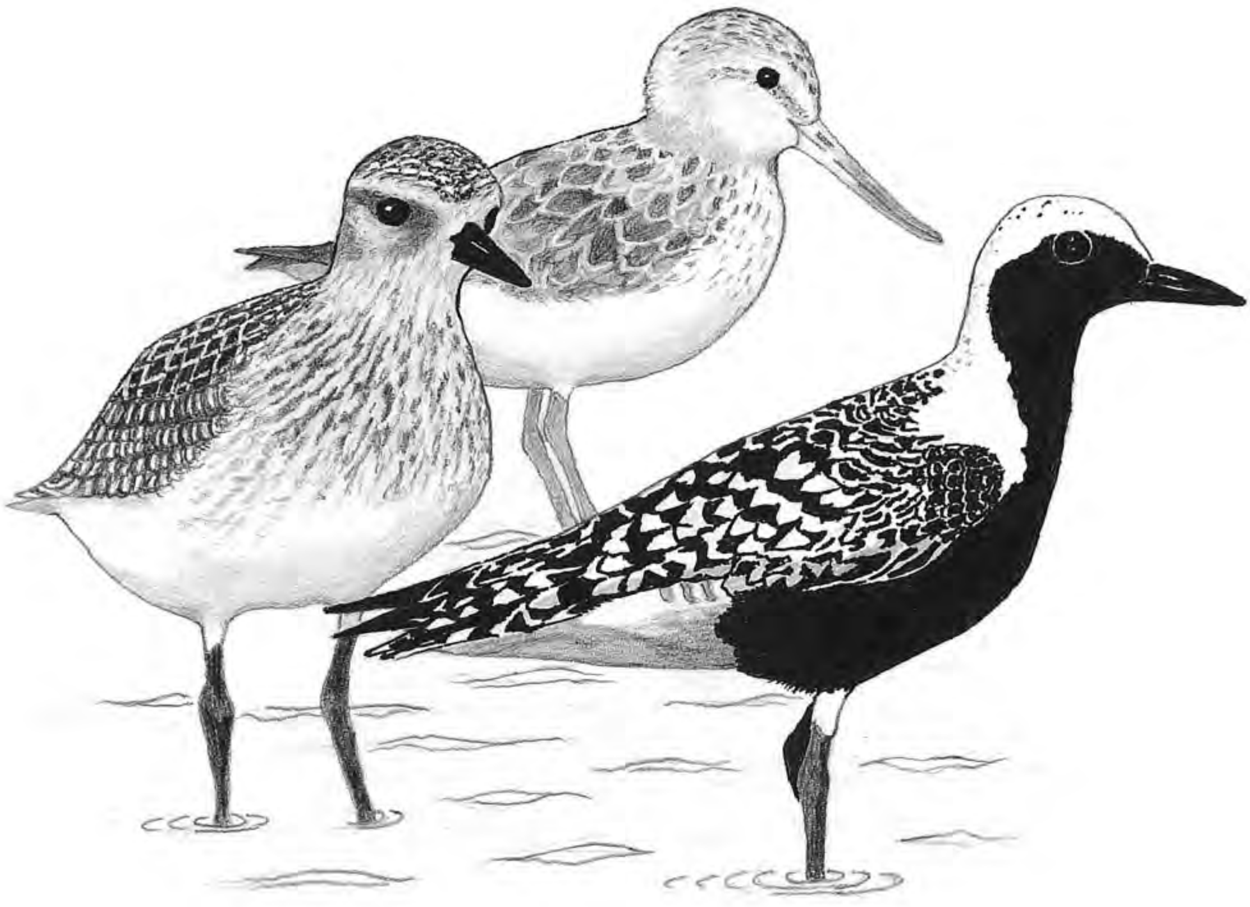
Stilt

The Journal for the East Asian-Australasian Flyway



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Australasian Wader Studies Group

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.

OFFICE BEARERS

Chairman: David Milton, 336 Prout Road, Burbank, Qld 4156, AUSTRALIA. Ph: (07) 3390 2179
Email: david.milton@csiro.au.

Vice Chairman: Phil Straw, P.O. Box 2006, Rockdale Delivery Centre NSW 2216, AUSTRALIA.
Ph and fax: (02) 9597 7765.
Email: philip.straw@awsg.org.au

Chair of Research Committee: Danny Rogers, 340 Ninks Rd, St Andrews Vic 3761, AUSTRALIA. Ph: (03) 9710 1345.
Email: drogers@melbpc.org.au

Editor: Birgita Hansen, University of Ballarat (Mt Helen), PO Box 663, Ballarat, Vic 3353, AUSTRALIA. Ph: (03) 5327 9952
Email: editor@awsg.org.au

Secretary: John Renowden, 64 Wilson St, Princes Hill Vic 3054, AUSTRALIA. Ph: (03) 9380 5759
Email: renowden@optusnet.com.au

Treasurer: Arthur Keates, PO Box 1483, Carindale Qld 4152, AUSTRALIA. Ph: 0410 960 955.
Email: arthur.keates@gmail.com

Conservation Officer: Joan Dawes, 28 Ritchard Avenue, Coogee, NSW 2034, AUSTRALIA. Ph: (02) 9664 2546
Email: jdawes1@bigpond.net.au

STATE CONSERVATION OFFICERS

QUEENSLAND
Joyce Harding, PO Box 1530, Cleveland Qld 4163.
Email: pallara@powerup.com.au

Sandra Harding, 336 Prout Road, Burbank QLD 4156
Email: pitta@gil.com.au

NEW SOUTH WALES
Joan Dawes Ph: 02 9664 2546
Email: jdawes@bigpond.net.au

TASMANIA
Eric Woehler (South Tas), 37 Parliament St, Sandy Bay Tas 7005. Ph: (03) 6223 1980 Email: eric_woe@iprimus.com.au

Ralph Cooper (North Tas) 7 Beach Rd, Legana Tas 7277.
Ph: (03) 6330 1255 Email: rabacooper@bigpond.com

SOUTH AUSTRALIA
Paul Wainwright, PO Box 255, Balhannah SA 5242
Ph: 0429 678 475 Email: paul.wainwright@sa.gov.au

VICTORIA
Doris Graham, 14 Falconer St, Fitzroy Vic 3068.
Ph (03): 9482 2112 Email: grahamdm@melbpc.org.au

WESTERN AUSTRALIA
Bill Rutherford (s. WA – cutoff Onslow), 199 Daglish St, Wembly, Perth 6014. Email: calidris@iinet.net.au

Chris Hassell (n. WA – cutoff Onslow), Global Flyway Network PO Box 3089, Broome, WA 6725. Ph: (08) 9192 8585 or 0408 954 655 Email: turnstone@wn.com.au

INTERNATIONAL REPRESENTATIVES

NEW ZEALAND

North Island:
Adrian Riegen, 213 Forest Hill Rd, Waiatarua, Auckland 0612, New Zealand. Ph: (09) 814 9741 Email: riegen@xtra.co.nz

South Island:
Rob Schuckard, 4351 Croisilles French Pass Rd RD3, French Pass 7139, New Zealand. Ph: 35765371
Email: rschckrd@xtra.co.nz

ASIA
Doug Watkins, Manager Wetlands International – Oceania, PO Box 4573, Kingston ACT 2604 AUSTRALIA.
Ph: +61 2 6260 8341.
Email: doug.watkins@wetlands-oceania.org

OTHER COMMITTEE MEMBERS

Maureen Christie, Jon Coleman, Heather Gibbs, Ken Gosbell, Chris Hassell, Roz Jessop, Penny Johns, Clive Minton, Adrian Riegen, Paul Wainwright and Doug Watkins.

MEMBERSHIP OF THE AUSTRALASIAN WADER STUDIES GROUP

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

Annual Subscriptions:	Australia & New Zealand	A$40.00
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	Institutions	A$50.00

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EDITORIAL

The wader community has been dealt another severe blow recently with the tragic loss of Heather Gibbs. For those that knew her, and I think it was many people, they will remember an enthusiastic, intelligent, hard working and generous woman. She was a significant contributor to the AWSG and to maintaining strong international relations with our Flyway counterparts. She also made major changes to the AWSG databases and the way information is stored and shared in the EAAF. We are grieved to lose her, especially on top of the recent loss of Mark Barter.

I would like to draw the membership's attention to the recent situation analysis on the Yellow Sea, produced by the IUCN and reporting some of the findings of Nick Murray's research on declining shorebirds at the University of Queensland. This report entitled "IUCN SITUATION ANALYSIS ON EAST AND SOUTHEAST ASIAN INTERTIDAL HABITATS, WITH PARTICULAR REFERENCE TO THE YELLOW SEA (INCLUDING THE BOHAI SEA)" co-authored by John MacKinnon, Yvonne I. Verkuil and Nicholas Murray, can be downloaded for free from http://www.iucn.org/about/work/programmes/water/?11127/IUCN-situation-analysis-on-East-and-Southeast-Asian-intertidal-habitats-with-particular-reference-to-the-Yellow-Sea-including-the-Bohai-Sea.

The Australasian Shorebird Conference was successfully held at the University of Adelaide at the end of September 2012. Included in this issue of *Stilt* are abstracts from spoken presentations. During the conference I briefly talked about the recent changes to *Stilt*. I outlined the aims and scope of the journal and how this fits into the broader objectives of the AWSG. In summary, the AWSG aims to disseminate information to government, scientists and the community for the conservation of waders. Importantly, in order to influence the decision-making process in government, wader research needs to be published in a rigorous and timely manner. The AWSG and its members work very hard to achieve this goal and be a voice for waders to all audiences. *Stilt* aims to facilitate the translation of wader research findings into government policy by regularly publishing a coherent collection of manuscripts from around the Flyway. My role as editor is to ensure these manuscripts are of the highest possible quality and clearly address the readership, in order to expedite the flow of research and monitoring information. With the current conservation status of many wader species looking so grim, this is more critical now than ever.

I also outlined the way in which Stilt is now edited. In the most recent and future issues, *Stilt* will contain several distinct sections. These repeat the structure of the journal in earlier years of the AWSG. The first and second sections are for original research and short communications, and are subject to external peer-review. The third section is for reports, which will, in most cases, be edited only. I would also like to include in future issues a fourth section reporting on the results of monitoring from state wader groups in Australia. Ideally these will be short report-style documents that contain up-to-date summaries of counts of species of interest. They will be subject to editing only. I think these will be helpful for keeping the broader readership informed of local changes in our wader populations. I would strongly encourage state coordinators and wader volunteers to start thinking about how updates on their activities can be compiled and submitted to *Stilt*. Book reviews are as always, welcomed.

You will find at the end of this issue Instructions to Authors. This document is an updated version of the instructions that appeared in earlier issues of *Stilt* (issues 33-38). I would strongly encourage all contributors, even those whom have published in *Stilt* previously, to familiarise themselves with this document before submitting new manuscripts. This document will appear on the website in due course. If you are uncertain about the suitability of material you would like to submit, please send me an outline and / or abstract and I will endeavour to provide timely and constructive feedback. Alternatively, you can contact me on my work phone number, listed on the inside front cover of *Stilt*.

The AWSG committee held its Annual General Meeting on 10 October at BirdLife Australia's Head Office in Melbourne. The new chair, Alison Russell-French, will provide a report in the next issue summarising the major outcomes of that meeting and highlighting strategic directions for the AWSG. One item was noted that I would like to bring to your attention here. The AWSG membership fee was increased at the start of 2012 to $40 for full members. Could all members please check that their membership is current and paid in full.

Happy wader watching over the festive season!

Birgita Hansen

ERRATUM

An error appeared in the article by B. Hansen in *Stilt* 60 "A Brief Overview of Literature on Waders in Decline". Table 1 has incorrectly listed several wader species as declining in reference to the Wilson *et al.* (2011) study in Queensland. The correct species list should be Red Knot, Bar-tailed Godwit, Ruddy Turnstone, Common Greenshank, Great Knot and Whimbrel. The author apologises for this error.

OBITUARY HEATHER GIBBS (1973–2012)

Heather Gibbs - Leg Flag Database and Banding Database manager for AWSG/VWSG, AWSG & VWSG Committee member and regular fieldwork participant – died, suddenly, on 9 November 2012. Her loss is a tragic blow to her family, to the AWSG, and to all her friends throughout the East Asian – Australasian Flyway.

Heather developed an interest in wildlife and the environment at an early age through accompanying her parents in the field and through living in the countryside outside Queenscliff in Victoria. She first took part in Victorian Wader Study Group banding activities at the age of 8 and shorebirds gradually came to be her area of greatest interest.

She obtained a Zoology degree at the University of Melbourne and then went on to complete her Masters via a research project on the food of Gannets nesting on Pope's Eye in the mouth of Port Phillip Bay. She then worked for Birds Australia for several years, mainly on HANZAB. A trip to Antarctica as the ornithologist on a boat from Hobart was a highlight of this period.

After the birth of her second child Heather took over the role of Manager of the AWSG/VWSG Leg Flag Database. As the volume of sightings rapidly grew she built up a huge network of contacts throughout the East Asian-Australasian Flyway and around Australia. She excelled in rapid and efficient communication of information back to the finder and the flagger. She developed the database and was a real expert in extracting data from it for analyses and providing this in the most useful form. Her friendly, cooperative, warm nature was noted and appreciated by everyone and her speed of meeting requests was unbelievable.

Heather maintained her love of fieldwork, taking part in several AWSG North-west Australia expeditions and VWSG activities in Victoria, South Australia and King Island (Tasmania). She particularly enjoyed in recent years bringing the children with her. She was the best mother of young children I have ever seen, quietly and patiently explaining everything to them and encouraging their participation.

Heather's intense care for the environment was increasingly the foundation for everything she did in recent years. Not surprisingly she chose the effects of climate change on birds as the subject of her near-completed Ph.D., through Deakin University. She published four papers in Emu and was a joint author of many others published in the AWSG journal *Stilt* and the VWSG Annual Bulletin.

Another aspect of her care for the environment was her preference to use an electric bicycle and even a hugely heavy electric motorbike for travel around Melbourne!

Heather will be hugely missed by all her friends and contacts in the bird world and even more so by her partner Brian, her children Dom and Amy, and her father, Colin.

Clive Minton, December 2012.

REVIEW OF AUSTRALIAN SHOREBIRD SURVEY DATA, WITH NOTES ON THEIR SUITABILITY FOR COMPREHENSIVE POPULATION TREND ANALYSIS

ROBERT S. CLEMENS[1], BRUCE E. KENDALL[2], JESSICA GUILLET[1] & RICHARD A. FULLER[1,3]

[1]*School of Biological Sciences, University of Queensland, St. Lucia, Queensland 4072, Australia.*
[2]*Bren School of Environmental Science & Management, University of California, Santa Barbara, Santa Barbara, CA 93106-5131, USA*
[3]*CSIRO Climate Adaptation Flagship and CSIRO Ecosystem Sciences, 41 Boggo Road, Dutton Park Queensland 4102, Australia*

Shorebirds are one of the most well-monitored taxa in Australia. In this paper, we review the spatial and temporal coverage of the Australian shorebird monitoring count data currently administered by BirdLife Australia, and comment on the subset of those data likely to be of immediate use for comprehensive trend analysis. Of the 253 shorebird areas known in Australia, seventeen in the southern half of Australia had consistent survey coverage over the last 30 years, with summer counts available in over 80% of those years, and with each area holding nationally significant numbers of some shorebird species. Similarly consistent data were available for eight additional shorebird areas, but these generally held fewer birds. Another 21 shorebird areas with nationally important numbers of shorebirds had 15 to 30 years of data with some variation in spatial coverage or changes in methods over time. Our review suggests that Australian shorebird monitoring data are of sufficiently high quality and spatial coverage to permit robust analysis of shorebird population trends across much of Australia.

INTRODUCTION

The wealth of data on the abundance and distribution of Australia's shorebirds is testament to a remarkable effort by hundreds of volunteers over many decades. This effort has allowed researchers to identify an unfolding crisis in Australia's shorebird populations with recent analyses revealing severe declines in the abundance of shorebird species at individual shorebird areas across the continent (Creed & Bailey 1998, Wilson 2001, Minton *et al.* 2002, Reid & Park 2003, Olsen & Weston 2004, Gosbell & Clemens 2006, Rohweder 2007, Close 2008, Wainwright & Christie 2008, Rogers *et al.* 2009, Herrod 2010, Wilson *et al.* 2011, Cooper *et al.* 2012, Dawes 2012, Milton & Harding 2012, Minton *et al.* 2012, Szabo *et al.* 2012). Despite these important studies at individual areas, a comprehensive quantitative population analysis that brings together all available shorebird count data is lacking. To fill this gap, a new project, which aims to investigate the magnitude and causes of declines in migratory shorebirds using the East Asian-Australasian Flyway, has recently commenced at the University of Queensland. This project is funded by the Australian Government and is co-funded by Department of Environment and Resource Management (Queensland Government), Queensland Wader Study Group, the Port of Brisbane, and the Department of Sustainability, Environment, Water, Population and Communities (Australian Government). The objectives of the project are to identify population trends in migratory shorebirds, identify the causes of any declines, identify the location of the threats to shorebirds across the Flyway, and investigate ways to increase the efficiency of shorebird monitoring in Australia.

A critical first step in any comprehensive analysis of biological monitoring data is an assessment of the completeness and robustness of the available information. Biological monitoring data are most robust if count methods have remained unchanged over time, and contain minimal missing values. We assess how much of Australia's shorebird monitoring data meets these requirements, noting that while new techniques are increasingly statistically robust to missing values (Newton 1998, Dennis *et al.* 2006, Amano *et al.* 2012), inference is ultimately limited by incomplete time series and inconsistent spatial coverage within the areas surveyed. The degree to which results of biological monitoring can be generalised across a wide area are dependent in part on the spatial coverage of monitoring efforts, with greater certainty arising from greater spatial representativeness across the landscape of interest.

Thirty-seven shorebird species regularly migrate to Australia, and recent reviews concluded that 22 occur in large numbers within the available data (Clemens *et al.* 2010) and at least 10 were recorded in enough locations over 26 years to indicate that broad scale analyses of their population trends is possible (Haslem *et al.* 2008). Among these 22 species, the proportion of the total Flyway population that reaches Australia varies from 9% to 100% (mean = 54.5%; Bamford *et al.* 2008), and the proportion of the Australian population of each present in areas sampled also varies (Clemens *et al.* 2010). Therefore, population trends observed in the areas sampled within Australia will offer varying reflections of the population trends occurring across both Australia and the entire Flyway. Most of Australia's shorebird count data has been brought together into BirdLife Australia's Shorebirds 2020 database, which incorporates data from the historical Australasian Wader Studies Group (AWSG; Wilson 2001), The *New Atlas of Australian Birds* data (Barrett *et al.* 2003), and several other local shorebird count programs (Oldland *et al.* 2008). The main sources of information not included in this database are the those from the University of New South Wales' aerial waterbird monitoring program (Kingsford & Porter 2009), several counts along the coast of the Northern Territory (Chatto 2003), and the ~90,000 bird surveys from the first atlas of Australian birds (birds represented as present or absent at 1 degree resolution 1977-81; Blakers *et al.* 1984).

Long-term shorebird count databases also exist in New Zealand and Japan (Bamford *et al.* 2008, Amano *et al.* 2010), which could be brought to bear on any Flyway analysis. However, for the purposes of this review we focus on those data currently administered by BirdLife Australia.

Shorebird data have been collected by hundreds of volunteers over many decades in Australia. Here we identify and discuss the spatial and temporal coverage of the available shorebird monitoring data in Australia. We begin by summarising available shorebird count data and the methods used to collect those data. We then highlight the spatial and temporal patterns in the data emphasising the variation in completeness of each time series, the spatial coverage of counts across Australia, and the variation in counts across time. We then identify the subset of data of immediate use in urgently needed broad scale population trend analyses.

Our purposes for conducting this review are to (i) showcase the great collective achievement of shorebird monitoring in Australia, (ii) illustrate how much of the available data are amenable to analyses of population trends, and (iii) stimulate readers to identify any missing data which could further complete the available set of data summarised here.

SOURCES OF AUSTRALIAN SHOREBIRD COUNT DATA

In May 2011, BirdLife Australia databases held a total of 220,164 surveys that have recorded shorebirds, collectively including well over 15 million counted shorebirds. These included 56,354 formal population monitoring surveys that used a taxon- and area-specific counting protocol within areas defined according to local shorebird habitat use (e.g. high tide roosts, coastal beaches or inland wetlands); the remaining 163,810 surveys were not designed specifically with monitoring as an objective (Table 1).

Population monitoring surveys

The vast majority of the formal surveys were conducted by the Australasian Wader Studies Group (AWSG), which has engaged over 650 uniquely identified volunteers and thousands of additional unidentified volunteers since 1980. Formal count data from AWSG were collected under two major banners. First, "Population Monitoring data have been collected since 1981 specifically to track population changes, with standardised counts repeated usually once in the austral summer and once in the winter" (Clemens *et al.* 2006). Second, "the 'Regular Counts' project collected monthly data from 1981 to 1990 across 114 areas, including many of the same areas surveyed for population monitoring, though the number of monthly counts varied between areas" (Clemens *et al.* 2006). Overall the consistency of the volunteer effort across these two population monitoring projects over a long period of time is remarkable given that the program was run entirely by volunteers from 1985 through 2006 (Figure 1a). From 2006 on, BirdLife Australia in partnership with the AWSG initiated the 'Shorebirds 2020' program (with paid staff), seeking to reinvigorate the long-term monitoring program, which still aimed to track population changes in shorebirds (Oldland *et al.* 2008).

A key aspect of the curation of the shorebird count data by BirdLife Australia has been the linking of the surveys to a series of 242 'shorebird areas' across Australia that have

Table 1. Shorebird survey data curated by BirdLife Australia.

Data type	Survey coverage	Number of surveys
Formal shorebird population monitoring surveys	Shorebird areas with complete coverage in each survey over the time series (30 shorebird areas comprising 300 count areas)	17,496
	Shorebird areas with incomplete coverage for some of the surveys over the time series (212 shorebird areas comprising 1,941 count areas)	38,858
Additional shorebird surveys	Shorebirds 2020 one-off counts using shorebird-specific methodology with approximate lat/long	21,864
	Atlas 2-hectare / 20 minute surveys containing counts of shorebirds with approximate lat/long	7,699
	Atlas 2-hectare / 20 minute surveys containing presence-only records of shorebirds with approximate lat/long	20,297
	Atlas area counts containing counts of shorebirds with approximate lat/long	22,408
	Atlas area counts containing presence-only records of shorebirds with approximate lat/long	79,878
	Atlas fixed-route survey containing counts of shorebirds with approximate lat/long	2,362
	Atlas fixed-route survey containing presence-only records of shorebirds with approximate lat/long	203
	Atlas incidental surveys containing shorebird counts	5,386
	Atlas incidental surveys containing shorebird presence-only data	3,657

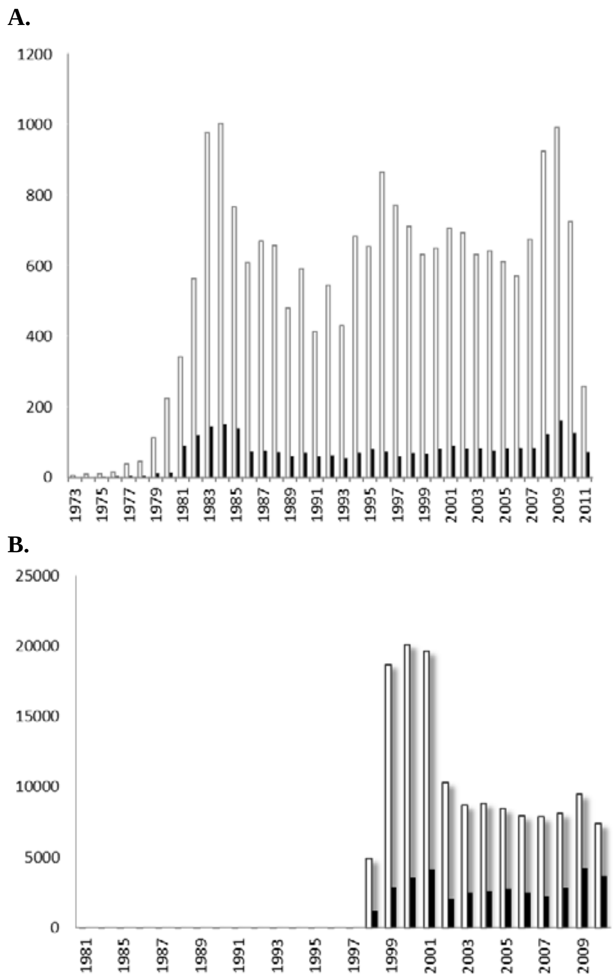

Figure 1 Temporal patterns in population monitoring data
(A) Number of surveys within spatially defined shorebird areas
■ = number of shorebird areas visited
□ = number of count areas visited
(B) Number of New Atlas surveys where shorebirds were recorded
■ = number of Atlas surveys where shorebirds were counted,
□ = number of Atlas surveys where shorebirds were recorded as present

now been mapped within a GIS at a scale of 1:100,000. This allows the time series data to be tied to an explicitly defined spatial extent. A shorebird area is expertly defined as the geographic area used by the same group of shorebirds over the main non-breeding period (November to February), something which members of the AWSG had long mentioned as being possible in areas where their understanding of how shorebirds used habitats in the non-breeding season were well developed (D. Rogers & C. Minton, *pers. comm.*). These expert-defined shorebird areas (Clemens *et al.* 2006) of various sizes have been shown to be used by the same group of shorebirds throughout the non-breeding season, with birds returning to that area year after year. For example, of over 12,000 shorebirds banded in five shorebird areas in the Bellarine Peninsula, Victoria, 98% of those recaptured were caught within the same shorebird area in which they were originally banded, despite these areas being separated by less than 10km (Herrod 2010). Similarly, in a study of movement of shorebirds in this same area, radio tracking and correlations in count data revealed little evidence of movements between these proximate areas (Rogers *et al.* 2010a). Moreover, grouping data into functional shorebird areas has been shown to increase population monitoring sensitivity by enabling smaller changes in populations to be detected over 20 years by avoiding grouping data that includes several independent populations, while aggregating data from adjacent areas between which birds are moving regularly (Herrod 2010, Purnell *et al.* 2010). The concept of shorebird areas is difficult to apply for some species, most notably Sharp-tailed Sandpiper (*Calidris acuminata*), that are known to move widely across the landscape in the non-breeding season in response to changing wetland conditions (Alcorn *et al.* 1994).

The data within each shorebird area are further divided into count areas within the BirdLife Australia database. A ‘count area’ is simply the area surveyed during a count, and might correspond to one shorebird roost, or the entire area covered by one team during their count. Over three decades a variety of shorebird counts were added to the National Shorebird Database. A resulting criticism of the shorebird count data was that it was not always possible to determine which areas were counted in the same way over time, and therefore which of these data were directly comparable (Driscoll 1997). To remedy this, staff at BirdLife Australia liaised with volunteer counters, and went through historic mud maps to identify the areas actually counted during the surveys. On average a shorebird area comprises ten separate count areas (range 1 to 185) and a total of 2,241 count areas were mapped within a GIS at a scale of 1:100,000 (Clemens *et al.* 2008). Most count area surveys in the database represent an attempted census of each mapped area.

In summary, the formal shorebird surveys present in BirdLife Australia databases attempt to represent censuses of each shorebird area based on local expert knowledge of shorebird habitat use. In tidal areas this required knowledge of optimal tide heights and weather conditions in which to survey, as well as a good understanding of sometimes dynamic roost locations. Data on inland surveys were also expertly adjusted in areas where varying water levels or changing weather conditions were known to alter the local distribution of shorebirds. Most of these shorebird areas were large (mean = 10,400 ha, ranging from 2 to 600,000 ha.), and required surveys to be undertaken by teams of observers simultaneously counting birds at a number of count areas to reduce the risk of double counting. Most surveys were completed in four hours, and in tidal areas surveys were generally timed to occur within two hours either side of a suitable high tide. Surveys in some areas do take more than one day to complete, and rarely for logistical reasons a complete survey may include count area surveys spread out over up to a month. The majority of surveys were ground based, but over 15% of areas were surveyed partially or entirely from boats. Potential count covariates such as tide height, weather, condition, threats and observer experience have recently been collected, but are absent from historical electronic data.

Time series for all shorebird areas contain gaps in the data (Table 2), but there are at least 30 shorebird areas for which summers with counts had at least one survey that included counts from most count areas (Table 1; A's, B's, D's, & some E's). This represents a core set of shorebird areas with the most robust monitoring data, and we discuss the properties of these data further below. The remaining 212 shorebird areas had incomplete counts resulting in data that are not comparable between years without careful consideration of the variation in survey coverage over time.

Additional surveys

Fieldwork for *The New Atlas of Australia's Birds* (Barrett *et al*. 2003) embodied the largest single collection of bird observations in Australia, with over 7.1 million bird records having been contributed by over 7,000 volunteers since 1998 (Figure 1b). The preferred atlas survey method was a search of 2 ha area for 20 minutes. Survey methods now used in the continuing Atlas include an area search where all the birds seen within a specific radius of a point (500 m or 5 km) were recorded, fixed route surveys where a spatially explicit area was surveyed repeatedly, and incidental surveys where a latitude and longitude were reported but the exact area searched was unknown. The application of these methods to shorebird monitoring is potentially limited. While fixed route monitoring is similar to a count area census, shorebird surveys that do not take into account variables such as tide height would not result in similar estimates of abundance in the same location as tide heights changed.

Informal shorebird surveys derived from the Atlas vastly outnumbered those conducted with shorebird-specific methodology. These comprised counts in the case of 37,885 surveys and presence-only data in the case of 104,037 surveys (Table 1). Although such data were not collected explicitly with population monitoring in mind, they are potentially useful for understanding patterns and changes in shorebird distributions, and could be subject to time series analysis using methods such as list length analysis (Szabo *et al*. 2010).

TEMPORAL AND SPATIAL PATTERNS OF SHOREBIRD SURVEY COVERAGE

Formal population monitoring for shorebirds in Australia has been remarkably consistent over time, with effort being sustained from the early 1980s until the present day, albeit with peaks in coverage during the early 1980s and late 2000s when funding was available to coordinate counts (Figure 1a). Recent efforts by volunteers and BirdLife Australia staff to collate historic shorebird count data has led to a marked increase in the number of historic records available since previous summaries of the data were presented (Gosbell & Clemens 2006, Clemens *et al.* 2010). The presence of these longer time series is critically important to identifying and understanding long-term trends (Newton 1998). The temporal patterns in data collected specifically for population monitoring contrast strongly with the *New Atlas* shorebird records, which commenced in the late 1990s (Figure 1).

Population monitoring surveys are much more geographically limited within Australia than *New Atlas* shorebird records (Figure 2). Population monitoring surveys from these available data were most common in areas close to Australia's cities, with comparatively low levels of formal survey effort across the Northern Territory, the Gulf of Carpentaria, and inland Australia, though this is slowly being addressed. The distribution of population monitoring effort remained roughly unchanged before and after 1995 (Figure 2a & b) whilst *New Atlas* shorebird records were much more spatially widespread (Figure 2c & d), but did not really start before 1995.

Shorebird populations are not evenly distributed across Australia (Figure 3), with a much more patchy distribution of areas supporting large numbers of shorebirds than distribution maps of the type found in field guides would suggest. This highly uneven distribution of the best shorebird habitats has been increasingly well documented and has allowed conservation efforts to be prioritised (Marchant & Higgins 1993, Watkins 1993, Higgins & Davies 1996, Geering *et al.* 2007, Clemens *et al.* 2010). Some areas supporting high abundances of shorebirds have received relatively little survey effort (compare Figure 3 with Figures 2 and 4). Examples include the coast of the Northern Territory, northern Queensland, and much of the interior (Watkins 1993, Chatto 2003, Bamford *et al.* 2008). Given the low human population density in Australia, it is not surprising that more remote parts of the country have received rather little shorebird count coverage. In fact given the limited resources available for conducting counts, low human populations, and volunteer-led efforts, the broad distribution of long time series data across Australia is remarkable (Figure 4). None-the-less, it is clear that these data do exhibit spatial sampling bias at a national scale. Several numerically important areas are chronically under-represented in the formal monitoring surveys, and survey effort is mostly concentrated near areas of high human habitation.

Variation in survey completeness

Overall effort conducting the population monitoring surveys has remained relatively consistent since 1981 (Figure 1a), but there was important variation in the spatial and temporal completeness of surveys (Table 2). Shorebird areas in Table 2 are ordered roughly by areas with the most years of data at the top, but with areas moved lower in the list if spatial coverage within that shorebird area varied over time, or if there were less than nationally significant numbers of shorebirds found in that shorebird area. There were 25 areas with less than 20% missing annual summer surveys (Table 2). However, only 13 areas had less than 10% missing summer surveys, had consistent methodology and spatial coverage each year, used experienced observers throughout the time series, and held nationally important numbers of shorebirds (A's; Table 2). Fortunately, over half of these 13 areas have received more than one summer and winter count each year, which should substantially improve the

Table 2. Availability of count data at shorebird areas across Australia, 1981-2010; Black = summer & winter counts available (Jan-Feb & June-July); Dark grey = summer count available, mid grey = winter count available, light grey =count during the year, but outside the summer and winter months, white = no count that year.

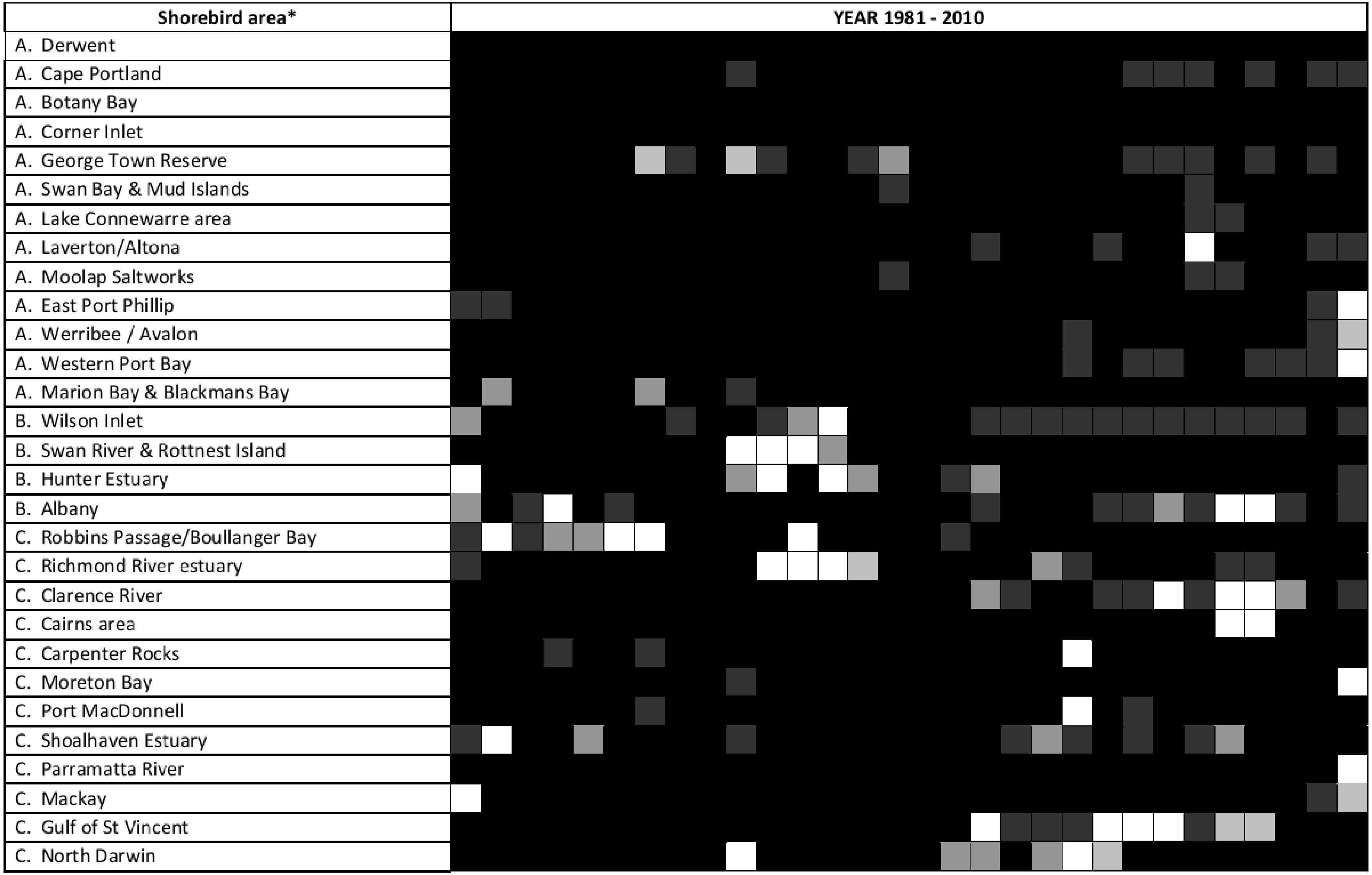

Table 2 continued. Availability of count data at shorebird areas across Australia, 1981-2010; Black = summer & winter counts available (Jan-Feb & June-July); Dark grey = summer count available, mid grey = winter count available, light grey =count during the year, but outside the summer and winter months, white = no count that year.

Shorebird area*	YEAR 1981 - 2010
C. Great Sandy Strait	
C. Coorong	
C. Townsville (Ross River area)	
C. Tweeds Estuary	
C. Swan Coastal Plain Lakes	
C. Anderson Inlet	
C. Lake George	
C. Roebuck Bay	
C. Streaky Bay	
D. Black Rocks / Breamlea (Bellarine Peninsula)	
D. Begola (Bellarine Peninsula)	
D. Belmont Common (Bellarine Peninsula)	
D. St. Leonards Salt Lake (Bellarine Peninsula)	
D. Lake Lorne (Bellarine Peninsula)	
D. Point Richards (Bellarine Peninsula)	
D. Lake Illawarra	
D. Nuytsland Nature Reserve	
E. Moulting Lagoon	
E. Bowen	
E. Armstrong Beach	
E. Port Fairy	
E. Hastings River	
E. Lades Beach	
E. Lake Corangamite area	
E. Port Stephens	
E. Peel & Yalgorup Lakes	
E. 80 Mile Beach	
E. Georges Bay	
E. Lake Eliza	
E. Kerang Lakes	
E. Shallow Inlet	

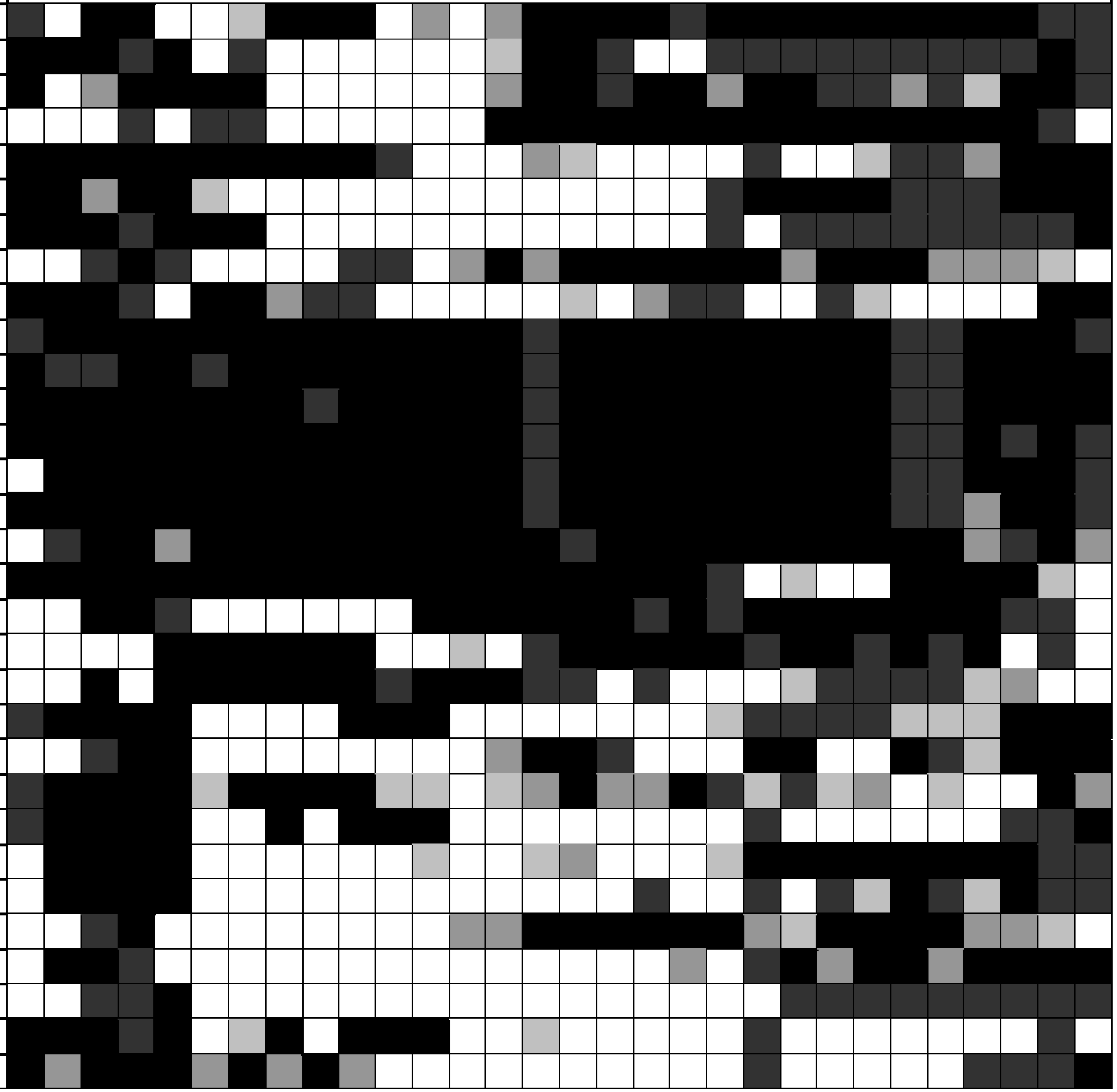

Table 2 continued. Availability of count data at shorebird areas across Australia, 1981-2010; Black = summer & winter counts available (Jan-Feb & June-July); Dark grey = summer count available, mid grey = winter count available, light grey =count during the year, but outside the summer and winter months, white = no count that year.

Shorebird area*	YEAR 1981 - 2010
E. Swan Hill	
E. Baird Bay	
E. Discovery Bay to Glenelg River	
E. Gunyah Beach	
E. Lake Hawdon	
E. Sceale Bay	
E. Vasse-Wonnerup Estuary	
E. Bush Point (south end of Roebuck Bay)	
E. Moruya Estuary	
E. Tuggerah Lakes	
F. Kinka Beach	
F. Narawntapu National Park	
F. Kelso, Tamar Estuary	
F. Woodman Point	
F. Douglas area (Wimmera)	
F. Mildura	
F. Lake Reeve (Gippsland Lakes)	
F. Gladstone	
F. Water Valley Wetlands IBA	
F. Mallacoota	
F. Manning River Estuary	
F. Maroochy River	
F. Toogoom to Point Vernon	
F. Fitzroy River Mouth	
F. Hattah Lake	
F. Lake St Clair	
F. Maurouard Beach	
F. Kangaroo Island	
F. Lake Hindmarsh (Wimmera)	

Table 2 continued. Availability of count data at shorebird areas across Australia, 1981-2010; Black = summer & winter counts available (Jan-Feb & June-July); Dark grey = summer count available, mid grey = winter count available, light grey =count during the year, but outside the summer and winter months, white = no count that year.

Shorebird area*	YEAR 1981 - 2010
F. Lake Robe	
F. Yarrawonga Point	
F. Black Point (Yorke)	
F. Bool lagoon	
F. Canunda National Park	
F. Brisbane Water	
F. King Island	
F. Bushland Beach	
F. Dubbo Sewage Ponds	
F. Fivebough Swamp	
F. Lake Wyn Wyn area (Wimmera)	
F. Nambucca River	
F. Brunswick River estuary	
F. Fox and Pub Lakes	
F. Garden Island	
F. Hamilton	
F. Munderoo Bay to Tickera Bay	
F. Rivoli Bay	
F. Jack Smith Lake (Gippsland Lakes)	
F. Lake Gore	
F. Port Victoria	
F. Hutt Lagoon	
F. Lake Buloke (Wimmera)	
F. Lake MacQuarie entrance	
F. Mullins Swamp	
F. Tullakool Saltworks	
F. Broadwater (Busselton)	
F. Camden Haven	
F. Franklin Harbour	
F. Lake Albacutya (Wimmera)	

Table 2 continued. Availability of count data at shorebird areas across Australia, 1981-2010; Black = summer & winter counts available (Jan-Feb & June-July); Dark grey = summer count available, mid grey = winter count available, light grey =count during the year, but outside the summer and winter months, white = no count that year.

Shorebird area*	YEAR 1981 - 2010
F. Lake Bathurst	
F. Lake Dulverton	
F. Nadzab Lagoon	
F. Nericon Swamp	
F. Sleaford Bay	
F. Stansbury / Oyster Point (Yorke)	
F. Tourville Bay	
F. Goldsmith Beach to Wattle Pt (Yorke)	
F. Guichen Bay	
F. Lake Newland	
F. Port Hedland	
F. Port Pirie Coast	
F. Barren Box Swamp	
F. Murat Bay	
F. Pine Point (Yorke)	
F. Troubridge Island / Shoal (Yorke)	
F. Dampier Saltworks	
F. The Broadwater (NSW)	
F. Lake MacLeod	
F. Reeves Lake	
F. Shark Bay	

* Rough categories of completeness of standardised surveys from 1981-2011: A = Surveys covered the same area, which held nationally important numbers of shorebirds and was conducted in the same way each time with no more than three missing summer counts; B = Same as A but with up to 20% of missing summer counts; C = Surveys with between 15 to 30 years of data, with, in some cases, variation in methods or spatial coverage over time and nationally important numbers of shorebirds; D = Same as A but with shorebird numbers less than national thresholds of importance; E = surveys in at least 10 summers and some inconsistencies which may be overcome with further investigation; F = at least 3 summers of data, usually with some counts in the 1980's and some in the last five years.

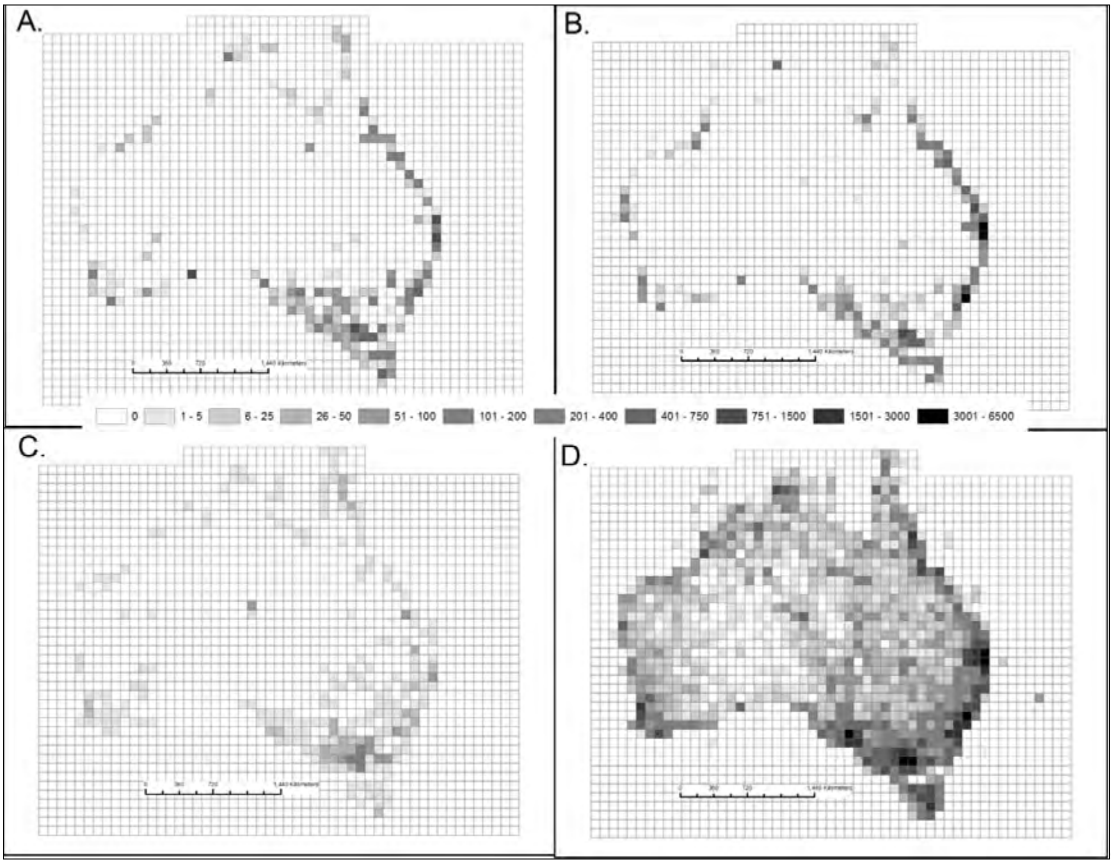

Figure 2. The number of shorebird surveys completed in mapped count areas for the purpose of monitoring populations: A. Population monitoring surveys prior to 1995, B. Population monitoring surveys 1995 – 2011; and the number of surveys for other birds where shorebirds were also recorded from both in the Shorebirds 2020 database, and The New Atlas of Australian Birds database, C. Additional surveys prior to 1995 D. Additional surveys 1995-2011.

probability of detecting a trend in those areas (Haslem *et al.* 2008, Wilson *et al.* 2011). An additional four areas had relatively well standardised survey methods, supported nationally significant numbers of birds, and had data missing from less than 20% of the summers (B's; Table 2). A further eight areas with less than nationally significant numbers of birds had consistently collected data, with no more than 10% of annual summer data (D's; Table 2). Together these 25 shorebird areas represent a core group of sites with the greatest consistency over time.

An additional 21 shorebird areas had nationally significant numbers of shorebirds recorded, and between 15 to 30 years of data available, but many of these also had variation in the number of count areas visited in any year (C's; Table 2). In this table many very incomplete counts are represented as simply having been conducted, and in two shorebird areas changes in the count areas themselves are not reflected. Three of these shorebird areas had excellent consistency in spatial count coverage, but had greater than 20% missing data, and several areas had long periods of very consistent counts among years of less consistent coverage. Fortunately, the count areas visited were generally well documented in surveys of these shorebird areas. This brings the total number of shorebird areas with reasonably strong data to 46. For many count areas, we know that counters covered the same areas from year to year, and in these 46 shorebird areas, we have a fairly good understanding of which count areas were included in any shorebird area survey. In fact in all but 14 of those 46 areas, we know that the shorebird area was counted across long periods with consistent spatial coverage, and in only that subset of 14 areas did the count areas surveyed vary substantially from year to year.

An additional 25 areas had at least 10 years of summer count data, and many were known to have had large inconsistencies in the number of count areas visited in any year (E's; Table 2). Uncertainty in which count areas were surveyed, or very high variation in count area visitation from year to year is apparent for many of the remaining shorebird areas, many having data from less than 15 summers (E's & F's; Table 2).

Analyses of Australian shorebird count data

Population trend analyses have been successfully produced for many of these shorebird areas, demonstrating the utility of the data (Creed & Bailey 1998, Wilson 2001, Minton *et al.* 2002, Reid & Park 2003, Olsen & Weston 2004, Gosbell & Clemens 2006, Rohweder 2007, Close 2008, Wainwright & Christie 2008, Rogers *et al.* 2009, Herrod 2010, Wilson *et al.* 2011, Cooper *et al.* 2012, Dawes 2012, Milton & Harding

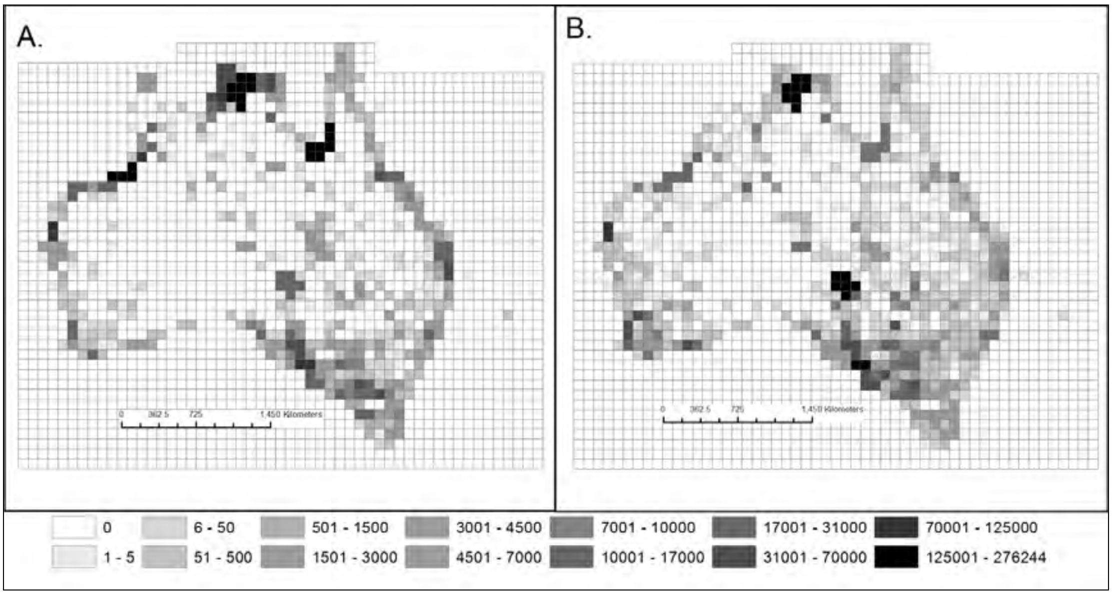

Figure 3. Maximum counts of A. migratory shorebirds & B. resident shorebirds taken from all available data in either the Shorebirds 2020 database or the Atlas of Australian Birds database. See Figure 2 for maps of spatial variation in survey effort.

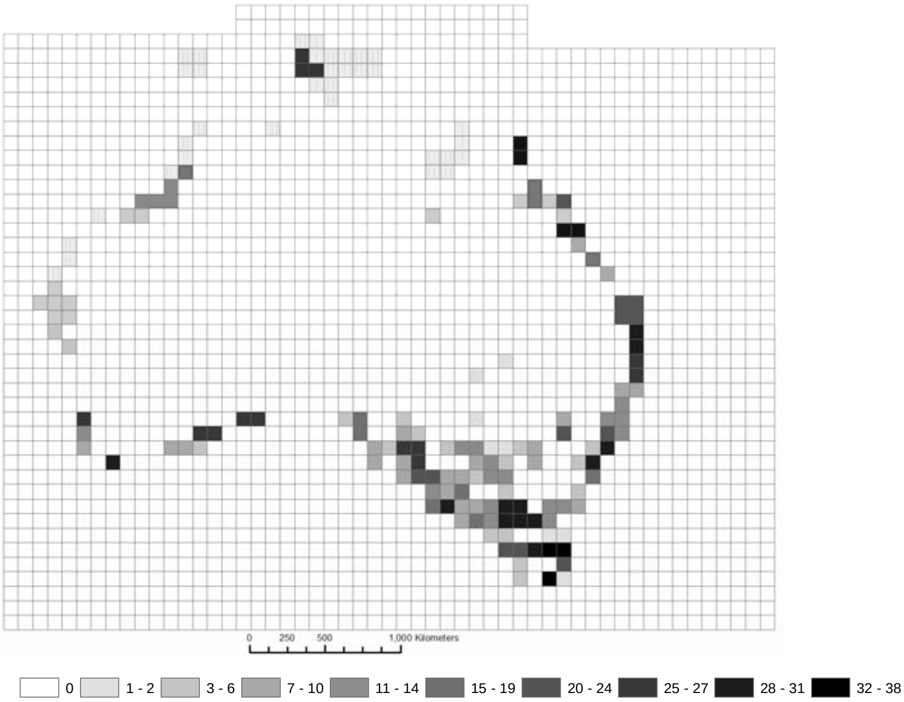

Figure 4. Total number of years with at least one summer count in a regularly visited 'shorebird area' based on count data administered by BirdLife Australia's Shorebird 2020 program.

2012, Minton *et al.* 2012). A power analysis by Haslem *et al.* (2008) concluded that to detect a 30% population decline in Australia over 26 years, the number of shorebird areas surveyed each year needed to be somewhere between 30 to 35 for each species. Those power simulations indicated that for a set of 22 core areas identified at that time, a population decline of greater than 60% could have been detected in 10 species (Haslem *et al.* 2008). Given that (i) the present review has identified several more areas with robust data, (ii) the analysis techniques now available are more sophisticated, and (iii) the number of years with available count data has increased to 31, we expect future analyses to detect smaller changes in abundance for more species.

Subset of data for immediate use in population analyses

While the 25 areas identified above as being the most consistently counted and therefore, a logical starting point for analysis, we believe that with work many of the additional areas (C's; Table 2) would also be suitable additions. This is due to recently developed analytical methods that appear to be able to cope with up to 50% missing values (Amano *et al.* 2012). However, many of the areas listed in Table 2 could currently contribute little to an Australia-wide analysis.

The kind of analyses currently being envisioned will require particular preparation. A summer count, or an index of abundance will be required for each year where data are available for each shorebird area. In many cases, among the set of 45+ areas with consistent data, there will be only one summer count to choose from that has similar numbers of count areas visited as in previous years. We recommend ignoring those shorebird area counts initially where only a small sub-set of the total shorebird area was surveyed.

DISCUSSION

Our review has identified a substantial set of shorebird areas for which robust population monitoring data exist over a long time series. The consistency in the way these data were collected over time, albeit with missing years for several areas, allows for a hierarchical modelling technique, such as that recently used in Japan (Amano *et al.* 2010). This type of analytical approach would have the potential to reliably identify broad scale population trends in Australia. Australian shorebird count data are characterised by long time series and are aggregated in a way that allows detection of small changes in abundance, due to a better match between the scale of surveys and the scale of habitat used by local populations in each shorebird area (Clemens *et al.* 2008, Haslem *et al.* 2008). With the addition of data from the Ornithological Society of New Zealand and the Japan Bird Research Association, we expect even greater power to detect trends across several additional species. Approximately 46 shorebird areas in Australia appear to have data sufficient for use in an analysis similar to that conducted in Japan (Amano *et al*. 2010). The final number of shorebird areas suitable for analysis will ultimately rest on how many contain comparable data, which will be determined on the basis of local counter verification.

In simulations using the Japanese hierarchical methods, smaller changes in abundance were detected by using covariates, and simulations indicate levels of missing data up to 50% are acceptable, although care was needed when missing values were not randomly distributed (Amano *et al.* 2012). Further advantages of these hierarchical techniques include the ability to account for the error associated with inter-shorebird area differences. The advantages of accounting for site or area specific effects has been shown in other bird count data such as the North American Breeding Bird Survey data (Sauer *et al.* 2005). Modelling trends in this way would deliver high levels of certainty regarding changes in abundance from within the geographical region that was sampled, in this case primarily southern and eastern parts of coastal Australia.

Additionally, such an approach would facilitate the ability to include covariates which would likely explain some of the variation in counts for some species in some areas. An example of a species where additional covariates might help improve the power of an analysis to detect trends over time is the Sharp-tailed Sandpiper (D. Rogers *pers. comm.*). This species is usually located in coastal areas but moves to inland wetlands when conditions suit (Alcorn *et al.* 1994). Rainfall, the Southern Oscillation Index, and streamflow data are examples of covariates which could help explain changes in local abundances of such species and all have been used to predict the changes in abundance of other waterbird species due to movement (Chambers & Loyn 2006).

The recent work in Japan provides an example of methods to help identify additional drivers of population changes, where associations between population changes and explanatory variables were tested using comparative phylogenetic generalised least squares (Amano *et al.* 2010). We suggest that these analytical techniques will allow clear articulation of the shorebird story with high levels of certainty. However, such techniques may not allow inference about changes beyond the areas sampled for some species, and do not lead to easy testing of some alternative hypotheses regarding likely drivers of population change, nor would such techniques maximise the value of the available incomplete data and expert opinion common throughout the Flyway. Therefore, we expect to explore other analysis techniques as well. Recent developments in modelling data collected by volunteers (Hochachka et al. 2012) may prove useful for these data, as may Bayesian networks which maximise the utility of more available information and expertise within a framework capable of testing alternative hypotheses (Chen & Pollino 2012). We also expect to explore techniques such as state-space modelling, which allow inclusion of the effects of demographic parameters into trend modelling (Wilson *et al.* 2011).

Shorebird population declines are being reported widely in the East Asian-Australasian Flyway (Ge *et al.* 2007, Moores *et al.* 2008, Nebel *et al.* 2008, Ma *et al.* 2009, Amano *et al.* 2010), as well as in other migratory flyways around the world (Morrison *et al.* 2001, Delany 2003, International Wader Study Group 2003, Baker *et al.* 2004, Committee for Holarctic Shorebird Monitoring 2004, Wetlands International 2006, Delany *et al.* 2009, Barshep *et al.* 2011). In the East Asian- Australasian Flyway a rapid rate of loss of inter-tidal habitat in staging areas, especially the Yellow Sea, has been documented (Barter 2002), and includes the loss of the most important known staging habitats in South Korea (Moores *et al.* 2008). Impacts from further reclamation are also continuing (Rogers *et al.* 2010b). This highlights the urgent need for definitive science to describe trends and quantify the contribution of habitat loss to migratory shorebird declines.

Shorebird count data collected in Australia over the last 30 years represent a remarkable effort by thousands of volunteers. This effort has formed the foundation for much of the progress in conserving shorebird habitat in Australia and has enabled the detection of what appear to be rapid and widespread population declines. We believe that these long-term, widely distributed and rigorous count data are now ready to be brought together to determine the scale and causes of apparent population declines for many of our migratory shorebirds.

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FIRST BREEDING RECORDS OF BLACK-WINGED STILT *HIMANTOPUS HIMANTOPUS HIMANTOPUS* IN INDONESIA

HASRI ABDILLAH[1], MUHAMMAD IQBAL[2] & HANIFAH MUTIA AMRUL[3]

[1]*Sumatra Rainforest Institute, Komplek Perumahan Mobil Oil, Jl. Dr. Mansyur III/16-A, Kel. P.B. Selayang-I, Kec. Medan Selayang, Medan 20131. Indonesia. h45ri_hab@yahoo.com*
[2]*KPB-SOS, Jalan Tanjung api-api km 9 Komplek P & K Blok E 1, Palembang 30152, Indonesia. kpbsos26@yahoo.com*
[3]*Universitas Pembangunan Panca Budi, Jl. Gatot Subroto Km. 4,5, Medan (20122). Indonesia. Hani_amrul@yahoo.co.id*

Since 2010, intensive surveys on Black-winged Stilt *Himantopus himantopus* or *H. h. himantopus* have been done in Sumatra and Java. Although the species has been suspected to breed in northern Sumatra, there are no positive records to support this hypothesis. In this paper, we present the first breeding records of Black-winged Stilt made during fieldwork on May-June 2010 in Sei Tuan wetland habitat, Pantai Labu sub-district, Deli Serdang district, Sumatera Utara Province. This breeding record is not only the first for Sumatra, but also for Indonesia.

INTRODUCTION

The Black-winged Stilt complex, *Himantopus himantopus ssp*. is often treated as a single species with three distinct subspecies, or as 3-5 monotypic species (Pierce 1996). Within the Asia-Pacific region two forms occur: *H. himantopus himantopus* or ‘Black-winged Stilt’ and *H. himantopus leucocephalus* or ‘White-headed Stilt’. Here we report on the first confirmed breeding record from Indonesia of Black-winged Stilt *H. himantopus himantopus*, as distinct from White-necked Stilt *H. himantopus leucocephalus*. We believe treating the two forms separately will result in a better understanding of their status and distribution, and ultimately their conservation (Delany & Scott 2006, Bamford *et al.* 2008).

Black-winged Stilt has generally been considered a scarce northern winter migrant to western Indonesia (e.g. Marle & Voous 1988). Extensive surveys conducted since 2010 have recorded birds at a number of locations in Sumatra and Borneo and at a single location in Java (Iqbal *et al.* 2010, Iqbal & Giyanto 2011, Jamaksari & Iqbal 2011). White-necked Stilt on the other hand is considered a local resident and austral migrant, with records across Indonesia (more common in the east and south). Breeding has been recorded as far west as West Java (Hellebrekers & Hoogerwerf 1967). Adult birds of both forms can be easily separated on plumage differences, primarily the colour of feathering on the hind-neck (Hayman *et al.* 1986).

Although breeding by Black-winged Stilt has been suspected in northern Sumatra (Iqbal & Giyanto 2011) until now it has not been positively confirmed. In this paper, we summarise our breeding observations of Black-winged Stilt in northern Sumatra: the first such record from Indonesia.

METHODS

Fieldwork was conducted in wetlands surrounding Sei Tuan Village, Pantai Labu Sub-district, Deli Serdang District, North Sumatra Province (3°42' N and 98°49' E; see Figure 1) between May and June 2010. The Sei Tuan wetland area covers around 3,000 ha and at the time of the survey was dominated by open marshland created by clearing mangrove in preparation for establishing oil palm plantations (Figure 2), and wetter areas dominated by swampy grassland and open pools. Birds were observed using both binoculars and telescope. Standard site description and waterbird count forms (Asian Waterbird Census form) were used to record observations. Nests were carefully inspected to determine condition and to record the number of eggs or chicks.

RESULTS

A total of 14 stilt nests were located around Sei Tuan village between May and June 2010. Of these 12 were nests of Black-Winged Stilt while two were of White-necked Stilt (Table 1). Unfortunately, we could not find any fledglings during this survey. Furthermore, two other birdwatchers visiting this site later also could not locate fledged birds (Giyanto & Chairunas Adhy Putra *in litt*).

In parallel to locating nests, surveys also recorded the general number of birds of each species present at the study site, indicating that overall Black-winged Stilt outnumbered

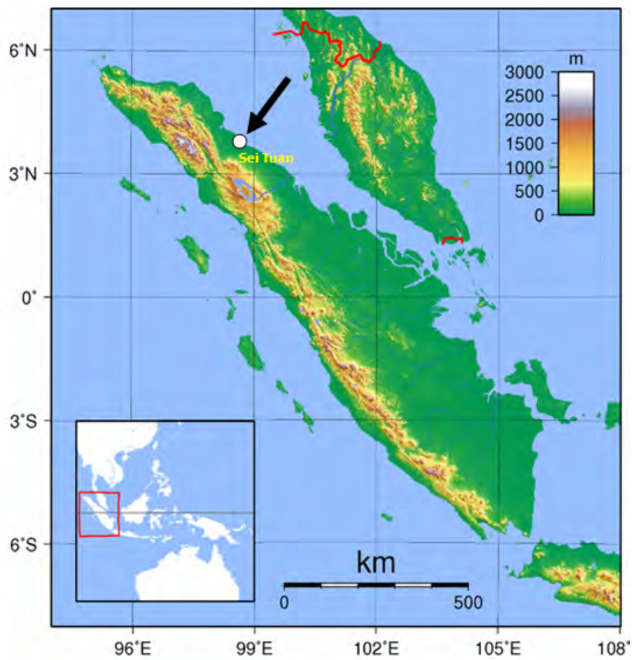

Figure 1. Map of Sumatra showing the location where nests of Black-winged Stilt were found.

Figure 2. Typical habitat created by the clearing of mangrove forest for conversion to palm oil plantation. Pantai Labu, North Sumatra, May-June 2010.

White-headed Stilt by around 6:1 (Table 2).

DISCUSSION

Our records of nest and egg of Black-winged Stilt in Sei Tuan wetland habitat north Sumatra province are the first breeding records for this species in Indonesia. The nearest known breeding location outside of North Sumatra is Thalai Noi-Songkhla Wetland Reserve in South-east Thailand (Wells 1999), approximately 450 km to the North.

Nests of stilt found during the survey conformed with descriptions from elsewhere: “nests widely space on ground, often among grasses and sedges; sometimes nest is floating mass of water weeds with well lined” (Pierce 1996). At Sei Tuan nests of three types were found, including those built like a small hill of 15-20 cm height from small dried twigs (Figure 3); those built from grasses and sedges to around 10-20 cm height, and; those laid on the ground with very simple nest material (Figure 4).

The two nests of White-headed Stilt found during the field survey are also of interest. Most breeding records of White-headed Stilt in the floodplain of Ogan Komering Lebak in Southern Sumatra were also made during the northern summer period (May to October; Iqbal 2008, Iqbal *et al.* 2009). This period corresponds with the main breeding of Black-winged Stilt in Thai-Malay Peninsula (Wells 1999). These Sumatran records suggest that both Black-winged Stilt and White-headed Stilt breed at the same time in the region. To date there have been no records of interbreeding between Black-winged Stilt and White-headed Stilt at the sites studied. As stated by Iqbal & Giyanto (2011) “if both species nest in the same places with limited or no hybridisation, then

Table 1. Summary of nests of Black-winged Stilt and White-headed Stilt found around Sei Tuan village, North Sumatra, May-June 2010.

Nest	Number of eggs	Form	
		Black-winged Stilt	White-headed Stilt
Nest 1	2	2	-
Nest 2	4	4	-
Nest 3	4	4	-
Nest 4	4	4	-
Nest 5	3	3	-
Nest 6	3	3	-
Nest 7	4	4	-
Nest 8	5	5	-
Nest 9	3	3	-
Nest 10	4	4	-
Nest 11	4	4	-
Nest 12	4	-	4
Nest 13	5	5	-
Nest 14	5	-	5
Total nests	**14**	**12**	**2**

Table 2. Observed numbers of Black-winged and White-headed Stilt in Sei Tuan wetland area, North Sumatra, May-June 2010.

Survey date	Black-winged Stilt	White-headed Stilt	Total
15th May 2010	19	3	22
16th May 2010	30	0	6
23rd May 2010	12	4	16
29th May 2010	8	3	11
6th June 2010	4	0	4
15th June 2010	42	11	53
18 June 2010	6	0	30
Total	**121**	**21**	**142**
Average number	**17**	**3**	**20**

Figure 3. A Black-winged Stilt nest within a habitat of cleared mangrove forest.

Figure 4. A simple nest of Black-winged Stilt containing three eggs.

they should be considered separate species". The observations reported here tend to support this hypothesis.

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PACIFIC GOLDEN PLOVER DISTRIBUTION IN WESTERN AUSTRALIA.

MARCUS SINGOR

149A Bishopsgate Street, Carlisle 6101, W.A., AUSTRALIA
E-mail: msingor@iprimus.com.au

In this paper, important austral summer (non-breeding) sites of Pacific Golden Plover, *Pluvialis fulva* along the Western Australian coast are identified, and the northward and southward migration patterns are examined. The core range for the species was found to occur between Broome and Port Hedland, and on the adjacent off shore islands. A decline in Pacific Golden Plover numbers at several sites was documented.

INTRODUCTION

Pacific Golden Plover are not considered a common shorebird in Western Australia based on the summer and winter wader population monitoring counts conducted annually by the Australasian Wader Studies Group (Kearney *et al.* 2008). Even in north-western Australia their numbers are low in comparison to other shorebird species as reflected in the results of the annual shorebird surveys (Rogers *et al*. 2009). There are a number of factors that make it difficult to obtain an accurate population estimate. Firstly, Pacific Golden Plover access a diverse range of habitat and some of their habitat choices fall outside the traditionally-counted shorebird sites such as beaches and mudflats. There are records in the Kimberley of Pacific Golden Plover foraging on inland plains in the company of Oriental Plovers (Rogers *et al*. 2011). Pacific Golden Plover like short, cropped grass and quite often share this habitat with Little Curlew on return migration (G. Swann *pers. comm.*). The full extent to which Pacific Golden Plover use the inland plains in north-western Australia is largely unknown. The number of Pacific Golden Plover that frequent off shore islands is hard to estimate as they are difficult to access and records are intermittent.

The Australasian Wader Studies Group launched the Monitoring Yellow Sea Migrants in Australia (MYSMA) project in 2004 (Rogers *et al*. 2009). They conducted intensive shorebird counts twice each austral summer and once each austral winter. North-west Australia, which is considered a strong-hold for Pacific Golden Plover in Western Australia, contains three important sites that have been regularly monitored as part of the MYSMA project: Roebuck Bay, Bush Point and a 60 km stretch of Eighty Mile beach. Data collected during these surveys is summarised here, alongside data obtained from other sources, to provide an update on the distribution and abundance of Pacific Golden Plover in Western Australia.

METHODS

The study concentrated on sites that had a comprehensive data base available covering five years or more (Figure 1). These locations were Broome, Carnarvon, Perth and Eyre. Records were obtained from a wide range of sources. These included the weekly reports from the Eyre Bird Observatory, the Shorebirds 2020 and Australasian Wader Studies Group databases, and records from regional bird observers. Observations published in bird magazines and newsletters were collected. The Western Australian Museum provided historical records and references related to these sightings. The summer (February) and winter (July) wader population monitoring counts conducted annually by the Australasian Wader Studies Group were used to examine Pacific Golden Plover trends in count totals at designated shorebird sites in Western Australia.

In addition to examining abundances, timing of northward and southward migration is also summarised. When Pacific Golden Plover return to Australia in August / September they still display varying amounts of black breeding plumage on the chest. This indicator was used to determine their date of arrival and to track their movement down the Western Australian coast.

RESULTS

The distribution of Pacific Golden Plover in Western Australia is discussed by covering the main coastal regions and southern inlets in a separate account for each site. In each site account, reference is made to the data sources that were accessed and findings made from appraising those records are presented. Comments on site-specific habitats used by birds and relevant historical data are also provided.

Kimberley (17.10° S, 123.36° E)

Pacific Golden Plover are considered scarce in the Kimberley and most records came from the Western Australian Museum. Museum historical accounts from Derby state "These birds are rare here and only about 6 or 8 are seen. At Point Torment (Derby) they were rare in December but became more plentiful in February and remained so till about 26 March and by 21 April 1911 they had all left. They feed out on grassy flats as well as on the beach" (J.P. Rogers 1911: Western Australian Museum *unpubl. data*).

In the Kimberley, Pacific Golden Plover are found to inhabit beaches, tidal flats and near coastal grassy flats (Storr 1980). They are usually seen in ones or two's though they are more numerous on passage (October and February-March) in flocks of up to 25 (Storr 1980). Sightings of up to ten birds come from Kununurra (10 on grassed fields), Kalumburu (1), Mitchell Plateau (7), and Sir Graham Moore Island (1). They have also been seen at Derby and Fitzroy Crossing (on grassed fields), Walcott Inlet and Curran Point at the mouth of the Drysdale River. At Derby, Pacific Golden Plover are seen at the edge of wet mudflat with tussocks of vegetation. They have been sighted on an annual

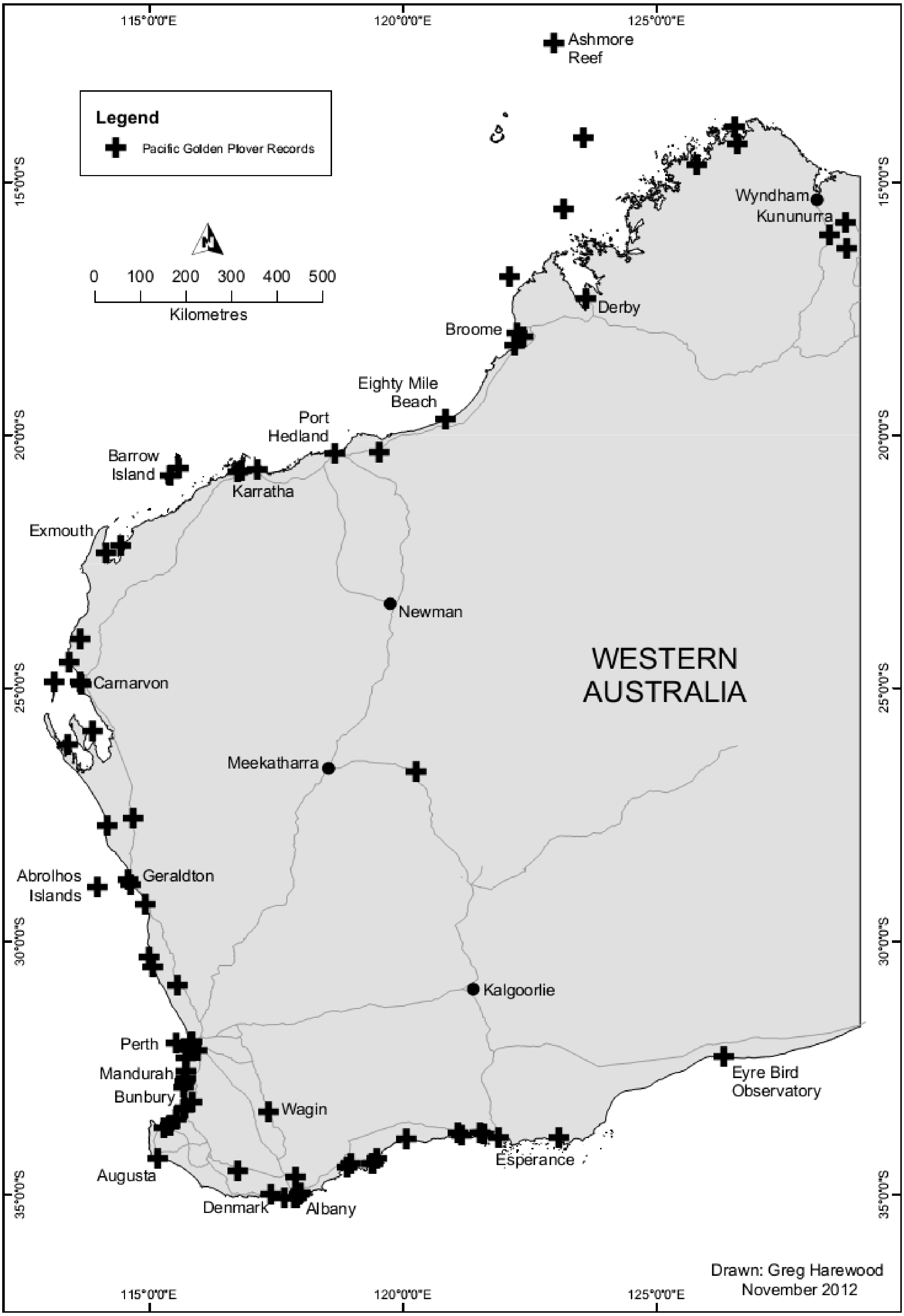

Figure 1. Map showing the distribution of Pacific Golden Plover records in Western Australia.

basis though fewer than five birds were observed at any one time (L. Leidwinger *pers. comm.*). Recent data from the region is lacking.

Broome and surrounds (17.58° S, 122.13° E)

Most Broome and surrounds records were sourced from the Australasian Wader Studies Group and Shorebirds 2020 databases. These records stem from the northern beaches of Roebuck Bay, east of Broome, Bush Point, which is a large shorebird roost at the southern end of Roebuck Bay and Eighty Mile Beach, which lies approximately 250 km south of Broome. Pacific Golden Plover showed a preference for Eighty Mile Beach as confirmed by the summer (Figure 2) and winter (Figure 3) survey results. The highest Western Australian mainland summer counts come from Eighty Mile Beach, although these rarely exceed 150 birds.

Summer counts on the northern beaches of Roebuck Bay have not exceeded 40, but have tended to be higher at Bush Point (Figure 2). Winter counts are typically low and made only at Bush Point and Eighty Mile Beach (Figure 3). The earliest sightings of returning Pacific Golden Plover were made in late August although most birds arrived in September and October. Summer surveys showed that Pacific Golden Plover were present in low numbers (10-40) within the bay (Figure 2). They were commonly found at the Broome sewage works and this is a reliable site to make observations, with up to 30 birds being present from September to April (Figure 4). They have also been sighted on the Roebuck Plains wetlands in small (1-4) numbers in September, October and November. There are a number of sites in the broader Broome region from which Pacific Golden Plover sightings have been reported, such as Taylor's Lagoon, Lake Eda, Cable Beach and LaGrange Bay (Rogers *et al*. 2009). Two hundred and seventy birds have been recorded on the Lacepedes Islands, which are approximately 100km north-west of Broome (AWSG *unpubl. data*). This sighting was made on 23 February 2003 and may be a pre-departure gathering.

In the region Pacific Golden Plover use a diverse range of habitats. They have been recorded at grassed ovals, sandy mud flats, fresh water wetlands, reefs and at the Broome sewage works. Historical surveys conducted between 1981-1985 identified Eighty Mile Beach as a significant site for Pacific Golden Plover with a maximum count of 440 being recorded (Lane 1987).

Pilbara (20.22° S, 118.38° E)

The Pilbara region stretches from the southern end of Eighty Mile Beach (just north of Port Hedland) to Onslow (east of Exmouth and south-west of Barrow Island). A small number of records were available from the Dampier and Port Hedland salt works in the Pilbara region, mainly from the November and December periods. Records were sourced from the Shorebird 2020 database and the Western Australian Museum. The Pacific Golden Plover is a scarce visitor in most months, usually occurring as single birds or occasionally in small parties (Storr 1984). Records from Dampier Peninsula come from Barred Creek (5), James Price Point (2) and Quondong Point (14). They are seen at Karratha on the mudflats each year, though fewer than five birds were observed at any one time (L. Leidwinger *pers. comm.*). They have also been seen at the Dampier and Port Hedland saltworks in small numbers of less than ten individuals. A migratory wader study conducted in connection with the Yannarie salt project surveyed the eastern side of Exmouth Gulf. These surveys were held in January, March and August 2004 (Biota 2005) and produced maximum numbers of seven birds. Pacific Golden Plover have been sighted at the sewage ponds at Goldsworthy and Wickham and at the Port Hedland race track.

Varanus Island (20.39° S, 115.34° E)

Varanus Island is to the north-east of Barrow Island and is part of the Lowendal Islands. Tony Kirkby conducted surveys on Varanus Island from August 1996 to December 1996. These surveys were carried out on a daily basis and covered the whole island. The beach area, located on the west side of the island, was frequented by Pacific Golden Plover, had a few mangroves and at low tide, an exposed reef. Pacific Golden Plover first arrived on 7 September and throughout the following summer, a small group of up to four birds was a regular sight (T. Kirby *pers. comm.*). None were recorded at any of the other beaches on the island.

The movement of Pacific Golden Plover through Varanus Island was monitored by recording the amount of visible breeding plumage (Table 1; source: T. Kirby). The variations in breeding plumage were used to differentiate between individual birds during September and October. These differences indicated that the birds were passing through in those months (T. Kirkby *pers. comm.*).

Barrow Island (20.47° S, 115.24° E)

On Barrow Island, Pacific Golden Plover is a regular migrant that visits the shoreline, shallows and inshore waters. Historical accounts reported the species from two localities – two birds were seen to the west of Stokes Point and parties of three and four birds were at Mattress Point (Sedgwick 1978). The Western Australian Museum reports sightings from September 1973 and 1974. Monthly surveys were conducted on Barrow Island from September 2003 to September 2004, and additionally during October 2005 and February / March 2006 (Bamford et al. 2011). Seasonal averages for Pacific Golden Plover on southward migration (Sept-Nov) were 28 for 2003 and 16 for 2005. On northward migration (March-May) the seasonal averages were 10 for 2003/04 and 24 for 2006. The maximum number of Pacific Golden Plover seen was 53. Pacific Golden Plover showed limited or no evidence of overwintering on Barrow Island during their breeding period (June-August) (Bamford et al. 2011).

Carnarvon (24.52° S, 113.40° E)

Sightings made along the Carnarvon coastline are rare and the majority come from grassed areas. Preferred sites appeared to be grassed fields of the Carnarvon Festival grounds and the East Carnarvon Primary School on weekends. There is an historical record from Bernier Island dated 1 September 1910.

Regular monthly counts in and around Carnarvon have been conducted since 2005 (L. George *pers. comm.*). The

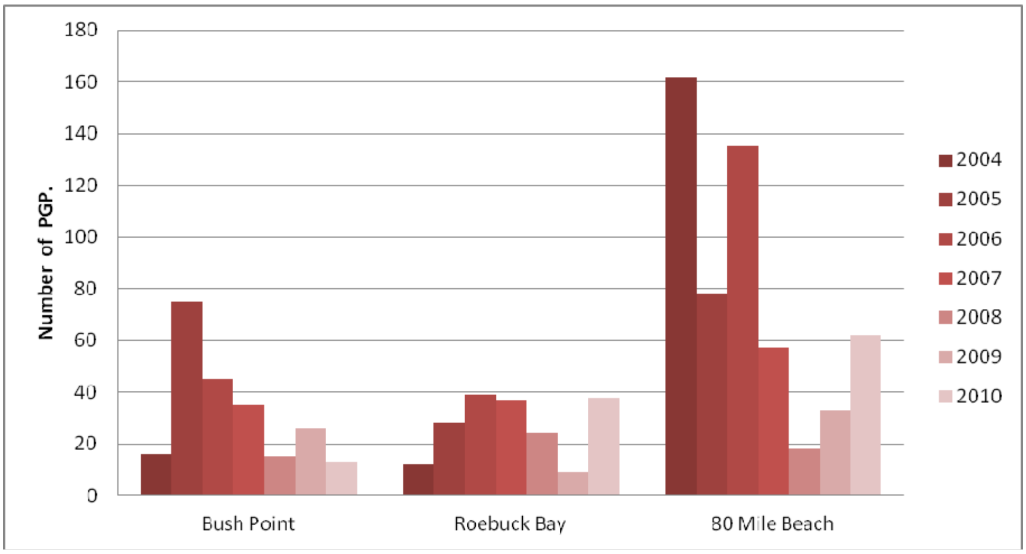

Figure 2. Highest summer (November, December) counts from three sites south of Broome (2004 to 2010).

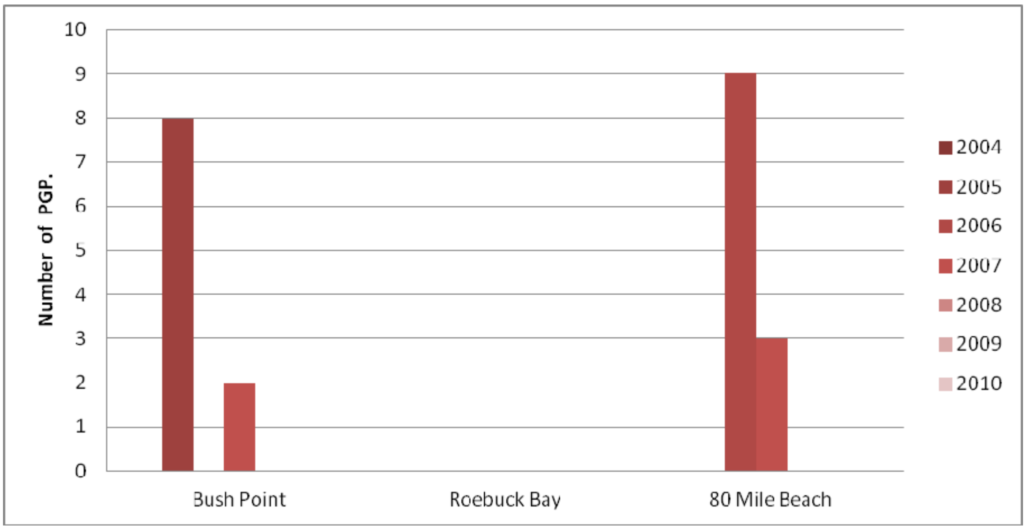

Figure 3. Highest winter (June, July) counts from three sites south of Broome (2004 to 2010).

count area covered extends to Miaboolya Beach 10 km to the north of Carnarvon and to Bush Bay 50 km to the south. The first birds were found to arrive in the Carnarvon region in early August, some still showing remnants of their breeding plumage. Although sightings increase over the ensuing months, numbers remain low with groups averaging about five birds. The maximum number of Pacific Golden Plover seen was 24 on 27 February 2012. Throughout summer their numbers remain stable and all Pacific Golden Plover have left the Carnarvon area by the second week of April. They are absent over the winter months May, June and July (Figure 5). Some sightings come from Lake McLeod to the north of Carnarvon for the months September, October and November. A maximum of seven Pacific Golden Plover have been recorded at Lake McLeod (Jaensch & Vervest 1990).

Geraldton (28.46^{o} S, 114.36^{o} E)

There were limited records for this region and most came from the Western Australian Museum. An historical record of five Pacific Golden Plover comes from Point Moore, Geraldton on 16 May 1936. In more recent times, Pacific Golden Plover have been sighted at Greenough River (1), Lake Thetis (4), Guraga Lake (10) and Boullanger Island (9) (Storr 1991). One observation made at Eurardy Station, Kalbarri (5) was probably birds in transit. A few sightings of solitary Pacific Golden Plover come from Pelsaert Island, Abrolhos Islands, where it is a rare visitor (October - February) (Storr *et al*. 1986).

Perth (32.02^{o} S, 115.49^{o} E)

In the Perth region, Pacific Golden Plover can be found on the exposed mudflats at Alfred Cove on the Swan River. They roost in the fringing samphire wetlands at high tide. There is a single record from the grassed oval at Troy Park

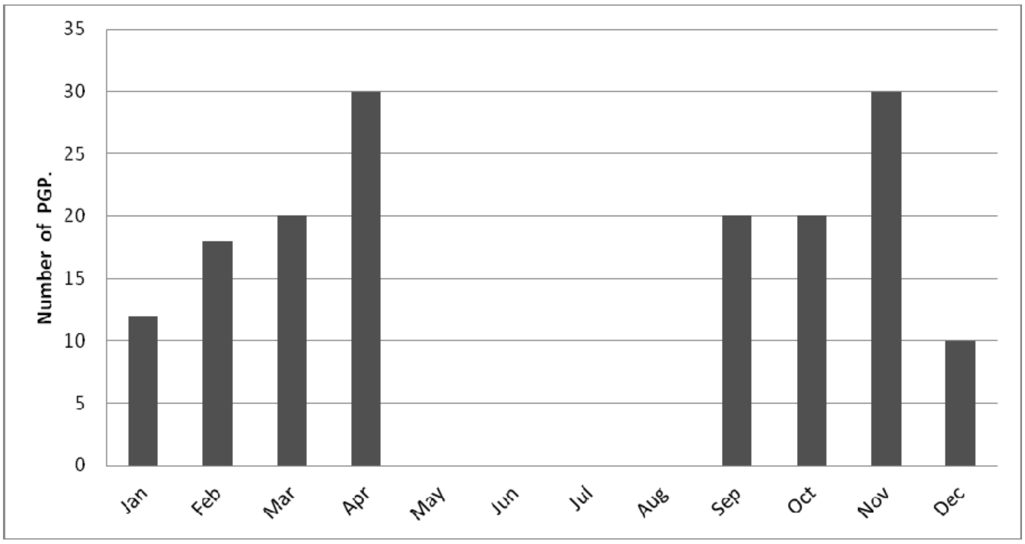

Figure 4. Highest monthly counts made at the Broome sewage works from 1996 to 2010.

Table 1. Records of individual Pacific Golden Plover on transit through Varanus Island, based on plumage variations (source: T. Kirby).

Date	Number of birds	Breeding plumage
9 September 1996	2	Breeding plumage 25%
19 September 1996	4	Breeding plumage 25%
25 September 1996	4	One in full breeding plumage Three in 50% breeding plumage
28 September 1996	2	One in non-breeding plumage One in 75% breeding plumage
12 October 1996	2	One in non-breeding plumage One with traces of breeding plumage
20 October 1996	4	All in non-breeding plumage, very rich plumage possible juveniles
29 October 1996	4	As above
13 November 1996	1	One in non-breeding plumage
24 November 1996	2	Two in non-breeding plumage

next to Alfred Cove. Records come from a number of other locations around Perth such as Rottnest Island, Milyu Nature Reserve, Forrestdale Lake, Lake Kogolup, Point Walter spit and the beach at Woodman Point. More recent records from Rottnest Island have them listed as a vagrant with intermittent sightings of solitary birds (Saunders & de Rebeira 1993).

Monthly waterbird surveys were conducted at Alfred Cove between mid 1981 and mid 1985 (Jaensch *et al*. 1988), and again from 2007 to 2012. The most recent sightings were of solitary birds, but up to four birds have been recorded, usually amongst flocks of Grey Plover.

Historical records mention sightings of Pacific Golden Plover at Pelican Point (Swan River), Heirisson Island (Swan River) and Lake Richmond (Rockingham). Observations made by D.L Seventy confirm that Pacific Golden Plover were more common in the past (Serventy 1938). He commented on the Swan River and mentioned that small parties of up to 7-8 birds were present early in the summer and increased to as many as 20 by the beginning of March, but all had gone by 7 April 1936 (Serventy 1938). Even back then, Serventy lamented that havens for shore birds on the Swan River were rapidly diminishing due to development. Flocks of up to 60 birds were recorded in Perth region during the 1960's in comparison to a maximum of four birds in the last decade (Tarburton 1974). Wetlands at Mounts Bay on the Swan River were reclaimed in 1967 to accommodate the Mitchell Freeway Interchange. More wetland reclamation work took place in 1964/1965 between Point Walter and Point Waylen along the Attadale foreshore. This reduction in suitable habitat will be a contributing factor in explaining these lower numbers.

In the past, Pacific Golden Plover were more common on Rottnest Island. They were reported singly or in parties of 2-4 round the salt lakes on Rottnest Island and on fresh water swamps. The Pacific Golden Plover was not observed on the island's coast. Records ranged from 19 September to 16 March (Storr 1964).

Mandurah (32.33° S, 115.42° E)

The Mandurah region contains several sites used by Pacific Golden Plover including Peel-Harvey Inlet and Lake McLarty. Lake McLarty is an ephemeral lake surrounded by grasslands and samphire. It is located to the east of the Peel-Harvey Inlet. The northern part of the Peel-Harvey Inlet contains Creery Island and Channel Island, which are

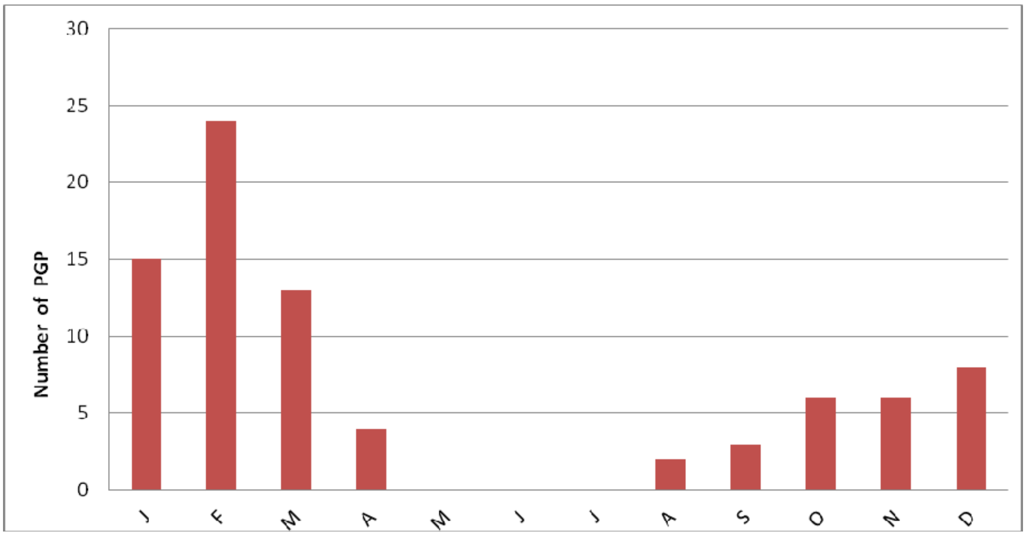

Figure 5. Highest monthly counts made at Carnarvon from 2005 to 2012.

surrounded by mudflats and are frequented by Pacific Golden Plover (Singor 1997).

Peel Inlet had counts of 70-80 Pacific Golden Plover in the 1980's but does not achieve these numbers anymore (Bamford & Bamford 2003). Pacific Golden Plover turn up most years and larger flocks are seen later in the season from December to February. Sightings of medium sized flocks come from the Harvey River estuary such as February 1997 (54), December 1998 (29) and February 1999 (22) (Lane *et al*. 2002).

The Department of Environment and Conservation held waterbird surveys throughout the Peel-Harvey Estuary in October 1996, December 1996, February 1997, October 1998, December 1998 and February 1999 (Lane *et al*. 2002). The Peel Inlet sightings range from October until March (Singor 1997). Birds were generally seen in small flocks 10-40. Variation in high water levels, availability of alternative wetlands and possible breeding success were factors considered to impact on their annual abundance (Bamford & Bamford 2003). The earliest (spring) sighting of Pacific Golden Plover at Lake McLarty was on 29 September 2010 and the latest (autumn) sighting was on 22 April 2001. There were no records from May to August at Lake McLarty and the Pacific Golden Plover was not present each year. At Lake McLarty solitary birds were usually seen though up to 10 have been recorded.

Augusta (34.16° S, 115.10° E)

The highest counts of Pacific Golden Plover for south-western Australia have been recorded on the mudflats at Hardy Inlet. Hardy Inlet is located next to the town of Augusta on the most southern tip of Western Australia. In the late eighties a sighting of up to 200 Pacific Golden Plover (12 March 1987) was reported from this site (Watkins 1993). Some high counts persisted up to 1992. The present status of Pacific Golden Plover at the Hardy Inlet is unknown as there have been no records after 1992. A few sightings come from the Vasse-Wonnerup wetlands, which are located to the north of Busselton and the Leschenault Inlet near Bunbury. In January 2012 a flock of Pacific Golden Plover (20) was seen at Point Douro, Leschenault Inlet. Some historical solitary sightings come from Benger Swamp (1969 and 1975) (Storr 1991).

Albany (35.03° S, 117.52° E)

The exposed tidal mudflats around Albany are the most reliable sites for seeing Pacific Golden Plover on the south-west coast. Oyster Harbour and Princess Royal Harbour support a small population of Pacific Golden Plover over summer (J. Morrison *pers. comm.*, AWSG *unpubl. data*). Rushy Point in Princess Royal Harbour is a preferred locality and they are occasionally seen at the Kalgan mudflats and Emu Point in Oyster Harbour. They roost in fringing samphire wetlands at high tide. The Western Australian Museum has records of Pacific Golden Plover from Albany and Torbay as far back as 1906 and 1907. Carter mentioned that Pacific Golden Plover were commonly seen in Albany Harbour in 1923. Shorebird counts reported here are from the Australasian Wader Studies Group and were supplemented by sightings from local observers and summer shorebird reports from June Morrison dating back to 1999.

Pacific Golden Plover numbers at Albany's two inner harbours were in excess of 50 birds in the 1980's (Smith 2002). Thirty birds are more usual in recent years with the highest count in the past decade being 38. Small flocks (<30) are present from September until March. In some years flocks of Pacific Golden Plover will turn up unexpectedly at other south coastal sites such as the inlets found between Albany and Esperance. Sporadic sightings have been made at a range of localities along the southern coast such as Beaufort Inlet (14), Bremer Bay Beach (1), Wellstead Estuary (2), Gorden Inlet (6), Stoke's Inlet (1) and (21), Culham Inlet (1) and Yokinup Bay (3). Small flocks have shown up at Wilson Inlet (Denmark) in the years 1987 (9), 2000 (8), 2003 (28), 2005 (14) and 2010 (5).

Eyre Bird Observatory (32.14° S, 126.19° E)

The Eyre Bird Observatory is located adjacent to Kanidal Beach, which is a stretch of beach 14 km in length. Pacific Golden Plover are encountered on the beaches and reefs (de

Rebeira & de Rebeira no date) and have been seen feeding on floating seaweed (Eyre Waves 2011). Kanidal Beach has been surveyed on a weekly basis since 1978 by the bird observatory wardens. Sightings of Pacific Golden Plover made at Kanidal Beach occur between September to March (Figure 6). Most observations are of 1-2 birds, although up to nine birds have been recorded (Eyre Bird Observatory 1996, 2003). Most sightings are made in October and November and lower numbers are seen in the latter part of the season, January to March.

Inland sites

Records from inland wetlands were extracted from published literature. There were a few inland sightings and these came from Lake Argyle (3), Lake Gore (1), Lake Magnesia (3), Mainbenup Swamp (2), Lake Violet (1), Wagin (3) and Yellinup Swamp (1). Lake Magnesia and Mainbenup Swamp are located near Lake Gore, Esperance. Lake Violet is located near Wiluna (600 km inland) (Curry 1979). One Pacific Golden Plover was seen at a wetland north of the Stirling Ranges in January 2012. Another sighting was made at Tordit Gurrup Lagoon (45), which is situated east of Lake Muir.

DISCUSSION

Important sites for Pacific Golden Plover in Western Australia.

The bulk of the Western Australian Pacific Golden Plover population spends summer along the Kimberley / Pilbara coastline and on the adjacent off shore continental islands. High numbers of Pacific Golden Plover have also been reported on some offshore islands like Adele Island, Barrow Island and the Lacepede Islands. Pacific Golden Plover use offshore islands both on migration and as a non-breeding destination (Bamford *et al.* 2011). The only mainland site that has numbers in excess of one hundred Pacific Golden Plover is Eighty Mile Beach, and this site consistently produces the highest summer counts in Western Australia.

The distribution of Pacific Golden Plover from the Pilbara southward consists of small groups in various scattered locations. There are few sightings between Shark Bay and Perth and no sites were identified along this stretch of coastline where Pacific Golden Plover stayed during the non-breeding season. The most important sites for Pacific Golden Plover in south-western Australia are the two major estuaries Peel-Harvey Inlet near Mandurah, and Oyster Harbour and Princess Royal Harbour at Albany. There is no recent data to support the continued importance of Hardy Inlet, Augusta, which was historically an important site.

Southward migration (September to November).

The first Pacific Golden Plover arrive at Broome and Carnarvon in August. The major influx occurs in September and October and probably continues on through to late November with the juveniles the last to arrive. Southward migration in Western Australia appears to progress quickly as by September, the first Pacific Golden Plover have reached Albany and the Eyre Bird Observatory, the state's most southern shorelines. The earliest sighting at the Eyre Bird Observatory was 22 September 1988 and transcontinental crossings might explain the early appearance of Pacific Golden Plover at this location. Records from the Atlas of Australian Birds (Blakers *et al.* 1984) confirm that Pacific Golden Plover migrate across the continent. Pacific Golden Plover show a strong fidelity to their non-breeding sites as indicated by two Pacific Golden Plover that were banded in Albany in March 2007 and have since returned to the same patch of samphire each year up to 2011 (J. Morrison *pers. comm.*). Banding at Albany showed that adults arrive first and juveniles follow a few weeks later (V. Smith *pers. comm.*).

Northward migration (March to April)

Most waders congregate on rich feeding grounds to build up reserves before undertaking the migratory flight north to their breeding grounds. No specific staging sites have been identified in north-western Australia that serve this purpose for the Pacific Golden Plover. The absence of any known staging site on mainland Western Australia suggests that Pacific Golden Plover fly straight to staging sites in Asia or

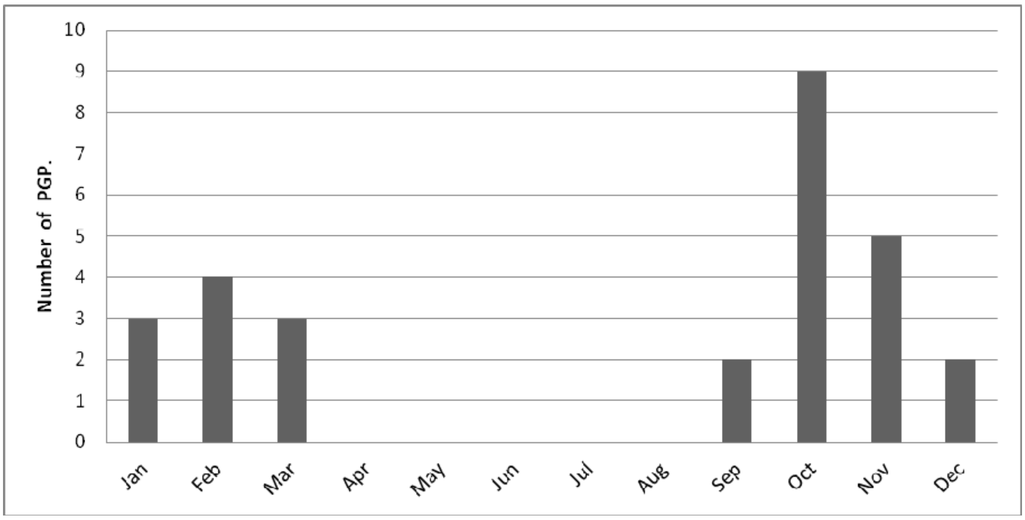

Figure 6. Highest monthly counts made at Eyre Bird Observatory from 1988 to 2011.

even straight to their breeding grounds. Their representation in 23 out of 29 northward migration shorebird counts conducted along the coast of the Yellow Sea is either low or absent (Barter *et al.* 2003, Riegan *et al*. 2006, Tang *et al.* 2011).

Pacific Golden Plover have departed from most sites in Western Australia by the first week in April and this pattern is consistent across most of the State. In the lower south-west of Western Australia, Pacific Golden Plover appear to leave earlier. Records from Albany show that Pacific Golden Plover have left by late February to mid March and the last sightings at Eyre Bird Observatory are from late March. Pacific Golden Plover occur more frequently on ovals and playing fields on their northward migration in March and April, for example, at Port Hedland and Broome.

Breeding season (May to July)

Records show that very few Pacific Golden Plover over-winter in Western Australia. Winter records are scarce and most observations come from the Pilbara and Kimberley regions, and these numbers tend to be less than 10 Pacific Golden Plover (Figure 2). There is a winter record from Barrow Island (Bamford *et al.* 2011) but no winter data from any other offshore island. There is a near absence of Pacific Golden Plover winter sightings for the lower half of Western Australia. One exception is three winter records from Albany (1994, 2006 and 2010) where Pacific Golden Plover were observed in transit, but they are otherwise not known to over-winter here. If Pacific Golden Plover over-winter on mainland Western Australia in large numbers then these locations have yet to be discovered. There are a few winter sightings from the Kimberley region and these come from Sir Graham Moore Island and Kalumburu.

There are several sections of the Western Australian coastline for which we have little information on Pacific Golden Plover. These are the Kimberley coast, Exmouth Gulf, Shark Bay and the immediate offshore islands. Furthermore, little is known about use of inland wetlands, and closer scrutiny of the flock composition of shorebirds frequenting inland plains may clarify to what extent Pacific Golden Plover use these habitats. Few Pacific Golden Plover migrate past Shark Bay to the southern part of Western Australia and I estimate the number to range between 50-100 birds annually based on present data. A decline in the number of Pacific Golden Plover is evident at some locations when historical records are compared with present observations. Sites where decreases are evident are Albany, Peel Inlet, Perth and Eighty Mile Beach. In compiling and updating information on the current status of the Pacific Golden Plover in Western Australia, a base line for future comparisons is provided.

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A COMMON SANDPIPER *ACTITIS HYPOLEUCOS* RECORD FROM STEWART ISLAND, SOUTHERN NEW ZEALAND

ANDREW C. CROSSLAND

No.3 The Lagoon, Seafield Lagoon, Brooklands, Christchurch 8083, South Island, New Zealand.
E-mail Andrew.Crossland@ccc.govt.nz

The Common Sandpiper *Actitis hypoleucos* breeds across Europe, central and northern Asia east to Japan. During the non-breeding season it is found throughout Europe, sub-Saharan Africa, south and south-eastern Asia, The Philippines, New Guinea and Australia (Marchant *et al.* 1986, Chandler 2009). Within the East Asian-Australasian Flyway (EAAF), the Common Sandpiper is considered the most widely distributed shorebird species (Li *et al.* 2009), but the southern limits of its regular migration are the southern coastlines of Australia (Lane 1987, Higgins & Davis 1996). In New Zealand the species is classified as a rare visitor (Heather & Robertson 1996). Since the first verified record in 1964 there have averaged less than eight records per decade, with the vast majority in the North Island (Turbott 1990, Higgins & Davis 1996, Heather & Roberston 1996). The seven South Island records were at Whanganui Inlet (1981-83), Lake Ki-Wainono (1980), Waipara Rivermouth (1992 and 1993), Ashley River (1993), Washdyke Lagoon (2010) and Tomahawk Lagoon (2010) (Bell 1981, Turbott 1990, Higgins & Davis 1996, Miskelly *et al*. 2011).

Stewart Island (1,746 km^3) is the third largest and southern-most of New Zealand's main islands (Figure 1). It is largely undeveloped and almost entirely covered with indigenous forest. The island has several estuarine areas, most contained within Patterson Inlet - a large tidal embayment on the north-east coast which almost cuts Stewart Island in half. Wader populations on the island include two Variable Oystercatcher *Haematopus unicolor*, the critically endangered Southern New Zealand Plover *Charadrius obscurus obscurus*, South Island Pied Oystercatcher *Haematopus finschi*, Pied Stilt *Himantopus himatopus leucocephalus*, Masked Lapwing *Vanellus miles*, Double-banded Plover *Charadrius bicinctus* and migratory Eastern Bar-tailed Godwit *Limosa lapponica baueri*. Access to wader sites is difficult as they are located in wilderness areas, far from roads. Consequently the island's wader populations are seldom monitored.

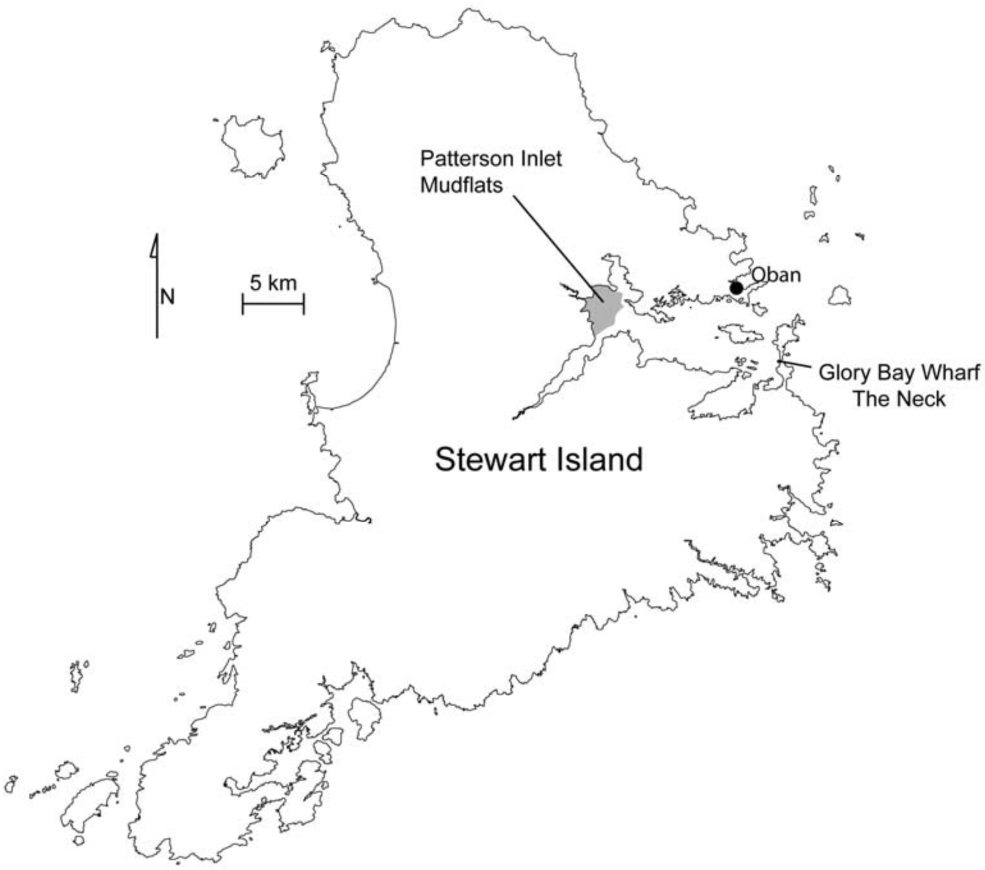

Figure 1. Location map of Stewart Island, New Zealand, showing location of Glory Cove Jetty, The Neck.

At approximately 22:00 hours (near dusk, but still daylight at this southern latitude) on 30 November 2005, I was on a small motorboat near “The Neck”, a narrow peninsula separating Patterson Inlet from the open ocean. I was with a “Fieldguides” bird watching group on an evening excursion to observe Stewart Island Brown Kiwi *Apteryx australis lawryi*. While approaching the Glory Cove jetty (46^{o}58’ S, 168^{o}10’ E) I noticed a small wader roosting on a shoreline boulder about 10 m away. The combination of brownish colouration above, white underparts and white shoulder “hook” (i.e. the patch of white feathering between the wing / carpal joint and the dark smudging on the breast) meant the bird was easily identifiable as an *Actitis* sandpiper. As the boat tied up, the bird became agitated and paced along the rocky shoreline, bobbing its head and tail energetically. I alerted others to the bird just as it flushed, flying past the stern and southwards along the adjacent shoreline before turning and flying westwards across the open waters of Glory Cove. It was not seen again. The bird had been feeding alone on an extensive stretch of rocky shoreline. This location was 14.5 km from mudflat habitats at the western end of Patterson Inlet where most of the island’s migratory wader flocks feed and about 2 km from a beach on The Neck that flocks sometimes use as a high tide roost.

In flight, greyish-brown wings with a prominent wide, white wing bar extending through the secondaries and into the inner primaries was clearly seen. This identified the bird as a Common Sandpiper and excluded Spotted Sandpiper *Actitis macularius*, a North American species not yet recorded from New Zealand but considered a potential future vagrant. It should be noted that many American migratory wader species have reached New Zealand as vagrants, including Stilt Sandpiper *Calidris himantopus*, Baird’s Sandpiper *Calidris bairdii*, White-rumped Sandpiper *Calidris fuscicollis*, Least Sandpiper *Calidris minutilla*, Semipalmated Sandpiper *Calidris pusilla*, Western Sandpiper *Calidris mauri*, American Whimbrel *Numenius phaeopus hudsonicus*, Hudsonian Godwit *Limosa haemastica*, Upland Sandpiper *Bartramia longicauda*, Wandering Tattler *Tringa incana*, Lesser Yellowlegs *Tringa flavipes*, Wilson’s Phalarope *Phalaropus tricolor*, American Golden Plover *Pluvialis dominicus*, and Semipalmated Plover *Charadrius semipalmatus* (Gill *et al.* 2010). Within this context, the potential occurrence of Spotted Sandpiper is possible and all sightings of *Actitis* sandpipers in New Zealand require careful scrutiny.

This observation was submitted to the Records Appraisal Committee of the Ornithological Society of New Zealand (OSNZ) and subsequently accepted as the first record of Common Sandpiper for Stewart Island. At latitude 46^{o} 58’, this sighting of Common Sandpiper is probably the southern-most occurrence of this species on the EAAF. Other extreme southern records (all in the Indian Ocean) have included Amsterdam Island (37^{o} 52’S), Crozet Islands (46^{o} 28’S), Prince Edward Islands (46^{o} 58’S) and Kerguelen Island (49^{o} 40’S) (Marchant *et al.* 1986, Shirihai, 2002).

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REPORT ON AUSTRALIAN SHOREBIRD POPULATION COUNTS WINTER 2009 AND SUMMER 2009-10

SJOUKE SCHOLTEN[1], LIAM COSTELLO[1], DAVID A. MILTON[2] & GOLO MAURER[1]*

[1]*BirdLife Australia, Suite 2-05, 60 Leicester St, Carlton, Victoria, 3053, Australia*
[2]*Queensland Wader Study Group, 336 Prout Rd., Burbank, Queensland, 4156, Australia.*
** Author for correspondence: Golo.Maurer@birdlife.org.au*

Shorebird count data have been collected throughout Australia for some thirty years. Here we present data collected by more than 1,300 registered volunteers in BirdLife Australia's Shorebirds 2020 monitoring programme for the 2009 / 2010 period. The winter 2009 count recorded 30,785 birds of 37 species in 89 Shorebird Areas and the summer count of 2009 / 2010 recorded 587,487 birds of 46 species in 120 shorebird areas. Species counts by state and by geographical areas within states are reported. This report has been compiled with a different methodology from that used for previous reports in that data reported are those collected closest to 30 June 2009 (winter count) and 15 January (summer count) for each shorebird area. Complete data are held in the Shorebirds 2020 database and are available for detailed analysis. While coverage of the counts is extensive, gaps still remain in the northern part of the country and ephemeral wetlands in Australia.

INTRODUCTION

Regular nationwide shorebird monitoring has been conducted in Australia under the Australasian Wader Studies Group population monitoring program since 1981 (Anon 1981), although some locations have data reaching back as far as the seventies. For the five years following 1981, Australian wetlands were surveyed relatively comprehensively with the aim of determining important shorebird sites across the country (Oldland *et al*. 2009). After this period, Commonwealth funding for the program decreased and the number of sites surveyed decreased progressively. By 2007, the number of areas surveyed had dropped below 30. This drop in survey coverage, and the recent indications of dramatic declines in some shorebird populations, led BirdLife Australia (then Birds Australia) and its special interest group the Australasian Wader Studies Group to initiate the Shorebirds 2020 monitoring program.

At its inception, BirdLife Australia's Shorebirds 2020 aimed to reinvigorate shorebird population monitoring in Australia (Oldland *et al.* 2009). The explicit aim was to generate quality monitoring data with temporal and spatial coverage sufficient to allow reliable assessment of population trends in migratory shorebirds Australia-wide and in important shorebird habitats. Statistical power analysis indicates that the program needs to include 150 Shorebird Areas in regular surveys to allow a more reliable assessment of population trends (Oldland *et al*. 2009). The project takes its name from the ambitious goal to achieve this coverage by the year 2020.

Here we summarise the data of the 2009 winter counts and the 2009 / 2010 summer counts. In this summary the methodology for reporting shorebird counts has changed from those used in previous reports in *Stilt*. Details are presented in Methods (below) and the implications of these changes are considered in the Discussion. In brief, we do not use the maximum count for each species in each Count Area in a season to calculate the Shorebird Area totals, as done in the last report (Olivera & Clemens 2009). Instead, we report data collected closest to 30 June 2009 (winter count) and 15 January (summer count) for each shorebird area. This is intended to ensure that such counts are conducted as close as possible to a unified summer and winter count date, which is part of the Shorebirds 2020 approach. It should also reduce the frequency of erroneous records resulting from double counting. Finally, it allows for easier (future) replication of the analysis with both past and future data.

METHODS

Data collection

Counting was conducted in spatially defined ecological units (Shorebird Areas) divided up into practical units (Count Areas) across Australia (Clemens *et al.* 2010). Shorebird Areas were visited at least once (and sometimes multiple times) in a 72 day period centred on 30 June for the winter count and in a 150 day period centred on 15 January for the summer count, and shorebirds were counted in one or more of the Count Areas. Counts were undertaken at high tide roosts by teams of one to 34 observers amounting to an estimated total of 1,300 volunteers. Local count coordinators ensured that all Count Areas within each Shorebird Area were visited simultaneously if possible, and were responsible for correcting double-counts caused by birds moving between different Count Areas in the same Shorebird Area. Most data were submitted to Shorebirds 2020 through its online database (www.birdlife.org.au/shorebird-2020/counter-resources), but Shorebirds 2020 paper forms and traditionally used paper forms were also accepted.

Data preparation

Data vetting occurred in two stages: first by a regional or state coordinator, and then by the Shorebirds 2020 team at BirdLife Australia's National Office. The exception to this was the data for Queensland, which were vetted by the Queensland Wader Study Group.

To produce this report, we queried the online Shorebirds 2020 database for data collected in each Count Area in each season. Where more than one count was conducted in any given season, the count undertaken closest to the central date for that season was extracted. These query results were then used to calculate the total number of individuals per species for each Shorebird Area.

The summary data for Queensland were prepared independently by DM, and were taken from the sums of the July (winter) and January (summer) counts at high tide roosts within specific Shorebird Areas. These data do not represent the total counts from that Shorebird Area, but only from those Count Areas that have been surveyed since QWSG began supplying data to the Australasian Wader Studies Group in the early 1990s.

We also determined the number of Shorebird Areas and Count Areas visited in each state and the number of Count Areas visited in each Shorebird Area for each season.

RESULTS

During the winter 2009 count, 30% of Shorebird Areas were visited, and during the 2009 / 2010 summer count, approximately 50% were visited. The numbers of Shorebird Areas visited in each state during the winter period (excluding Qld), and summer counts are shown in Tables 1 and 2.

The winter 2009 count recorded 30,785 birds of 37 species in 89 Shorebird Areas and the summer count of 2009 / 2010 recorded 587,487 birds of 46 species in 120 shorebird areas. National and State totals for the winter 2009 counts are given in Table 1 and corresponding results for the summer 2009 / 2010 counts are given in Table 2. Table 3 and Table 4 present counts for all Shorebird Areas visited in winter 2009 and summer 2009 / 2010 respectively. The counts are presented by state and Shorebird Areas are listed in alphabetical order.

DISCUSSION

The data from counts made in the 2009-2010 winter and summer season indicate that an increase in the number of Shorebird Areas monitored has occurred in Australia as compared to previous years (Olivera & Clemens 2009). Statistical power analysis suggests that this level of coverage of Shorebird Areas, if sustained, will enable more reliable detection of large-scale population trends (Clemens *et al.* 2009).

This report presents a summary of shorebird numbers in Australia during the Austral winter 2009 and the Austral summer 2009-2010. It differs from reports in previous years establishing a new methodology for summarising data. In this report we did not attempt to compile the absolute maximum for each species recorded in each Count Area or Shorebird Area during a winter or summer period. Instead, for each Count Area we use data collected closest to a central date. We consider this approach more appropriate as it reduces the potential for counting birds twice in different Shorebird Areas, and thus should give a more reliable population estimate. Furthermore data compilation is more standardised and repeatable. Two potential drawbacks of this method are (1) repeat counts, made necessary by bad weather and other unforeseen circumstances during the original scheduled count of an area, may be omitted from summaries with this method; and (2) care must be taken when comparing these data with count summaries from previous years.

The Shorebirds 2020 monitoring does not aim to provide a full inventory of shorebirds in Australia. Rather, it compiles a sample of shorebird numbers to allow the analysis of overall shorebird population trends. Whether this sample can be considered representative of the species' Australian population will have to be determined on a case-by-case basis.

For some of the most numerous migratory species, such as Great Knot, Bar-tailed Godwit and Red-necked Stint, around half the estimated Australian population for the species were counted in both present and previous surveys (Geering *et al.* 2007). For these species, the Shorebirds 2020 count data will provide a reasonably reliable basis for the assessment of overall population trends than for species where only a small proportion of the total population is counted annually.

For resident shorebird species, reliability of population trend assessments based upon Shorebirds 202 count data is also variable. While only about 15% of the estimated total population of Red-capped Plovers was counted during this survey period, about 70% of the Australian Pied Oystercatcher population was recorded during the summer 2009-2010 monitoring (Geering *et al.* 2007). This is likely a reflection of the different detectability and specific habitat requirements of different shorebird species, for example, the inland salt lakes used by Red-capped Plovers are less comprehensively surveyed than the coastal habitat of oystercatchers.

In this report we also present data on coverage of Shorebird Areas by state, which was rarely available in previous reports. These data will help to give an estimate of the representativeness of the data compiled for preliminary analyses. Nonetheless, a detailed analysis of trends will still require using the original data.

The data on Shorebirds Areas visited compared with all Shorebird Areas identified, regardless of whether or not they were counted, can also be used to guide future activities for the Shorebirds 2020 program. For instance, the data show, perhaps unsurprisingly, that states with significant shorebird habitat in northern and remote regions have rather incomplete coverage. Coverage in these areas suffers from a lack of observers locally, dangerous field work conditions and the distance from major urban centres (affecting counter availability). Many of these areas, for example, the Gulf of Carpentaria, contain important shorebird habitat and are likely to hold considerable numbers of birds. In order to improve trend estimates, additional surveys in these areas are highly desirable, although prohibitively expensive at present.

Count coverage in the Shorebirds 2020 program currently provides the best available data for deriving population trend estimates of migratory shorebirds. However, gaps still exist in these data hindering absolute quantification of population changes. This problem is not peculiar to the East Asian-Australasian Flyway and is similar to that found in other flyways (Colwell 2010). Previous and current research indicates that it can only be addressed through increased spatial coverage of the survey effort. This is one of the key objectives of the Shorebirds 2020 program.

Table 1. Summary of winter shorebird counts Australia-wide computed from a 150-day period centred on 30 June 2009.

Species Totals	**NSW**	**NT**	**QLD**	**SA**	**TAS**	**VIC**	**WA**	**Australia**
Shorebird Areas Counted/ Total	**18/43**	**1/18**	**6/ -**	**10/47**	**9/21**	**19/35**	**10/39**	**67/203**
Count Areas Counted/ Total	**63/205**	**9/19**	**-**	**44/208**	**30/89**	**103/264**	**54/290**	**303/1075**
Comb-crested Jacana, *Irrediparra gallinacea*	7	12						19
Latham's Snipe, *Gallinago hardwickii*					1			1
Swinhoe's Snipe, *Gallinago megala*								
Black-tailed Godwit, *Limosa limosa*	19		22					41
Bar-tailed Godwit, *Limosa lapponica*	806		1672	6	52	2982	112	5630
Little Curlew, *Numenius minutus*								
Whimbrel, *Numenius phaeopus*	21	20	126				31	198
Eastern Curlew, *Numenius madagascariensis*	53	3	298		2	73	48	477
Common Redshank, *Tringa totanus*								
Marsh Sandpiper, *Tringa stagnatilis*								
Common Greenshank, *Tringa nebularia*	1		5	36			36	78
Wood Sandpiper, *Tringa glareola*								
Terek Sandpiper, *Xenus cinereus*		7					1	8
Common Sandpiper, *Actitis hypoleucus*		4					5	9
Grey-tailed Tattler, *Tringa brevipes*	8	92	227				228	555
Wandering Tattler, *Tringa incana*	1							1
Ruddy Turnstone, *Arenaria interpres*	6		8		26	2	3	45
Asian Dowitcher, *Limnodromus semipalmatus*								
Great Knot, *Calidris tenuirostris*		13	84	4		15	42	158
Red Knot, *Calidris canutus*			1			150	20	171
Sanderling, *Calidris alba*	1		1				14	16
Red-necked Stint, *Calidris ruficollis*	470	10	470	957	396	1463	883	4649
Long-toed Stint, *Calidris subminuta*	1						4	5
Pectoral Sandpiper, *Calidris melanotos*								
Sharp-tailed Sandpiper, *Calidris acuminuta*			1					1
Curlew Sandpiper, *Calidris ferruginea*	45		34			22	9	110
Broad-billed Sandpiper, *Limicola falcinellus*								
Ruff, *Philomachus pugnax*	1							
Bush Stone-curlew, *Burhinus grallarius*	1							1
Beach Stone-curlew, *Esacus magnirostris*	4	1	1					6
Pied Oystercatcher, *Haematopus longirostris*	155	7	202	380	1060	1024	82	2910
Sooty Oystercatcher, *Haematopus fuliginosus*	15			110	330	480	7	942
Black-winged Stilt, *Himantopus himantopus*	638	2	1543	20		514	503	3220
Red-necked Avocet, *Recurvirostra avosetta*	5		124	37		58	37	261
Banded Stilt, *Cladorhynchus leucocephalus*	14			237		23	1	275
Pacific Golden Plover, *Pluvialis fulva*	4		9			1		14
Grey Plover, *Pluvialis squatarola*							27	27
Red-capped Plover, *Charadrius ruficapillus*	210	63	202	293	418	928	1362	3476
Double-banded Plover, *Charadrius bicinctus*	399		128	93	1608	2138	20	4386
Lesser Sand Plover, *Charadrius mongolus*			10	2				12
Greater Sand Plover, Charadrius leschenaultii		162	1	1			261	425
Oriental Plover, *Charadrius veredus*								
Inland Dotterel, *Charadrius australis*								
Black-fronted Dotterel, *Elseyornis melanops*	108	2	58	17	17	46	28	276
Hooded Plover, *Thinornis rubricollis*	16			18	138	142	39	353
Red-kneed Dotterel, *Erythrogonys cinctus*	2		7			58		67
Banded Lapwing, *Vanellus triciolor*					39	1	31	71
Masked Lapwing, *Vanellus miles*	190	38	95	141	440	867	3	1774
Small wader No ID			5				90	95
Medium wader No ID		1						1
Large wader No ID						20		20
Sum Total	**3201**	**437**	**5334**	**2352**	**4527**	**11007**	**3927**	**30785**
Number of species	**28**	**15**	**25**	**16**	**13**	**20**	**27**	**37**

Table 2. Summary of 2009/2010 summer shorebird counts Australia-wide computed from 150-day period centred on 15 January 2009.

Species Totals	**NSW**	**NT**	**QLD**	**SA**	**TAS**	**VIC**	**WA**	**Australia**
Shorebird Areas Counted/ Total	**19/43**	**2/18**	**6/ -**	**32/47**	**13/21**	**25/35**	**23/39**	**114/203**
Count Areas Counted/ Total	**63/205**	**10/19**	**-**	**108/208**	**47/89**	**107/264**	**203/290**	**539/1075**
Comb-crested Jacana	7							7
Latham's Snipe	67				2	127		196
Swinhoe's Snipe							2	2
Black-tailed Godwit	136	112	514	52	19		696	1017
Bar-tailed Godwit	3351	48	11097	716	365	12093	75280	92115
Little Curlew		3					3102	3105
Whimbrel	426	32	840	19	10	20	2184	2721
Eastern Curlew	779	20	1039	31	197	638	1129	2819
Common Redshank				33				33
Marsh Sandpiper		9	34	71		63	312	455
Common Greenshank	8	4	98	1076	156	260	3539	5043
Wood Sandpiper		1		15		1	436	453
Terek Sandpiper	27	52	95	1			4607	4687
Common Sandpiper	1	101		31			139	272
Grey-tailed Tattler	113	54	789	28	2	1	10032	10271
Wandering Tattler			1					1
Ruddy Turnstone	84	118	188	1593	1265	11	3222	6293
Asian Dowitcher							5	5
Great Knot	227	1269	3221	327	13	10	153788	155673
Red Knot	16	292	51	2240	783	774	26348	30454
Sanderling	33	173		1417	79	440	5107	7249
Red-necked Stint	1078	120	5419	25040	10811	23918	42425	103397
Long-toed Stint				91			42	133
Pectoral Sandpiper							1	1
Sharp-tailed Sandpiper	257	48	486	12992	495	7469	3365	24626
Curlew Sandpiper	219	4	936	1321	408	2307	3598	7857
Broad-billed Sandpiper			5				41	41
Ruff					2		3	5
Bush Stone-curlew								
Beach Stone-curlew	4	1	3					5
Pied Oystercatcher	302	17	363	1304	2724	926	1716	7003
Sooty Oystercatcher	53		3	685	563	279	116	1696
Black-winged Stilt	95	16	364	598		1334	5183	7269
Red-necked Avocet			34	89		499	709	1297
Banded Stilt				2308			501	2809
Pacific Golden Plover	826	124	276	128	307	249	169	1803
Grey Plover	3	37	37	1386	75	292	1769	3562
Red-capped Plover	249	35	227	4158	470	1186	10526	16643
Double-banded Plover	9			6	23	146		184
Lesser Sand Plover	2	64	687	10	3	10	217	314
Greater Sand Plover	11	2087	85	36		2	29620	31756
Oriental Plover				25			23586	23611
Inland Dotterel								
Black-fronted Dotterel	7			55	8	16	168	276
Hooded Plover				72	85	75	117	349
Red-kneed Dotterel				34		5	13	52
Banded Lapwing				26	68	102	57	253
Masked Lapwing	150	32	59	845	511	1254	57	2865
unidentified small wader					2	35	100	137
unidentified large wader						1	150	151
unidentified medium wader						6	70	76
Sum	**8540**	**4873**	**26951**	**59479**	**19444**	**54549**	**414247**	**587487**
Count	**29**	**27**	**27**	**36**	**26**	**30**	**43**	**46**

Table 3. Shorebird counts closest to the 30th of June 2009 (winter counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

NSW ***Species***	**Barren Box S**	**Botany Bay**	**Brisbane W.**	**Brou L.**	**Brunswick E.**	**Clarence R.**	**Hastings R.**	**Hunter E.**	**L. Illawarra**	**Longreef**	**Manning E.**	**Moruya E.**	**Narooma E.**	**Parkes Sew.**	**Parramatta R.**	**Richmond E.**	**Shoalhaven E.**	**Tuggerah L.**
Areas counted	1/1	9/17	1/2	1/1	4/5	4/6	1/1	2/37	3/7	1/1	2/2	1/4	1/1	1/1	12/31	5/7	13/18	1/5
Min/Max diff. 31/7/09	33	3/3	16	30	0/1	24	21	22	4/35	3	6	23	30	9	3/25	0	3/34	15
Comb-crested Jacana					7													
Latham's Snipe																		
Swinhoe's Snipe																		
Black-tailed Godwit															1		18	
Bar-tailed Godwit	4	67			3	84	52		102		25	1	91		54	19	285	19
Little Curlew																		
Whimbrel		15				2										3	1	
Eastern Curlew		17				10			1		1	5					19	
Common Redshank																		
Marsh Sandpiper																		
Common Greenshank									1									
Wood Sandpiper																		
Terek Sandpiper																		
Common Sandpiper																		
Grey-tailed Tattler		3														4	1	
Wandering Tattler																1		
Ruddy Turnstone		5														1		
Asian Dowitcher																		
Great Knot																		
Red Knot																		
Sanderling											1							
Red-necked Stint	378	9								21	4			38				20
Long-toed Stint	1																	
Pectoral Sandpiper																		
Sharp-tailed Sandpiper																		
Curlew Sandpiper	45																	
Broad-billed Sandpiper																		
Ruff	1																	
Bush Stone-curlew													1					
Beach Stone-curlew											2					2		
Pied Oystercatcher		62		16	10	4			10		6	6	4			22	9	6
Sooty Oystercatcher		3							2	4			1					5
Black-winged Stilt	25	4			14	6		131	17					36	269		3	133
Red-necked Avocet						2									3			
Banded Stilt	14																	
Pacific Golden Plover											4							
Grey Plover																		
Red-capped Plover				50	2				27		8			67		2	39	15
Double-banded Plover		34		10					52	10	22	3		63		38	151	16
Lesser Sand Plover																		
Greater Sand Plover																		
Oriental Plover																		
Inland Dotterel																		
Black-fronted Dotterel	15							14	3					1	13			62
Hooded Plover														16				
Red-kneed Dotterel	2																	
Banded Lapwing																		
Masked Lapwing	33	3			6	5	40	13	2					5	8	0	3	72
Small wader No ID																		
Medium wader No ID																		
Large wader No ID																		
Sum Total	**518**	**222**	**0**	**76**	**42**	**113**	**92**	**158**	**217**	**35**	**73**	**15**	**97**	**226**	**348**	**92**	**529**	**348**
Number of species	**10**	**11**	**0**	**3**	**6**	**7**	**2**	**3**	**10**	**3**	**9**	**4**	**4**	**7**	**6**	**10**	**10**	**9**

Table 3 continued: Shorebird counts closest to the 30th of June 2009 (winter counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

NT/ QLD ***Species***	**N. Darwin, NT**	**Bowen**	**Cairns**	**Mackay**	**Moreton Bay**	**Townsville**	**Tweed R**
Areas counted	9/14	N/A	N/A	N/A	N/A	N/A	N/A
Min/Max diff. 31/7/09	23	N/A	N/A	N/A	N/A	N/A	N/A
Comb-crested Jacana	12						
Latham's Snipe							
Swinhoe's Snipe							
Black-tailed Godwit			2		20		
Bar-tailed Godwit			31		1410	231	
Little Curlew							
Whimbrel	20	1	24		96	5	
Eastern Curlew	3		18		273	7	
Common Redshank							
Marsh Sandpiper							
Common Greenshank					5		
Wood Sandpiper							
Terek Sandpiper	7						
Common Sandpiper	4						
Grey-tailed Tattler	92		38		189		
Wandering Tattler							
Ruddy Turnstone					8		
Asian Dowitcher							
Great Knot	13		29		45	10	
Red Knot			1				
Sanderling					1		
Red-necked Stint	10		14		451	5	
Long-toed Stint							
Pectoral Sandpiper							
Sharp-tailed Sandpiper					1		
Curlew Sandpiper					34		
Broad-billed Sandpiper							
Ruff							
Bush Stone-curlew							
Beach Stone-curlew	1		1				
Pied Oystercatcher	7	2	2		196	2	
Sooty Oystercatcher							
Black-winged Stilt	2	19			1514	10	
Red-necked Avocet					124		
Banded Stilt							
Pacific Golden Plover					9		
Grey Plover							
Red-capped Plover	63	10	5		183	4	
Double-banded Plover					128		
Lesser Sand Plover					2	8	
Greater Sand Plover	162				1		
Oriental Plover							
Inland Dotterel							
Black-fronted Dotterel	2		22		36		
Hooded Plover							
Red-kneed Dotterel					7		
Banded Lapwing							
Masked Lapwing	38	9	7		79		
Small wader No ID					5		
Medium wader No ID	1						
Large wader No ID							
Sum Total	**437**	**41**	**194**	**0**	**4817**	**282**	**0**
Number of species	**15**	**5**	**13**	**0**	**23**	**9**	**0**

Table 3 continued: Shorebird counts closest to the 30th of June 2009 (winter counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

SA ***Species***	**Black Pt. (Yorke)**	**Carpenter Rocks**	**Coffin Bay**	**Coorong**	**Eyre I**	**Goldsmith B - Wattle Pt (Yorke)**	**Gulf St of Vincent**	**Kangaroo I**	**Murat Bay**	**Port MacDonnell**
Areas counted	1/2	7/10	1/5	3/30	1/5	1/1	9/26	13/19	1/1	7/8
Min/Max diff. 31/7/09	11	8	11	8/24	16	8	9/11	8/33	17	28
Comb-crested Jacana										
Latham's Snipe										
Swinhoe's Snipe										
Black-tailed Godwit										
Bar-tailed Godwit								6		
Little Curlew										
Whimbrel										
Eastern Curlew										
Common Redshank										
Marsh Sandpiper										
Common Greenshank					6		30			
Wood Sandpiper										
Terek Sandpiper										
Common Sandpiper										
Grey-tailed Tattler										
Wandering Tattler										
Ruddy Turnstone										
Asian Dowitcher										
Great Knot								4		
Red Knot										
Sanderling										
Red-necked Stint	41			300			465	61		90
Long-toed Stint										
Pectoral Sandpiper										
Sharp-tailed Sandpiper										
Curlew Sandpiper										
Broad-billed Sandpiper										
Ruff										
Bush Stone-curlew										
Beach Stone-curlew										
Pied Oystercatcher	2	12	86				30	240		10
Sooty Oystercatcher	6	17	3		1			80		3
Black-winged Stilt							20			
Red-necked Avocet							37			
Banded Stilt							237			
Pacific Golden Plover										
Grey Plover										
Red-capped Plover	24	2					135	67		65
Double-banded Plover	50	24					2			17
Lesser Sand Plover							2			
Greater Sand Plover								1		
Oriental Plover										
Inland Dotterel										
Black-fronted Dotterel								17		
Hooded Plover		1						17		
Red-kneed Dotterel										
Banded Lapwing										
Masked Lapwing		6	2	2	4		43	74	8	2
Small wader No ID										
Medium wader No ID										
Large wader No ID										
Sum Total	**123**	**62**	**91**	**302**	**11**	**0**	**1001**	**567**	**8**	**187**
Number of species	**5**	**6**	**3**	**2**	**3**	**0**	**10**	**10**	**1**	**6**

Table 3 continued: Shorebird counts closest to the 30th of June 2009 (winter counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

TAS ***Shorebird areas: 21*** ***Count areas: 89*** ***Species***	**Derwent**	**Georges B**	**King I**	**Lades Beach**	**L Dulverton**	**Marion B & Blackmans B**	**Maurouard Beach**	**Robbins Passage/ Boullanger B**	**Scamander**
Areas counted/Total	10/12	4/5	1/25	1/1	1/1	1/1	4/4	7/11	1/1
Min/Max diff. 31/7/09	25	30/31	5	5	10	16	26/30	4	30
Comb-crested Jacana									
Latham's Snipe								1	
Swinhoe's Snipe									
Black-tailed Godwit									
Bar-tailed Godwit	41	11							
Little Curlew									
Whimbrel									
Eastern Curlew	1	1							
Common Redshank									
Marsh Sandpiper									
Common Greenshank									
Wood Sandpiper									
Terek Sandpiper									
Common Sandpiper									
Grey-tailed Tattler									
Wandering Tattler									
Ruddy Turnstone								26	
Asian Dowitcher									
Great Knot									
Red Knot									
Sanderling									
Red-necked Stint	58	35		5			84	214	
Long-toed Stint									
Pectoral Sandpiper									
Sharp-tailed Sandpiper									
Curlew Sandpiper									
Broad-billed Sandpiper									
Ruff									
Bush Stone-curlew									
Beach Stone-curlew									
Pied Oystercatcher	524	172	11	34		120	25	166	8
Sooty Oystercatcher	46	16	3	3		27	4	231	
Black-winged Stilt									
Red-necked Avocet									
Banded Stilt									
Pacific Golden Plover									
Grey Plover									
Red-capped Plover	114	26	4	24		38	41	157	14
Double-banded Plover	169	6	2	50		32	16	1332	1
Lesser Sand Plover									
Greater Sand Plover									
Oriental Plover									
Inland Dotterel									
Black-fronted Dotterel	13				4				
Hooded Plover		6		3		14	39	76	
Red-kneed Dotterel									
Banded Lapwing					39				
Masked Lapwing	84	192	20	59	54		3	28	
Small wader No ID									
Medium wader No ID									
Large wader No ID									
Sum Total	**1050**	**465**	**40**	**178**	**97**	**231**	**212**	**2231**	**23**
Number of species	**9**	**9**	**5**	**7**	**3**	**5**	**7**	**9**	**3**

Table 3 continued: Shorebird counts closest to the 30th of June 2009 (winter counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

VIC ***Species***	**Begola**	**Belmont Common**	**Black Rocks / Breamlea**	**Corner Inlet**	**Discovery B - Glenelg R**	**Douglas, Wimmera**	**Hamilton**	**L Connewarre**	**L Lorne, Bel.**	**Laverton**	**Mallacoota**	**Mildura**	**Moolap**	**Pt Richards**	**Port Fairy**	**St Leonards**	**Swan B & Mud I**	**Werribee**	**Western Port**
Areas counted/Total	1/1	1/1	2/2	25/40	1/6	3/5	2/2	4/6	1/1	1/8	2/4	3/3	5/6	2/3	12/21	1/1	8/8	4/26	25/25
Min/Max diff. 31/7/09	10	10	8	9/23	28	3	8/9	10	10	1	21	9/30	8	8	16/17	8	8/9	36	20
Comb-crested Jacana																			
Latham's Snipe																			
Swinhoe's Snipe																			
Black-tailed Godwit																			
Bar-tailed Godwit				2870							30						68		14
Little Curlew																			
Whimbrel																			
Eastern Curlew				33															40
Common Redshank																			
Marsh Sandpiper																			
Common Greenshank																			5
Wood Sandpiper																			
Terek Sandpiper																			5
Common Sandpiper																			
Grey-tailed Tattler																			
Wandering Tattler																			
Ruddy Turnstone																			2
Asian Dowitcher																			
Great Knot				15															
Red Knot				150															
Sanderling																			
Red-necked Stint			75	748	10			20					27		6		102	136	339
Long-toed Stint																			
Pectoral Sandpiper																			
Sharp-tailed Sandpiper																			
Curlew Sandpiper													19					3	
Broad-billed Sandpiper																			
Ruff																			
Bush Stone-curlew																			
Beach Stone-curlew																			
Pied Oystercatcher				723	45			8			8		19		30		15	11	165
Sooty Oystercatcher				465									1		13				1
Black-winged Stilt								80		2		126	69		67		72	98	
Red-necked Avocet													25		3				30
Banded Stilt						11							12						
Pacific Golden Plover																			1
Grey Plover																			
Red-capped Plover			39	67	10	23		67			10	115	144		143		204	45	61
Double-banded Plover			14	880	90			21			2		93		37		370	4	627
Lesser Sand Plover																			
Greater Sand Plover																			
Oriental Plover																			
Inland Dotterel																			
Black-fronted Dotterel								11			2	12	13				2	6	
Hooded Plover			8	7							2				93		32		
Red-kneed Dotterel								1							22			35	
Banded Lapwing								1											
Masked Lapwing	2			6			24	52		2	10	17	103	6	51		88	5	501
Small wader No ID																			
Medium wader No ID																			
Large wader No ID								20											
Sum Total	**2**	**0**	**136**	**5964**	**155**	**34**	**24**	**281**	**0**	**4**	**64**	**270**	**525**	**6**	**465**	**0**	**953**	**343**	
Number of species	**1**	**0**	**4**	**11**	**4**	**2**	**1**	**9**	**0**	**2**	**7**	**4**	**11**	**1**	**10**	**0**	**9**	**9**	

Table 3 continued: Shorebird counts closest to the 30th of June 2009 (winter counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

WA ***Shorebird areas: 39*** ***Count areas: 290*** ***Species***	**Albany**	**Benje Benjenup L**	**Esperance**	**L Gore**	**Peel & Yalgorup L**	**Shark B**	**Swan Coastal Plain L**	**Swan R & Rottnest I**	**Warden L, Esperance**	**Wilson Inlet**
Areas counted/Total	5/17	1/1	5/10	1/3	1/28	16/45	1/8	11/16	9/9	4/12
Min/Max diff. 31/7/09	24	15	14/18	12	9	0/26	11	5/8	13/15	5/23
Comb-crested Jacana										
Latham's Snipe										
Swinhoe's Snipe										
Black-tailed Godwit										
Bar-tailed Godwit	5					107				
Little Curlew										
Whimbrel						31				
Eastern Curlew						48				
Common Redshank										
Marsh Sandpiper										
Common Greenshank	19					17				
Wood Sandpiper										
Terek Sandpiper						1				
Common Sandpiper		4				1				
Grey-tailed Tattler	2					226				
Wandering Tattler										
Ruddy Turnstone								3		
Asian Dowitcher										
Great Knot	24					18				
Red Knot	20									
Sanderling			5			9				
Red-necked Stint	168	42	84		200	64		8	317	
Long-toed Stint								4		
Pectoral Sandpiper										
Sharp-tailed Sandpiper										
Curlew Sandpiper			5			1			3	
Broad-billed Sandpiper										
Ruff										
Bush Stone-curlew										
Beach Stone-curlew										
Pied Oystercatcher	60					16		1		5
Sooty Oystercatcher			7							
Black-winged Stilt		55			150	146	77	29	40	6
Red-necked Avocet		7	3				25	2		
Banded Stilt								1		
Pacific Golden Plover										
Grey Plover	18					9				
Red-capped Plover		191			600	346		89	134	2
Double-banded Plover					1				19	
Lesser Sand Plover										
Greater Sand Plover	8					253				
Oriental Plover										
Inland Dotterel										
Black-fronted Dotterel			5			20		1	2	
Hooded Plover			9	18					12	
Red-kneed Dotterel										
Banded Lapwing						29		2		
Masked Lapwing			2						1	
Small wader No ID						90				
Medium wader No ID										
Large wader No ID										
Sum Total	**324**	**299**	**120**	**18**	**951**	**1432**	**102**	**140**	**528**	**13**
Number of species	**9**	**5**	**8**	**1**	**4**	**18**	**2**	**10**	**8**	**3**

Table 4. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

NSW ***Species***	**Bellambi Point**	**Botany Bay**	**Brou L.**	**Brunswick River E**	**Clarence River**	**Hastings River**	**Hunter Estuary**	**Lake Illawarra**	**Longreef**	**Manning River E**	**Merimbula Lake**	**Narooma**	**Parkes Sewage Farm**	**Port Stephens**
Areas counted	1/1	10/17	1/1	4/32	2/6	1/1	2/37	4/7	1/1	2/2	3/3	1/1	1/1	5/9
Min/Max diff.	2/2	2/30	5/60	23/24	32/32	1/1	6/6	48/69	53/53	0/1	25/25	30/30	22/22	29/29
Comb-crested Jacana				7										
Latham's Snipe				6				60						
Swinhoe's Snipe														
Black-tailed Godwit					136									
Bar-tailed Godwit		379	70	23	331	160		163		275	140	300		876
Little Curlew														
Whimbrel		53			26	18			1	17				271
Eastern Curlew		155	1	7	65	32		8		32	1	1		376
Common Redshank														
Marsh Sandpiper														
Common Greenshank				2	1			4						
Wood Sandpiper														
Terek Sandpiper														2
Common Sandpiper														1
Grey-tailed Tattler		34		13		5			3	3				22
Wandering Tattler														
Ruddy Turnstone		20		1					26					5
Asian Dowitcher														
Great Knot					186			2						
Red Knot								7	1					1
Sanderling				1					1	24				
Red-necked Stint		132		5	14	6		24	170	138				42
Long-toed Stint														
Pectoral Sandpiper														
Sharp-tailed Sandpiper				4			40	150	22					
Curlew Sandpiper				1	4			5	3					
Broad-billed Sandpiper														
Ruff														
Bush Stone-curlew														
Beach Stone-curlew				2										
Pied Oystercatcher		53	5	5	9	2		10		26	5	4		144
Sooty Oystercatcher		9							6	1				19
Black-winged Stilt				9			2	33					8	
Red-necked Avocet														
Banded Stilt														
Pacific Golden Plover		28		22	4				8	181				7
Grey Plover					2			1						
Red-capped Plover			30	1				66		15				20
Double-banded Plover								7	1					1
Lesser Sand Plover									2					
Greater Sand Plover					1				1					
Oriental Plover														
Inland Dotterel														
Black-fronted Dotterel				2			3						2	
Hooded Plover														
Red-kneed Dotterel														
Banded Lapwing														
Masked Lapwing		7		10	7	2	6	4		10	3		5	24
Small wader No ID														
Medium wader No ID														
Large wader No ID														
Sum Total		**870**	**106**	**121**	**786**	**225**	**51**	**544**	**245**	**722**	**149**	**305**	**15**	**1811**
Number of species		10	4	18	13	7	4	15	13	11	4	3	3	15

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

NSW Cont. ***Species***	**Richmond River E**	**Shoalhaven E**	**Tuggerah Lakes**	**Tuross**	**Ulladulla**
Areas counted	7/7	12/18	1/5	2/12	3/7
Min/Max diff.	3/29	26/28		5/61	29/29
Comb-crested Jacana					
Latham's Snipe	1				
Swinhoe's Snipe					
Black-tailed Godwit					
Bar-tailed Godwit	99	412	23	100	
Little Curlew					
Whimbrel	39	1			
Eastern Curlew	38	63			
Common Redshank					
Marsh Sandpiper					
Common Greenshank				1	
Wood Sandpiper					
Terek Sandpiper	25				
Common Sandpiper					
Grey-tailed Tattler	25	6	2		
Wandering Tattler					
Ruddy Turnstone	2	2	28		
Asian Dowitcher					
Great Knot	39				
Red Knot		2		5	
Sanderling	6			1	
Red-necked Stint	50	121	275	100	1
Long-toed Stint					
Pectoral Sandpiper					
Sharp-tailed Sandpiper	28		1	12	
Curlew Sandpiper	176	2	28		
Broad-billed Sandpiper					
Ruff					
Bush Stone-curlew					
Beach Stone-curlew	2				
Pied Oystercatcher	10	6	5	16	2
Sooty Oystercatcher			18		
Black-winged Stilt		2	41		
Red-necked Avocet					
Banded Stilt					
Pacific Golden Plover	405	112	43	16	
Grey Plover					
Red-capped Plover		14	14	80	9
Double-banded Plover					
Lesser Sand Plover					
Greater Sand Plover	8	1			
Oriental Plover					
Inland Dotterel					
Black-fronted Dotterel					
Hooded Plover					
Red-kneed Dotterel					
Banded Lapwing					
Masked Lapwing		28	33		11
Small wader No ID					
Medium wader No ID					
Large wader No ID					
Sum Total	**953**	**772**	**511**	**331**	**23**
Number of species	**16**	**14**	**12**	**9**	**4**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

NT/QLD ***Species***	**Darwin Harbour NT**	**North Darwin NT**	**Bowen**	**Cairns**	**Mackay**	**Moreton Bay**	**Townsville**	**Tweed River**
Areas counted	1/1	10/14	N/A	N/A	N/A	N/A	N/A	N/A
Min/Max diff.	1/1	1/52	N/A	N/A	N/A	N/A	N/A	N/A
Comb-crested Jacana								
Latham's Snipe								
Swinhoe's Snipe								
Black-tailed Godwit		112		17		497		
Bar-tailed Godwit		48		82		10827	188	
Little Curlew		3						
Whimbrel		32		8		735	97	
Eastern Curlew	2	18		15		959	65	
Common Redshank								
Marsh Sandpiper		9				34		
Common Greenshank		4		8		84	6	
Wood Sandpiper		1						
Terek Sandpiper	7	45		23		72		
Common Sandpiper	1	100						
Grey-tailed Tattler	2	52		68		686	35	
Wandering Tattler						1		
Ruddy Turnstone		118				188		
Asian Dowitcher								
Great Knot		1269		281		560	2380	
Red Knot		292				25	26	
Sanderling		173						
Red-necked Stint		120		40		4310	1069	
Long-toed Stint								
Pectoral Sandpiper								
Sharp-tailed Sandpiper		48		34		442	10	
Curlew Sandpiper		4		49		887		
Broad-billed Sandpiper						5		
Ruff								
Bush Stone-curlew								
Beach Stone-curlew		1	1				2	
Pied Oystercatcher		17	5	2		356		
Sooty Oystercatcher						3		
Black-winged Stilt		16				364		
Red-necked Avocet						34		
Banded Stilt								
Pacific Golden Plover		124		2		251	23	
Grey Plover		37				34	3	
Red-capped Plover		35		2		225		
Double-banded Plover								
Lesser Sand Plover		64		12		421	254	
Greater Sand Plover		2087		28		39	18	
Oriental Plover								
Inland Dotterel								
Black-fronted Dotterel								
Hooded Plover								
Red-kneed Dotterel								
Banded Lapwing								
Masked Lapwing	1	31	3	8		48		
Small wader No ID								
Medium wader No ID								
Large wader No ID								
Sum Total	**13**	**4860**	**9**	**679**	**0**	**22087**	**4176**	**0**
Number of species	**5**	**27**	**3**	**17**	**0**	**26**	**14**	**0**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

SA ***Species***	**Baird Bay**	**Beachport CP**	**Black Pt**	**Carpenter Rocks**	**Eyre Island**	**Fox and Pub L**	**Franklin Harbour**	**Goldsmith Beach to Wattle Pt**	**Guichen Bay**	**Gulf of St Vincent**	**Gunyah Beach**	**Kangaroo Island**
Areas counted	3/4	1/1	1/2	7/10	3/5	1/1	2/2	1/1	1/1	21/26	2/3	15/19
Min/Max diff.	16	14	9	6	23/24	19	30	11	15	5/15	4	7/43
Comb-crested Jacana												
Latham's Snipe												
Swinhoe's Snipe												
Black-tailed Godwit					3							2
Bar-tailed Godwit					105		1			450		4
Little Curlew												
Whimbrel					2					4		11
Eastern Curlew				1	3		1			22		3
Common Redshank										6		
Marsh Sandpiper										7		
Common Greenshank	28		15	23	158		2	3		355		99
Wood Sandpiper										15		
Terek Sandpiper										1		
Common Sandpiper				1						28		2
Grey-tailed Tattler												
Wandering Tattler												
Ruddy Turnstone	142		11	206	14			40		123		84
Asian Dowitcher												
Great Knot	75				26					5		
Red Knot	355				18					1406		
Sanderling			1	1	27						856	
Red-necked Stint	904		400	1426	2004		984	60		5716	1	686
Long-toed Stint										2		
Pectoral Sandpiper												
Sharp-tailed Sandpiper	205				329		255	20		2808		172
Curlew Sandpiper	301		2		138		48			247		7
Broad-billed Sandpiper												
Ruff												
Bush Stone-curlew												
Beach Stone-curlew												
Pied Oystercatcher	78	2		19	198		11	3		112	48	235
Sooty Oystercatcher	33	3	4	13	110			4	2	61	28	187
Black-winged Stilt										395		2
Red-necked Avocet										27		
Banded Stilt	1				1					2228		
Pacific Golden Plover				23	1					3		
Grey Plover	294				168		101			185		74
Red-capped Plover	60		20	20	303		246	12	14	1624	48	170
Double-banded Plover												
Lesser Sand Plover	3				5							
Greater Sand Plover	15		1		4					10		
Oriental Plover												
Inland Dotterel												
Black-fronted Dotterel										53		2
Hooded Plover		2		3				2			22	20
Red-kneed Dotterel						4				11		4
Banded Lapwing	2									5		9
Masked Lapwing			4	12	2	5	2			137		365
Small wader No ID												
Medium wader No ID												
Large wader No ID												
Sum Total	**2496**	**7**	**458**	**1748**	**3619**	**9**	**1651**	**144**	**16**	**16046**	**1003**	**2138**
Number of species	**15**	**3**	**9**	**12**	**21**	**2**	**10**	**8**	**2**	**29**	**6**	**20**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

SA Cont. *Species*	**Lake Eliza**	**Lake George**	**Lake Hawdon**	**Lake Newland**	**Lake Robe**	**Lake St Clair**	**Legoes Swamp**	**Munderoo Bay to Tickera Bay**	**Nadzab Lagoon**	**Port MacDonnell**	**Port Victoria**	**Rivoli Bay**	**Sceale Bay**	**Sleaford Bay**	**St Peter Island**	**Stansbury / Oyster Pt**	**Streaky Bay**
Areas counted	5/7	1/4	2/3	4/7	1/1	5/5	1/1	1/3	1/1	8/8	3/3	1/1	3/4	2/3	3/5	1/1	3/15
Min/Max diff.	19	26	13	8/9	19	20	13	40	18	5	22	14	17	13	21	9	1/1
Comb-crested Jacana																	
Latham's Snipe																	
Swinhoe's Snipe																	
Black-tailed Godwit																	
Bar-tailed Godwit				4							43				57		49
Little Curlew																	
Whimbrel													1				
Eastern Curlew															1		
Common Redshank																	27
Marsh Sandpiper			34	30													
Common Greenshank		8	2	2				7		3	21		14		116	34	69
Wood Sandpiper																	
Terek Sandpiper																	
Common Sandpiper																	
Grey-tailed Tattler													1		26	1	
Wandering Tattler																	
Ruddy Turnstone		1								270	153	76	74		144		245
Asian Dowitcher																	
Great Knot											127						82
Red Knot											85				95		200
Sanderling										320			202				
Red-necked Stint	590	5088		566		13		120		1270	557	1	1037		1685	263	952
Long-toed Stint														89			
Pectoral Sandpiper																	
Sharp-tailed Sandpiper	22	244	7860	113						325	75		79		31	8	155
Curlew Sandpiper		180	15							41	1		139		1		23
Broad-billed Sandpiper																	
Ruff																	
Bush Stone-curlew																	
Beach Stone-curlew																	
Pied Oystercatcher										10	15	1	32		249	1	132
Sooty Oystercatcher									20	1			2	32	99	6	70
Black-winged Stilt			195	3											1		
Red-necked Avocet	12			50													
Banded Stilt				52									18		8		
Pacific Golden Plover	77									1	17						2
Grey Plover								21			15				97		364
Red-capped Plover	134	622	36	94		32		25	25	56	23	5	87	25	154	15	241
Double-banded Plover		6															
Lesser Sand Plover																	1
Greater Sand Plover																	6
Oriental Plover																	25
Inland Dotterel																	
Black-fronted Dotterel																	
Hooded Plover				11						3	2	2	3			2	
Red-kneed Dotterel														15			
Banded Lapwing											10						
Masked Lapwing	15	10	29	14		61		2		95	4	7	2		7	9	24
Small wader No ID				531													
Medium wader No ID				9													
Large wader No ID				80													
Sum Total	**850**	**6159**	**8171**	**1559**	**0**	**106**	**0**	**175**	**45**	**2395**	**1148**	**92**	**1691**	**161**	**2771**	**339**	**2667**
Number of species	**6**	**8**	**7**	**14**	**0**	**3**	**0**	**5**	**2**	**12**	**15**	**6**	**14**	**4**	**16**	**9**	**18**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

TAS ***Species***	**Cape Portland**	**Derwent**	**George Town Reserve**	**Georges Bay**	**Kelso, Tamar Estuary**	**King Island**	**Lake Dulverton**	**Marion Bay & Blackmans Bay**	**Maurouard Beach**	**Moorland Point**	**Narawntapu National Park**	**Robbins Passage / Boullanger Bay**	**Scamander**
Areas counted	1/15	10/12	1/1	5/5	1/1	10/25	1/1	1/1	4/4	1/1	1/1	10/11	1/1
Min/Max diff.	16	30	3/3	33	22/22	8/36	36	30/30	33/34	26/26	20	16	33
Comb-crested Jacana													
Latham's Snipe							1					1	
Swinhoe's Snipe													
Black-tailed Godwit			12					7					
Bar-tailed Godwit		36		28	4	1					1	295	
Little Curlew													
Whimbrel		1	9										
Eastern Curlew		43	18	8							17	111	
Common Redshank													
Marsh Sandpiper													
Common Greenshank		5	8	8		10						125	
Wood Sandpiper													
Terek Sandpiper													
Common Sandpiper													
Grey-tailed Tattler										1		1	
Wandering Tattler													
Ruddy Turnstone			69	39		230				100		827	
Asian Dowitcher													
Great Knot												13	
Red Knot	2											781	
Sanderling				14		10						55	
Red-necked Stint	1314	475	42	458	190	202		180			200	7750	
Long-toed Stint													
Pectoral Sandpiper													
Sharp-tailed Sandpiper	67	2				242						184	
Curlew Sandpiper	75		3									330	
Broad-billed Sandpiper													
Ruff						2							
Bush Stone-curlew													
Beach Stone-curlew													
Pied Oystercatcher	49	896		214	132	50		224	8	23	154	962	12
Sooty Oystercatcher	24	27	4	7	22	30			14			435	
Black-winged Stilt													
Red-necked Avocet													
Banded Stilt													
Pacific Golden Plover	57	25				1				6		218	
Grey Plover												75	
Red-capped Plover	50	119		32	37	74		24			10	117	7
Double-banded Plover		1		1	1			10			6	4	
Lesser Sand Plover												3	
Greater Sand Plover													
Oriental Plover													
Inland Dotterel													
Black-fronted Dotterel						6	2						
Hooded Plover	2			1	2	22		7	14			35	2
Red-kneed Dotterel													
Banded Lapwing							30				38		
Masked Lapwing	37	155	10	28	116	121			2			37	5
Small wader No ID						2							
Medium wader No ID													
Large wader No ID													
Sum Total	**1677**	**1785**	**175**	**838**	**504**	**1001**	**33**	**452**	**38**	**130**	**426**	**12359**	**26**
Number of species	**10**	**12**	**9**	**12**	**8**	**15**	**3**	**6**	**4**	**4**	**7**	**21**	**4**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

VIC ***Species***	**Anderson Inlet**	**Begola**	**Belmont Common**	**Black Rocks / Breamlea**	**Corner Inlet**	**Discovery Bay to Glenelg River**	**Douglas area**	**Fitzroy River Mouth**	**Hamilton**	**Lake Buloke**	**L Connewarre area**	**L Corangamite area**	**Lake Hindmarsh**	**Lake Lorne**
Areas counted	8/9	1/1	1/1	2/2	13/40	1/6	1/5	3/6	2/2	1/1	6/6	15/37	1/1	1/1
Min/Max diff.	2/14	23	23	10/23	16/61	37	37	37	37	0	9/33	16	58	23
Comb-crested Jacana														
Latham's Snipe			9								7			7
Swinhoe's Snipe														
Black-tailed Godwit														
Bar-tailed Godwit	30				11523	1					30			
Little Curlew														
Whimbrel					20									
Eastern Curlew	1				496									
Common Redshank														
Marsh Sandpiper						1						2		
Common Greenshank				1	32	14					56	1		
Wood Sandpiper									1					
Terek Sandpiper														
Common Sandpiper														
Grey-tailed Tattler														
Wandering Tattler														
Ruddy Turnstone					11									
Asian Dowitcher														
Great Knot					8									
Red Knot					730									
Sanderling					100									
Red-necked Stint	600			79	10044	5		189	150		1846	2177		
Long-toed Stint														
Pectoral Sandpiper														
Sharp-tailed Sandpiper	100				50			4			1191	2698		
Curlew Sandpiper					65						815			
Broad-billed Sandpiper														
Ruff														
Bush Stone-curlew														
Beach Stone-curlew														
Pied Oystercatcher	15				793	20		6						
Sooty Oystercatcher					271									
Black-winged Stilt			4						670		52	121	2	11
Red-necked Avocet												34		
Banded Stilt														
Pacific Golden Plover														
Grey Plover					290									
Red-capped Plover	8			12	10	22		56	45		27	206		
Double-banded Plover					120			1						
Lesser Sand Plover					10									
Greater Sand Plover					2									
Oriental Plover														
Inland Dotterel														
Black-fronted Dotterel								2			5			
Hooded Plover	2			1	4			6						
Red-kneed Dotterel									1		2			
Banded Lapwing														
Masked Lapwing	8			21	20	16		49			86	410	30	36
Small wader No ID														
Medium wader No ID														
Large wader No ID														
Sum Total	**764**	**0**	**13**	**114**	**24599**	**79**	**0**	**313**	**867**	**0**	**4117**	**5649**	**32**	**54**
Number of species	**8**	**0**	**2**	**5**	**20**	**7**	**0**	**8**	**5**	**0**	**11**	**8**	**2**	**3**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

VIC Cont. ***Species***	**Lake Wyn Wyn**	**Laverton/Altona**	**Mallacoota**	**Mildura**	**Moolap Saltworks**	**Point Richards**	**Port Fairy**	**Shallow Inlet**	**St Leonards Salt L**	**Swan Bay & Mud I**	**Swan Hill**
Areas counted	1/10	2/8	1/4	2/3	4/6	2/3	21/21	4/10	1/1	8/8	5/5
Min/Max diff.	57/57	13/26	24/24	9/16	25/25	23/23	37/37	8/8	23/23	9/24	36/36
Comb-crested Jacana											
Latham's Snipe					2		100	2			
Swinhoe's Snipe											
Black-tailed Godwit											
Bar-tailed Godwit		2	60					53		394	
Little Curlew											
Whimbrel											
Eastern Curlew			2					103		36	
Common Redshank											
Marsh Sandpiper		34			1						25
Common Greenshank		31			40		8	33		44	
Wood Sandpiper											
Terek Sandpiper											
Common Sandpiper											
Grey-tailed Tattler								1			
Wandering Tattler											
Ruddy Turnstone											
Asian Dowitcher											
Great Knot					1			1			
Red Knot								5		39	
Sanderling							30	310			
Red-necked Stint		1754	40	1370	287		1126	1813		2348	90
Long-toed Stint											
Pectoral Sandpiper											
Sharp-tailed Sandpiper		492		67	679		1580	7		306	295
Curlew Sandpiper		566	2		209		9	593		48	
Broad-billed Sandpiper											
Ruff											
Bush Stone-curlew											
Beach Stone-curlew											
Pied Oystercatcher			8		20		42	2		20	
Sooty Oystercatcher					1		5	2			
Black-winged Stilt		147		116	75	12	71			13	40
Red-necked Avocet		26		428	10						1
Banded Stilt											
Pacific Golden Plover								224		25	
Grey Plover								2			
Red-capped Plover		24	20	266	132		246	3		79	30
Double-banded Plover							24	1			
Lesser Sand Plover											
Greater Sand Plover											
Oriental Plover											
Inland Dotterel											
Black-fronted Dotterel					7						2
Hooded Plover			2				51	9			
Red-kneed Dotterel					2						
Banded Lapwing											102
Masked Lapwing		10	12	43	69	13	145	10	8	91	177
Small wader No ID								35			
Medium wader No ID								6			
Large wader No ID								1			
Sum Total	**0**	**3086**	**146**	**2290**	**1535**	**25**	**3437**	**3216**	**8**	**3443**	**762**
Number of species	**0**	**10**	**8**	**6**	**15**	**2**	**13**	**22**	**1**	**12**	**9**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

WA / *Species*	80 MB	Albany	Benje Benjenup L	Broadwater	Broome	Broome Beaches	Bush Point	C Gordon – C Villaret	N of 80 MB	Dampier PI	Hutt Lagoon	Lake Gore
Areas Counted	44/50	5/17	1/1	1/1	9/9	3/3	7/8	1/3	4/4	4/4	5/5	3/3
Min/Max Diff	32/35	8/22	39	25	32	32	31	33	33/34	32	20/56	37/38
Comb-crested Jacana												
Latham's Snipe												
Swinhoe's Snipe												
Black-tailed Godwit	52						1					
Bar-tailed Godwit	47973	12				52	19103	10	842			
Little Curlew	784				727		37					
Whimbrel	309	3				22	379		96	34	1	
Eastern Curlew	377					5	196		22			
Common Redshank												
Marsh Sandpiper	127				2							
Common Greenshank	2269	36			4	1	3		6	5	2	6
Wood Sandpiper							267					
Terek Sandpiper	3763						199		4			
Common Sandpiper	2	6				10	3	2	8	9	3	1
Grey-tailed Tattler	6818	3				2	196	30	113	102		
Wandering Tattler												
Ruddy Turnstone	2161	2				145	189		237	39	8	
Asian Dowitcher	2						3					
Great Knot	123561	132				211	9489		415	1	3	
Red Knot	23109						27			27		
Sanderling	3329					246	1129		208	23	6	33
Red-necked Stint	27302	520	127	207		149	1905	25	458	83	15	
Long-toed Stint												
Pectoral Sandpiper												
Sharp-tailed Sandpiper	204	15	4						1	5	4	
Curlew Sandpiper	2821		50				27			1	65	
Broad-billed Sandpiper	34						1					
Ruff											1	
Bush Stone-curlew												
Beach Stone-curlew												
Pied Oystercatcher	793	111				29	365		78	7	16	
Sooty Oystercatcher	25	1						4	1	33	1	
Black-winged Stilt	10		4		23		2				34	5
Red-necked Avocet			17								2	6
Banded Stilt			70								120	32
Pacific Golden Plover	71					12	33		1	21		
Grey Plover	999	81				31	260		74	24		
Red-capped Plover	6131	23	23	69		91	1480	5	543	50	86	
Double-banded Plover												
Lesser Sand Plover	4					22	124	2	7	2		
Greater Sand Plover	21093	22				202	5258	5	928	179		
Oriental Plover	17296				12	2	5364					
Inland Dotterel												
Black-fronted Dotterel				12						2	2	
Hooded Plover												
Red-kneed Dotterel												
Banded Lapwing												
Masked Lapwing		3			42	2						
Small wader No ID												
Medium wader No ID												
Large wader No ID												
Sum Total	**291419**	**970**	**295**	**288**	**810**	**1234**	**46040**	**83**	**4042**	**647**	**369**	**83**
Total of species	**28**	**15**	**7**	**3**	**6**	**18**	**26**	**8**	**19**	**19**	**17**	**6**

Table 4 continued. Shorebird counts closest to the 15th of January 2010 (summer counts), by state, with Shorebird Areas in alphabetic order. Abbreviations as follows B= Bay, E = Estuary, I = Island, L = Lake, N = North, PI = Peninsula, Pt = Point, R = River, S = Swamp, Sew = Sewage Farm, W = Waters. NA=unable to determine.

WA cont. ***Species***	**Nuytsland NR**	**Peel & Yalgorup L**	**Roebuck Bay**	**Roebuck Plains**	**Shark Bay**	**Swan Coastal Plain L**	**Swan R & Rottnest I**	**Vasse-Wonnerup E**	**Warden Lakes**	**Wilson Inlet**	**Woodman Pt**
Areas Counted	1/1	12/28	16/19	2/2	28/45	6/8	15/16	8/10	7/9	10/12	1/1
Min/Max Diff	55	4/28	31/32	32	0/64	11/52	2/18	25/74	38/41	1/46	5
Comb-crested Jacana											
Latham's Snipe											
Swinhoe's Snipe				2							
Black-tailed Godwit		2	641								
Bar-tailed Godwit		13	5595		1673		7				
Little Curlew			1224	330							
Whimbrel		5	1187		148						
Eastern Curlew		11	339		179						
Common Redshank											
Marsh Sandpiper		5		177				1			
Common Greenshank	4	88	493	9	302	24	22	83		182	
Wood Sandpiper				138	31						
Terek Sandpiper			634		5		2				
Common Sandpiper		8	24	2	46	2	1	10	1	1	
Grey-tailed Tattler		5	2332		431						
Wandering Tattler											
Ruddy Turnstone			244		143		52				2
Asian Dowitcher											
Great Knot		10	19762		199		4				1
Red Knot		14	3076		95						
Sanderling					75		58				
Red-necked Stint	31	6046	1459	21	2009	41	1143	802	82		
Long-toed Stint		7		35							
Pectoral Sandpiper				1							
Sharp-tailed Sandpiper		2102	180	430	369	4		21	14	12	
Curlew Sandpiper		59	365	1	181		24	1		3	
Broad-billed Sandpiper			6								
Ruff				2							
Bush Stone-curlew											
Beach Stone-curlew											
Pied Oystercatcher	13	8	23		198		74			1	
Sooty Oystercatcher	11		33		4					3	
Black-winged Stilt		1688	344	252	122	1747	60	814		78	
Red-necked Avocet		541	39			51	24	25		4	
Banded Stilt		62				4	10	3	200		
Pacific Golden Plover			23	1	3	2	2				
Grey Plover		21	181	14	59		21				4
Red-capped Plover	35	127	204	24	428	830	112	200	40	21	4
Double-banded Plover											
Lesser Sand Plover			33		23						
Greater Sand Plover		1	1238		694						
Oriental Plover			898	14							
Inland Dotterel											
Black-fronted Dotterel				21	121	6		2	2		
Hooded Plover		102							15		
Red-kneed Dotterel				3	9	1					
Banded Lapwing					45		12				
Masked Lapwing				3					7		
Small wader No ID					100						
Medium wader No ID					70						
Large wader No ID					150						
Sum Total	**94**	**10925**	**40577**	**1480**	**7912**	**2712**	**1628**	**1962**	**361**	**305**	**11**
Total of species	**5**	**22**	**26**	**20**	**26**	**11**	**17**	**11**	**8**	**9**	**4**

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Coordinators

George & Teresa Baker, Chris Baxter, Rod Bird, John & Judy Blyth, Anne Bondin, Hazel Britton, Nigel & Mavis

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Groups

Bellarine Peninsula Shorebird Observers, Birds Australia WA (BAWA), NSW Wader Data Base, Queensland Wader Study Group (QWSG), SESA Shorebirds.

New South Wales

Chris Brandis, Frances Bray, Jeff Campbell, Greg Clancy, Simon Clayton, , Martin Cocker, Rod Corinaldi, Ricki Coughlan, Phil Craven, Mike Crowley, Joan Dawes, Rob Farnes, Winston Filewood, Margaret Hamon, John Harding, Judy Harrington, Janice Hosking, Nigel Jackett, Russell Jago, Julie Keys, Cilla Kinross, Ann Lindsey, Hans Lutter, Gordon McCarthy, Alan Morris, Jo Oldland, Jan Olley, Joy Pegler, Joan Rosenthal, Peter Roberts, Bob Rusk, Paul Shelly, Alan Stuart, Bryce Taylor, Pete Ward, Hazel Watson, Rex Worrell, Mark Young.

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Ian Hance, Colin Heap, Arthur & Sheryl Keates, Peter Kyne, Gavin O'Brien.

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South Australia

Sue Abbotts, Heather Adamson, Jim Allen, Rod Attwood, George & Teresa Baker, Mike Barth, Chris Baxter, Cath Bell, Mel Berris, Steve Berris, John & Judy Blyth, Chris Brandis, Hazel Britton, Nigel & Mavis Burgess, Jeff Campbell, Derek Carter, Maureen Christie, Rob Clemens, Jane Cooper, Ralph Cooper, Trevor Stephen James Cowie, Graham Andrew Crooks, Peter Dann, Peter Day, Rob Farnes, Anthony Frederick France, Toby Galligan, Les George, Peter Gower, Dorothy & Phil Green, Phill Du Guesclin, Travis Hague, Margaret Hamon, Judy Harrington, Jean Haywood, Colin Heap, Anne Houghton, Bea Hurrell, Teresa Jack, Alan Jamieson, Barbara Jones, Richard Jordan, Gregory Ker, Michele Jane Lane, Sue Mather, David McCarthy, Ken Monson, Euan Moore, Alan Morris, Kay Muggleton, Vicki Natt, Gavin O'Brien, Jo Oldland, Jan Olley, Kimberly Onton, Robyn Pickering, Chris Purnell, Ken Read, Jane Renwick, Robert & Krystyna Rowland, Bob Rusk, Tony Russell, David Secomb, John Spiers, Iain Stewart, Rod Sutherland, Rod Tetlow, Margie Tiller, Kent Treloar, Brian Walker, Steve Walsh, Jim & Anthea Whitelaw, Ernie Wild, Bill & Evelyn Williams, Sue Winwood, Stella Wynne, Lynda Yates, Liz Znidersic.

Tasmania

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Victoria

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Western Australia

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WADER BREEDING SUCCESS IN THE 2011 ARCTIC SUMMER, BASED ON JUVENILE RATIOS OF BIRDS WHICH SPEND THE NON-BREEDING SEASON IN AUSTRALIA

CLIVE MINTON[1], ROZ JESSOP[2] & CHRIS HASSELL[3]

[1] *165 Dalgetty Road, Beaumaris, Victoria 3193, Australia. e-mail: mintons@ozemail.com.au*
[2] *Phillip Island Nature Park, PO Box 97, Cowes, Victoria, 3922, Australia. e-mail: rjessop@penguins.org.au*
3 PO Box 3089, Broome, Western Australia, 6735, Australia. e-mail: turnstone@wn.com.au

INTRODUCTION

Each year the Victorian Wader Study Group (in south-east Australia, SEA) and the Australasian Wader Studies Group (in north-west Australia, NWA) put a great deal of fieldwork effort into trying to catch satisfactory samples of the main migratory wader species in each area to enable estimates to be made of breeding success in the preceding Arctic summer. Fieldwork is carried out in the period November / March when wader populations are reasonably stable, that is, when most adults and juveniles have arrived in their non-breeding areas and before adults commence their northward migration the following year. The breeding success (really an *index* of breeding success) is measured by the proportion of juveniles in catches made with cannon-nets at a range of locations / dates in each region.

Breeding productivity is one of the key parameters (other than survival rate) controlling population levels. It is therefore important, especially at the present time when population levels are changing markedly, to try and obtain quantitative information on breeding success to measure year-to-year variations and, potentially more importantly, changes over time. It is practically difficult to find large numbers of nests of waders in their Northern Hemisphere (mainly Arctic) breeding grounds and to follow them through to obtain hatching / fledging success rates. It is even more difficult, and prohibitively expensive, to do this over an extended period of many years and for a wide range of species.

The current approach of using “percentage juvenile sampling” as an index of breeding success has its limitations, but is considered the most practical method over prolonged periods (33 years now for some species in SEA). There are undoubtedly many variables that may affect the number of juvenile birds in a sample of birds caught for banding. It has long been known that mist-netting produces an inordinately high proportion of juveniles, perhaps because of their relative naivety compared with adults (Pienkowski & Dick 1976). Only cannon-net catches are therefore incorporated into the data used to calculate the juvenile ratios each year. Some locations seem to consistently have a higher proportion of young birds than others, so a range of different catching sites are sampled if possible. Also the composition of individual catches at any site can vary significantly, sometimes for unknown reasons, so the larger the number of samples obtained the more likely the figure is to be representative of the population of a species in a region. The distribution of juveniles in a large roosting flock can also be non-homogenous with young birds sometimes clumping and at other times segregating to the outer fringes of a flock. Being less wary, juveniles may also enter / roost in the cannon-net catching area more readily than adults. Finally it should be pointed out that the measurement obtained is the proportion of young birds in the population some six months on average after the juvenile birds have first fledged. The figure is therefore not an estimate of how many birds fledged but how many also successfully carried out their first southward migration and then survived for some months afterwards.

The above limitations on the data used to calculate juvenile ratios need to be acknowledged when assessing the conclusions drawn. Year to year comparisons are probably more accurate than absolute figures. At the very least the breeding success categorisation each year (good, average, poor etc.) is probably representative of coarse differences between years.

This paper presents the results of percentage juvenile sampling of waders in SEA and NWA during the November 2011 to March 2012 non-breeding season, thereby giving an estimate of wader breeding success in the 2011 Northern Hemisphere summer for a range of species.

METHODS

Data were collected using standard cannon-netting techniques (Minton *et al.* 2005). In SEA this was via a large number of catches at a wide range of locations throughout the period, between mid-November and late March. In NWA most of the data were collected during a concentrated three-week period of fieldwork at Roebuck Bay (Broome) and 80 Mile Beach between 18 February and 11 March 2012.

Information collected is compared with previous data by using median values (for SEA) where datasets are long (18 to 33 years), or average values (for NWA) where datasets are shorter (13 years). A qualitative assessment of breeding success is then made for each species in each region by comparing medians or averages.

RESULTS

The figures for 2011/12 are given in Table 1 (SEA) and Table 2 (NWA). This year it was possible to sample all of the main species in SEA because Curlew Sandpiper and Sharp-tailed Sandpiper mostly returned to their traditional non-breeding areas along the coasts rather than (presumably) stopping off at ephemeral wetlands present extensively in central Australia, as they were thought to have done in the previous year. Similarly in NWA all of the principal species sampled annually were caught in reasonable numbers and, additionally, good samples of Ruddy Turnstone and Broad-billed Sandpiper (for the second consecutive year) were

Table 1. Percentage of juvenile/first year waders in cannon-net catches in south-east Australia in 2011/2012

Species	**No. of catches**		**Total caught**	**Juv./ 1st year**		**Long term median* % juvenile (years)**	**Assessment of 2011 breeding success**
	Large (>50)	**Small (<50)**		**No.**	**%**		
Red-necked Stint *Calidris ruficollis*	8	5	3869	611	**15.8**	14.3 (33)	Average
Curlew Sandpiper *C. ferruginea*	2	4	304	11	**3.6**	10.0 (32)	Very poor
Bar-tailed Godwit *Limosa lapponica*	2	1	184	34	**18.5**	18.5 (22)	Average
Red Knot *C. canutus*	0	4	34	23	**67.6**	58.0 (18)	Good
Ruddy Turnstone *Arenaria intepres*	2	6	177	17	**9.6**	9.6 (21)	Average
Sanderling *C. alba*	2	2	348	7	**2.0**	12.2 (20)	Very poor
Sharp-tailed Sandpiper *C. acuminata*	1	4	115	6	**5.2**	10.7 (30)	Poor

All birds cannon-netted in period 15 November to 28 February except for Red-necked Stint, Ruddy Turnstone, and Sanderling, for which catches up to 29 March are included.
* Does not include the 2011/2012 figures

Table 2. Percentage of juvenile/first year waders in cannon-net catches in north-west Australia in 2011/2012

Species	**No. of catches**		**Total caught**	**Juv/1st year**		**Assessment of 2011 breeding success**
	Large (>50)	**Small (<50)**		**No.**	**%**	
Great Knot *Calidris tenuirostris*	9	5	1369	89	6.5	Poor
Bar-tailed Godwit *Limosa lapponica*	2	8	491	38	7.7	Below average
Red-necked Stint *C. ruficollis*	0	8	90	22	24.4	Average
Red Knot *C. canutus*	0	4	77	6	7.8	Very poor
Curlew Sandpiper *C. ferruginea*	0	6	79	1	1.3	Very poor
Ruddy Turnstone *Arenaria intepres*	1	2	58	8	13.8	Average?
Sanderling C. *alba*	0	3	3	-	(-)	-
Sharp-tailed Sandpiper *C. acuminata*	0	0	0	0	(-)	-
Non-arctic northern migrants						
Greater Sand Plover *Charadrius leschenaultia*	6	6	544	102	18.8	Below average
Terek Sandpiper *Xenus cinereus*	1	8	225	12	5.3	Very poor
Grey-tailed Tattler *Heteroscelus brevipes*	2	9	285	57	20	Average
Broad-billed Sandpiper *Limicola falcinellus*	0	2	46	13	28.3	Good?

All birds cannon-netted in period 1 November to mid-March

obtained. However, Sanderling and Sharp-tailed Sandpiper, species which are rarely sampled adequately, were only caught in small numbers.

Table 3 (SEA) and Table 4 (NWA) show the annual percentage juveniles in catches for each of the main species in each year since 1998/99 (when annual sampling commenced in NWA). The average figure thus gives an estimate of typical percentage juveniles in catches in recent years against which the most recent results can be compared.

DISCUSSION

The 2011 breeding season was clearly far less satisfactory than 2010 for almost all species of waders which spend their non-breeding season in Australia (see Minton *et al*. 2010, Minton *et al*. 2011). Only one of seven species (Red Knot) monitored in SEA had a breeding success rating higher than average. Two species (Curlew Sandpiper and Sanderling) were rated “very poor” and Sharp-tailed Sandpiper as “poor”.

In NWA none of the key species had breeding success higher than average, and three species (Curlew Sandpiper, Terek Sandpiper and Red Knot) were classed as “very poor”. Great Knot also appeared to have poor breeding success and Bar-tailed Godwit and Greater Sand Plover had percentage juvenile ratios below average. Only Broad-billed Sandpiper, of which adequate samples are obtained very occasionally, seem to have had a good breeding season in 2011.

Factors affecting breeding success

Analyses of breeding success data on a range of species worldwide have shown that a number of factors can affect breeding success, particularly in Arctic breeding birds. These include the date of snowmelt, average temperatures in June and/or July, the occurrence of late snowfalls (particularly at the time of chick hatching in early July) and predator levels (Arctic Foxes, Stoats, Minks, skuas etc.) (Soloviev *et al.* 2006, Summers & Underhill 1987). The strongest correlations have been shown with predator levels, which in turn are related to lemming numbers and which in the past often occurred in a regular three-year annual cycle in northern Central Siberia.

Analysis of the Australian data has not so far shown any clear pattern of correlation with any single parameter. This is probably partly because the wader species coming to Australia in the non-breeding season come from a wide

Table 3. Percentage of first year birds in wader catches in south-east Australia 1998/1999 to 2011/2012

Species	**98/99**	**99/00**	**00/01**	**01/02**	**02/03**	**03/04**	**04/05**	**05/06**	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	***Average (13yrs)***
Ruddy Turnstone *Arenaria intepres*	6.2	29	10	9.3	17	6.7	12	28	1.3	19	0.7	19	26	10	*14.2*
Red-necked Stint *Calidris ruficollis*	32	23	13	35	13	23	10	7.4	14	10	15	12	20	16	*17.2*
Curlew Sandpiper *C. ferruginea*	4.1	20	6.8	27	15	15	22	27	4.9	33	10	27	(-)	4	*17.6*
Sharp-tailed Sandpiper *C. acuminata*	11	10	16	7.9	20	39	42	27	12	20	3.6	32	(-)	5	*20.0*
Sanderling *C. alba*	10	13	2.9	10	43	2.7	16	62	0.5	14	2.9	19	21	2	*16.7*
Red Knot *C. canutus*	(2.8)	38	52	69	(92)	(86)	29	73	58	(75)	(-)	(-)	78	68	*56.7*
Bar-tailed Godwit *Limosa lapponica*	41	19	3.6	1.4	16	2.3	38	40	26	56	29	31	10	18	*23.9*

All birds cannon-netted between mid November and 25 March (except Sharp-tailed Sandpiper and Curlew Sandpiper to end February only). Averages (for previous 13years) exclude figures in brackets (small samples) and exclude 2011/2012 figures

Table 4. Percentage of first year birds in wader catches in north-west Australia 1998/1999 to 2011/2012

Species	**98/99**	**99/00**	**00/01**	**01/02**	**02/03**	**03/04**	**04/05**	**05/06**	**06/07**	**07/08**	**08/09**	**09/10**	**10/11**	**11/12**	*Average (13yrs)*
Red-necked Stint *Calidris ruficollis*	26	46	15	17	41	10	13	20	21	20	10	17	18	24	*21.0*
Curlew Sandpiper *C. ferruginea*	9.3	22	11	19	15	7.4	21	37	11	29	10	35	24	1	*19.4*
Great Knot *C. tenuirostris*	2.4	4.8	18	5.2	17	16	3.2	12	9.2	12	6	41	24	6	*13.1*
Red Knot *C. canutus*	3.3	14	9.6	5.4	32	3.2	(12)	57	11	23	12	52	16	8	*19.8*
Bar-tailed Godwit *Limosa lapponica*	2.0	10	4.8	15	13	9.0	6.7	11	8.5	8	4	28	21	8	*10.8*
Non-arctic northern migrants															
Greater Sand Plover *Charadrius leschenaultii*	25	33	22	13	32	24	21	9.5	21	27	27	35	17	19	*23.6*
Terek Sandpiper *Xenus cinereus*	12	(0)	8.5	12	11	19	14	13	11	13	15	19	25	5	*14.4*
Grey-tailed Tattler *Heteroscelus brevipes*	26	(44)	17	17	9.0	14	11	15	28	25	38	24	31	20	*21.3*

All birds cannon-netted in the period 1 November to mid March. Averages (for previous 13 years) exclude figures in brackets (small samples) and exclude 2011/2012 figures

range of longitudes and latitudes in Siberia and Alaska, where factors that influence breeding success vary considerably. With local factors and climate varying simultaneously but independently it is not surprising that this confounds the data and masks any correlation with a single factor.

Professor Marcel Klaassen of Deakin University and one of his students, Yaara Rotman, are currently re-examining all of the Australian juvenile ratio data and testing for correlations with climatic/predation factors. A synthesis is expected to be completed later in 2012.

CONCLUSION

Overall, 2011 was a poor breeding season for most wader species which spend their non-breeding season in Australia. This was not unexpected given that the two previous breeding seasons both appear to have been above average (with 2010 being particularly good). Sampling will continue in SEA and NWA in the 2012/2013 season. Let us hope for an improved outcome.

ACKNOWLEDGEMENTS

Teams of 10 – 30 people from the VWSG and from AWSG NWA Expeditions have spent considerable effort in obtaining the data presented in this report. They are thanked for their huge physical and time consuming effort in achieving this, often in somewhat difficult climatic conditions – cold wet and windy in SEA and hot and sometimes very wet in NWA.

All those landowners who allowed access via their properties to beach catching sites are also greatly thanked, as are Broome Bird Observatory, Anna Plains Station, Rosemary Davidson (Yanakie, Victoria) and many other people in SEA for providing local accommodation for fieldwork teams. The Australian Bird Banding Scheme kindly granted appropriate banding licences and the various state environment/conservation bodies kindly provided state licences and, where necessary, ethics and other animal capture approvals.

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PLENARY:

ECOLOGICAL CONSEQUENCES FOR THE COORONG FROM OVER-EXTRACTION OF WATER IN THE MURRAY DARLING BASIN

DAVID C. PATON

Ecology, Evolution and Landscape Sciences, School of Earth & Environmental Sciences, The University of Adelaide, SA 5005, Australia

ABSTRACT

The Coorong is a Wetland of International Importance and is a unique and diverse wetland system near the Mouth of the River Murray. Using data gathered over the last 30 years, David will summarize recent trends and future predictions for this region. Its ecology is driven by hydrology and as the last wetland system in the Murray Darling Basin to receive water is a barometer for assessing sustainable use of water within the Basin. Reductions in flows to the Murray Mouth not only affect whether the Murray Mouth remains open, but also result in increasing salt loads in the Coorong and disruption to water levels. Increases in salinity and low water levels during the last decade resulted in significant reductions in the abundances and distribution of key aquatic plants, aquatic invertebrates, fish and birds, including waders. Despite flows returning to the region in spring 2010, components of the system have not fully recovered, and some have deteriorated further. The proposed return of 2750 GL of water to the environment as outlined in the current draft Murray Darling Basin Plan will be too little and too late to maintain the ecological character of the Coorong.

BIOGRAPHY

David Paton is a graduate of the University of Adelaide (B.Sc. Hons, 1974) and Monash University (Ph.D., 1980). After holding research fellowships at the University of California and the Australian Museum in Sydney, he returned to the University of Adelaide in 1983, holding various teaching and research fellowships until 1997 when he took a tenured position. He was Head of the Discipline of Ecology and Evolutionary Biology 2007-2009. He has contributed to the understanding and management of Australia's natural environment for three decades, and has a commitment to long-term studies that help understand and manage the natural environment for future generations. He frequently provides informed comment on wildlife and environmental issues to politicians, the general public and the media.

David has received numerous awards for his ecological and conservation work including the Serventy Medal from Birds Australia (2011); membership of *the General Division of the Order of Australia* for services to conservation, education and the environment (2008); a National Carrick Citation for environmental education (2006); the Premier's Science Excellence Award for Excellence in Research for Public Good Outcomes (2006); and the SA Great Award for the Environment (1999). His book *At the end of the river: the Coorong and Lower Lakes* (2010) also received a Whitely award.

REPRODUCTIVE SUCCESS OF ARCTIC BREEDING WADERS INDICATE THAT LEMMING CYCLES ARE LOOSING THEIR GRIP ON THE FUNCTIONING OF ARCTIC ECOSYSTEMS

Y. AHARON- ROTMAN[1]*, M. KLAASSEN[1], C. MINTON[2], C. HASSELL[3], M. SOLOVIEV[4], P. TOMKOVICH[5]

[1] Centre for Integrative Ecology, School of life and environmental Science, Deakin University, Australia
[2] Victorian Wader Study Group, 165 Dalgetty Road, Beaumaris, VIC. 3193, Australia
[3] Global Flyway Network, PO box 3089, Broome, WA 6725, Australia
[4] Department of Vertebrate Zoology, Biological Faculty, Lomonosov Moscow State University, 119991, Moscow, Russia
[5] Zoological Museum, Lomonosov Moscow State University, Moscow, Russia
**yaara.rotman@deakin.edu.au*

The alternative prey hypothesis suggests lemming cycles in the Arctic breeding grounds are indirectly responsible for inter-annual fluctuation in breeding success of geese and waders. Previous studies found such interactions in the East Atlantic Flyway. We studied whether lemming cycles may also indirectly affect breeding success of waders from the East Asian- Australasian flyway, however no evidence for such an effect was found. Most species did not show population cycles, as would have been expected if they are under the influence of lemming cycles, and breeding success did not correlate with lemming abundance in the different breeding areas. We interpret our results to be due to current changes in lemming cycles showing a tendency to disappear over the past two decades.

WATER, SALT AND SUBSTRATE; HOW THESE ABIOTIC PARAMETERS CREATE GLOBALLY SIGNIFICANT SHOREBIRD HABITAT IN TROPICAL AUSTRALIAN SALINAS

D. BERTZELETOS

School of Natural Sciences, Edith Cowan University, WA, Australia
d.bertzeletos@ecu.edu.au

Many shorebird populations are currently declining in the East Asian-Australasian Flyway, probably because of habitat loss in Asia. A potential way to ameliorate these declines is by recreating and managing habitats elsewhere. Salinas are often used by shorebirds and are potentially suitable settings for such work. Salinas are areas where high solar evaporation rates allow for the accumulation of salt from salt water. The habitats in these areas are attractive to shorebirds; however, there have been few studies examining the parameters, biotic and abiotic, behind this attraction globally and none done in Australia. By investigating these parameters in three salinas in northern Western Australia, Lake MacLeod and the Port Hedland and Dampier

Saltworks; my study aims are to discover the parameters influencing shorebird distribution at these sites, how they do so and if any of these can be utilized to predict shorebird distribution in other areas and habitats. I will do so by examining and sampling abiotic (water, substrate, salinity, wind) and biotic (invertebrate and shorebird numbers and behaviours) factors across a range of habitats found at these three sites; eventually inputting these in species distribution models and testing these in other shorebird habitats and areas.

PROGRESS TOWARD UNCOVERING EVIDENCE OF DECLINES IN MIGRATORY SHOREBIRDS IN AUSTRALIA AND THE HABITATS THEY RELY ON IN SE ASIA

R.S. CLEMENS*[1], N.J. MURRAY[1], H.B. WILSON[1], B.E. KENDALL[2], C.E. STUDDS[1], K. DHANJAL-ADAMS[1], R.A. FULLER[1,3]

[1] School of Biological Sciences, University of Queensland, St Lucia, QLD 4072, Australia
[2] Bren School of Environmental Science & Management, University of California, Santa Barbara, Santa Barbara, CA 93106-5131, USA
[3] CSIRO Climate Adaptation Flagship and CSIRO Ecosystem Sciences, 41 Boggo Road, Dutton Park, Queensland 4102, Australia
**r.clemens@uq.edu.au*

Shorebird monitoring by volunteers since 1980 has resulted in an exceptionally rich data set on an important component of Australian biodiversity. Here, we review the spatial and temporal coverage of the Australian shorebird monitoring count data. We report on some of the techniques used to identify changes in abundance in wildlife, and highlight some of the growing number of results indicating long-term declines in some migratory shorebird species at selected individual sites in Australia. We then report on progress in quantifying the loss of staging habitat which is thought to be one of the most likely causes for some shorebird declines. Developing a novel remote sensing approach which uses Landsat data selected with the help of a regional tide model, we have mapped the extent of intertidal wetlands in the Yellow Sea in 1980's and 2000's. Here we describe the status and distribution of intertidal mudflats across the Yellow Sea region. We have discovered that a large proportion of intertidal habitat has been lost primarily to coastal reclamation. Together habitat loss estimates and available count data will form the foundation of a project seeking to quantify the scale of declines in migratory shorebirds while identifying the causes of those declines.

BANDED STILTS IN THE BRINE: LAKE TORRENS BREEDING EVENT, MAY 2010

STUART COLLARD[1], ALEX CLARKE[2]

[1]Rural Solutions, SA, Australia
[2]Department of Environment and Natural Resources, SA, Australia

In early 2010, heavy rain fell across outback South Australia, providing ideal conditions for one of the largest Banded Stilt breeding events ever recorded in Australia. Aerial surveys of the inland salt lakes led to the discovery of the breeding colony at Lake Torrens National Park. A field surveillance team from the Department of Environment and Natural Resources was deployed to observe the breeding birds and if needed, protect them from predatory Silver Gulls. In this paper, we describe the climatic conditions leading up to the mass breeding event and the techniques used to locate the colony. We present results from field-based behavioural observations, including the impact of Silver Gulls and the overall success of the breeding event. We also provide information from follow-up observations, including the discovery of a second, smaller breeding colony at Lake Torrens in the same year. Stilt behaviour was similar to that observed in previous studies, although the impact of gulls was lower than anticipated. Findings are discussed in the context of Banded Stilt conservation and the long-term implications of the breeding event on population viability in southern Australia.

CONSERVING MIGRATORY SHOREBIRDS UNDER DYNAMIC THREATS

K.L. DHANJAL-ADAMS*[1], H.B. WILSON[1], B.E. KENDALL[2], C.E. STUDDS[1], H.P. POSSINGHAM[1], R.A. FULLER[1,3]

[1] School of Biological Sciences, University of Queensland, St Lucia, QLD 4072, Australia;
[2] Bren School of Environmental Science & Management, University of California, Santa Barbara, Santa Barbara, CA 93106-5131, USA;
[3] CSIRO Climate Adaptation Flagship and CSIRO Ecosystem Sciences, 41 Boggo Road, Dutton Park, Queensland 4102, Australia;
** kiran.dhanjaladams@uqconnect.edu.au*

In Moreton Bay over the last 15 years, at least seven shorebird species have declined by up to 79%. Population trends in Moreton Bay are therefore likely indices of declines occurring elsewhere along the flyway and are most likely being amplified by migratory connectivity. Yet our understanding of how to conserve migratory birds is remarkably poor, with few tools available for diagnosing the reasons for population change in migratory species, and even fewer available for prioritising conservation actions for migrants that are sufficiently responsive in time and space. Our work addresses these fundamental gaps in our knowledge by 1) discovering how to manage the threat of disturbance to migratory species whose populations are dynamic in time and space, 2) developing and testing a method to distinguish local from remote causes of population

change in migratory species, and 3) prioritising actions for migratory species at local and international scales.

FEEDING MECHANISMS OF MIGRATORY SHOREBIRDS IN SALTPANS

SORA M. ESTRELLA[1,2]

[1]*Coastal Wetlands Conservation Group, Biology Department, School of Sciences of the Sea and Environment, University of Cádiz, 11510 Puerto Real, Spain*
[2]*School of Animal Biology, University of Western Australia, 35 Stirling Highway, Crawley WA 6009, Australia*
sora.estrella@uwa.edu.au

Most migrant waders depend at some stage of their migrations on aquatic systems such as saltpans which present physical and chemical characteristics distinct from those present in the intertidal or terrestrial areas. Nevertheless, waders are able to use an arsenal of feeding mechanisms and behaviours that allow them to exploit efficiently these distinctive aquatic systems. A common feeding mechanism in small or medium-sized wader species feeding on small prey items in saltpan shallow waters is the Surface Tension Transport (STT). Birds using STT can transport a prey up to 3.6 times faster than the theoretical value predicted previously and are capable of achieving high intake rates foraging on small prey items when they are available at high densities. In saltpans, preys are located at different depths in the water column and vary in size over a small range. Waders are found to modulate their bill gape in response to differences in prey size and position in the water column, which is a common behaviour among trophic generalists. Waders' bill gape is modulated frequently through the use of distal rhynchokinesis. Although the use of distal rhynchokinesis has been commonly associated with the deep probing feeding method, its use and occurrence was reported recently for the first time in wild long-billed waders feeding on small prey items suspended in saltpans water column. Foraging behaviour of typical plovers is highly stereotyped, and to date, the use of a sandpiper-like foraging method by typical plovers is considered anecdotal. However sandpiper-like foraging method is common in Grey Plover (*Pluvialis squatarola*) and Ringed Plover (*Charadrius hiaticula*) feeding in prey-abundant pans, being particularly important for Ringed Plover.

LYNGBYA MAJUSCULA BLOOMS IN ROEBUCK BAY, WA: EFFECTS ON BAR-TAILED GODWITS

SORA M. ESTRELLA

School of Animal Biology, University of Western Australia, 35 Stirling Highway, Crawley WA 6009, Australia.
sora.estrella@uwa.edu.au

Roebuck Bay is one of the main non-breeding areas for migratory shorebirds in Australia. The bay is characterised by an extremely high diversity and biomass of benthic invertebrates which supports the elevated shorebird numbers. Since 20% of shorebird species that regularly migrate along the East Asian-Australasian Flyway have been officially classified as globally threatened, due at least in part to habitat degradation along the flyway, there is an urgent need to monitor and conserve the remaining important sites in the flyway. But since 2005 blooms of toxic cyanobacterium (blue-green algae) *Lyngbya majuscula* have increased in frequency and extension in the bay and the potential impacts of these blooms on shorebirds remain unidentified. *Lyngbya* blooms in Roebuck Bay appear to be related with changes in the diversity of benthic invertebrates, but little is known about how these changes in prey availability can affect the feeding behaviour of shorebirds. The foraging behaviour of Bar-tailed Godwits was analysed in two wet seasons, one with an intense bloom and the other with a non-significant bloom. Although there were not significant differences in the number of probes per minute and prey captured per minute between both situations, a shift in Bar-tailed Godwits diet was detected. The effect of this shift in prey on the energy acquisition by this long distance migratory bird is evaluated.

WHAT CAN GEOLOCATORS TELL US ABOUT SHOREBIRDS BREEDING IN THE ARCTIC?

KEN GOSBELL*, CIVE MINTON

Australasian Wader Studies Group, Victoria, Australia
** ken@gosbell.id.au*

Our understanding of breeding characteristics of shorebirds in the breeding areas is generally poor due to difficulties of geography and location. Here we describe how the data obtained from geolocators can be used to obtain information about incubation timings relative to arrival and departure of several species of shorebirds studied by VWSG and AWSG in 2009 to 2011. The core of the study is related to 26 geolocators retrieved from Ruddy Turnstone originally banded at Flinders, Victoria, SE of SA and King Island, Tasmania. Our presentation will show data demonstrating successful breeding outcomes in almost half of the birds studied. Moreover, we present evidence that a second nesting attempt is often made in the case of the first attempt failing. Data from smaller samples from Eastern Curlew and Sanderling will also be presented. This information is important to aid the understanding of breeding characteristics and their influence on population dynamics. It also demonstrates the valuable contribution geolocators can make to improving our understanding of shorebird behaviour and ecology.

SHOREBIRD RESPONSES TO MAJOR INFRASTRUCTURE DEVELOPMENTS ON BOTANY BAY

CHELSEA HANKIN[1], JOAN DAWES[2] AND PHIL STRAW[1,2]

[1]*Avifauna Research and Services Pty Ltd, 15 Kings Road, Brighton-Le-Sands, NSW 2216, Australia*

[2] *Australasian Wader Studies Group, NSW, Australia*

Since 1990 construction of the third runway for Kingsford Smith Airport and a major expansion of Port Botany have had major impacts on important shorebird feeding and roosting sites on the north side of Botany Bay. Over the same period there has been some habitat degradation on the south side of the Bay, but no major development. We have analysed summer shorebird populations on the north and south sides of Botany Bay from 1980 to 2012. Total shorebird numbers in the Bay have decreased by >50% during this period; on the north side the decline has been >80%, but on the south side only 20%. Bar-tailed Godwit are the most numerous migratory shorebird in Botany Bay and are found on both sides of the Bay. Their population has declined by >50%, but their distribution is relatively unchanged. By contrast, Curlew Sandpiper, Pacific Golden Plover and Red-necked Stint were largely found on the north side in the 1980s. Their numbers have declined dramatically and the great majority of those that remain are now found on the south side of the Bay. Whimbrel, which only occur on the south side of Botany Bay, have remained stable over this period.

INDUSTRIALISATION THREATENS TWO SUBSPECIES OF RED KNOT

CHRIS HASSELL

PO Box 3089, Broome, WA 6725, Australia
turnstone@wn.com.au

Rapid industrialisation of tidal mudflats in the Yellow Sea threatens many species of migratory shorebirds. A small area of mudflat in the north west of Bohai Bay is a staging site for up to 75% of both the *piersmai* and *rogersi* subspecies of Red Knot. This staging site is bordered on all sides by industrial development and there are plans for development of this site as well. Numbers of Red Knot at our study site are increasing but this is not positive. It is due to the loss of other areas of mudflat in Bohai Bay. The *rogersi* and *piersmai* subspecies of Red Knot can be reliably separated on plumage characteristics when they are in full breeding plumage. We have shown the different timing of migration through the site by separating birds on plumage and by using field observations of birds abdominal profiles (a visual score of fat stores). I discuss an on-going research programme on the staging of Red Knots in NW Bohai Bay, the work of the Global Flyway Network and the reasons for individual colour-marking of birds. All this work is funded with money from outside Australia.

SHOREBIRD POPULATION TRENDS IN THE HUNTER ESTUARY

CHRIS HERBERT, LIZ CRAWFORD

Hunter Bird Observers Club

The Hunter Estuary has long been considered the most important site for migratory shorebirds in NSW. A large part of the estuary, including an embayment with extensive intertidal mudflats, was declared a Nature Reserve in 1983 and subsequently listed as a Wetland of International Importance under the Ramsar Convention because of the large numbers of migratory shorebirds. Unfortunately, migratory shorebird populations have since declined and species such as Eastern Curlew, once present in internationally significant numbers, no longer meet the 1% of Flyway Population criterion. Since the earliest records in the Hunter Estuary (1970), migratory shorebird populations have decreased to such an extent that some species, such as the Lesser Sand Plover, have become locally extinct while others are now present in counts of only 5 to 40 per cent of maximum numbers recorded in the 1970s. While migratory shorebird populations have decreased significantly, non-migratory shorebirds such as Pied Oystercatcher, Sooty Oystercatcher and Red-necked Avocet have increased in the Hunter Estuary.

HEADLINES, DEADLINES AND SEXING UP - THE ROLE OF MEDIA IN CONSERVATION OF SHOREBIRDS

KAREN HUNT

PO Box 4740 Kirwan QLD 4740, Australia
editor@thebirdsnest.net.au

Conservation has lost its sex appeal – unless it’s a small bird vs. a mining giant or the Japanese whaling fleet vs. a band of hard core sea shepherds, many believe the media isn’t interested in publishing stories about conservation issues or initiatives. It’s hard to get airtime in the mainstream media for those issues that require a detailed analysis or which can’t be explained in a 10 second soundbyte. But whether it’s through radio, TV, newspapers or social media, going public is still the best way to engage Mr and Mrs Ordinary in conservation issues, and through them, to get those issues on the national agenda. So how does the conservation community get their agendas noticed in a very crowded media space? There are organisations and institutions which use the media well but for many, engaging with the media is something to be avoided at all costs. The idea of developing a media strategy to run alongside research projects is even more foreign, but one which is being used by other industries very successfully. New technologies such as social and mobile media, and practices such as crowd sourcing and blogging offer new opportunities for spreading the conservation message but it will mean moving beyond comfortable boundaries.

DEPARTURE DATES AND FLOCK CHARACTERISTIC OF NORTHWARD MIGRATING WADERS FROM ROEBUCK BAY, WESTERN AUSTRALIA 1994 TO 2008

GREGORY D. KERR, CLIVE D. T. MINTON*

Australasian Wader Studies Group, Victoria, Australia
**mintons@ozemail.com.au*

For long-distance migratory species the duration of stay and timing of departure from key stopover sites along their flyway is an integral feature of its migration strategy. An understanding of when each species departs from a migratory stopover, the degree of rigidity or plasticity in the timing of departures within and between species, and the conditions under which they successfully depart provides key insights into each species migratory ecology. This study is based on a relatively extensive and long-term (15 years) data set of departure dates for 17 species from Roebuck Bay in the north west of Australia. A total of 331,028 birds were recorded departing and 61,561 were recorded returning – having aborted migration – in a total of 5416 flocks over the study. We report on an analysis of species by species departure dates, departure times, flock sizes and migration patterns. The frequencies with which flocks aborted migration and returned to Roebuck Bay were also investigated.

AVIAN INFLUENZA IN AUSTRALIAN WADERS: A SOUVENIRE FROM MIGRANTS?

SIMEON LISOVSKI, MARCEL KLAASSEN

Centre for Integrative Ecology, Deakin University, Geelong, Victoria 3220, Australia

Besides Anseriformes, Charadriiformes, and in particular gulls, terns and waders, are expected to constitute the major natural reservoir for low pathogenic avian influenza viruses (LPAI). Hundreds of thousands of migratory waders from the Australasian flyway spend their winter in Australia, potentially introducing and distributing LPAI viruses into native avifauna. However, our knowledge on the frequency and temporal dynamics of infections among migratory waders is still rather limited. Here we want to present an overview of our research in Avian Influenza studies on waders and how we can improve our knowledge by combining different sampling methods with powerful epidemiological modelling approaches.

RETURNING THE BALANCE: FIVE YEARS OF MANAGING THREATS TO THE HOODED PLOVER

G. S. MAGUIRE[1], M. A. WESTON[2], G. C. EHMKE[1], M. CULLEN[1]

[1]*BirdLife Australia, Suite 2-05, 60 Leicester St, Carlton Victoria 3053, Australia*
[2]*Centre for Integrative Ecology and Faculty Research Cluster in Environmental Sustainability, School of Life and Environmental Sciences, Faculty of Science and Technology, Deakin University, 221 Burwood Hwy, Victoria 3125, Australia.*

Hooded Plovers are Australian shorebirds that nest directly on the beach or dunes during late spring and summer, and are consequently highly impacted by human recreation. Threats include direct crushing of eggs and chicks by people, dogs, horses and vehicles, as well as impacts of disturbance leading to overheating of eggs, starvation of chicks and increased depredation rates. Poor breeding success is resulting in population decline within Victoria. Management efforts are being implemented to alleviate threats, including fencing nesting sites, signage, wardening and chick shelters. We monitored between 70 and 90 pairs of Hooded Plovers in Victoria across five breeding seasons (2006-2011). At each breeding territory, the presence and intensity of threats were recorded per visit, enabling a standardized comparison of the effectiveness of on-ground managements across sites. Managed nests experienced higher hatching rates, however, fledgling production appeared equal between unmanaged and managed nests. When site-based threats were accounted for, there was a significant improvement in fledging success for heavily threatened sites that were managed compared to heavily threatened, unmanaged sites. This suggests that on-ground management efforts are effective at reducing human-based threats. We present results which explore threats across regions of Victoria and discuss barriers to effectively conserving beach-nesting birds.

SALTWORKS AS SUITABLE HABITATS FOR SHOREBIRDS: AN OVERVIEW

JOSE A. MASERO

Department of Anatomy, Cell Biology and Zoology. University of Extremadura, Spain.
jamasero@unex.es

Coastal saltworks are man-made hypersaline wetlands used for obtaining salt by evaporation of sea water. This review provides an overview of the role of coastal saltworks as foraging, roosting and breeding habitats for migratory shorebirds. Coastal saltworks support important numbers of shorebirds and other waterbirds around the world. Several studies have shown that saltworks are high-quality foraging and roosting habitats for migratory shorebirds during the non-breeding season, supporting the idea that saltworks are valuable buffer wetlands that may supplement declining natural habitat for many shorebirds. The role of coastal saltworks in providing functional wetlands for non-breeding shorebirds will vary according to several factors, including gradient of salinity, type of exploitation, time of year, and geographical position in the flyways. Within this context it must be noted that these wetlands are hypersaline habitats, so their role as foraging grounds depends on the ability of shorebirds to cope with high salt concentrations. This issue is relevant, especially during the breeding season, because recent studies performed with shorebirds have showed that developing and maintaining an active osmoregulatory machinery is energetically expensive; moreover, the strength of the immune response of small-sized migratory shorebirds is negatively influenced by salinity. Overall, a threat to the value of the present coastal saltworks for shorebirds is the abandonment of the salt production as a consequence of economic constraints. In this sense, the current and new potential uses of saltworks are reviewed, from artisanal fisheries or food products such as 'flower of salt" to ecotourism or microalgae and halobacteria cultures.

THE TRICKY QUESTION OF HOW TO MONITOR THE ECOLOGICAL CHARACTER OF AUSTRALIA'S RAMSAR SITES TO MEASURE UNACCEPTABLE CHANGE

DAVID MILTON*[1], PETER DRISCOLL[2] AND SANDRA HARDING[2]

[1]*Australasian Wader Studies Group, Queensland, Australia*
[2] *Queensland Wader Study Group, Australia*
**david.milton@csiro.au*

Nomination of a wetland as a Ramsar site involves demonstrating that the wetland meets at least one of the eight criteria. Two criteria refer directly to the wetland-dependent birds, including waders – the site must hold > 1% of the population of a migratory species or support > 20,000 wetland-dependent birds. The federal government recently established a process to obtain appropriate criteria by which to identify unacceptable changes to our Ramsar wetlands. These unacceptable ecological change criteria are intended to be used as a trigger for more targeted on-ground management actions to recover and maintain the integrity of the wetland. Bowling Green Bay, about 50 km south of Townsville was nominated and listed as a Ramsar site in 1996. The nomination documented large aggregations of waterbirds within the site, particularly Brolga and Magpie Geese. Wader counts at Cape Bowling Green in the mid-1990s included a large count of Black-tailed Godwit (2,100) and Red-necked Stint (4,500) that exceeded the 1% criteria for both species. I will explore the tricky question of how to identify appropriate criteria for unacceptable change. This will show the critical role of wader count programs by volunteers in monitoring the ecological character of many Ramsar sites.

UNLOCKING SOME OF THE MYSTERIES OF MIGRATION – GEOLOCATORS PROVIDING NEW INSIGHTS OF THE MIGRATION STRATEGIES FOR FOUR SHOREBIRD SPECIES

CLIVE MINTON*, KEN GOSBELL

Australasian Wader Studies Group, Victoria, Australia
**mintons@ozemail.com.au*

During 2009 to 2011, the VWSG and AWSG deployed a number of geolocators on four different species, Ruddy Turnstone, Eastern Curlew and Sanderling in several locations in Southeast Australia and Greater Sand Plover in Broome, northwest Australia. With good retrieval rates on Ruddy Turnstone and Greater Sand Plover, we were able to increase our knowledge of migration strategies for both these species in particular. The northward migration of Ruddy Turnstone was on a narrow path with many birds completing an initial non-stop flight of 7,600 km to Taiwan. Most later staged in the Yellow Sea before locations became indiscernible as birds encountered continuous daylight. The southward migration paths generally showed a much wider spread, ranging from Mongolia to the central Pacific including one of unexpected results was a bird that moved east to the Aleutian Islands before making a long trans Pacific flight in two successive years; a round trip of 27,000 km each year. Several birds have now been tracked for two successive years which provides evidence of repeat strategies. This program has already added to our knowledge of migration pathways, departure dates, return dates and speeds as well as highlighting several conservation issues. The use of the northern Yellow Sea as a stopover for Ruddy Turnstone was a new insight as was the widespread individual strategies of southward migration adopted by this species. We will present information on the migration strategy and timings for Eastern Curlew which breed in sub Arctic regions. In the case of Greater Sand Plovers, we show how the use of the coasts of Vietnam for stopovers was important as they travelled to northern China and Mongolia to breed.

MODELLING WATERBIRD RESPONSES TO ECOLOGICAL CONDITIONS IN THE COORONG, LOWER LAKES, AND MURRAY MOUTH RAMSAR SITE

JODY O'CONNOR, DAN ROGERS, PHIL PISANU

Department for Environment, Water, and Natural Resources, SA, Australia

The Coorong, Lower Lakes and Murray Mouth Ramsar site is ranked as one of Australia's most important wetlands for migratory shorebirds. The site regularly supports over 100,000 waterbirds in summer, when large numbers of international migrants visit to forage on local prey resources. The distribution and abundance of waterbirds at this site is largely regulated by water flows from the River Murray and associated ecological conditions within wetland habitats. Between the early 2000s-2009, prolonged drought and upstream diversion of River Murray water resulted in a cascade of adverse ecological changes in the CLLMM. Water levels in the Lower Lakes fell below sea level, exposing harmful acid-sulphate soils, and salinity in the Coorong South Lagoon increased to >200ppt (modelled natural is 80ppt). These unprecedented conditions had a negative impact on the abundance and distribution of waterbirds as well as the fish, macro invertebrate and plant species that make up much of their diet. In order to better understand the impact of the site's hydrology on the availability of waterbird habitat, we developed Bayesian models that enable managers to predict the consequences of ecological change for waterbirds. These species-specific models characterise cause and effect relationships between habitat components and a particular measure of waterbird habitat. We demonstrate the use of these habitat models as tools for the effective management and conservation of waterbirds.

BANDED STILTS: CROSS-CONTINENTAL MOVEMENTS BY AN EXTREME BOOM-BUST SPECIES

R.D. PEDLER, A.T.D. BENNETT

Centre for Integrative Ecology, Deakin University, Geelong, Victoria 3220, Australia

Banded Stilts are iconic among Australian birds for their classic boom and bust life ecology strategy, which involves them travelling hundreds of kilometres to inland salt lakes following major rainfall events and breeding *en masse* in colonies totalling tens or hundreds of thousands to exploit rich but highly ephemeral food resources. Despite Australian ornithology's fascination with boom and bust and this species in particular, there is very little known about the strategies and cues important to this complex and risky ecological strategy, particularly in view of the threats facing the species from climate change, regulation of inland waterways, toxic waste-water storages and predation at breeding events. Early results from satellite tracking using 5 gram solar-powered tags attached to Banded Stilt at a recent breeding event demonstrate that a large number of inland ephemeral lakes, coastal wetlands and artificial salt fields play an important role as post-breeding stop-over sites for this species. Cross-continental scale movements demonstrate that the degree of interconnectedness between eastern and western Australia is likely to be much greater than previously thought and suggest that regular movements of hundreds of kilometres are commonplace for this species.

A PINCH OF SALT: THE VALUE OF THE COMMERCIAL SALTFIELDS AS SUPRATIDAL HABITATS FOR SHOREBIRDS IN GULF ST VINCENT

CHRIS M. PURNELL

BirdLife Australia, Adelaide Mt Lofty Ranges NRM, SA, Australia

Gulf St Vincent has long been recognised as an internationally significant area for shorebirds, however coastal eutrophication, increased disturbance, mangrove incursion, extreme weather events and sea-level rise threaten to decrease the value of intertidal habitat. Given these threats, population monitoring and mapping of the gulf's supratidal shorebird habitats has become a conservation priority for land managers. In Gulf St Vincent, the most significant supratidal habitat is provided by a series of commercial salt evaporation ponds (salinas) found within Cheetham Salt's Dry Creek operation. Since 1976, 52 species of shorebirds have been recorded in the salt fields, nine of them in international significant numbers (>1% EAA Flyway pop). The predictable manipulation of water depth and salinity used for salt production, create variations in fluvial dynamics and benthic substrates resulting in distinct invertebrate communities that represent reliable yet diverse shorebird habitats. Consequently, the salinas provide both preferential high-tide and supplemental low-tide feeding habitats for a variety of shorebirds species, increasing the number of birds that the region can sustain and reducing the detrimental impacts of the loss of intertidal habitats elsewhere in the gulf.

WATER BIRD MONITORING PROGRAM ALONG CHINA'S COAST IN 2005-2012

BAI QINGQUAN, ZHANG MING, CHEN JIANZHONG, WANG FENGQIN, SHAN KAI, MENG DERONG, HAN YONGXIANG, LI JING*, TONG MENXIU, ZHANG LIN, BO SHUNQI, YANG ZHIDONG, NI GUANGHUI, TANG QINYUAN, YANG JIN, CHEN ZHIHONG, XU ZHIWEI, ZENG XIANGWU, TIAN SUIXING, CHEUNG H.F., FION CHEUNG KA WING, WING KAN VIVIAN FU, YU YAT TUNG

The China Coastal Water-bird Census Team
** Sylvie.jing@gmail.com*

China Coastal Waterbird Census is a program conducted by volunteers with the aim of monitoring the distribution, migration and seasonal changes of waterbirds through monthly surveys along the eastern coast of China mainland. The program covers 15 sites from 11 provinces and Special Administrative Regions (Liaoning, Hebei, Tianjin, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Hong Kong S.A.R. and Hainan) and was started in September 2005. Regular monthly surveys were carried out in 11 sites and all these 11 sites are Important Bird Areas. Survey results provide more information about the migratory birds along the East Asian-Australasian Flyway. Seventy-three species of waterbird reach 1% of East Asian-

Australasian Flyway population in a single site of a single survey. Among them, Eastern Curlew, Asian Dowitcher, Spoon-billed Sandpiper and several other endangered species show different migratory strategies on southward and northward migration and stop over sites selections, for which no previous field data exists. Surveys also reported the great changes of waterbird habitat due to reclamation, invasive plant and economic development, among other things. Two survey reports were published and four training seminars were hold and around 200 volunteers have been participating the survey work in the past seven years.

FEMALES FLY FURTHER - EXTREME DIFFERENTIAL MIGRATION IN THE GREY PLOVER

DANNY ROGERS

340 Ninks Rd, St Andrews, Victoria 3761, Australia
drogers@melbpc.org.au

Grey Plovers (*Pluvialis squatarola*) are widespread long-distance migrants, breeding in arctic tundra and migrating to non-breeding grounds thousands of kilometres to the south. We examined sex ratios in non-breeding populations of Grey Plover, using genetic methods to sex Grey Plovers captured in Australia, and label data to obtain sex-ratios from museum skins worldwide. Remarkably, over 98% of Grey Plovers in Australia proved to be female. The proportion of males in the non-breeding population increased gradually to the north, and the northernmost non-breeding populations of the East Asian – Australasian Flyway are dominated by males. Similar sex skews occur in other migratory flyways of the world, but they may be less strong. Grey Plovers appear to exhibit the strongest differential migration known in migratory waders. I discuss possible reasons, and also consider whether their differential migration increases their vulnerability to habitat loss.

DAMPIER SALT LIMITED - USE OF BIODIVERSITY ACTION PLANNING TO PROTECT MIGRATORY BIRDS

STEVE RUSBRIDGE

Principal Advisor Sustainable Development, Dampier Salt Limited, WA, Australia

Dampier Salt Limited (part of the Rio Tinto Group) produces about 11 Mtpa of solar salt for the global chemical industry from our three salt producing operations at Lake MacLeod, Dampier and Port Hedland in Western Australia's Gascoyne and Pilbara regions. All three sites are identified as important bird areas (IBA's) because of the habitat in and around the operating sites that attract a number of key migratory bird species. This presents both opportunities and threats for the Company. Rio Tinto recognises that conservation and responsible management of biodiversity are important business and societal issues. In 2004 Rio Tinto committed to delivering a net positive impact on biodiversity. Rio Tinto's operations in environmentally sensitive areas are required to develop and implement a biodiversity action plan which aims to leave the area in a better ecological condition when the operation eventually ends. In line with this strategic approach to biodiversity, DSL made the decision to invest in a number of programs supporting migratory birds. This involves committing to a significant research program that would define the relationship between our production ponds and migratory species that utilize them. Beyond this DSL is also engaging with various NGOs to investigate opportunities to invest in the protection of inter-tidal habitats along the East-Asian Australasian Flyway that are vital to the future of the migratory species found at the DSL sites.

TRADITIONAL SALT-PANS VITALLY SUSTAIN SHOREBIRD POPULATIONS IN THE INNER GULF OF THAILAND

SIRIYA SRIPANOMYOM

Independent conservation ecologist, Thailand

The Inner Gulf of Thailand is the country's largest tidal flat known to supports a large number of overwintering shorebirds in Southeast Asia. Nevertheless, supratidal habitats of the area have been heavily destroying and converted for developments. Migratory shorebirds were surveyed at 20 sites covering most of the Inner Gulf during October 2007 – April 2008 and were related with landscape configurations of each site. Sites with salt-pans present in a larger proportion of the total landscape held significantly higher species richness, abundance and diversity of shorebirds, in contrary to sites that the landscape dominated by aquaculture, which shorebirds tends to avoid. Landscapes with a larger proportion of tidal flats accompanying with salt-pans were the best predictors of sites with higher species richness, abundance and diversity. Shorebirds appeared to use salt-pans both roosting sites and supplementary feeding grounds during high tide. Traditional salt-pans therefore contribute significantly support to overwintering shorebird populations in the Inner Gulf of Thailand. Collaboration between researchers, salt farmers and planning authorities in soundly manage salt-pans as shorebird important roost sites are urgently needed. Fortunately, at least public awareness for this area recently commenced.

TRACKING FLYWAY POPULATION TRENDS USING AUSTRALIAN SHOREBIRD 2020 VOLUNTEER SURVEY DATA

DAN WELLER*, GOLO MAURER

BirdLife Australia, Suite 2-05, 60 Leicester St, Carlton, Victoria 3053, Australia
**dan.weller@birdlife.org.au*

BirdLife Australia's *Shorebirds 2020* program commenced in 2007 to reinvigorate the volunteer-driven national shorebird population monitoring program started by the AWSG in 1981, with support from the Australian Government's *Caring for our Country* initiative. The program collates shorebird population count data collected

by a 1400-strong volunteer network at over 150 mapped Shorebird Areas for over three decades in a national online database. Here we present a brief overview of preliminary comparative analyses between national count summary data following the 2011/2012 summer counts, and the last-published count summary data (2009/2010 summer counts), providing an up-to-date perspective of shorebird population trends in Australia, which continue to demonstrate declines in a number of resident and migratory species. The overview highlights an increase in areas counted providing some confidence for population trends deduced from the Shorebirds 2020 dataset, especially for a number of common migratory shorebird species. However, incomplete spatial coverage continues to be an issue, especially in northern Australia, and therefore much uncertainty remains. Our data show that the maintenance of the counter base and the geographic expansion of the Shorebirds 2020 program are crucial in identifying flyway population trends more rapidly and accurately. Improvements relating to a standardised count methodology and streamlined data collection, vetting, and management are required to facilitate effective and timely identification of population trends. Ongoing recruitment of and support for volunteer counters is essential for the Shorebirds 2020 program to continue to guide best-practice management and conservation outcomes for shorebirds across Australia.

HUMAN DIMENTIONS OF MANAGING BEACH-NESTING BIRDS

MICHAEL WESTON, GRAINNE MAGUIRE, KELLY MILLER, MEGHAN CULLEN*, STACEY HENRY, KATHRYN WILLIAMS, ALICE GOUZERH, KIRSTEN YOUNG AND JAMES RIMMER

BirdLife Australia, Suite 2-05, 60 Leicester St, Carlton, Victoria 3053, Australia
**Meghan.cullen@birdlife.org.au*

The breeding success of beach-nesting birds is heavily impacted by human recreation on beaches. Awareness and understanding of threats, and minor adjustments to recreational behavior are required to improve the conservation status of this suite of highly threatened birds. We investigated human attitudes and values regarding three elements of beach-nesting bird conservation through a series of questionnaires and interactions with beach users, using the Hooded Plover as a flagship species: 1) the characteristics people value about beaches; 2) understanding of threats to Hooded Plovers and acceptance of the different management strategies available, and; 3) attitudes toward leashing dogs on beaches. Our results show that beaches were regularly used by coastal residents of south-east Australia and that they value uncrowded, clean beaches with opportunities to view wildlife. Within Victoria, there were high levels of awareness about Hooded Plovers but there was considerable variation in the levels of understanding about mechanisms of threat to breeding birds. Dog owners in particular commonly did not perceive their dog as a threat to beach-nesting birds, and their propensity to leash their dog was subject to how they valued unleashed exercise for their dog's health and social pressures. These findings provide important insight into designing and improving education and awareness campaigns for beach-nesting birds.

Stilt - INSTRUCTIONS TO AUTHORS

Stilt is the journal of the Australasian Wader Studies Group and publishes material on all aspects of waders (shorebirds) of the East Asian-Australasian Flyway and nearby parts of the Pacific region. Authors should send their manuscript by email to the editor at editor@awsg.org.au. Authors are strongly encouraged to consult these instructions in conjunction with the most recent issue of *Stilt* when preparing their manuscripts. Authors are asked to carefully check the final typescript for errors and inconsistencies in order to minimise delays in publication. Authors are also encouraged to seek collegial advice on writing style and English before submitting manuscripts.

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Suitable material submitted before 1st February or 1st August will normally be published in the next issue of *Stilt* in April or October, respectively. Late submissions may be accepted at the editor's discretion.

Submissions should be presented in a Microsoft Word version compatible with Word 2003. Please do not send Windows 7 (*.docx) files as this will delay processing of manuscripts. All contributions, including table and figure captions and references, should be in 11 pt Times New Roman font. Tables should be in 10 pt Times New Roman. Please refer to the most recent version of *Stilt* for table styles. If photographs or grayscale images are to be included, please submit images in one of the following formats: jpg, jpeg, tiff, gif, bmp, pdf, pcx or eps. Figures, photos or other graphics exceeding 2 MB in size should be forwarded as separate files, clearly labelled to enable cross-referencing. Please ensure that photographs are of highest possible quality. Poor quality images will not be accepted.

Stilt publishes research papers, short communications, reports, book reviews, conference abstracts (usually only from the Australasian Shorebird Conference), notifications of AWSG committee matters and state-wide wader group reports. Research papers and short communications are peer-reviewed and authors are welcome to suggest one or more suitable reviewers. Other material will usually be edited only, although reports may receive one or more reviews at the editor's discretion.

RESEARCH PAPERS

Please note at present, *Stilt* does not publish keywords. Research papers should contain the following sections:

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JOHN SMITH[1], STEPHEN BROWN[2] & MAX WELL[3]

[1] 1 Main St., Melbourne 3001 Victoria, AUSTRALIA

[2] Department of Biology, University of Queensland, St Lucia 4068 Qld. AUSTRALIA

[3] Birds Singapore, National University, Jurong N4321 SINGAPORE

ABSTRACT. This will summarise the main findings of the study, preferably in fewer than 200 words.

INTRODUCTION - This should be a short section of about half a journal page to "set the scene" and explain to the reader why the study was important. It should end with a clear definition of the aims of the study.

METHODS. This will describe the methods used in the study in sufficient detail to enable the work to be repeated

RESULTS. The key findings of the study are provided here. Where feasible, data should be presented in figures and/or tables.

DISCUSSION. This section explains the significance of the major results obtained, their relevance to other work, and implications for future research.

ACKNOWLEDGEMENTS. In this section the author(s) should thank others who have contributed to the work. If applicable, ethics committee approvals and funding sources should be detailed.

REFERENCES. This section gives details of all the literature cited in the paper. References should be in alphabetic and chronological order with multi-authored references after single author citations by the same author. Examples of the required format follow:

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

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

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

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

TABLES. There should be no lines in the table except at the top and bottom of the table and below the column headings. All tables should be prepared using the word processing table function and included after the Reference section. Please do not produce tables created as lists using tab stops.

FIGURES. Figures should be placed after Tables. All maps should have a border, distance scale, reference latitude and longitude and/or inset map to enable readers unfamiliar with the area to locate the site in an atlas. Google Maps and Google Earth images will be accepted but are discouraged as they reproduce poorly in print. Line figures are preferred. At their minimum, Google Earth images should retain the Google trademark device and year of image publication.

SHORT COMMUNICATIONS AND REPORTS

These will present material, insufficient for a research paper, on any matters relating to the flyway and the shorebirds in it. They are not usually subdivided like research papers and do not require an abstract. Generally, short communications should be word documents less than 6 pages 1.5-spaced including all tables, figures and photographs.

STILT STYLISTIC MATTERS

The terms "summer" and "winter" should be avoided, if possible. Instead, it is recommended that authors use the terminology "breeding" and "non-breeding". If this is not possible, a clear explanation of the month(s) referred to are necessary. East Asian-Australasian Flyway (**not** East-Asian Australasian Flyway) should be spelt out in full on first mention and then subsequently written as EAAF. Subsequent mention of the EAAF as the flyway should be title case, as in, Flyway. Directions should be lower case and hyphenated, as in "north-west" not "North West". Coordinates should be listed in degrees and minutes, usually with the northing (or southing) first followed by the easting, as in Bagan Serdang (3^{o}42' N, 98^{o}50' E)

OTHER MATTERS

In general, nomenclature of Australian birds should follow **Christidis, L. & W. Boles.** 2008. Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Australia. The first reference to a species in the text should have the scientific name in *italics* after the common name. Where alternative nomenclature is used, the appropriate reference(s) should be clearly cited.

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