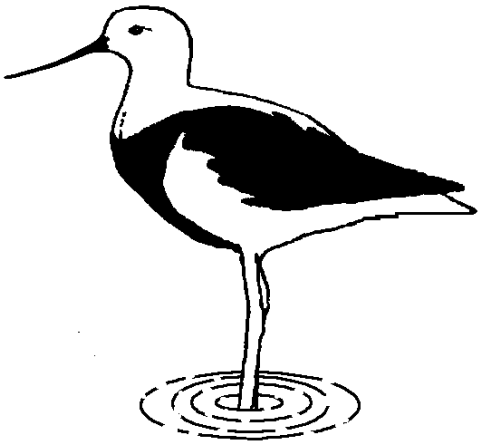
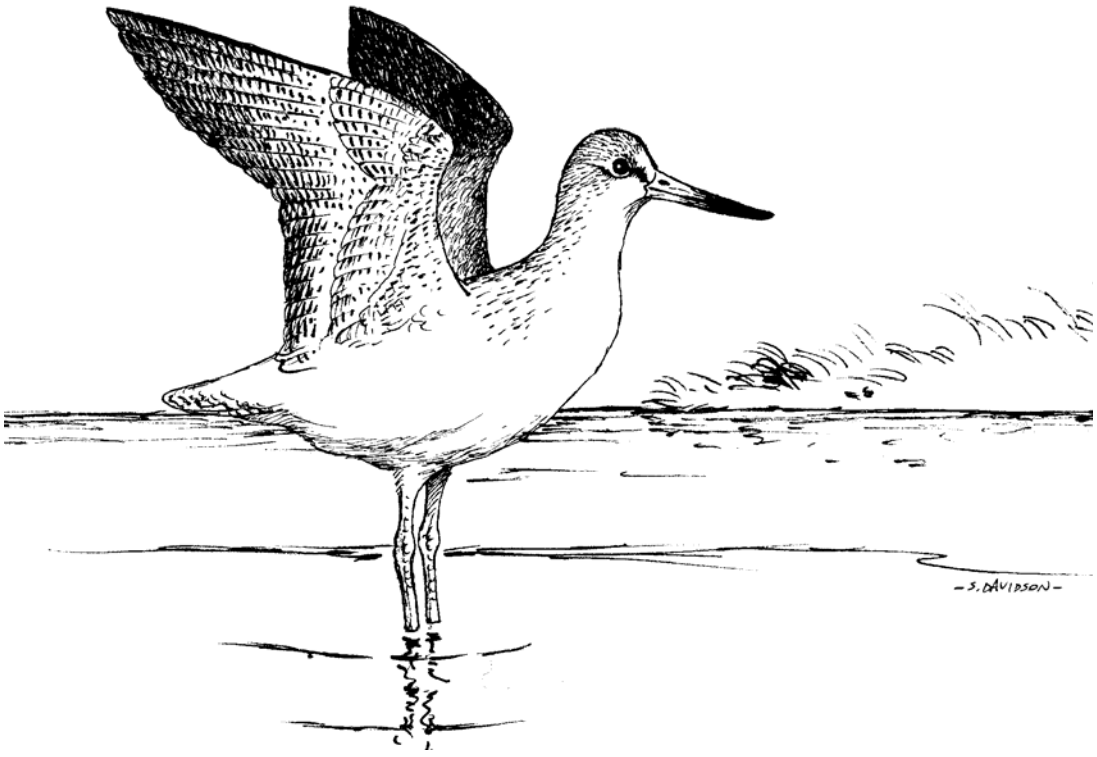
The *Stilt*



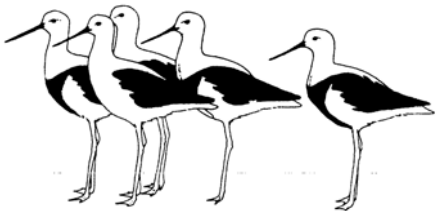
The Bulletin of the East Asian-Australasian Flyway



Australasian Wader Studies Group

A special interest group of Birds Australia

Number 30
April 1997



The Stilt

ISSN 0726-1888

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

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

MEMBERSHIP OF THE AUSTRALASIAN WADER STUDIES GROUP

Membership of the AWSG is open to anyone interested in the conservation and research of waders (shorebirds) in the East Asian-Australasian Flyway. Members receive the twice yearly bulletin *The Stilt*, and the quarterly newsletter *The Tattler*. Please direct all membership enquiries to the Membership Manager at Birds Australia (RAOU) National Office, 415 Riversdale Rd, East Hawthorn, 3122. Vic., AUSTRALIA. Ph: 03-9882 2622, fax: 03-9882 2677. Email: Membership@RAOU.COM.AU

Cover Illustration: Stephen Davidson

EDITORIAL

The last *Stilt*, with its new format and layout, certainly produced a wide range of reactions. Some loved it and some did not! The recent changes are aimed at increasing production quality, while keeping costs down. There were certainly some problems with *Stilt* 29, mostly because of teething problems associated with the new production process. Such a major change in the way the bulletin is produced was bound to bring some headaches. Of course, the editorial team will work to overcome these problems, so that the *Stilt* arriving on your doorstep is of the highest quality. I would encourage written feedback on the new *Stilts* from the membership at large.

We are in the fortunate position of having a backlog of material for *Stilt*. This means that not all material can be published immediately. I would advise contributors to read the *Instructions to Contributors* and *Submission Procedure* carefully before submitting material. This will ensure that submitted material is published quickly. We will try to publish contributions as quickly as possible.

I would like to encourage the submission of papers and short notes on waders from throughout the Flyway. There is a definite bias towards Australian material in *Stilt*. Remember that the *Stilt* is "*The Bulletin of the East Asian-Australasian Flyway*" so go back through your notebooks if you have travelled or live along the Flyway, and write-up something for *Stilt*!

I would like to express my thanks to Andrew Dunn for the many hours he devoted to the last volume, and to the members who sent letters of support. The ongoing financial assistance of Wetlands International and Environment Australia (formerly ANCA) is greatly appreciated.

Michael Weston, *Editor*

CHAIR'S REPORT FOR 1996

Nineteen ninety six was a year of significant achievements for the AWSG, with major events being the Conference on Shorebird Conservation in the Asia-Pacific Region, the largest banding expedition ever held in north-west Australia and the Shorebird Research and Training Workshop in China. Good progress was also made on a number of other fronts.

The Shorebird Conservation Conference was held in Brisbane, Queensland, in mid March, on the weekend prior to the commencement of the Ramsar Conference. The attendance of 145 registrants, including representatives from 15 overseas countries, made all the hard work well worthwhile. The Queensland Wader Study Group deserves particular thanks for their on-ground efforts, especially as they were heavily involved in preparing for the Ramsar Conference. The Conference Summary Statement and paper abstracts have been published in *Stilt*.

The 1996 expedition to north-west Australia, the seventeenth, was the largest and most successful, to date. Eighty-three people from 16 countries participated during the seven week period in March and April. A total of 8135 waders of 29 species were caught, and all were yellow leg-flagged. Comprehensive biometric data was obtained for large samples of many species. Useful additional information was collected on plumages, especially with respect to racial identification, sexing and ageing.

Two AWSG members led a very successful Shorebird Research and Training Workshop (co-organised with the Chinese Bird Banding Centre) from 25 March - 16 April at Chongming Dao, an island in the Yangtze estuary to the north of Shanghai. Fourteen biologists from Chinese wetland reserves and banding stations attended. During the workshop, much useful information was obtained on habitat alteration, disturbance, hunting pressure and arrival masses of waders, especially those flying non-stop from Australia. The data is currently being analysed and written up.

A new, and enlarged, Committee took office from June for a two year period. The restructuring meant that Brenda Murlis (Secretary) and David Henderson (Treasurer) were able to take richly well deserved rests. We all owe them a very large debt of gratitude for their efforts, which date from the very beginnings of the AWSG in the early eighties. Fortunately, they have agreed to stay on the Committee and, thus, their knowledge and experience is still readily available to us.

The Asia-Pacific Migratory Waterbird Strategy (APMWS) was published early in the year, and the most important shorebird-related development that has occurred so far is the launching, at the Ramsar Conference, of the East Asian-Australasian Shorebird Reserve Network with 19 sites in eight countries. A Shorebird Working Group, of which I am honoured to be the interim Chairman, is to be formed during 1997. I attended the first meeting of the Migratory Waterbird Conservation Committee, held in Kuala Lumpur in late November. The Committee is charged with overseeing the implementation of the Strategy. So, wader conservation is being steadily "internationalised", and opportunities for Australian involvement are many.

You will all have noticed the changes in *Stilt* brought about by the new Editor, Mike Weston, and his team. This continuing development and improvement in *Stilt* is important as Wetlands International (WI) is keen for it, and *Tattler*, to become the main means of communication of wader news within the East Asian-Australasian Flyway. WI has already commenced funding the mailing of complimentary copies to wetland

reserve managers, researchers and Government personnel in the Asia-Pacific region.

It is encouraging to see the acceleration in writing up of Australian recovery and banding data. Such information is crucial to the development of soundly-based conservation plans under the APMWS. The recently published papers on Red-necked Stint weights and migration routes are particularly important contributions; as are the updates on the very successful leg-flagging programme, which continues to provide extremely important information on migration routes at a greater rate than band recoveries.

There is much to do in the year ahead. Major tasks are to review our current research programme and modify it, as necessary, in order to support the flyway conservation effort, and development of *Stilt* and *Tattler* to become fully effective flyway publications.

I would like to particularly thank Sandra Harding, the AWSG Conservation Officer, who made a major contribution, through the Wetlands Alliance, to the successful involvement of non-governmental groups at the Ramsar Conference. Much came out of that meeting which needs to be taken up by the AWSG and this will assist considerably in developing the our conservation activities.

Mark Barter, *Chair*

SECRETARY/TREASURER'S REPORT FOR 1996.

Since the last Treasurer's report (*Stilt* 28) major changes have taken place in the structure and membership of the AWSG Committee and the RAOU (Birds Australia) has taken over the day-to-day operation of our membership and financial records.

Because of the upheaval caused by these major changes it is possible that the following figures may contain some minor errors, in particular it is presumed that the RAOU management fee may need to be revised in light of a more accurate figure for membership numbers.

Jeff Campbell, *Secretary/Treasurer*

AUSTRALASIAN WADER STUDY GROUP
CONSOLIDATED ACCOUNTS
As at 31 December 1996

APPORTIONMENT	TOTAL ($Aus.)	DETAILS
Income:		
Subscriptions	7,094	
Contract - ANCA	3,000	
Donations	656	
Interest received	225	
AWSG Conference	14,020	
Sales	1,716	includes $660 at conference
TOTAL INCOME	**26,711**	
Expenditure:		
Conference expenses	11,956	
WSG Subscriptions	558	
WWFN for National Plan Sales	2,193	share of profit from sales
Advertising and promotion	237	AWSG poster
Bank charges	58	
Insurance	456	
Licence	100	Aust. marine conservation society
Australian Wetland Alliance	200	Donation
Cash float	1,000	Brenda Murlis, Secretary
Printing and postage-Tattler	912	
Printing and postage - Stilt	4,587	
Office expenses	1,505	includes committee officers expenses
Travel	202	Sandra Harding, Conservation Officer
Direct Expenses	23,964	
RAOU management fee	330	$1 per member
TOTAL EXPENDITURE	**24,294**	
BALANCE AT YEAR END	**2,417**	
BALANCE FROM LAST YEAR	**11,734**	
CURRENT BALANCE	**14,151**	

POPULATION, STATUS, MOULT, AND MEASUREMENTS OF GREAT KNOT *Calidris tenuirostris* WINTERING IN SOUTH INDIA.

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ABSTRACT

The Great Knot was considered to be rare in South India but was found to be a regular non-breeding winter visitor. It completes the later part of the primary moult in south east India and attains over 50% of breeding plumage before leaving for the breeding grounds. Though it completes the primary moult much earlier than in Australia, the weight during the departure period is much lower than the weight recorded during the same period in Australia.

INTRODUCTION

The Great Knot *Calidris tenuirostris* migrates from Siberian breeding grounds to the Indian subcontinent, south east Asia and Australasia. Much larger numbers than previously suspected are now known to be regular visitors to Australia, especially on the north west and Gulf coasts, and only a scarce migrant in west Indonesia. The majority apparently migrate via the Philippines and New Guinea (Hayman *et al.* 1986). Cramp & Simmons (1983) mention the breeding grounds of the Great Knot are in north east Siberia, and that its distribution as imperfectly known, extending from Verkhoyansk Range to Koryatsk Range. It's non-breeding range extends from Pakistan to southern China and Australia. Barter (1986) estimated about 270,000 Great Knots spend the non-breeding season in Australia. Piersma (1985) counted 1240 in the Nakdong Estuary, South Korea, during September 1984. Ali & Ripley (1983) described its status as a winter visitor as not abundant but not rare on Makran, Sind, Kutch and Kathiawar coasts of India. The species is also recorded from Assam, Calcutta, Madras, Andaman and Laccadive Islands. It is also recorded from Point Calimere (Ali & Hussain 1981), Pulicat Lake (Mohapatra & Rao 1993) and Kaliveli Lake.

This paper provides information on the population, moult, biometrics and weight changes of Great Knot wintering in South India based on birds captured for banding between 1985 and 1988 at Mandapam in the Gulf of Mannar (GOM) area. Subsequently, wintering refers to the non-breeding period (i.e. the northern hemisphere winter).

METHODS

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

Birds were aged as "adults" and "first-years" based on the characters described in the Prater *et al*. (1977). "Adult" refers to birds older than first-years and this category included second-year birds from the first of August onwards. The term "first-year" refers to birds hatched in the same year.

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

Monthly bird counts were carried out to determine the seasonal fluctuation in bird numbers. Though a few migrants started arriving in late August, the netting occurred from September onwards. Hence, each season commenced from September and ended in August. Thus, 1985-86, 1986-87, 1987-88 seasons are subsequently referred to as “first”, “second” and “third” seasons respectively.

STUDY AREA

Two coral islands, namely Manali and Hare islands in the GOM, a lagoon called Pillaimadam on the mainland near Mandapam, and the Dhanushkodi lagoon on Rameswaram Island are the major study areas selected for this study (Figure 1).

RESULTS

Seasonal fluctuation

The birds start arriving in the first week of October and their numbers peak in November. The population declines from December to February, and attains a small numerical peak in March during the return journey. Though the peaks were observed in November and March, a few individuals stay throughout the northern hemisphere winter. The two peaks indicate the presence of a transient population during southward and return migration (Figure 2). During the 1985-86 season the second peak was not noticed. The maximum number was counted at Kundugal Point, near Pamban on Rameswaram Island. The annual population was around 350 for the three seasons.

Age composition

Adults outnumbered first-year birds in each of the three seasons. The percentage of first-year birds was higher in the 1985-86 season (40%) and 22% in the remaining two

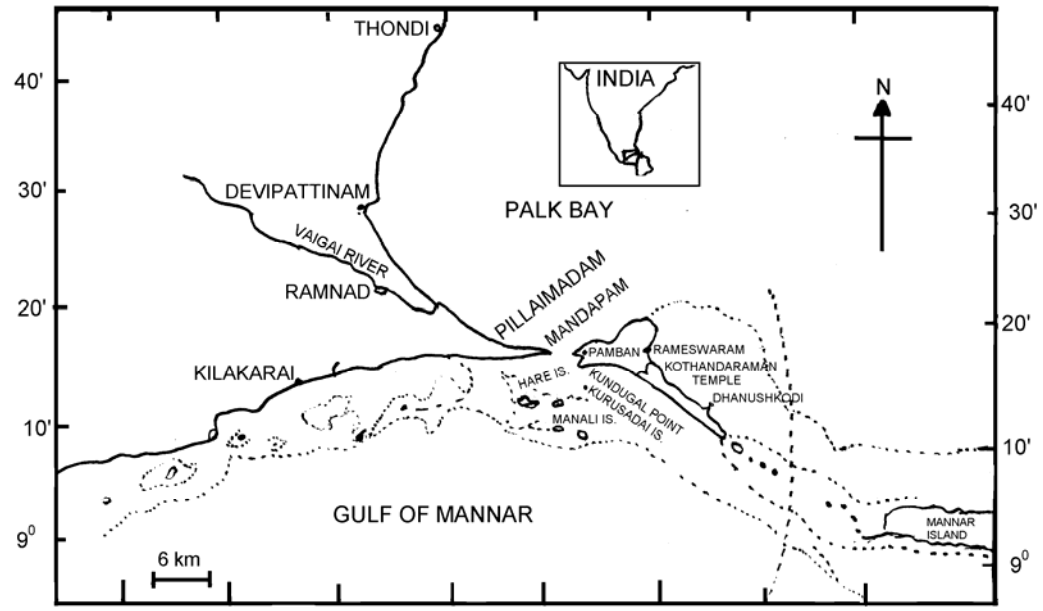

Figure 1. Study area of the marine National Park, Gulf of Mannar.

seasons. The percentages were generated from small sample sizes which varied from 10 to 22 birds.

Moult

The adults start their primary moult elsewhere, either at the breeding grounds or on passage, and complete it at Mandapam by the first week of January. Birds caught immediately after their arrival in October had an advanced moult score. The earliest adult captured (7 October) had a moult score of 25. In Australia the adult Great Knot starts its moult by the end of August or in early September, and the first year birds by late March from 7-8th primaries; 45% of them complete the wing moult by mid April (Barter 1986). A first-year bird caught at Mandapam on 26 March had a moult score of 15 which coincides with the commencement date of moult in Australia. As the sample size was small in the study, the duration of moult was not estimated. Suspended moult was not noticed. Hence, the adult birds leave for the breeding ground with renewed primaries, however most of the first-year birds have old worn primaries, though some have renewed a few inner primaries.

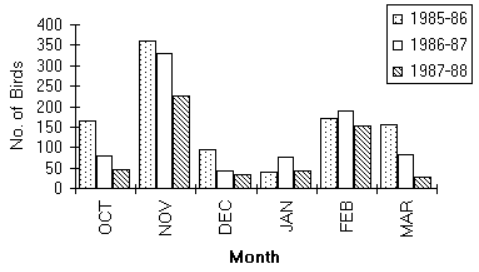

Figure 2. Seasonal fluctuation of *Calidris tenuirostris* in southern India.

Plumage changes

About 50% of the adult birds arrive in the study area with partial post-breeding plumage and retain a trace of it until November. All the birds caught in December and January were in non-breeding plumage. A few adults attained partial pre-breeding plumage from late February. The majority of the birds caught in late March had attained over 50% of their breeding plumage.

Fidelity to wintering sites

At least some site fidelity exists in this species, as demonstrated from the following retrap.

Ring No.	4555
Date of ringing	24.12.85
Place of ringing	Manali Is.
Date of recapture	24.12.86
Place of recapture	Manali Is.

This retrap is interesting as it was retrapped exactly on the same date in the subsequent year. The distance between the place of ringing and retrap was about five kilometres. The percentage of banded birds retrapped in the subsequent year was 10%.

Other recoveries

Birds ringed in Western Australia during the northern winter have been recovered on their spring passage in China, between late March and early May (Lowe 1987). A bird ringed in January 1986 in Australia (Swan Island, Queenscliff, 38°15'S, 144°40'E) was recovered in March

1986 in China (30°47'N, 121°25'E) indicating that the population wintering in Australia is from Eastern Siberia.

Biometrics

The range of the measurements of wing, bill and tarsus recorded in this study vary with those given Ali & Ripley (1983). Adult wing measurements were higher than those of the first-year birds. The biometrics are summarised in Table 1.

Measurements of Great Knot from other sources are given in Table 2.

In this study the tarsus measures 5 mm more than the maximum measurements given by other authors. The difference may be due to the measurement of specimens rather than live specimens.

Weight changes

The average weight increased from October to December and decreased slightly in January. An increase was also noticed in March. The average weight in the month of March was 20% higher than that in October as shown in Table 3.

However, the maximum weight observed during March (212g) was much lower than that observed in Australia (250-270g) by Barter (1986).

DISCUSSION

According to Ali & Ripley (1983) the Great Knot in India is not an abundant winter visitor, but it is also not rare on the Makran, Sind, Kutch and Kathiawar coasts. The annual wintering population of 350 and the ringing total of 53 birds at Mandapam plus 17 at Point Calimere suggests that the Great Knot is a regular winter visitor to the south east coast in small numbers. It is not as rare as suggested by Cramp & Simmons (1983).

The Great Knot is one of the late winter visitors to Mandapam and spends the whole winter in India. Birds appear to be faithful to the wintering site. Before leaving for the breeding ground the adult bird completes the primary moult which starts elsewhere. Though little is known about their breeding range and the migratory routes used between the breeding and wintering grounds, the recovery data compiled by Lowe (1987) clearly indicates that the migratory route of the Great Knot from the only known Siberian breeding ground to Australian wintering grounds is via the Chinese coast and south-east Asia. The birds wintering in India may be from the same population, a small portion taking a diversion from China, and possibly entering India via Mongolia. It is evident that they migrate through the east coast as it was recorded 15 and 10 days earlier at Pulicat Lake and Point Calimere respectively, to the north of Mandapam. Even though it has to overfly large areas to south India, it is not rare there.

Birds wintering in south India weighed much less than those wintering in Australia, which is probably due to the variation in distances being covered during their return journey. This kind of variation in weights between the two wintering sites was also observed in two other waders: Large Sand Plover *Charadrius leschenaultii* and Red Knot *Calidris canutus* (Balachandran In press).

ACKNOWLEDGMENTS

This study was carried out as a part of the Bombay Natural History Society's (BNHS) bird migration study supported

Table 1. Measurements (in mm) of Great Knot in India

Structure	Age	Range	Mean	SD	n
Wing	Adult	179-201	189.8	5.8	32
	1 year	177-192	183.4	3.8	13
Bill	Adult	40-49	44.3	1.96	40
	1 year	43-47	44.8	1.29	13
Tarsus	Adult	33-43	37.4	2.1	39
	1 year	34-43	37.4	1.9	13

Table 2. Published measurements (in mm) of Great Knots.

Wing	Bill	Tarsus	Source	Comment
165-185	39-47	34-38	Ali & Ripley 1983	Measurements of dead birds
181-203 (Adult)	39-47	33-38	Cramp & Simmons	Measurements of dead birds
170-190 (1 year)			1983	
170-203	39-47	32-38	Hayman *et al.* 1986	
175-202 (Adult)	39-50 (Adult)		Barter 1986	Measurements of live birds
170-186 (1 year)	40-48 (1 year)			

Table 3. The average weight (g) of Great Knot (October–March)

Month	Oct.	Nov.	Dec.	Jan.	Mar.
Average weight	143.2	146.4	153	146	170

by U.S. Fish & Wildlife Service under a grant from PL-480 funds No. 14-16-0009-87-02 released through Department of Environment, Wildlife and forests, Government of India. I gratefully acknowledge the permission given to work in the area by the Tamil Nadu Forest Department and the facilities provided by the regional centre of Central Marine Fisheries Research Institute, Mandapam camp. I wish to express my sincere thanks to Mr J.C Daniel, the then Director of BNHS for his guidance and for going through this manuscript.

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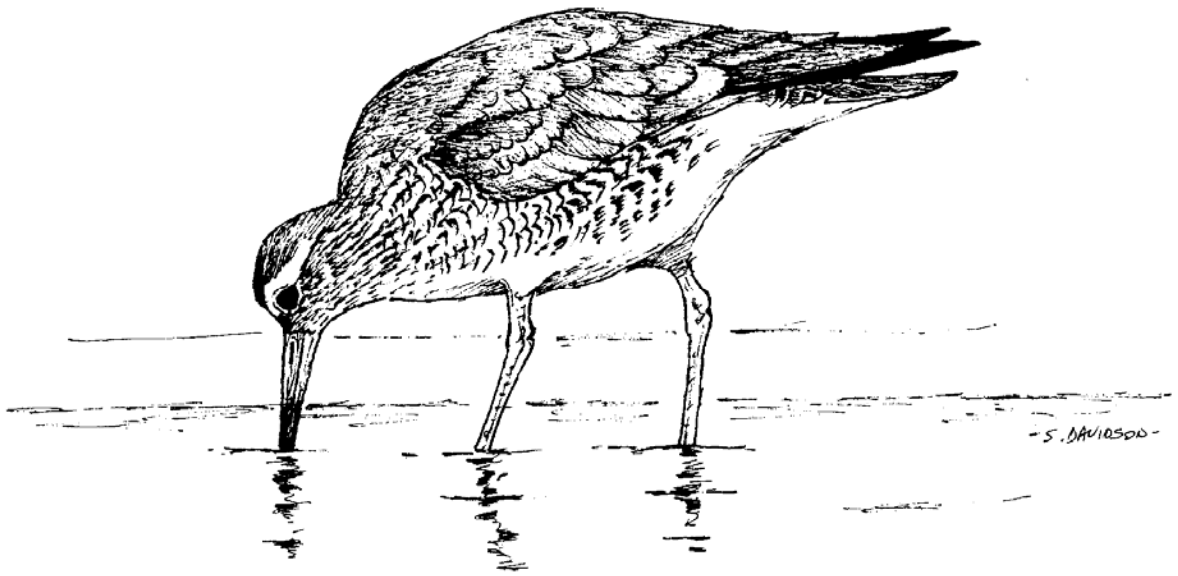

WADER NUMBERS ON CHONGMING DAO, YANGTZE ESTUARY, CHINA, DURING EARLY 1966 NORTHWARD MIGRATION AND THE CONSERVATION IMPLICATIONS.

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

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ABSTRACT

Two comprehensive counts of waders on east Chongming Dao were carried out at the end of March and in mid April 1996. Total numbers counted declined from 24,770 to 10,950 between the two periods. The most common species (Dunlin, Kentish Plover and Great Knot) represented 90%, or more, of the total number on both counts, although the proportion of Dunlin doubled between the counts and those of Kentish Plover and Great Knot halved. The conservation significance of the Yangtze Estuary for waders is discussed.

INTRODUCTION

Chongming Dao, located at 31^0 30'N, 121^0 45'E in the mouth of the Yangtze River, 45 km north east of Shanghai (Figure 1), is an extremely important staging area for a wide variety of migratory waders (Scott 1989).

Scott (1989) reports that up to 10,000 waders have been seen on Chongming Dao at one time and 43 species have been recorded. Counts made in 1990 (Wang & Tang

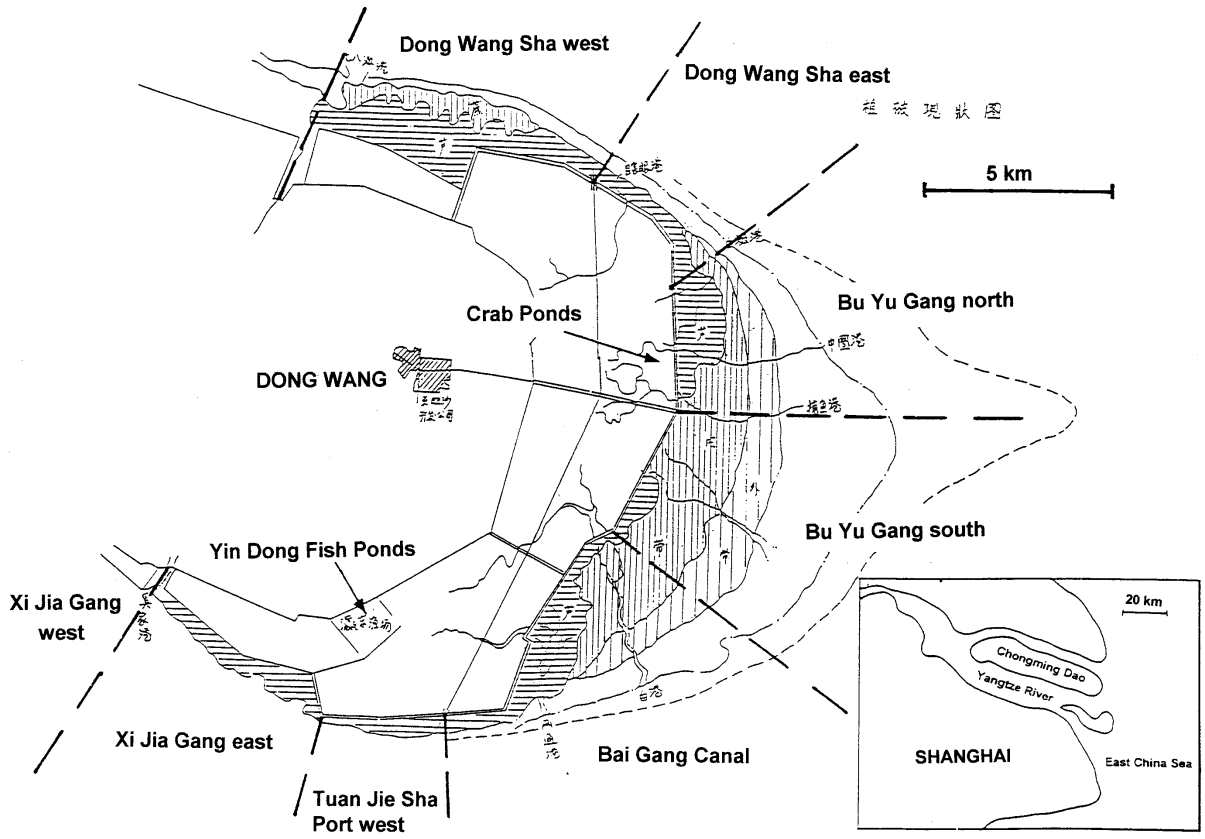

Figure 1. Map of Chongming Dao, showing general location (inset) and count sections.

1990), resulted in 2,148 waders of 27 species being recorded on 13-14 April and 9,519 waders of 32 species on 2 May. The detailed results of the 1990 counts are given in Table 2. A listing of scientific names for waders referred to in this paper is given in Table 1.

Table 1. Common and scientific names of waders referred to in the paper.

Common Name	Scientific Name
Eurasian Woodcock	*Scolopax rusticola*
Common Snipe	*Gallinago gallinago*
Black-tailed Godwit	*Limosa limosa*
Bar-tailed Godwit	*Limosa lapponica*
Little Curlew	*Numenius minutus*
Whimbrel	*Numenius phaeopus*
Eurasian Curlew	*Numenius arquata*
Eastern Curlew	*Numenius madagascariensis*
Spotted Redshank	*Totanus erythropus*
Common Redshank	*Totanus totanus*
Marsh Sandpiper	*Tringa stagnatilis*
Common Greenshank	*Tringa nebularia*
Nordmann's Greenshank	*Tringa guttifer*
Green Sandpiper	*Tringa ochropus*
Wood Sandpiper	*Tringa glareola*
Terek Sandpiper	*Xenus cinereus*
Common Sandpiper	*Actitis hypoleucos*
Grey-tailed Tattler	*Heteroscelus brevipes*
Ruddy Turnstone	*Arenaria interpres*
Asian Dowitcher	*Limnodromus semipalmatus*
Great Knot	*Calidris tenuirostris*
Red Knot	*Calidris canutus*
Sanderling	*Calidris alba*
Red-necked Stint	*Calidris ruficollis*
Temminck's Stint	*Calidris temminckii*
Sharp-tailed Sandpiper	*Calidris acuminata*
Dunlin	*Calidris alpina*
Curlew Sandpiper	*Calidris ferruginea*
Spoon-billed Sandpiper	*Eurynorhynchus pygmaeus*
Eurasian Oystercatcher	*Haematopus ostralegus*
Black-winged Stilt	*Himantopus himantopus*
Pied Avocet	*Recurvirostra avosetta*
Pacific Golden Plover	*Pluvialis fulva*
Grey Plover	*Pluvialis squatarola*
Ringed Plover	*Charadrius hiaticula*
Little Ringed Plover	*Charadrius dubius*
Kentish Plover	*Charadrius alexandrinus*
Lesser Sand Plover	*Charadrius mongolus*
Greater Sand Plover	*Charadrius leschenaultii*
Oriental Plover	*Charadrius asiaticus*
Northern Lapwing	*Vanellus vanellus*
Grey-headed Lapwing	*Vanellus cinereus*
Oriental Pratincole	*Glareola maldivarum*

An opportunity to obtain additional count data occurred during March/April 1996, when the Australasian Wader Studies Group and the National Bird Banding Centre of China ran a co-operative Shorebird Research and Training Workshop on Chongming Dao. Comprehensive counts were made over a seven day period at the end of March, during the preparatory period for the Workshop, and on a single day in mid-April, by the workshop participants.

Observations of wader feeding and roosting behaviour

The coastal habitat used by waders on east Chongming Dao comprises mud flats backed by extensive regions of *Scirpus mariqueter* and *Phragmites communis*. Birds foraged on both the mud flats and in areas of *Scirpus mariqueter*, and did not seem to follow the tide edge as is typical in Australia. The coastal strip, outside the sea wall, varies in width from about 100 metres (e.g. at Xi Jia Gang west) to approximately five kilometres at the far eastern part of the island. Very large areas of suitable feeding habitat were still available on spring high tides. Waders were generally observed feeding and were rarely seen roosting. This behaviour is to be expected when birds are preparing for the next migration stage or have just arrived after a long flight, especially when so much suitable feeding habitat is available at all stages of the tide.

METHODS

The continuous feeding behaviour meant that accurate counting required the whole length and breadth of the coastline to be covered. This is a particularly arduous exercise on the eastern part of the island as the foraging region is intersected by numerous channels, often containing deep mud. We learnt a lot about how to cross such regions safely and became skilled at extracting ourselves from thigh deep mud. The 44 km length of coastline was split up into eight sections (Figure 1).

Seven of these sections (not including Dong Wang Sha west) were surveyed during the 25-31 March period, along with two brackish inland wetlands - Yin Dong fish ponds and the Crab Ponds. These counts were carried out by the authors over a seven day period. During this time counts were made at all stages of the tide. It is possible that some double counting occurred, although it is unlikely to be significant as Bu Yu Gang north and south were counted at the same time, and many of the waders on Bai Gang Canal were located well south of the boundary with Bu Yu Gang south.

In the light of results from the earlier counts and subsequent survey information, the 15 April count concentrated on the five most important sections (Dong Wang Sha west and east, Bu Yu Gang north and south, and Bai Gang Canal). The inland ponds were not counted. The one day count was made possible by the addition of 11 workshop participants allowing the formation of five teams, each with an experienced leader. The count was made from 0900-1500 h, with high tide occurring at 1005 h (3.56 m, i.e. medium height high tide). The wind direction changed from east to south, and strengthened from gentle to moderate, during the count. Light rain occurred late in the count.

Table 2. Count details for 13-14 April and 2 May 1990, adapted from Wang & Tang (1990).

	13-14 APRIL 1990		2 MAY 1990	
	Number	**%**	**Number**	**%**
SPECIES				
Red-necked Stint	636	29.61	2515	26.42
Great Knot	382	17.78	20	0.21
Sharp-tailed Sandpiper	358	16.67	35	0.37
Kentish Plover	125	5.82	214	2.25
Common Greenshank	105	4.89	48	0.50
Bar-tailed Godwit	93	4.33	4	0.04
Greater Sand Plover	90	4.19	481	5.05
Common Redshank	52	2.42	38	0.40
Spotted Redshank	36	1.68		
Whimbrel	35	1.63	196	2.06
Lesser Sand Plover	30	1.40	1790	18.80
Little Ringed Plover	26	1.21	2	0.02
Curlew Sandpiper	19	0.88	71	0.75
Ruddy Turnstone	16	0.74	66	0.69
Marsh Sandpiper	16	0.74	28	0.29
Snipe sp.	11	0.51	5	0.05
Common Sandpiper	6	0.28	24	0.25
Grey Plover	6	0.28	120	1.26
Eurasian Curlew	5	0.23	15	0.16
Woodcock	4	0.19	2	0.02
Eurasian Oystercatcher	4	0.19		
Dunlin	3	0.14	1149	12.07
Eastern Curlew	2	0.09	4	0.04
Terek Sandpiper	2	0.09	1	0.01
Green Sandpiper	2	0.09	1	0.01
Nordmann's Greenshank	2	0.09		
Grey-headed Lapwing	1	0.05	3	0.03
Wood Sandpiper			16	0.17
Grey-tailed Tattler			1	0.01
Asian Dowitcher			5	0.05
Little Curlew			26	0.27
Black-tailed Godwit			60	0.63
Spoon-billed Sandpiper			9	0.09
Red Knot			80	0.84
Black-winged Stilt			11	0.12
Unidentified waders	81	3.77	2479	26.04
TOTAL	**2148**		**9519**	
SPECIES	27		32	

RESULTS

In the late March period, a total of 24,770 waders of 29 species were counted, including 2159 in brackish water habitats (Table 3). Three species, Dunlin, Kentish Plover and Great Knot, accounted for 90% of the total. The east/south-east portion of the coastline supported nearly 90% of the birds present. This dominance can be explained by the fact that the eastern shore of Chongming Dao is the region of highest accretion and, presumably, also has relatively high benthic fauna concentrations due to the high nutrient inflow (Prater 1981).

In mid April, 10,950 waders of 20 species were seen on the five prime sections previously identified (Table 4). On this occasion the combined numbers of the three most common species in the earlier count (Dunlin, Kentish

Table 3. Count details for 25-31 March 1996.

SITE	DWSE	BYGN	BYGS	BGC	TJSPW	XJGE	XJGW	CP	YDFP	TOTAL	%
	25	31	31	30	29	27	26	29	27		
SPECIES	March	March	March	March	March	March	March	March	March		
Dunlin	310	598	3800	4049				260	16	9033	36.47
Kentish Plover	136	663	3640	1804		8	66	134	751	7202	29.08
Great Knot	25	336	5200	200						5761	23.26
Eastern Curlew		379	10	405						794	3.21
Marsh Sandpiper				1				450		451	1.82
Spotted Redshank		1						382		383	1.55
Grey Plover	64	69	116	82		1				332	1.34
Bar-tailed Godwit	6		2	301						309	1.25
Common Greenshank	19	1						30	9	59	0.24
Curlew sp.	55									55	0.22
Greater Sand Plover			50							50	0.20
Red-necked Stint	34		5	6				1		46	0.19
Black-tailed Godwit								40		40	0.16
Common Redshank	2	8		5				20	3	38	0.15
Little Ringed Plover							5	2	22	29	0.12
Snipe sp.			3		1	4	7	2	5	22	0.09
Common Sandpiper					3	3		14	1	21	0.08
Eurasian Curlew		7		6						13	0.05
Wood Sandpiper									5	5	0.02
Red Knot			4							4	0.02
Black-winged Stilt								4		4	0.02
Pied Avocet								4		4	0.02
Whimbrel		4								4	0.02
Curlew Sandpiper								2		2	0.01
Pacific Golden Plover	1									1	<0.01
Ringed Plover							1			1	<0.01
Green Sandpiper								1		1	<0.01
Eurasian Oystercatcher	1									1	<0.01
Grey-headed Lapwing									1	1	<0.01
Unidentified waders	74						30			104	0.42
TOTALS	**727**	**2066**	**12830**	**6859**	**4**	**16**	**109**	**1346**	**813**	**24770**	
%	2.9	8.3	51.8	27.7	<0.01	0.1	0.4	5.4	3.3		
SPECIES	11	10	10	10	2	4	4	15	9	29	

Key: DWSE = Dong Wa Sha east; BYGN = Bu Yu Gang north; BYGS = Bu Yu Gang south; BGC = Bai Gang Canal; TJSPW = Tuan Jie Sha Port west; XJGE = Xi Jia Gang east; XJGW = Xi Jia Gang west; CP = Crab Ponds; YDFP = Ying Dong fish ponds

Table 4. Count details for 15 April 1996.

SITE SPECIES	DWSW	DWSE	BYGN	BYGS	BGC	TOTAL	%
Dunlin	1112		6600	10	48	7770	70.96
Kentish Plover	222	11	1060	11	12	1316	12.02
Great Knot	227	192	820	11	12	1262	11.53
Grey Plover	169		3	1	32	205	1.87
Eastern Curlew	35	15	24	1	46	121	1.11
Bar-tailed Godwit	11	27	44	11		93	0.85
Red-necked Stint	40					40	0.37
Sharp-tailed Sandpiper	20					20	0.18
Common Greenshank	9	6			2	17	0.16
Common Redshank	2			3	8	13	0.12
Snipe sp.	1	1	5	4	2	13	0.12
Red Knot		4	7		1	12	0.11
Whimbrel	5			2	3	10	0.09
Greater Sand Plover	5				2	7	0.06
Marsh Sandpiper					5	5	0.05
Spotted Redshank	1			1	1	3	0.03
Eurasian Curlew	1		2			3	0.03
Curlew Sandpiper	1					1	0.01
Little Ringed Plover	1					1	0.01
Ruddy Turnstone					1	1	0.01
Unidentified waders		20		17		37	0.3
TOTALS	**1862**	**276**	**8565**	**72**	**175**	**10950**	
%	17.0	2.5	78.2	0.7	1.6		
SPECIES	17	7	9	10	14	20	

Key: DWSW = Dong Wa Sha west; remainder as in Table 3.

Plover and Great Knot) had increased to almost 95% of the total, whilst the three east/south-east sections accounted for a little over 80% of the birds counted. Dong Wang Sha west, which was not included in the first count, contained 1,862 waders which represented 17% of the total.

Comparison of the two counts (Table 5), in which only the four sections common to both have been considered (i.e. Dong Wang Sha east, Bu Yu Gang north & south, and Bai Gang Canal), indicates that the number of waders present had declined by 60% between end-March and mid-April. Although the three most common species represented 90%, or more, of the total in both counts, the proportion of Dunlin had doubled, whilst those of Kentish Plover and Great Knot had both halved by mid-April. The decline in numbers was least for Dunlin (24%), whilst those for Kentish Plover, Great Knot, Eastern Curlew and Grey Plover were large (i.e. > 80%), indicating that a majority of the latter four species had left Chongming Dao.

The results of the 1996 counts are very different to those obtained in mid-April 1990 (Table 2), both in respect to numbers and species composition. In percentage terms, Red-necked Stint and Sharp-tailed Sandpipers were far more common in 1990, whilst Dunlin and Kentish Plovers were noticeably absent.

Early migrants from Australia, such as Great Knot, Eastern Curlew and Grey Plover, are well represented in the 1996 counts. Bar-tailed Godwit, for which the main departure from north-west Australia commences late in the first week of April (Barter 1996), were, understandably, present only in small numbers. The main passage of many other species, e.g. Sharp-tailed Sandpiper, Red Knot, Lesser Sand Plover, Terek Sandpiper, Curlew Sandpiper and Red-necked Stint, does not commence until mid April, or later (Wang & Qian 1988), and this is reflected in the low numbers of these recorded in both counts in 1996.

DISCUSSION

The great importance of Chongming Dao for migratory waders has been confirmed by the 1996 counts. Elsewhere (Barter *et al.* 1997), it has been suggested that at least three species (Great Knot, Red Knot and Bar-tailed Godwit) are spending little time on Chongming Dao following arrival. This implies a fast turnover rate, which in turn means that the total number of individual waders supported at some stage during northward migration greatly exceeds the maximum count of 24,770.

Table 5. Comparison of the two 1996 counts.

	25-31 March		15 April	
	Number	**%**	**Number**	**%**
SPECIES				
Dunlin	8757	38.95	6658	73.26
Kentish Plover	6243	27.77	1094	12.04
Great Knot	5761	25.62	1035	11.39
Eastern Curlew	794	3.53	86	0.95
Grey Plover	331	1.47	36	0.40
Bar-tailed Godwit	309	1.37	82	0.90
Curlew sp.	55	0.24		
Greater Sand Plover	50	0.22	2	0.02
Red-necked Stint	45	0.20		
Common Greenshank	20	0.09	8	0.09
Common Redshank	15	0.07	11	0.12
Eurasian Curlew	13	0.06	2	0.02
Whimbrel	4	0.02	5	0.06
Red Knot	4	0.05	12	0.13
Snipe sp.	3	0.01	12	0.13
Eurasian Oystercatcher	1	<0.01		
Spotted Redshank	1	<0.01	2	0.02
Pacific Golden Plover	1	<0.01		
Marsh Sandpiper	1	<0.01	5	0.06
Ruddy Turnstone			1	0.01
Unidentified waders	74	0.33	37	0.40
TOTALS	**22482**		**9088**	
SPECIES	19		16	

A figure well in excess of 100,000 is certainly not an unreasonable estimate.

The full significance of Chongming Dao for migratory waders can only be completely established when numbers of birds passing through on southward migration and those remaining during the non-breeding season are included. It is possible that Chongming Dao supports more than 250,000 individual waders at some time during their annual life cycles; say, 150,000 during northward migration, 75,000 during the less important southward migration (Qian & Cui 1988, Tang & Wang 1991) and 25,000 during the remainder of the non-breeding season. This total represents approximately 5% of the migratory waders in the East Asian - Australasian Flyway. The island is also an important staging site for threatened species, such as the Spoon-billed Sandpiper, Nordmann's Greenshank and Asian Dowitcher (Scott 1989).

The critical importance of the Yangtze estuary for wader conservation is further confirmed by a report of the presence of 160,000 - 200,000 waders on the island of Jiuduansha, located just to east of Shanghai, in late March 1996 (Lu Jian Jian pers. comm.).

The major concentrations of waders on Chongming Dao occur in areas heavily disturbed by eeling, crab digging, shell fishing, buffalo grazing, reed cutting, etc.; these areas are also suffering from substantial ongoing reclamation (Tonkinson in prep.).

The everchanging morphology of islands, actual or incipient, in the Yangtze estuary, and the high disturbance levels, mean that effective conservation can only be achieved by an holistic approach involving the sustainable use of all wetland areas in the region.

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Our thanks are due to the other workshop participants for their dedication in developing the identification and counting skills which allowed a successful single day count to be made in mid April.

The Dong Wang Hotel assisted greatly with transport arrangements for both counts and in supplying copious quantities of food to sustain counters during and after the counts. The hotel staff also deserve our sympathy for having to put up with returning muddy counters.

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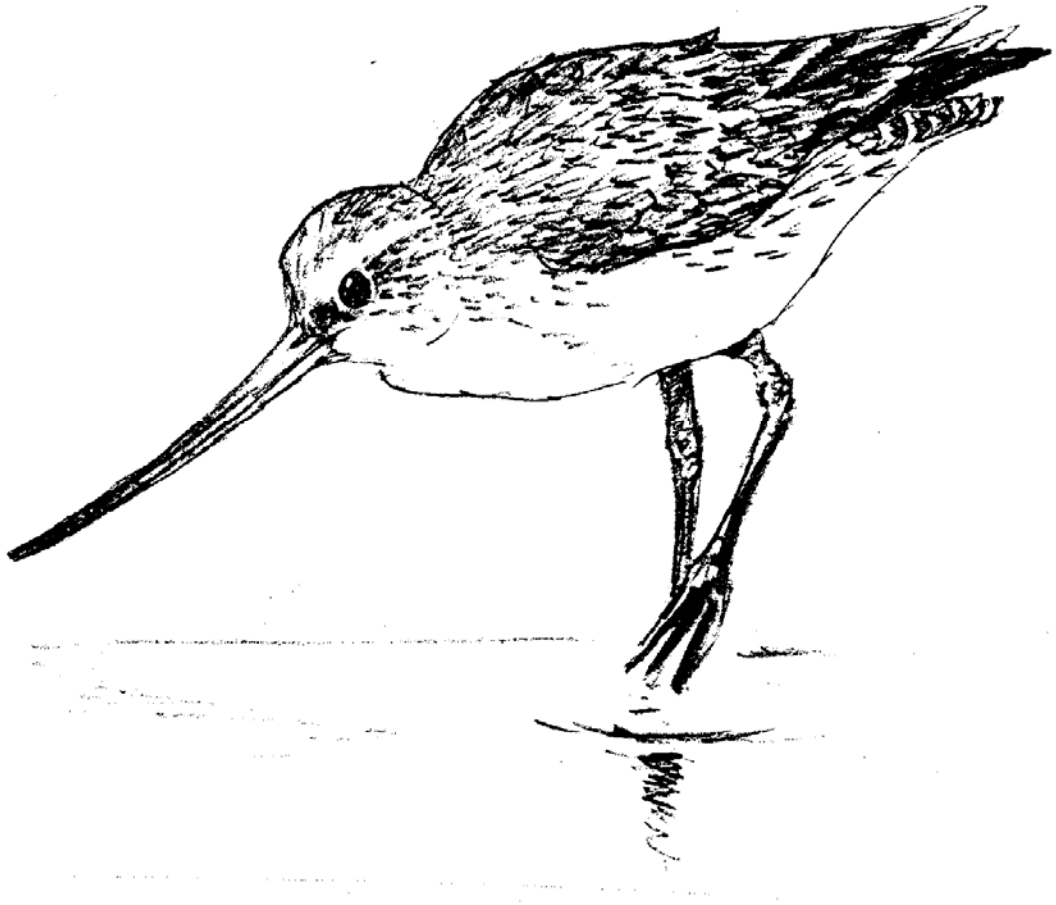

THE EASTERN CURLEW *Numenius madagascariensis* IN KAMCHATKA, RUSSIA

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ABSTRACT

This paper presents information on Eastern Curlew migration, breeding, diet and conservation in the Kamchatka region of eastern Russia. The data has been collected for over 20 years, and includes data generated during studies of waterfowl.

INTRODUCTION

The Eastern Curlew (*Numenius madagascariensis*) of Kamchatka is an isolated part of the far east Russian breeding population. It is separated from the main population by the Sea of Okhotsk. The Eastern Curlew breed in the main part of the Kamchatka Peninsula and south part of Koriaksky Upland. The most northerly nesting points are Geka Bay and the lower basin of Apuka River at 60°30'N, 169°40' (Portenko 1964, Firsova & Levada 1982, Lobkov 1986).

METHODS

Data on Eastern Curlew have been collected in Kamchatka for more than 20 years. Before 1990 information about spring migration was collected jointly with counts of Anatidae, which began in 1975. In 1990-1994, special spring counts of migrating shorebirds were conducted at the mouths of Moroshechnaya (56°50'N, 156°10'E), Vachil (53°15'N, 159°38'E), Bolshaya (62°32'N, 156°17'E) and Opala (52°00'N, 156°30'E) Rivers. The breeding information was mainly collected in the Paratunka River Valley (52°57'N, 158°17'E) in 1992 and 1993.

RESULTS

In this paper, autumn and winter refer to boreal autumn. and winter respectively.

Northern migration

The spring migration took place in May each year. Arrival of the first Eastern Curlews in south-west Kamchatka was recorded on 7 May 1993 (Mouth of Bolshaya River) and 7 May 1994 (Mouth of Opala River).

At the mouth of the Opala River, active migration took place 16-18 May 1982 and 21-24 May 1994; in total 552 Eastern Curlews were counted in 1994, the largest flocks having 56 and 60 individuals. At the mouth of the Bolshaya River active migration was observed on 23 May 1980 and 17-19 May 1993.

Long-term information about spring migration was collected during vast waterfowl migration studies conducted in the mouth of Moroshechnaya River (north-west Kamchatka) between 1974 and 1990. Arrival dates of Eastern Curlews were recorded: 10 May 1977 and 1989; 12 May 1976, 1979 and 1980; 13 May 1974 and 1983; 14 May 1975. The period of active migration took place from 14-18 May 1975 to 22-26 May 1977. The highest number of birds counted was in 1976, when 223 were seen.

At the Mouth of Vachil River (south-east Kamchatka) arrival of Eastern Curlews were recorded on 10 May 1991 and 7 May 1992. In the first observation year, the period of active migration was on 15-22 May, when 434 birds were counted. The next year, active migration took place on 18-21 May, when 216 birds were counted.

Breeding

Soon after arriving Eastern Curlews occupy nesting areas. Each pair protects the individual nesting area until the chicks hatch, but the intensity of defence decreases during the hatching period. Display flights of males are the most noticeable element of the breeding behaviour. Birds often display in the morning and especially in the evening.

In the south part of Kamchatka, egg laying takes place in late May. Six nests were found in the Paratunka River Valley in 1992 and 1993. All of them were located in a gull and tern colony (Common Black-headed Gull *Larus ridibundus*, Common Tern *Sterna hirundo* and Aleutian Tern *S. aleutica*). The habitat was a typical wetland of the type found in south-east Kamchatka. The plant community in this habitat consists mainly of *Myrica tomentosa*, *Carex* spp. and mosses.

The nests were situated on the same type of moss tussock. The diameter of nests ranged 190-220 mm, and averaged 203.3 (SE=5.6; n=6). Nest depths were 60-100 mm, with an average of 70.8 (SE=6.6; n=6). A clutch has four eggs, olive-brown or olive-green in colour with dark-brown spots. Normal egg size ranges 66.5-74.2 x 45.3- 49.1 mm, and averages 70.32±0.62 x 47.55±0.23

(SE; n=18). In one nest two eggs were 62.2 x 46.7 and 63.2 x 46.6 mm i.e. much shorter than usual. Both males and females incubate eggs and stay together with broods.

Crows *Corvus corone* were driven from Curlew nest sites very often. Crows caused serious damage to breeding waterfowl, nevertheless we did not find any case of Crow damage to Eastern Curlew nests in spite of numerous attacks by the crows. Nests were predated by dogs *Canis familiaris* which made regular raids from the nearest village to the river valley.

Chicks appear in the last third of June (24-26 June in the case of our observations). In late clutches, hatching takes place in early July (Lobkov 1986). The process of hatching is rather long. About four days are necessary for hatching after the first appearance of shell cracks.

The chicks appearance excite the parents, who become very agitated. During this period we observed a return to nest building activity. Two hours before the first chicks hatched out, the male, which was on the nest, began picking grass around the nest and laying it around. The male became rather carried away with the activity, and left the nest to continue collecting building material.

Chicks break free of the shell without the help of the parents. The egg shells stay in the nest. The weight of newly hatched chicks is 50.4-66.3 g, with an average of 57.57g (SE=2.34; n=7). The brood leaves the nest some hours after hatching, and stay nearby.

Some unmated birds flocks inhabit nesting sites during the breeding period. Formation of the first large feeding or resting flocks takes place in first half of July. Near the town of Kluchi (Central Kamchatka; 56°20'N, 160°50'E) a flock of 60 Eastern Curlews was observed on 20 July 1982. The most important place for summer concentration of this species is in the Moroshechnaya Estuary. Thus, on 9 July 1984 we counted about 170 feeding Eastern Curlew on a 3 km section of the estuary. Approximately the same number was observed again two weeks later. Obviously, they were not breeding birds.

Southern migration

The autumn migration starts in north-west Kamchatka in early August, the latest Eastern Curlews were observed at the Moroshechnaya Estuary 10 September 1972. In the mouth of the Kambalnaya River (south Kamchatka; 51°10'N, 156°44'E) we noted the first migrant birds on 8 August 1992. In Zupanova lagoon (south-east Kamchatka; 53°38'N, 159°53'E) we observed the autumn migration from 2 to 16 September 1993. The latest registrations of Eastern Curlews in Kamchatka took place in late September - early October (Lobkov 1986).

Diet

Stomach contents of Eastern Curlew which were shot were shells of Bivalvia and Gastropoda, Oligohaetae, bones of fish, and different parts of plants. In August - September, berries are very important food, especially *Empetrum nigrum*.

Conservation

During the last 20-30 years, numbers of Eastern Curlew in Kamchatka have been decreasing. Hunting is the main reason, and may be sole threat for this species in Kamchatka. The Eastern Curlew was a favourite game-species for waterfowl hunters before 1976, after which a ban on shooting them was implemented. However, changes to hunting regulations in 1989 reinstated this species as a game bird. Inclusion of the Eastern Curlew in the new Red Data Book of Russia will once again guarantee protection of this species, at least from legal hunting.

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A FIFTEEN MONTH SURVEY OF WADER AND TERN NUMBERS FROM CORIO BAY, CENTRAL QUEENSLAND, AUSTRALIA.

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ABSTRACT

Wader and tern counts are presented for a high tide roost at Sandy Point, Corio Bay, Central Queensland. Eighteen observations were made at spring tides at monthly (and sometimes fortnightly) intervals over a fifteen month period. Over 15,000 waders (26 species) and 10,000 terns (7 species) were observed during this period. Most species were highly seasonal in occurrence. Regional comparisons showed that in Central Queensland, Corio Bay supported the highest single counts of Red-necked Stint, Red-capped Plover, Sanderling, Double-banded Plover and Little Tern and the second highest counts for Lesser Sand Plover, Sharp-tailed Sandpiper and Beach Thick-knee. Three species were of conservation significance - Eastern Curlew, Little Tern and Beach Thick-knee. The potential for disturbance by off-road vehicles is discussed. Corio Bay was found to support nationally significant numbers of Whimbrel and Terek Sandpiper and internationally significant numbers of Lesser Sand Plover and Eastern Curlew. These findings support its listing as a Ramsar site.

INTRODUCTION

The tidal portion of Corio Bay has recently been nominated, along with Shoalwater Bay, as a Ramsar site (i.e. a wetland of international significance). It is also recognised as a wetland of national importance (ANCA 1996) and at the State Government level as a Fish Habitat Reserve and Marine Park. Data available for management of this important wetland habitat, however, is limited to inventories of fauna and flora (Habitat 1975) and incidental observations on shorebirds (Driscoll 1995). Published information on shorebirds in the region include a study of Pied Oystercatcher *Haematopus longirostris* movements in Keppel Bay (Wilson 1994), anecdotal observations (Crawford 1992) and shorebird species' inventories for the Curtis Coast (QDEH 1994) and Capricornia coast (Crawford 1993).

This study was aimed at documenting species composition and abundance of wader and tern species at Sandy Point, Corio Bay, over a 15 month period (from March 1995 to early May 1996). Such information will contribute to the database upon which proper management of this Ramsar nominated wetland is dependent. This information will also contribute to a wider understanding of the habitat requirements of shorebirds and terns in central Queensland.

STUDY SITE

Corio Bay is a moderately sized, shallow embayment which is mostly less than 5 m deep (ANCA 1996). It lies approximately 50 km north-east of Rockhampton in Central Queensland (Figure 1). Other important wader habitats in the region include Shoalwater Bay and Port Clinton to the north, and to the south, the mouth of the Fitzroy River, the Narrows, Port Curtis and Rodds Bay.

Corio Bay lies just north of the Tropic of Capricorn and the region experiences a subtropical maritime climate (QDEH 1994). The area receives an annual rainfall averaging between 1338mm at Yeppoon, to the south of Corio Bay, and 1731mm at Parnass Vale to the north (Habitat 1975). Rainfall is markedly seasonal with the wettest months being January and February and the driest months August and September. Evaporation rates match rainfall levels with an annual evaporation rate of 1377mm recorded for Yeppoon (Habitat 1975).

The tidal range is high with a maximum tidal range of 5.1 m (ANCA 1996). Maximum tidal events occur in the summer months during which time the diurnal high tides exceed the nocturnal high tides. The situation is reversed in winter.

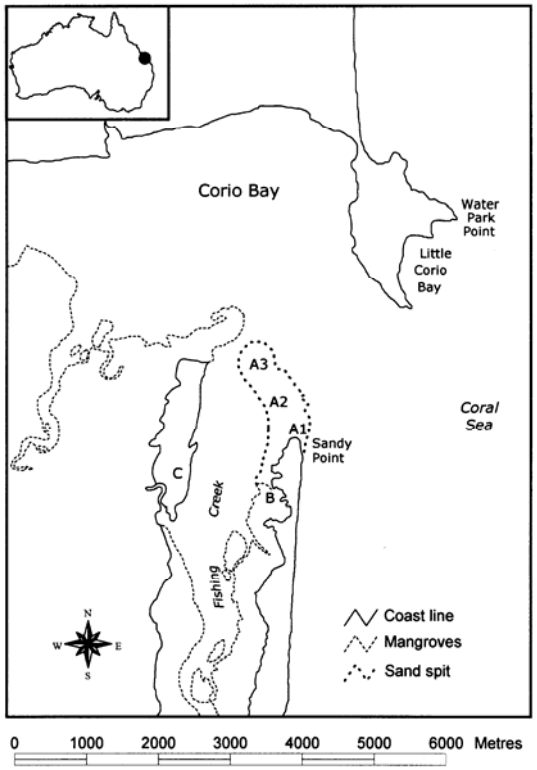

Figure 1: Map of Sandy Point Showing Location of Roosting Sites.

The bay is bordered by an extensive margin of mangroves (30km^2 - Dowling & McDonald 1982), particularly in association with tidal creeks. Water Park Creek represents the main freshwater input into the bay. A feature of this system is the marine plains forming extensive tidal and freshwater pastures in the upper reaches of the small creeks. Bare tidal saltflats are less extensive in Corio Bay than elsewhere in Central Queensland. Within the bay, extensive areas of sandflats are exposed at low tide.

The marine plains associated with Sandfly, Deep and Fishing Creeks have been altered by the construction of bund walls to entrap the diffuse freshwater flows emanating from these creeks as they reach the marine plains. In association with water supply requirements for resort and township development, small weirs and groundwater extraction also diminish freshwater flows into the bay. A small amount of grazing occurs on the pastures of the marine plains.

On the southern side of the bay, between the ocean beach and the mouth of Fishing Creek, lies a northerly directed sandspit - Sandy Point (Figure 1). Preliminary observations indicated that this was the main sandspit area available in Corio Bay for roosting by shorebirds on spring high tides and it was selected as a study site. This site is bounded on the east by an ocean beach, to the south by low dunes and associated strand vegetation, to the west by a sheltered beach and to the south-west by saltmarshes and mangroves bordering Fishing Creek. As such, a number of potential roosting sites for shorebirds are encompassed by the site, making it particularly valuable as a wader roosting area.

METHODS

Between March 1995 and May 1996, observations were made during morning spring high tides at monthly (and in a few months, fortnightly) intervals (Table 1). The only exception was April 1996 when it was not possible to survey the site due to unfavourable weather conditions. Instead a count was made in early May. Height of spring high tides ranged from 3.7m to 4.7m. Kowa spotting scopes (x25 and x30 lenses) were used to count and identify waders. Generally, observation times ranged between two and four hours. Every effort was made to ensure waders were not disturbed by our activities.

Preliminary observations identified three main areas as preferred roosting sites for waders: **1.** the sandspit itself (sites A1, A2 and A3 in Figure 1); **2.** a small area of saltmarsh, mangrove shrub and sheltered beach (site B in Figure 1); and **3.** a narrow beach on the western shore of Fishing Creek (site C, Figure 1). The sandspit was further subdivided into A1 representing the southern end of the sandspit bordering low dunes and including a small portion of ocean beach; A2 representing the central and sheltered western beach of the sandspit; and A3 representing the northern extremity including a rise which forms an island during extreme spring high tides. The latter area was observed to support only a few waders except during these extreme high tide events. Its isolation by tidal waters at this time and its distance from accessible shorelines precluded identifications of roosting waders. Fortunately, such problems occurred only on tides in excess of 4.5m and affected only two counts (January and February, 1996).

RESULTS

Species composition and abundance

Table 2 shows species composition, the total numbers for each species over the study period (i.e. the summation of all counts) plus the average count and the maximum single count for each species over the study period.

In all, twenty-six species of waders and seven tern species were recorded during the study. The number of wader species ranged from eight in May and August 1995 to twenty in November 1995.

Most abundant wader species were Lesser Sand Plover *Charadrius mongolus*, Red-necked Stint *Calidris ruficollis*, Eastern Curlew *Numenius madagascariensis*, Red-capped Plover *Charadrius ruficapillus*, Terek Sandpiper *Xenus cinereus*, Whimbrel *Numenius phaeopus* and Bar-tailed Godwit *Limosa lapponica*. Of the terns, Crested *Sterna bergii*, Little *S. albifrons*, Common *S. hirundo* and Gull-billed Tern *S. nilotica* were the most abundant.

Table 1: Count dates and tidal information for those dates.

Date of Count	High Tide Height (m)	Time of High Tide
14.3.95	4.08	0729
28.3.95	4.17	0734
13.4.95	4.10	0733
28.4.95	3.78	0822
13.5.95	3.96	0747
12.6.95	3.75	0817
12.7.95	3.72	0858
11.8.95	3.84	0930
8.9.95	3.85	0829
25.9.95	3.94	0923
28.10.95	4.02	1203
9.11.95	4.00	1005
25.11.95	4.44	1100
9.12.95	4.03	1015
21.1.96	4.73	0945
17.2.96	4.50	0800
17.3.96	4.36	0743
3.5.96	3.88	0858

Table 2: Species Composition and abundance (total, mean and maximum single count) for 15 month period at Sandy Point, Corio Bay, Queensland.

Common Name	Scientific Name	Total	Mean per Count (n=18)	Standard Deviation	Maximum Single Count
Bar-tailed Godwit	*Limosa lapponica*	438	24.3	21.06	70
Beach Thick-knee	*Esacus magnirostris*	17	0.9	1.43	5
Black-winged Stilt	*Himanotopus himanotopus*	2	0.1	0.47	2
Common Greenshank	*Tringa nebularia*	76	4.2	6.18	18
Curlew Sandpiper	*Calidris ferruginea*	139	7.7	13.48	50
Double-banded Plover	*Charadrius bicinctus*	87	4.8	12.39	45
Eastern Curlew	*Numenius madagascariensis*	2095	116.4	73.93	350
Great Knot	*Calidris tenuirostris*	1	0.1	0.24	1
Greater Sand Plover	*Charadrius leschenaultii*	146	8.1	10.30	30
Grey Plover	*Pluvialis squatarola*	14	0.8	1.22	4
Grey-tailed Tattler	*Heteroscelis brevipes*	141	7.8	23.64	100
Lesser Sand Plover	*Charadrius mongolus*	5114	284.1	255.38	750
Marsh Sandpiper	*Tringa stagnatilis*	2	0.1	0.47	2
Masked Lapwing	*Vanellus miles*	7	0.4	0.78	2
Oriental Plover	*Charadrius veredus*	1	0.1	0.24	1
Pacific Golden Plover	*Pluvialis dominica*	132	7.3	9.42	30
Pied Oystercatcher	*Haematopus longirostris*	87	4.8	2.77	10
Red Knot	*Calidris canutus*	1	0.1	0.24	1
Red-capped Plover	*Charadrius ruficapillus*	1338	74.3	55.61	250
Red-necked Stint	*Calidris ruficollis*	3635	201.9	373.68	1550
Ruddy Turnstone	*Arenaria interpres*	49	2.7	3.59	10
Sanderling	*Calidris alba*	39	2.2	5.11	20
Sharp-tailed Sandpiper	*Calidris acuminata*	159	8.8	17.96	60
Terek Sandpiper	*Xenus cinereus*	477	26.5	59.65	200
Wandering Tattler	*Heteroscelis incana*	10	0.6	2.36	10
Whimbrel	*Numenius phaeopus*	466	25.9	32.34	100
Unidentified Waders		1250	69.4	236.95	1000
Combined Wader Counts		**15923**	**884.6**	**753.69**	**2755**
Total Wader Species		**26**			
Caspian tern	*Sterna caspia*	48	2.7	2.03	8
Common Tern	*Sterna hirundo*	534	29.7	77.37	300
Crested Tern	*Sterna bergii*	6272	348.4	435.91	1750
Gull-billed Tern	*Sterna nilotica*	345	19.2	19.31	70
Lesser Crested Tern	*Sterna bengalensis*	12	0.8	1.61	4
Little Tern	*Sterna albifrons*	2863	159.1	399.91	1300
White-winged Black Tern	*Childonias leucoptera*	1	0.1	0.24	1
Combined Tern Counts		**10075**	**559.7**	**816.14**	**3146**
Total Tern Species		**7**			

Species recorded as present in all months were Eastern Curlew, Pied Oystercatcher, Red-capped Plover, Red-necked Stint, Whimbrel and Crested Tern. Two species were present in all but one month and these were Lesser Sand Plover and Caspian Tern *Sterna caspia*.

Rare species at Sandy Point (i.e. those recorded in one month only) were Black-winged Stilt *Himanotopus himanotopus*, Oriental Plover *Charadrius veredus*, Marsh Sandpiper *Tringa stagnatilis*, Red Knot *Calidris canutus*, Great Knot *C. tenuirostris*, Wandering Tattler *Heteroscelis incana* and White-winged Black Tern *Childonias leucoptera*.

Roosting preferences

Eastern Curlew roosted mainly along the sheltered western edge of the sand spit and central portion (Site A2). Occasionally, small flocks of 30-40 individuals were observed roosting amongst mangrove shrubs (*Avicennia marina*) at Site B, on the water's edge at Site C or, during extreme tides, at Sites A1 and A3 on the sandspit.

Medium sized waders such as Whimbrel and Bar-tailed Godwit were observed in largest numbers roosting along the waters edge of the sand spit (Site A2). Small flocks

were also observed roosting at Site C and amongst saltmarsh and mangrove vegetation at Site B. Tattlers, Pacific Golden Plover *Pluvialis dominica*, Common Greenshank *Tringa nebularia* and Terek Sandpiper roosted mainly amongst low saltmarsh and mangrove shrub vegetation (Site B).

Almost all the smaller waders (Red-capped Plover, Lesser Sand Plover, Greater Sand Plover *Charadrius leschenaultii*, Double-banded Plover *Charadrius bicinctus* and Red-necked Stint) were observed roosting near to the foredunes at the southern edge of the sand spit (Site A1). They used the shelter provided by **1.** high tide strand lines comprised of mangrove leaves and other debris; **2.** low foredune vegetation; and **3.** wheel tracks left by four wheel drive vehicles as they accessed either the sand spit or the ocean beach. Sanderling *Calidris alba* were observed feeding mainly on the ocean beach at Site A1 but did aggregate with other small waders at times.

Seasonality

As expected, migratory waders were highly seasonal in occurrence (Figures 2-4) with peaks in abundance between late spring and mid-autumn (October to April). Most of these species breed in the Northern Hemisphere summer but migrate south to warmer latitudes such as Australia to avoid the Northern Hemisphere winter. This correlates with their peak abundance in Australia during the Southern Hemisphere summer. The exception to this was the Double-banded Plover which was present on the study site only between the months of May and August (Figure 2). Their presence in Corio Bay was also recorded in June and July 1994. This species is an east-west migrant which breeds in New Zealand during the Southern Hemisphere summer and over-winters in Australia.

The only abundant resident species, Red-capped Plover, showed a seasonal pattern of abundance with a peak in summer (Figure 2).

In all, eight species of waders were observed in either full or partial breeding plumage and these were: Lesser Sand Plover (March and May, 1995; February to May, 1996), Bar-tailed Godwit and Red-necked Stint (both March 1995 and 1996), Double-banded Plover (June and August, 1995), Curlew Sandpiper *Calidris ferruginea* (July, 1995), Pacific Golden Plover (March, 1996), and Grey-tailed Tattler *Heteroscelis brevipes* and Wandering Tattler (both May, 1996).

Abundance of terns was found to be seasonal with the highest counts recorded in October and November (Figures 5 and 6).

Individuals of several species of terns were observed in breeding plumage including Crested, Little, Gull-billed and Caspian Tern. A few individuals of Little Tern were

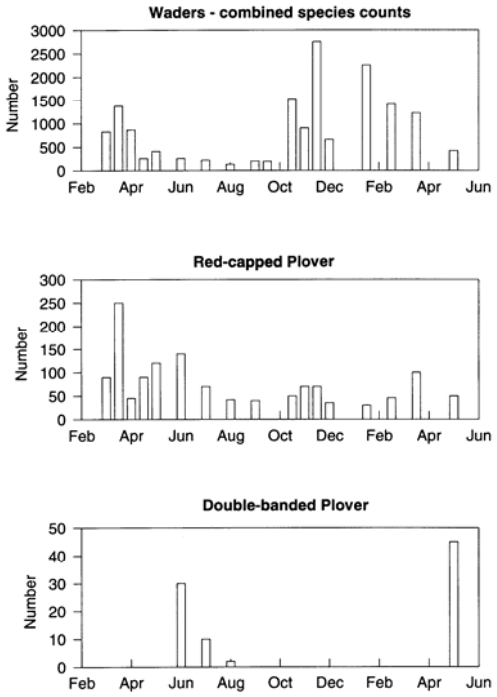

Figure 2: Seasonal abundance (March 1995 to May 1996) of all wader species combined, Red-capped Plover and Double-banded Plover.

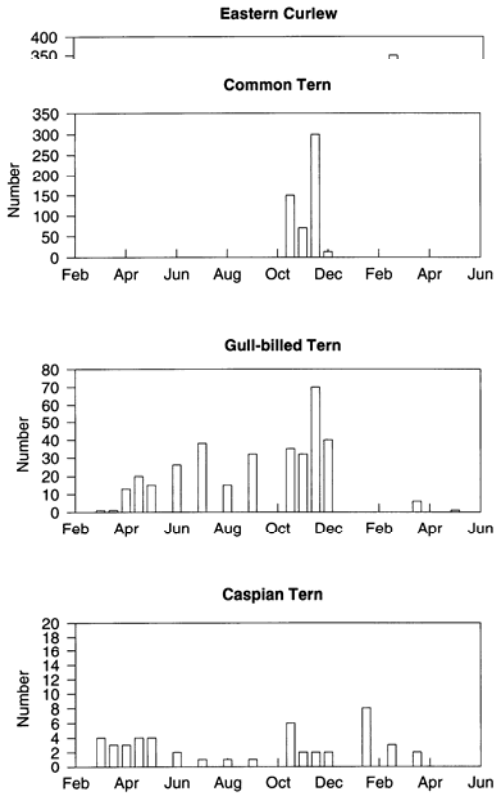

Figure 6: Seasonal abundance (March 1995 to May 1996) of Common Tern, Gull-billed Tern and Caspian Tern.

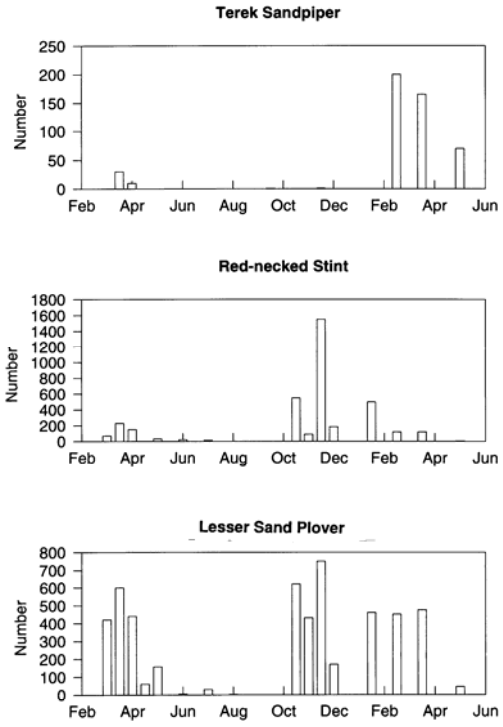

Figure 4: Seasonal abundance (March 1995 to May 1996) of Terek Sandpiper, Red-necked Stint and Lesser Sand Plover.

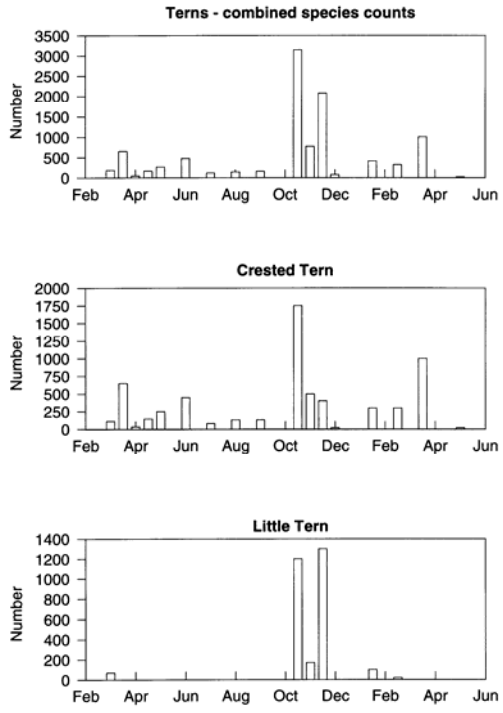

Figure 5: Seasonal abundance (March 1995 to May 1996) of all tern species combined, Crested Tern and Little Tern.

observed undertaking courtship displays but no nesting was observed.

Breeding

Dependent young of Beach Thick-knee *Esacus magnirostris*, Red-capped Plover and Crested Tern were observed at the study site.

DISCUSSION

Waders

Efficacy of spring high tide counts of the Sandy Point roosting site at estimating population numbers for waders in Corio Bay varies depending on species' roosting preferences. A number of species appeared to favour mangrove or saltmarsh vegetation as roosting sites (e.g. Tattlers, Whimbrel, Pacific Golden Plover, Greenshank and Terek Sandpiper). Such roosting sites are widely available in Corio Bay and consequently counts from Sandy Point underestimate populations for these species. Thompson (1993) found similar problems in using high tide roosts to census some of these species in Moreton Bay in southern Queensland.

In contrast, other species such as Eastern Curlew, Lesser Sand Plover and Red-necked Stint favoured the sandspit habitat as a high tide roosting site. Roosting sites for such species are limited within the bay, particularly during the high tidal levels encountered during spring tides at which counts were undertaken. It seems probable that the high tide counts for these three species do provide a guide to their actual population levels within Corio Bay.

In order to give the study a regional context, maximum counts for each wader species obtained in this study (Table 3) were compared to: **1.** maximum high tide counts based on data from 64 coastal sites in central Queensland and listed in Tables 4, 5 and 6 of Driscoll (1995) and **2.** combined high tide counts for Shoalwater Bay (Driscoll 1996, Table 1). Based on these comparisons, the Sandy Point roost site recorded the highest maximum regional counts for Red-necked Stint, Red-capped Plover, Sanderling and Double-banded Plover; the second highest maximum counts for Lesser Sand Plover, Sharp-tailed Sandpiper *Calidris acuminata* and Beach Thick-knee and the third highest maximum counts for Terek Sandpiper.

Of the migratory waders which breed in the northern hemisphere in the northern summer (i.e. the Australian winter - June to August), only five species were recorded in the bay during all three winter months: Eastern Curlew, Grey-tailed Tattler, Whimbrel, Lesser Sand Plover and Red-necked Stint. For these species maximum winter monthly counts represented 21%, 20%, 9%, 4% and 1% respectively of the maximum summer counts. The substantial portion of the Eastern Curlew population present in the bay during the northern hemisphere summer breeding season and its relatively constant population (Figure 3) indicates that Corio Bay

supports an overwintering population of about 50 individuals.

Terns

Crested Tern, while present throughout the year, peaked in abundance in October (Figure 5). This species reportedly breeds in summer (Higgins & Davies 1996) and it is possible that these large aggregations represent prebreeding aggregations prior to departure for the breeding grounds.

Gull-billed Terns were absent from the study site during January and February (Figure 6), months which correspond with their breeding season (Higgins & Davies 1996). Favoured breeding grounds are known to be inland wetlands and birds may have moved inland to breed during these months.

Comparisons of counts of non-breeding aggregations of Little Tern in Central Queensland (Mackay/Capricorn Section, Figure 7 of O'Neill 1995) shows that Sandy Point recorded a maximum count (1300 individuals) equal to the highest count elsewhere in this region.

Conservation significance and threats

Several of the populations of species recorded during the study are considered to be under threat (Garnett 1992) and are listed as rare (Eastern Curlew and Little Tern) or vulnerable (Beach Thick-knee). All three species are considered to be vulnerable to human disturbance (Higgins & Davies 1996; Garnett 1992). One of the main disturbances to waders and terns at the study site is disruption of high tide roosts by recreational off-road vehicles (particularly at Site A1).

The presence of breeding pairs of Beach Thick-knee indicates some management of the recreational use of the site may be required in the breeding season. This would also benefit other beach nesting species which either breed at Sandy Point (Red-capped Plover) or may potentially breed at Sandy Point (e.g. Pied Oystercatcher and Little Tern).

Based on population estimates provided by Watkins (1993), Corio Bay supports nationally significant populations (ie. greater than 1% of the estimated Australian population) of Lesser Sand Plover, Eastern Curlew, Whimbrel and Terek Sandpiper. Of these, two species are present in internationally significant numbers (Lesser Sand Plover and Eastern Curlew). These findings support the listing of Corio Bay as a Ramsar site either individually or in conjunction with Shoalwater Bay.

ACKNOWLEDGMENTS

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Table 3: Comparison of maximum counts for selected wader species between Sandy Point, 64 localities in Central Queensland (data from Tables 4, 5 and 6 in Driscoll 1995) and Shoalwater Bay (Driscoll 1996).

Common Name	Scientific Name	Sandy Point, Corio Bay	Sixty-four Localities in Central Qld.	Shoalwater Bay
Bar-tailed Godwit	*Limosa lapponica*	70	800	**5077**
Beach Thick-knee	*Esacus magnirostris*	5	5	**17**
Curlew Sandpiper	*Calidris ferruginea*	50	**318**	27
Double-banded Plover	*Charadrius bicinctus*	**45**	11	-
Eastern Curlew	*Numenius madagascariensis*	350	369	**2844**
Greater Sand Plover	*Charadrius leschenaultii*	30	**1000**	61
Grey-tailed Tattler	*Heteroscelis brevipes*	100	451	**3014**
Lesser Sand Plover	*Charadrius mongolus*	750	**1000**	106
Pacific Golden Plover	*Pluvialis dominica*	30	**300**	13
Red-capped Plover	*Charadrius ruficapillus*	**250**	100	90
Red-necked Stint	*Calidris ruficollis*	**1550**	800	434
Sanderling	*Calidris alba*	**20**	16	-
Sharp-tailed Sandpiper	*Calidris acuminata*	60	**61**	**61**
Terek Sandpiper	*Xenus cinereus*	200	235	**3410**
Whimbrel	*Numenius phaeopus*	100	196	**7089**

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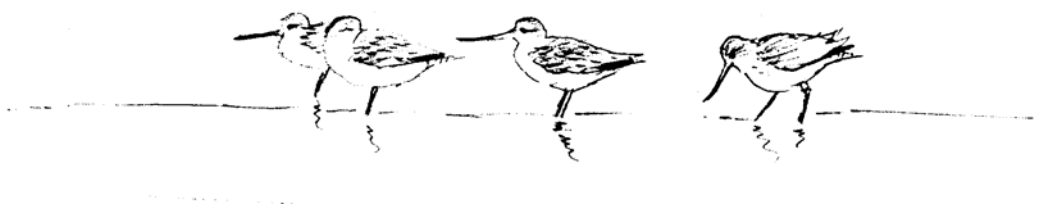

HOODED PLOVER *Thinornis rubricollis*: WINTER FLOCKS AND BREEDING SUCCESS IN NORTH-EAST TASMANIA, AUSTRALIA.

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ABSTRACT

This paper presents data on breeding success, local movements and social organisation of Hooded Plovers in north-east Tasmania, based on 11 years of observations by the author. Estimation of breeding productivity, based on the proportion of juveniles, is possible and this method is discussed. Density of birds along beaches in the breeding season, may shed light on seasonal local movements. Conservation requirements are also mentioned.

INTRODUCTION

Eleven years of observations of Hooded Plovers *Thinornis rubricollis* in the Cape Portland area of north-east Tasmania have given sufficient data to tentatively assess breeding success, local movements and social organisation. This paper presents those data.

RESULTS AND DISCUSSION

At least five counts were made during the flocking period each year. The best time to check the ratio of juveniles to adults is from early April to early June. By mid-June the remnants of juvenile plumage has disappeared on some birds. Because all observations were made in the lagoon areas where birds are usually easily approachable, the "frosty" crowns of immature birds in late plumage change are usually easily visible. By August this feature has usually disappeared although it has been seen on one bird as late as mid-October. Dispersal begins in August and numbers around the lagoons in the study area fall sharply. Table 1 shows the largest number of juveniles in flocks in each of nine years. In 1986 and 1987 the flocks were not examined for first-year birds so these years are missing from Table 1.

The average flock content of juveniles over nine years is almost 15%, but 1994 seems anomalous. Two juveniles were seen that year with nine adults in January but this last figure is ignored because it is too small a sample and was made outside the optimum sampling time of April-June. Even if sampling is, as far as possible, centred around the April-June period, the net recruitment rate could be less than 15% because there are still roughly six months before the next breeding season, during which time predation and other loss could occur. Since not all juveniles breed in their first breeding season (M.A. Weston pers. comm.) the survival time to the first breeding season is correspondingly longer for some birds.

Table 1. Age composition of Hooded Plovers in winter flocks.

Date	Number of Juveniles	Number of Adults
26 April 1988	8	36
1 July 1989	4	19
16 April 1990	14	36
18 April 1991	6	51
31 May 1992	6	41
25 April 1993	3	38
14 April 1994	1	42
27 April 1995	2	30
19 May 1996	11	50

Local population changes

Maximum number of birds counted are given for each of 11 years (Table 2).

The maxima recorded over the last decade show some variation but at least no decline in numbers is indicated, and the lagoon area just scrapes in as an area of international importance (Watkins 1993) with over 1% of the total estimated population. However, with a January 1995 count of 2093 birds in Western Australia, the earlier estimate of population size may now be considered to bee too low (Newbey 1996).

Sampling local beaches in the breeding season - October surveys are used here - showed a density of 1.5 birds per kilometre of beach as a reasonable estimate. Several estimates of density in Tasmania have appeared in *Stilt* (Holdsworth & Park 1993, Schulz 1993). However, breeding densities vary significantly from place to place, so the only breeding densities which seem useful are

Table 2. Observed maxima over 11 years.

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Maxima	49	48	44	23	36	57	47	41	43	32	61

local ones. Applying a density of 1.5 birds per kilometre to the 11 year average flock size (43 birds), the winter flocks are drawn from roughly 28 km of coast. This might give a good indication of beach areas worthy of special protection, but this needs to be substantiated by a banding study.

The flocking areas

The study area is shown in Figure 1.

The favoured lagoon areas begin drying out at the end of the year so that by the end of the breeding season, areas of shallow water with broad dry margins become available. The lagoon substrate varies from wind-blown sand from active dune systems (North Beach in Figure 1) through to South Tregaron which has a heavy black mud substrate high in organic matter derived from decayed algae and marsh plants which, when dried out, forms a network of deeply fissured plates.

Following the drought year of 1994 this area became available, for the first time in at least 25 years, as a completely dry lagoon. In April 1996, 44 out of 47 birds (94%) were found there, 57 out of 61 (93%) in May, and 42 out of 54 (78%) of birds in June. If birds can become so attached to a small area for many weeks, then surveys in other areas of Australia would need very good coverage, otherwise significant groups of birds may be missed.

Salinity varies greatly with rainfall and drainage patterns. The Tregaron Lagoon system is filled mainly by pasture run-off and is of low salinity. The shallow Salties is very saline as are the sand lagoons of North Beach (see Figure

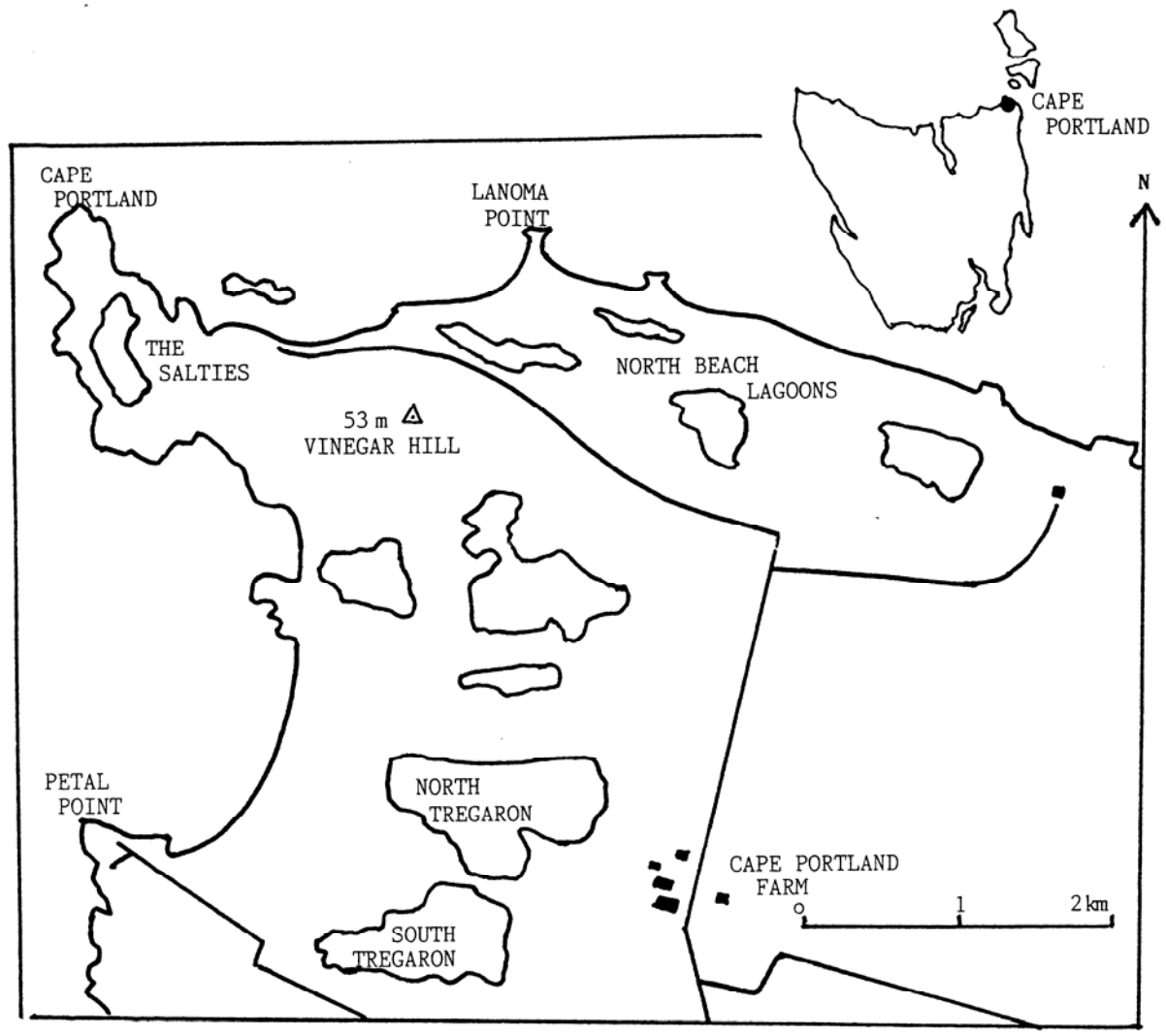

Figure 1. A map of the study area.

1). All these areas are used, often simultaneously, by sub-groups of the winter flock, whether there is standing water in them or not. Every year the lagoon system presents a great variety of substrates, water levels and the opportunity to use sheltered areas.

Social groupings

No particular pattern was found despite many observations. Occasionally a juvenile, or a small group of juveniles, may be found away from the main flock of adults on the same lagoon bed. The flock may have scattered sub-groups on one day, then form a large group for a few days. All the lagoons must be searched to ensure that no component sub-groups of the flock are missed.

Timing of pair formation and breeding

In the north-east of Tasmania nests with eggs have been found in October, but at this time pair formation is at its height. A survey of 10 km of beach and sandspit to the east of Cape Portland on 26 October 1994 located groups of four, four, three, two and two. A survey of the nearby Mount William National Park located eight, three, two and two. The discrete pairs seemed territorial, and at Mount William one pair had an active scrape. On 26 October 1996 the same beach area at Cape Portland had groups of nine, four, two and two. Again the two pairs held territories but the others were constantly on the move, calling and chasing. However, the fact that groups other than solitary pairs are seen does not imply that all members of these groups have yet to form breeding pairs. Attention has been drawn to the tendency for social units to aggregate when disturbed by the presence of observers (Heislers & Weston 1993, Weston & Heislers 1995). Colour-banding has shown that groups may be aggressive associations of pairs (M.A. Weston pers. comm.). Elsewhere in Tasmania breeding has been recorded from the beginning of September (eggs) to mid-April (Park 1993) though these are probably extreme dates. In the north-east, November-January is the usual season.

Conservation issues

All the lagoons at Cape Portland are within a Wildlife Sanctuary established by the owner and National Parks under a management plan. Several kilometres of beaches front onto this property where the owner regards incursions by vehicles as unwelcome and is able to control access to some extent. In the long-term owner stewardship may not be enough because only land access through his property can be controlled. Much of the beach area in the north-east of Tasmania has been designated as Coastal Reserve, but this adds little practical protection because there is little political will or intention to control vehicular access to beaches. Driving on most beaches in the north-east is illegal but this fact is widely disregarded. Inadequate staff levels within the Department of Environment and Land Management make adequate control almost impossible. Beach and dune driving continues to increase even though official coastal policy places emphasis on protection of vulnerable and endangered species (Tas. Government 1996).

Conclusion

Estimation of breeding productivity is possible, but for each year several visits are needed within the optimum period (April-June). Sometimes birds flock in a small area for weeks at a time and all known locations have to be searched to make sure that no birds are missed. Density of birds along beaches in the breeding season, determined by local sampling, may indicate the "gathering ground" from which winter flocks are drawn and this may be translated into conservation requirements. However, firm evidence would need to be generated by a banding study to examine this idea.

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LITTLE TERNS *Sterna albifrons* IN THE WEST KIMBERLEY DIVISION OF WESTERN AUSTRALIA.

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ABSTRACT
The Western Australian population of Little Tern generally considered to be migratory. This paper reports the first confirmed nesting record of Little Tern in Western Australia. Important roost sites in the Broome area including the Port and beaches along Roebuck Bay (Quarry Beach and Bush Point) are documented. The largest roost (1200 birds) is at Bush Point on the extreme southern edge of the bay. Feeding areas and associated species are also discussed. The possible origins of the migratory portion of the Broome Little Tern population and ageing techniques are investigated.

INTRODUCTION

Three populations of Little Tern *Sterna albifrons* are present in Australia. All belong to the sub-species *sinensis* and have white shafts to the outer primaries. The population often referred to as the eastern Australian population breed in the austral spring and summer and may be partly migratory. This population overlaps with the northern Australian population which breeds between the Gulf of Carpentaria and the east coast of Cape York Peninsula (Higgins & Davies 1996). The northern Australian population is thought to be sedentary and may breed throughout the year (Ray Chatto pers. comm). The third population consists of Asian migrants which spend the non-breeding season (austral spring, summer and autumn) in Australia, departing for their northern breeding grounds in March/April (Higgins & Davies 1996).

The breeding population of Little Terns in Australia is regarded as Vulnerable (Garnett 1993) and generally the Australian population is regarded as rare or uncommon throughout its range (Hill *et al.* 1988). The most recent count in 1991 found a total breeding population of no more than 320 pairs in east Australia with smaller numbers in the north (Starks 1992). The population worldwide is suffering a decline throughout its range and measures are being taken to protect its breeding areas (Hill *et al.* 1988).

This paper collates the information gathered by the Broome Bird Observatory (BBO), Australasian Wader Studies Group (AWSG) expeditions to north-west Australia and seven months field work by the authors from October 1995 to May 1996 and puts it into the context of the Little Tern in Australia.

RESULTS AND DISCUSSION

Seasonal variation in Little Tern numbers

Little Terns have been noted from around the Broome area (18^0 00'S 122^0 22'E) for many years (Johnstone 1983). Since the opening of the BBO in 1988 wardens have kept a daily bird log of all species seen by wardens and visitors. This information reflects the areas most frequently visited - the observatory, Broome town, Roebuck Bay and the southern end of Roebuck Plains Station. Less information is available during the wet season due to difficulty of access and lack of visitors. It should also be noted that major wader banding expeditions by the AWSG occur about every eighteen months, either in March/April or September/October giving a more comprehensive coverage of sites at these times.

Early BBO records suggested that Little Terns disappeared from the Broome area between June and August (Wells & Hooper 1991) however more recent analysis shows they are present all year (Collins 1995). More Little Terns are present during the wet season (October to March) than during the rest of the year with the highest numbers being recorded in March/April and October/November (Figure 1). Birds arrive in Roebuck Bay from late September and depart during March and April but in some years they remain as late as May. The largest flocks observed have been at Bush Point. Unfortunately as this site is only accessible by hovercraft it has not been regularly counted. The largest flock recorded there was 1200 in April 1996 with 480 still there on 4 May 1996. This is a late date for large numbers of Little Tern to be present in Broome and there are two possible explanations. The first is that Little Terns gather at Bush Point prior to migration and their departure was delayed by two late season cyclones perhaps producing a larger than usual flock. The second possibility is that they were a mixed flock of adults and juveniles from an Australian population at a favoured roosting/feeding area that had previously not been noted due to difficulty of access, or they were perhaps a mixture of both.

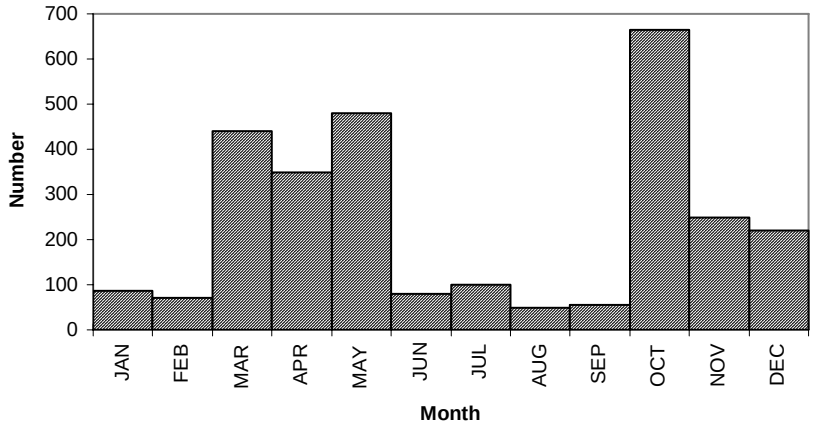

Figure 1. Maximum number of Little Terns seen per month at Broome (compiled from BBO Daily Bird Log 1988-96, Bush Point not included).

High tide roosts of Little Terns around Broome

Broome Little Terns favour three non-feeding areas commonly called roost sites. These have in common their sandy nature and juxtaposition to the sea, so by inference feeding areas. Muddy or rocky substrates are not favoured, although Little Terns have been seen in small numbers (less than 20) roosting on rocks close to feeding grounds. During strong winds Little Terns may use pebbly or rocky beaches for shelter (authors pers. obs). The three most important roost sites are:

1. The Port area. The sandy beach to the north of Broome port has small to medium numbers of Common (*S. hirundo*) and Little Terns in the wet season with numbers increasing during periods of cyclonic activity. During periods of strong winds or cyclonic activity Little Terns shelter behind rocks at the landward side of the beach. Birds roosting in this area feed during flood and ebb tides in the entrance to the port.
2. Quarry Beach, Roebuck Bay. Quarry Beach is a long stretch of red sand located eight kilometres north of BBO on the northern shore of Roebuck Bay. Flocks sometimes numbering a few hundred have been noted in this area and the birds feed along the coast of the bay on incoming and high tides when small bait fish are in the shallows.
3. Bush Point, Roebuck Bay. Bush Point supports by far the highest numbers of Little Terns and is a large sandy spit at the extreme southern edge of Roebuck Bay. Eight hundred were counted by the AWSG in April 1994 and 1200 in April 1996. Birds roosting here are thought to feed during incoming and outgoing high tides over the vast mudflats.

Of the three main roosts the most important appears to be Bush Point. Access to the area is extremely difficult and the last four counts of the area were achieved by hovercraft. While the isolation of the area might be offered as an explanation for the popularity of this site for wary species such as Little Tern, it should be noted that other two areas are very popular with holiday makers and locals who utilise the beaches for a variety of recreational pastimes such as fishing, swimming and exercising the family pooch. It would seem that the main factors that influence the suitability of a roost site for Little Terns are the closeness of suitable feeding areas, the amount of human activity being of secondary importance.

Associated tern species

The entrance channel to the port of Broome is also a favoured fishing area of Lesser Crested (*S. bengalensis*) and Crested Terns (*S. bergii*) throughout the year. Common, Caspian (*S. caspia*), Roseate (*S. dougalii*) and Gull-billed Terns (*S. nilotica*) are also present during the wet season. During March/April Common and Little Terns can often be seen feeding with the larger species especially when the smaller bait fish are close to the surface (authors pers. obs). Also during March and April Whiskered (*Chlidonius hybridus*) and White-winged Black Terns (*C. leucopterus*) may feed in coastal waters. The amount of rainfall and local flooding in the hinterland control the appearance of these species. If conditions are favourable breeding takes place and no birds are present on the coast.

During March, April and September large flocks of mixed tern species have been seen at the port and in Roebuck Bay near the mouth of Crab Creek feeding on large shoals of small fish (BBO Daily Bird Log. authors pers. obs). The mangrove fringes and sea-grass beds of

the bay are presumably nursery areas for many fish species and concentrations of small fish would be common especially during spawning. The largest flock recorded was on April 1 1996 when an estimated 5000 terns were seen feeding during the incoming tide (authors pers. obs). Most of the terns could not be specifically identified. Counts of high tide roost around Roebuck Bay made between October 1995 and May 1996 (unpublished data) indicate that the vast majority were probably Lesser Crested and Crested Terns. Common and Little Terns would also have been present. Two sub-species of Gull-billed Terns were also observed. The Australian sub-species *S. n. macrotarsa* is larger than the migratory subspecies that could have been either *S. n. affinis* from the Malay Archipelago and southern China, or possibly *S. n. nilotica* from Asia Minor and Mongolia. *S. n. macrotarsa* breeds in Australia following good wet season rains.

Little Tern roost sites are shared with several other tern species. When roosting Crested and Lesser Crested Terns prefer rocks to perch on whereas Common, Little, Roseate, Whiskered, White-winged Black and Caspian Terns all rest on sandy beaches. At times of spring high tides when most rocks are covered by water Lesser Crested and Crested Terns will also roost on the same beaches as the other species. The smaller species avoid their more aggressive cousins by walking out of pecking distance.

During cyclonic activity other tern species are forced off their normal feeding or breeding grounds and come into shore often associating with Little Terns. Species noted during the 1995/96 cyclone season were Sooty Terns *(S. fuscata*) and Bridled Terns (*S. anaethetus*) together with Common Noddies (*Anous stolidus*). Twelve Black-naped Terns (*S. sumatrana*) were recorded with Little and Common Terns at Bush Point in April 1996, first Western Australian records (A. Boyle, A. Tree and AWSG pers comm.).

In south east Australia Little terns frequently mingle with Fairy Terns *Sterna nereis* and indeed sometimes hybridise with them (Higgins & Davies 1996). However in the Broome area Fairy Terns are considered to be extremely uncommon and have not been noted by the authors. They have been recorded in December 1989 and April 1990 and apparently both times in breeding plumage (Wells & Hooper 1991).

Breeding records

Until the following observations were made by P. Collins there had been no confirmed nesting colonies of Little Terns west of 135^0W i.e. none in WA (Higgins & Davies 1996).

In December 1995 cyclone Gertie passed close to the north west coast of WA which prompted a search for beach washed birds between Gantheaume Point and Coconut Well near Broome. During this search a small flock of Little Terns were noticed behaving in a highly territorial fashion - taking to the air uttering a series of alarm calls, typical of terns within a breeding colony. A cursory investigation of the area revealed three nests, two with two eggs and another with one egg. To minimise disturbance the observer moved away and watched from a distance for a further 10 minutes. Twenty-seven Little Terns landed within the area that was thought suitable for nesting.

The breeding site was a triangular piece of flat sand bounded by a beach on one side, a lagoon outlet on the second side and the edge of a dune system on the third. The whole area was on a raised platform about half a meter above the normal high tide mark. The main area was devoid of growing vegetation though there was some organic debris from extreme high tides and storm surges. The surface temperature was very high in excess of 40 degrees though no accurate measurements were taken it was too hot to stand on in bare feet. On 10 January the colony was checked by local resident H. Macarthur and seven nests were found but no details of clutch size were noted to keep disturbance down to a minimum. On 14 January the authors accompanied by M. Russell and H. Macarthur visited the site to conduct a more detailed survey. There were three nests with one egg, ten nests with two eggs, one nest with two downy young and one fledged chick. The two downy young were banded. To accommodate the increase in nests the colony had expanded towards the dune system. As far as could be ascertained all the birds in the colony were of the Australian subspecies *sinensis*. Using as a general rule one visit per week, to minimise disturbance, a further visit was made on 21 January. The colony was abandoned, no sign of adults, chicks or eggs were found within the area though one egg was found about 50 metres away (lodged with the WA Museum). The probable reasons for the terns leaving the area were indicated by the presence of small child-sized footprints. The whole colony had been effectively wiped out by children. If we take the best scenario it can be assumed that six chicks hatched and survived out of a possible 27 from a total of 14 nests.

As the breeding population of Little Tern in Australia is small this colony is not only an important extension to the breeding range but also represented a significant percentage of the total breeding population.

The sighting of a bird caught and banded in Broome (indicated by a yellow leg-flag) feeding fledged young at Broome Port (Entrance Point Beach) was reported on the 21 January 1996 (G. Swann pers comm.) and shows that there must be at least one other colony of unknown size in the Broome area as no flagged birds were noticed in the Coconut Well colony.

In eastern States of Australia Little Terns breed in the spring and summer months (Reside *et al.* 1990). Around the Elliott River in northern Queensland nests were found between June and December (Ey 1990). The population in the Gulf of Carpentaria breed in the autumn and winter months (Officer 1976, Garnett 1985, Starks 1992). Thus, these Little Terns in Broome were breeding at the same time as birds from the eastern population on the east coast.

Possible composition of the Broome population

The origins of Little Terns in Broome, their major breeding localities and migratory routes are unknown. However, birds from the northern hemisphere, eastern and northern Australian populations use similar primary feather moult strategies. These strategies are associated with the breeding cycle and result in birds from different populations having different primary moults at the same time of year. This coupled with the stage at which they are entering or leaving breeding plumage will give an almost definite place of origin.

Northern hemisphere birds start to go into breeding plumage in late February and are in full breeding plumage by mid-April, just before northward migration (Chandler & Wilds 1994). Birds breeding in eastern Australia are in breeding plumage from September to February. However, birds from the Northern Territory may be in breeding plumage for much of the year as they tend to have a protracted breeding period. Thus during March/April when most cannon net catches were made in Broome it is possible that populations from Asia and the Northern Territory were in breeding plumage.

In Victoria most Little Terns have been caught in January when a bird moulting in two places is assigned to the northern hemisphere population (Clive Minton pers. comm.). Little Terns from the northern hemisphere populations are thought to begin primary moult on the breeding grounds but suspend the moult during southward migration. This first moult is completed by December in Australia. Between October and December a second primary moult commences replacing primaries one to six giving rise to a moult typically of $1^{1}5^{4}3^{1}0^{4}$ or $5^{1}4^{1}3^{1}5^{4}4^{1}0^{2}$ as seen in Victoria in January. A third moult begins in March/April replacing primaries one to five. The outer primaries by this time are very worn.

In Victoria during January local breeders are commencing first primary moult and by March/April four to five primary feathers are replaced. A second primary moult is thought to begin in June/July and begin their third partial moult in August in preparation for the following breeding period. This gives rise to the same formula as the northern birds but two months earlier. The Little Terns in the Broome area can be assumed to follow the same or very similar strategy as these Victorian birds.

Most catches of Little Terns in Broome have been made during summer and early winter. Using primary moult scores and the amount of breeding plumage these birds could be categorised in the following way:

1. Birds coming into breeding plumage. These were probably northern Australian birds or a northern hemisphere population preparing to migrate.
2. Birds in full breeding plumage which were either from a local breeding population or came from the northern population
3. Birds with no breeding plumage, these were aged with some trepidation as adult non-breeding but they could well have been birds in their second year whose natal area could be from any of the three populations.
4. Three birds that were banded as pulli from the breeding colony near Broome. All the birds that were caught belonged to the subspecies *sinensis.*

Ageing Little Terns in Broome

Ageing Little Terns from the Broome area in the hand has caused some confusion in the past. However in the light of recent catches it has become clear that juvenile, second year and adult plumages are identifiable at most times of the year.

Adults (2+) in breeding plumage are easily aged and no description is needed but in non-breeding plumage details such as soft part colouration and moult strategy can be used to age most birds prior to breeding. The legs and feet often have a brownish tinge or even a distinct orange colour. The cubital bar is black though often narrow and, although identifiable in the hand, not easily seen at times in the field.

Second year birds (2) sometimes go into a semi-breeding plumage which made them very difficult to age with any great certainty, however many birds had retained juvenile coverts when they were examined in March and April 1996. These were aged as two year olds as they had nearly completed the moult of their juvenile plumages. As they were part of the birds first set, these feathers are by this time extremely worn and they have a distinct grey colour to them, as opposed to black in adult birds. If the outer two primaries are in a very worn state this is also used as an indication that the bird is in its second year (Higgins & Davies 1996) After the coverts and outer primaries are moulted it is impossible to separate them from adult non-breeding and in Broome they are aged as 2+.

Migration

Sightings of banded and individually colour marked Little Terns from a study at the Gippsland Lakes in Victoria indicate that northern migrants probably move up and down the east coast (Minton 1990, 1991, 1993,

1996). No sightings or recoveries of banded or colour marked birds from eastern Australia have been reported from WA. If the northern Australian population is sedentary and the eastern population move along the eastern seaboard the population that occurs in the Broome area can be considered to be mostly a migratory population with a proportion of local breeding birds.

To date very few Little Terns have been banded and yellow leg-flagged in Broome, and sightings both extralimitally and locally have been correspondingly low. Apart from the bird at Broome port the only other sighting of a leg-flagged bird is from 20 km north along the coast from Willie Creek (G. Swann pers comm.). This may suggest that some Little Terns breed further north on the Dampier Peninsula or alternatively are seeking out favoured feeding areas or preparing for a longer migration into Asia.

Some of the birds banded in Broome were heavy e.g. one in March 1996 weighed 60g while there were several in the middle to high 50g range at the same time of the year. If an analogy to migratory waders can be drawn it would appear that these birds were putting on fat reserves in preparation for a long distance flight (based on AWSG banding data).

Conservation

Little Terns are the subject of numerous conservation projects throughout the world. Projects to protect them on their breeding grounds have been in place in Europe for many years ranging from the building of artificial sand banks and islands to a variety of fences (Holloway 1993, Murray & Reside 1995). In Victoria during the breeding season fencing is used to keep members of the public away from colonies by diverting walkers away from them. Electric fences are also utilised to deter predators such as dogs and foxes as well as kangaroos which trample vegetation, eggs and young (Reside *et al*. 1989). Wintering quarters are generally poorly understood and therefore not given protection from disturbance. In other species of birds notably waders it is understood that non-breeding areas are vitally important to the well being of a species and as such are often afforded some degree of conservation value. After the breeding season Little Terns are often seen in small family parties with the adults continuing to feed the young away from nesting areas. These areas also need consideration when conservation plans are formulated. Disturbance at this time of the year could have a seriously detrimental effect on the survival rate of that years offspring.

In the Kimberley (northern WA) definite conservation plans are difficult to formulate due to the paucity of knowledge about breeding areas and non-breeding areas. In a winter survey in northern Queensland and eastern Australia helicopters and seaplanes were used to cover areas that otherwise would prove impossible to survey using traditional ground based methods (Starks 1992). Computer predictions for suitable sites were also produced using the ARIS database (Australian Resources Information System). It would be desirable to if similar techniques and resources could be used in the Kimberley as it is becoming apparent that this is not only an extremely important non-breeding area but also has the potential to have several important breeding colonies in the more remote areas.

Those areas that are accessible need to be monitored very carefully although the port is not or never will be within a conservation area the Roebuck Bay roosts are listed under the Ramsar Convention as an important wetland area. The Quarry Beach and the Broome port Little Tern roosts are often disturbed during the late wet season when they are building up fat reserves to migrate or are recovering from the breeding season, depending on the origins of the population. Disturbance from recreational fishermen, four wheel drive enthusiasts, birdwatchers and the general tourist trade are not considered to be individually major problems. However when they all occur simultaneously during high tide periods the disturbance reaches extreme levels. The less accessible areas of Roebuck Bay are under no immediate threat but developments such as mineral sand extraction and tourist development are either in the early stages of development, or proposed. In the future they could have an impact on the major roost site at Bush Point. A monitoring program needs to be developed for this remote site to ensure no lasting damage is done to a pristine area.

Conclusion

There is a lot of mystery surrounding the status of the Little Tern populations that occur around Broome. More work needs to be done to unravel some of these mysteries. Of utmost importance is to discover the breeding grounds of the migratory population that obviously use the area to feed on their way north. With recoveries in Japan of birds from Victoria it is tempting to speculate that the birds in the Broome area also go this far north. With this in mind it is proposed to undertake an intensive banding programme of these Terns during migration times to enhance the chances of sighting and recoveries on their migration routes.

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WADER CENSUSES FROM DARWIN, NORTHERN TERRITORY, AUSTRALIA, 1970 TO 1972.

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ABSTRACT

The results of weekly wader censuses conducted on beaches and at a saline coastal swamp in the Darwin area, Northern Territory, are described. The beach and swamp censuses were conducted over 18 and ten month periods respectively. A summary of the relative abundance of 27 Palearctic waders recorded in the two censuses is given.

INTRODUCTION

A series of censuses of waders and waterfowl was carried out in the Darwin area, Northern Territory, in the early 1970's. Several papers which analyse and summarise this material were produced but the census data for waders was never published. Habitat and climate effects on waders in the Darwin area are discussed in Crawford (1979, 1980).

METHODS AND RESULTS

A weekly census was made along the coast between July 1970 and January 1972. Birds were counted at Camerons Beach, Lee Point-Buffalo Creek, East Point, Darwin Wharfs and Sandgrove Creek and a map of the area appears in Crawford (1972) . Table 1 shows the monthly maximums for each species.

A second census was conducted at Leanyer Swamp

Table 1. Monthly maximum numbers from a weekly census of waders recorded for Darwin beaches from July 1970 to January 1972.

	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	0ct	Nov	Dec	Jan
Beach Thick- knee	4	1	2	3	2	2	3	2	2	1	1	1	2	1	1		1	1	1
Pied Oystercatcher	19	16	3	13	27	38	30	22	23	16	17	14	15	2		3	5	8	8
Grey Plover	14	14	25	21	15	29	24	17	8	10	2	8	20	14	11	18	13	13	14
Pacific Golden Plover	7	13	39	39	85	35	21	13	7	6		2	4	8	14	38	12	23	26
Mongolian Plover	58	59	120	97	80	71	54	74	17	70	30	46	67	81	87	155	48	31	57
Large Sand Plover	133	146	240	251	114	179	167	88	48	85	76	158	146	171	449	499	292	129	110
Oriental Plover			7						7	3		1			2	13			
Red-capped Plover	76	56	21	15	8	2	5	4	3	2	7	12	33	23	21	68	11	3	7
Ruddy Turnstone	13	29	64	75	61	35	36	31	21	31	22	15	17	8	25	48	37	14	21
Eastern Curlew	4	15	20	24	12	16	13	20	5	5	12	22	21	20	15	34	20	10	15
Whimbrel	44	55	60	34	27	32	31	23	6	16	7	26	24	15	17	23	43	21	9
Grey-tailed Tattler	28	15	39	36	29	30	23	26	26	34	30	28	36	29	24	20	34	28	19
Common Sandpiper	1	7	25	11	10	8	10	9	8	5	1		2	8	9	9	8	9	13
Greenshank	7	14	22	11	15	8	10	8	5	11	1		10	6	7	5	8	9	7
Marsh Sandpiper			1					1											
Terek Sandpiper	10	16	85	153	152	119	70	121	63	79	42	17	41	17	45	92	162	72	92
Black-tailed Godwit	3		13	9	7		17	22	107	7				1	1		1		3
Bar-tailed Godwit	66	49	54	97	100	42	68	55	60	55	60	61	88	30	60	83	69	56	40
Red Knot	43	18	8	28	7	6	20	4	7	25	1			1	2	6	15	5	1
Great Knot	107	101	230	247	446	656	739	607	987	1168	98	104	135	107	61	579	959	1030	972
Sharp-tailed Sandpiper		13	26	14	78	2	4							7	37	49	52	5	6
Red-necked Stint	33	53	202	344	176	223	122	32	2	3	8	24	46	46	156	325	241	88	40
Curlew Sandpiper	6	6	10	12	6	6	10	8	2					1	6	4	15	6	3
Sanderling	7	10	20	23	14	19	41	11	11	3	10	6	2	6	4	21	12	22	5
Broad-billed			7	6	4	5		1							2	6	7	4	
Asian Dowitcher																1			
Redshank	1																		

from October 1970 to July 1971. This area was a salt marsh environment. The census started within a few days of the area beginning to fill with the first thunder showers of the wet season and ceased when the area became completely dry in the following July. At the time of the census the area was largely unaffected by the close proximity of the city but soon after it became the site of the sewage works. A description of the area appears in Crawford (1980). Table 2 shows the monthly maximum values for the census area.

Table 3 shows the relative abundance of palearctic species in all census sites from July 1970 to July 1971.

The census areas are not the preferred habitat of the Little Curlew *Numenius minutus* which is the most common species of wader visiting the Darwin area in October and November (Crawford 1978).

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Table 2. Monthly maximum numbers from a weekly census of waders recorded for Leanyer Swamp from October 1970 to July 1971.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July
Masked Lapwing	4	4	3	2	4	1	4	7	13	39
Grey Plover									2	
Pacific Golden Plover	6	4	6	1	4		1			
Mongolian Plover	7	5	24	11	15	3	7	2		
Large Sand Plover		2	2							
Red-capped Plover		2	15	9	11	7	19	24	33	21
Black-winded Stilt	19	24	19	19			7	26	27	6
Eastern Curlew		4	1	4	1					
Whimbrel						1	8	5	1	
Little Curlew	6	2	4							
Wood Sandpiper	9	1	4	5	6	2	1			
Greenshank	115	77	32	14	19	7	10	14	24	4
Marsh Sandpiper	32	16	15	19	11	2	4	5	6	
Swinhoe's Snipe			3		1					
Black-tailed Godwit	182	14	120	106	109		32	38	46	
Bar-tailed Godwit			12							
Red Knot	6									
Great Knot			71							
Sharp-tailed Sandpiper	150	43	56	29	8	1	2	1		
Red-necked Stint	19	24	19	19			7	26	27	6
Curlew Sandpiper	8	16	15	19	11					
Broad-billed		6	6	9						
Oriental Pratincole		43								

Table 3. Relative abundance of palearctic waders recorded in this study. Species are ranked from the most to least numerous. Total numbers are the sum of all counts from July 1970 to July 1971. The relative abundance is given by the percentage of the grand total. Frequency refers to the number of times each species was recorded in the six census areas. The maximum possible number of sightings was 306 per species. Included in this, are data from a small grassy area on East Point. This area was frequented on occasions by Little Curlew *N. minutus*, Ruddy Turnstone *Arenaria interpres* and Pacific Golden Plover *Pluvialis fulva*.

	Total No.	Percentage of Total	Frequency
Great Knot	11731	31.2	119
Large Sand Plover	4440	11.8	176
Red-necked Stint	3398	8.9	164
Terek Sandpiper	2673	7.2	161
Bar-tailed Godwit	2384	6.3	154
Mongolian Plover	2282	6.1	150
Black-tailed Godwit	1326	3.5	57
Ruddy Turnstone	1265	3.4	155
Sharp-tailed Sandpiper	1195	3.2	150
Grey-tailed Tattler	1036	2.8	195
Greenshank	969	2.6	150
Whimbrel	928	2.5	200
Little Curlew*	754	1.9	11
Grey Plover	590	1.6	89
Pacific Golden Plover	589	1.6	81
Eastern Curlew	398	1.1	133
Marsh Sandpiper	386	0.9	35
Red Knot	308	0.8	87
Sanderling	293	0.8	39
Curlew Sandpiper	283	0.7	61
Common Sandpiper	222	0.6	119
Broad-billed Sandpiper	76	0.2	24
Wood Sandpiper	54	0.1	18
Oriental Pratincole	43	0.1	1
Oriental Plover	24	0.1	5
Swinhoe's Snipe	2	<0.1	2
Redshank	1	<0.1	1
Totals	37650	100.1	

BREEDING SEASON CENSUS OF PIED OYSTERCATCHERS *Haematopus longirostris* IN CORNER INLET, VICTORIA.

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ABSTRACT

This paper describes a breeding season survey of the distribution of Pied Oystercatchers in the Corner Inlet section of Nooramunga National Park, made by helicopter, in December 1996. An exceptionally large breeding population was located. Significant flocks, presumably of immature birds, were also found. The area was therefore considered to be extremely important for Pied Oystercatchers in the breeding season. The significance of this data is discussed.

INTRODUCTION

Pied Oystercatchers *Haematopus longirostis* occur along the coast and in bays and inlets all around Australia. Watkins (1993) estimated the total Australian population at 10000, with all states except New South Wales having at least 1000 birds. However his data, reflected in the distribution map in Marchant & Higgins (1993), suggested that the greatest concentration was in south-eastern Australia. This information was based on late summer and winter counts of birds in flocks and showed that "Corner Inlet", in south-eastern Victoria, had the highest population (average 870) at such times.

There is very little quantitative information on the distribution of Pied Oystercatchers in the breeding season, and in particular of the main breeding locations and breeding concentrations. In Victoria some data on coastal beach breeding sites has been collected during the course of other studies (e.g. of the Hooded Plover *Thinornis rubricollis*). Also a comprehensive survey, by helicopter, was undertaken in Westernport in 1990 and 1992, covering both French Island and the total perimeter coastline of the Bay (Campbell 1993). In Corner Inlet only those areas readily accessible by boat (and thereafter on foot) - mainly the outer islands of Dream Island, Box Bank, Clonmel Island, and the ocean shore of Snake Island - have been censused during the breeding season. However this was sufficient to indicate the extreme importance of the area as a breeding location for Pied Oystercatchers.

The 1996 aerial survey

With the aid of a grant from the Coast Action/Coast Care programme a helicopter survey of the shores of all islands and the mainland of the Nooramunga National park section of "Corner Inlet", was carried out on 23 December 1996. The survey took 4.5 hours of flying time (plus 2 refueling stops) at a speed of 40 knots and mostly at a height of 50 ft. It coincided with the high tide period, thus minimising the area to be covered. Under these conditions all waders and waterbirds could be readily identified and numbers and locations were marked on large scale maps. It was necessary to fly at this low altitude in order to ensure all Pied (and Sooty) Oystercatchers *H. fuliginosus* were flushed - they seem to be the species least perturbed by the helicopter.

Most breeding Pied Oystercatchers were sighted together in obvious pairs. Occasionally two individuals were located a little distance apart and were also classed as a pair. Also a few single birds on suitable breeding habitat and displaying a strong attachment to an area were considered as paired. Some of these, and others, were seen leaving nests above the high tide mark while other pairs obviously had chicks (some half grown chicks were seen). But the majority of pairs were just standing around at or close to the tide edge suggesting that many breeding attempts had failed. This is a common occurrence at Corner Inlet because of storm tides. Such tides in late November 1996 are known to have washed out most breeding terns. However some of the pairs may also have been "non-breeding" pairs.

RESULTS

The area covered by the survey is shown in Figure 1 and the results are detailed in Table 1.

Breeding pairs

A total of 250 pairs of Pied Oystercatchers was located in the Nooramunga National Park and adjacent areas of "Corner Inlet" between McLoughlin's Beach in the east and Snake Island/Barry Beach Point in the west.

Between 20 and 32 pairs were found on each of the main 'ocean barrier' islands - Dream, Box Bank, Clonmel and Snake - with the majority of birds being on the inland side of the islands and on the sandy spits at each end, rather than on the narrow seaward ocean beach.

By far the biggest surprise in the results was the huge number of breeding pairs on Sunday Island and the associated Drum Island (73 pairs). These were around much of the perimeter of the island. It is probably significant that this is the only 'inland' island where the coastline is not dominated by mangroves. Instead there are extensive areas of narrow saltmarsh as well as sandy beaches and muddy inlets, all providing suitable nesting habitat. It is also interesting that it is the only inhabited

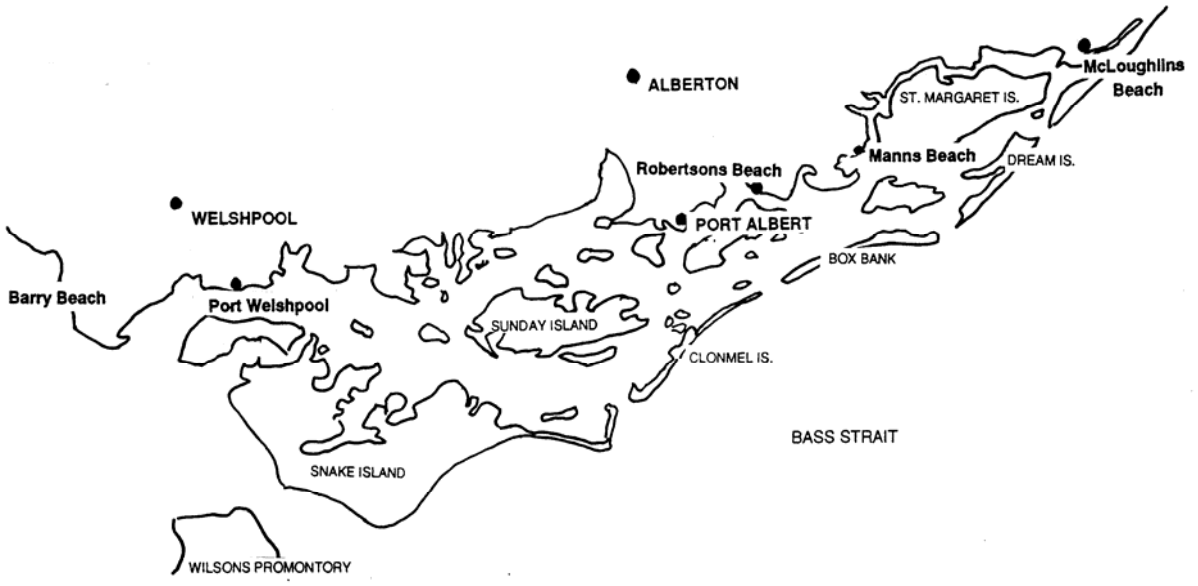

Figure 1. Nooramunga National Park, Corner Inlet.

island in the area, being privately owned, with many small 'weekend cottages' (much used by deer hunters). A key factor in its popularity for breeding Pied Oystercatchers may also be its long-term freedom from foxes and cats - exterminated many years ago.

Another slight surprise was the significant number of pairs of Pied Oystercatchers with territories on the mainland coast of the complex. Nearly every suitable saltmarsh area or sandy/muddy point held pairs, with a particularly good section being opposite the inland side of St Margaret Island, between Mann's Beach and McLoughlin's Beach.

Even quite small islands held pairs of Pied Oystercatchers. The overall impression gained was that there were pairs in virtually all suitable (non-mangrove) areas, though the density on Snake Island appeared lower than might have been expected and that on Little Snake Island was very low. Snake Island is known to be heavily populated with foxes, and this may have proved a deterrent.

Flocks

A total of 341 Pied Oystercatchers and 60 Sooty Oystercatchers was found in flocks during the aerial survey. Flock sizes ranged from three to 50 (mostly 10-20) for Pied Oystercatchers and from one to 10 for Sooty Oystercatchers. These were presumably immature (one to four year old) birds.

Flocks were mainly on the mainland shores of the complex or on islands, or parts of islands, not used significantly by breeding birds. This is in contrast to the larger late summer/autumn/winter flocks which gather mainly on the sandier ocean barrier islands. Presumably during the breeding season the concentration of territorial pairs on these outer islands drives flock birds to seek high tide roosting sites elsewhere.

DISCUSSION

The aerial survey has confirmed that 'Corner Inlet' is an extremely important breeding area for Pied Oystercatchers. It may well be the largest breeding concentration in Australia.

The figure of 250 pairs represents 5% of the total estimated Australian population of Pied Oystercatchers. However on the basis that probably 30% of the total population does not breed each year - derived from this census and that of Westernport in 1990 and 1992 plus the knowledge that breeding does not commence until age 4 to 7 (Newman 1992) - there are probably about 3500 pairs of Pied Oystercatchers in Australia. The Corner Inlet breeding pairs could therefore represent 7% of the Australian breeding population.

The finding of so many non-breeding Pied Oystercatchers and Sooty Oystercatchers, in the more inaccessible and less frequently visited inner areas of Corner Inlet, has solved the previous mystery of the location of the principal flocks of immature birds during the breeding season. It probably means that Corner Inlet is the most important location in Australia for non-breeding Pied Oystercatchers in the spring and early summer, as well as at other times of the year. It also

Table 1. Results of the Pied and Sooty Oystercatcher Aerial Survey, Nooramunga National Park (Corner Inlet) 23 December 1996.

Location	Pied Oystercatcher breeding pairs	Pied Oystercatcher (non-breeding birds)	Sooty Oystercatcher (non-breeding birds)
Islands			
Dream Is.(& Little Is.)	20	6	12
Box Bank	30	-	-
Clonmel Is.	32	3	6
Snake Is.	24	40	17
St. Margaret Is.	2	-	-
East Scrubby Is.	2	-	-
One Tree Is.	2	-	-
Robertson Is.	2	-	-
Nooramunga Is.	3	31	11
Scrubby Is.	-	15	-
Horn Is.	3	1	-
Shag Is. and Old Man Clumps	6	4	1
Sunday Is. (including Drum Is.)	73	-	-
Little Snake Is.	1	-	-
Total Islands	204	100	47
Mainland			
Above McLoughlin's Beach	7	6	-
McLoughlin's Beach to Mann's Beach	14	59	1
Mann's Beach to Port Albert	2	71	-
Port Albert to Port Welshpool	23	90	1
Port Welshpool to Barry's Beach	-	15	11
Total Mainland	46	241	13
TOTAL NOORAMUNGA NP	250	341	60

indicates that immature Sooty Oystercatchers remain on muddy/sandy areas even when the adult birds return to rockier shores to breed.

There is no doubt that a helicopter survey is the ideal method for censuring species such as Pied and Sooty Oystercatchers on a complex or relatively inaccessible shoreline. It would appear that November would have been the optimum timing (this aerial survey could not take place earlier because funding was only granted in early December), as some failed breeders or non-breeding pairs may possibly have abandoned their territories and adjourned to flocks by late December. Evidence for this is provided by three areas which had been comprehensively counted from the ground (or boat) on 16 November 1996. On the aerial survey on 23 December, 11 fewer pairs (38 versus 49) were found. The figure of 250 pairs of Pied Oystercatchers may therefore be a slight underestimate of the annual breeding population of Pied Oystercatchers in the Nooramunga section of Corner Inlet.

Conclusion

The aerial survey was most successful in quantifying the exceptionally high breeding population of Pied Oystercatchers in Corner Inlet and also in locating significant flocks of, presumably immature, non-breeding Pied and Sooty Oystercatchers.

It is recommended that the remainder of Corner Inlet, from Barry Beach right around the base of Wilson's Promontory, be aerial surveyed in 1997 to complete the quantification for the whole Corner Inlet complex. It is expected however that the number of pairs there will be much lower (possibly less than 50 pairs) although there could well be further significant non-breeding flocks.

Such data, when added to information collected along the ocean coasts of Victoria during the November 1996 Hooded Plover/Oystercatcher survey (yet to be analysed), will potentially enable a full picture to be determined of the population and status of Oystercatchers throughout Victoria during the breeding season.

A further aerial survey of the area covered in December 1996 should be undertaken in five years time to assess population changes. These may derive from overall changes in population levels (there seems to be a tendency for a gradual increase) and/or from action now in hand to eradicate foxes from further areas of the Nooramunga National Park.

ACKNOWLEDGMENTS

I am extremely grateful to Coast Action/Coast Care for a $2500 grant to the Victorian Wader Study Group to enable this aerial survey to be undertaken. Without this funding such a comprehensive survey could not have been carried out.

I would also like to thank Susan Taylor and Kath Gosden of the Victorian Department of Natural Resources and Environment, Yarram, for encouraging us to apply for such funding. Their advice and support, and that of Graeme Davis and Nick Walton of the Victorian National Parks and Wildlife Service, was invaluable and much appreciated.

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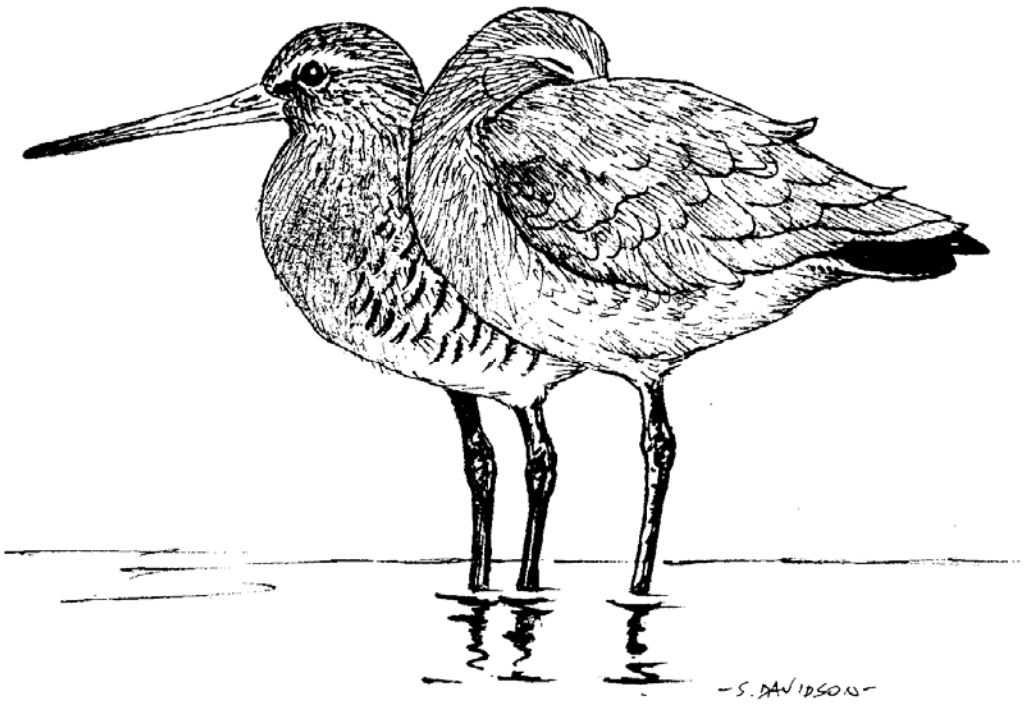

WADERS OF THE CREERY WETLANDS AND ADJACENT MUDFLATS, WESTERN AUSTRALIA.

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ABSTRACT

Results presented in this article were obtained from wader counts made in the Creery wetlands area 1994-96, in addition historical records are considered. Twenty-seven wader species are discussed in detail, and information on habitat, local distribution, numbers, seasonality and behaviour are presented. A higher number of overwintering Bar-tailed Godwits than expected and the presence of an Eastern Curlew during the winter months were discovered. Potential threats to the wetlands are discussed.

INTRODUCTION

The Creery wetlands form an integral part of the tidal marshes and mudflats that span right across the northern part of the Peel Inlet. These important wetlands are located near the resort town of Mandurah (population 41400) which is about one hours drive south of Perth, Western Australia.

The Peel Inlet and Harvey Estuary combine to make up a large tidal estuary system that, including waterways, covers 155 square kilometres. Fresh water is discharged into the system through the Serpentine, Murray and Harvey Rivers. Salt water enters through the Mandurah estuary which is the natural outlet to the Indian Ocean and also through the Dawesville Cut, an artificial outlet located at the northern end of the Harvey Estuary. The Dawesville Cut was made to improve the water quality of the estuary and flush out the high nutrient load that originated from the agricultural catchment areas. The Creery wetlands are one of at least three significant sites around the Peel/Harvey Estuary that are capable of holding in excess of 20000 waders (see Table 1). For an area so rich in waders it is surprising how little has been published about these premier wader sites of south-western Australia.

Study site

The Creery wetlands are sometimes referred to as " The Creery Marshes", "Creery Lagoon", "Creery Island" etc but these names basically identify different localities within the wetlands. The Creery wetlands described here are located between the "new" Mandurah estuary bridge and the end of Wanjeep Street at Coodanup. An overview of the whole wetland area can be had from the top of the bridge. The area is shown in Figure 1.

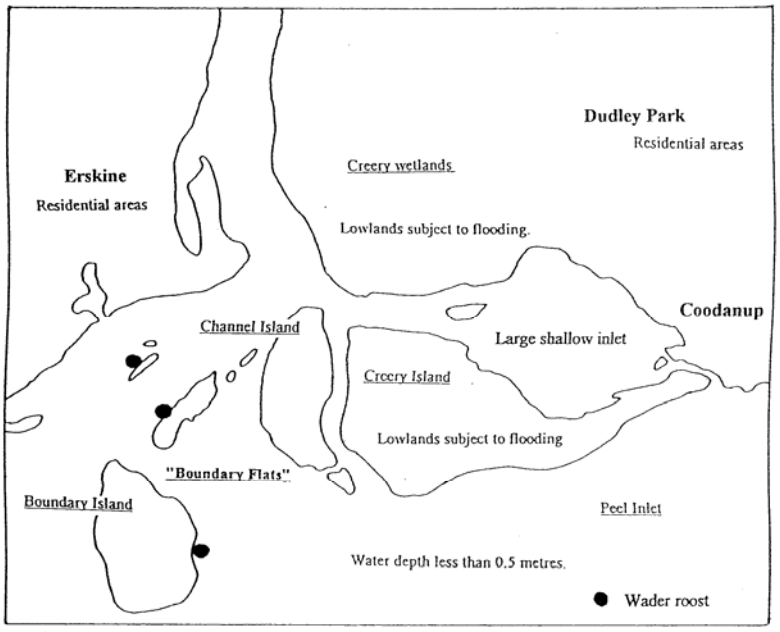

Figure 1. A map of the study site showing wader roost sites

Table 1: Highest counts for the northern peel inlet.

Location	A Creery wetl.	B Coodanup	C Serp. River	D Creery wetl.	E Austin Bay	F L. McLarty
Year	1996	1984	1985	1992	1985	1996
Pied Oystercatcher	6		2	60		
Grey Plover	134	7	7	600	16	
Pacific Golden Plover	13			85		4
Red-Kneed Dotterel						90
Black-Fronted Plover			4		5	26
Hooded Plover					1	
Little Ringed Plover						1
Lesser Sand Plover		3				
Large Sand Plover	21			15	6	
Red-Capped Plover	33	11	32		1158	690
Black-Winged Stilt	>300	362	148		2703	1580
Banded Stilt	>2000	5	10	9000	6394	1000
Red-Necked Avocet	5	124	37		606	5000
Ruddy Turnstone	3				9	1
Eastern Curlew	11			11	2	
Whimbrel	15			7	2	
Wood Sandpiper						112
Grey-Tailed Tattler	5				5	
Common Sandpiper	1		2		2	1
Greenshank	122	7	10	200	213	103
Marsh Sandpiper				284	1	142
Terek Sandpiper	4			7		
Pin-Tailed Snipe						1
Asian Dowitcher						1
Black-Tailed Godwit	14	2	13			65
Bar-Tailed Godwit	145	7		500	537	
Red Knot	>100	6		100	542	1
Great Knot	>100			850	98	
Sharp-Tailed Sandpiper	>350	463	5	2381	2119	3000
Pectoral Sandpiper		1			3	12
Little Stint						1
Red-Necked Stint	>4000	780	1520	3246	8063	8000
Long-Toed Stint					8	96
Curlew Sandpiper	>3000	366	44	2000	2804	3000
Broad-Billed Sandpiper						2
Ruff					1	5
Oriental Pratincole						10
Unidentified Waders		100				
Total	10382	2244	1834	19346	25298	22944

Footnote:

Column A. Current survey's highest wader counts conducted from April 1994 to October 1996 at the Creery wetlands.

Column B. Wader counts made from July 1983 to June 1984 (Baker, 1988). Covered two and a half kilometres of the Northern Peel Inlet between Coodanup and the Serpentine river estuary. Highest figures listed.

Column C. Northwards migration count conducted from February to April 1985 (Baker 1988). Covered half a kilometre of Northern Peel Inlet near Serpentine estuary. Highest figures listed.

Column D. Waterbirds of South-Western Australia: highest numbers counted between 1981 and 1992 (Jaensch *et al.* 1993). Article contained some information relating to the Creery wetlands which was extracted.

Column E. The nature reserve Austin Bay is located on the eastern side of the Peel Inlet. Details contained in Jaensch *et al*. (1988). Highest numbers counted are listed. Area interacts with northern Peel Inlet.

Column F. Highest counts made at Lake McLarty (Burbidge & Craig 1996). Information was collated from various databases up to 1996. See references in Burbidge & Craig (1996). Area interacts with rest of Peel Inlet.

The Creery wetlands contain the largest marsh area in the study site. The wetlands are an extension of the mainland, bordered by Sheoaks and Tuart forest on the north and north-eastern side. The wetlands consist of large samphire flats that are subject to inundation at different times of the year. The Creery wetlands hold some permanent pools of water however, generally speaking, the marshes are flooded during autumn and winter and dry out during spring to be largely dry in summer.

Opposite the wetlands lies the samphire covered Creery Island which has some small shallow lakes of it's own and a southern fringe of Sheoaks. Between the Creery

wetlands and Creery Island is a large shallow inlet/lagoon that at times contained very large numbers of waterbirds and waders. When the Banded Stilt *Cladorhynchus leucocephalus* appeared they could be found here in numbers. The lagoon offered a protected and sheltered environment.

Channel Island is to the west of Creery Island and separated by a narrow waterway. Boundary Island can be found further out into Peel Inlet and was the most isolated of the three islands. The water depth surrounding the whole complex of islands and wetlands was less than half a meter and during spring and summer, when the water levels dropped and the tide was out, extensive mudflats were exposed. Some mudflats extended for a considerable distance out into the Peel Inlet.

Boundary Flats is found between Boundary Island and Channel Island and was the richest wader site both in terms of numbers and diversity from September through to December. High water levels in winter meant that some wader habitats remained inaccessible for surveying, in particular Boundary Island.

Regional interactions

The wetlands of the northern Peel Inlet area cannot be viewed in isolation when considering wader numbers and wader movement. The wetlands are inextricably linked with other important sites around the Peel and Harvey Estuary system. The variables to be considered in the context of this article and which should be included in any future research are:

1. Wader movement patterns between different sites within the northern wetlands. Considerable exchange was observed between the waders from the Creery wetlands, the adjacent Coodanup beach area, the Serpentine river estuary and the other wetlands along the Mandurah estuary and Sticks Channel. A passing bird of prey was sufficient to set the rotation of waders in motion.
2. Wader movement patterns within the Peel- and Harvey Estuary system. The Austin Bay nature reserve and other nature reserves around the Peel Inlet form a chain of important and interlinking sites. The potential exchange of waders between these sites still remains to be investigated.
3. Wader movement patterns between the Peel- and Harvey Estuary system and the nearby ephemeral lakes and coastal areas e.g. banks of the Serpentine river and Lake Mclarty.
4. The interaction with the larger lake systems to the north and south of the Peel Inlet. During summer alternative feeding sites become progressively available as lakes dry out. To the north are Lake Cooloongup, Lake Walyungup and lakes that form part of the lower reaches of the Serpentine river. To the south is Lake Clifton, Lake Preston etc.
5. Recreational pressures and variable water levels would make some sites less desirable at certain times of the year and probably result in localised wader movement.

Large fluctuations in some of the count data could be explained by some of the above mentioned factors.

METHODS

Data were collected during 29 visits made to the Creery wetlands, Boundary Flats and nearby Creery, Channel and Boundary Islands. Visits covered all months of the year and were made between April 1994 and October 1996. The number of visits made were 1994 (5), 1995 (12) and 1996 (12). Most visits fell in the period between September and December. The location was surveyed in the morning by walking and wading a predetermined circuit, mainly at low tides. Observations were made with Zeiss 15x60 binoculars. Efforts were mainly concentrated on Boundary Flats and the Creery Wetlands and to a much lesser extend on the wetlands along the Mandurah Estuary and the Coodanup to Nairns foreshore.

The Coodanup to Nairns beach front must rate as one of the most accessible locations to conduct wader counts anywhere. Just back from the beach and mudflats are grassed areas and a parallel road making it ideal for surveys. Figures 2 and 3 show the locations where different wader species were observed on a consistent basis at low tides. These details may prove of assistance for future reference and for comparisons.

A number of wader roosts were identified. One was at the mouth of the Serpentine River which fell outside the area surveyed. The roost at the Serpentine River is within a wildlife sanctuary and consisted of samphire, sandbanks and mudflats. Another roost was on the south-eastern side of Boundary Island and it can be reached by boat. The small unnamed islets between Boundary Island and Channel Island, and those in the Sticks Channel also had roosts on their lee sides. The foreshore at Mandurah Quay offers accessibility and elevation, both facilitate wader counts. The wader roosts on the off-shore islets can be readily surveyed by telescope from Mandurah Quay. The waders did not frequent the roosts on a consistent basis and factors such as recreational pressures, water levels and wind direction may have influenced the occupation of roost sites. During high tides and inclement weather waders occasionally dispersed to the samphire marshes.

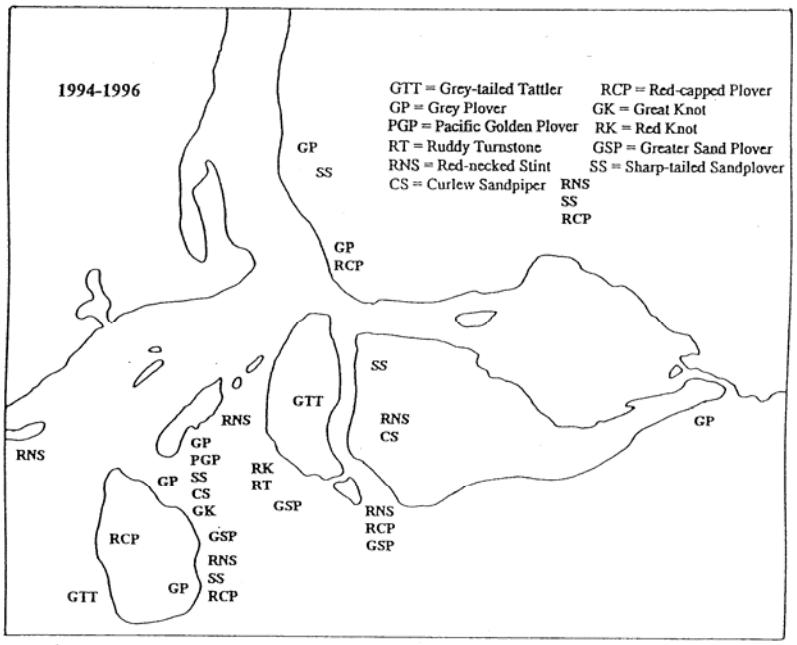

Figure 2. Distribution of small and medium sized wader species.

RESULTS

Species accounts

The following comments should be read in the context of the 1994-1996 observations. In the species account the "maximum number" and the" months present" refers only to the area surveyed as displayed on Figure 1. Reference has been made to past observations from the Creery wetlands to supplement current observations. These records were obtained from Western Australian Bird Notes and Storr & Johnstone (1988). Arrival dates were determined by the first sightings of a wader species in the wetlands or in the case of overwintering species the date of arrival of waders showing traces of breeding plumage.

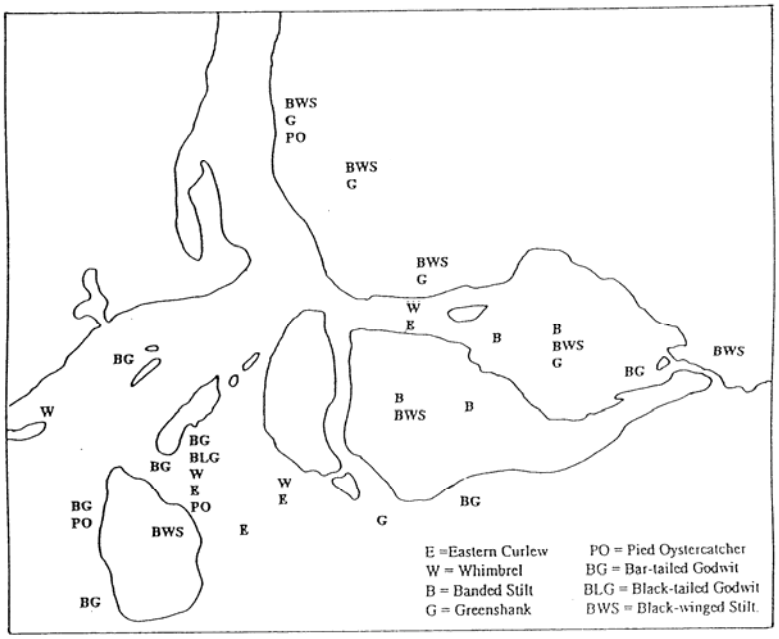

Figure 3. Distribution of large wader species.

The fact that some endemic/transequatorial waders were not listed for a specific month does not always mean they were not present, it merely means they were not observed. A summary of bird species distributions is given in Figures 2 and 3 and a summary of maximum counts is given in Table 1.

Pied Oystercatcher, *Haematopus longirostris*.
A couple of Pied Oystercatchers were regularly present on the sandy foreshore east of the new Mandurah estuary bridge. Pied Oystercatchers could be found foraging on Boundary Flats and on the sandy beaches of Creery, Boundary, and Channel Islands. Usually observed in pairs. Breeding on Boundary Island suspected. Observations also come from Nairns beach and the grassed grounds in nearby residential estates.

Maximum number: 6
Months present: July, August, October, November, December, January, February, April.

Grey Plover, *Pluvialis squatarola*.
One of the more common waders. A small number of Grey Plovers overwintered. The first groups (120) arrived in mid-September with many still showing extensive black breeding plumage. Initially groups remained together but as the season progressed they gradually dispersed throughout the region. A moderate sized flock of 60-80 Grey Plovers stayed at Boundary flats from September through to January.

On 12 May 1996 a Grey Plover was sighted near Boundary Island in partial breeding plumage which was unusual considering the time of the year. Could this have been a late departing bird? Movement to coastal beaches was suspected in winter.

Maximum number: 134
Months present: September, October, November, December, January, February, March, April, May, June

Pacific Golden Plover, *Pluvialis fulva*.
Earliest observations were made in the first week of October. November however was the month in which the majority of observations were made. The Pacific Golden Plover was seen on Boundary Flats and near Creery Island often in the company of Grey Plovers. The Pacific Golden Plover's stay was brief and it's numbers were few. An observation of 14 Pacific Golden Plovers was made at Creery Island on 6 January 1994 (Anon 1994).

Maximum number: 13
Months present: October, November, December, January.

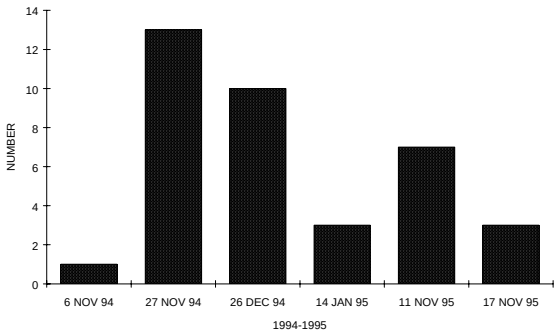

Figure 4. Variation in the number of Pacific Golden Plover in the summer of 1994/95.

Hooded Plover, *Thinornis rubricollis*.
Absent during this survey however previously one Hooded Plover was sighted during a RAOU excursion on 14 November 1992 (Taylor 1993).

Maximum number: 1
Months present: November.

Large Sand Plover, *Charadrius leschenaultii*.
Appeared first in mid September and was present throughout the area surveyed. Most observations were of one to three plovers, occasionally more were counted. The Large Sand Plover was observed less frequently after December. Two Large Sand Plovers were sighted at the east breakwater, Mandurah, on 4 May 1991(Vervest 1991).

Maximum number: 21
Months present: September, October, November, December, January, February.

Red-capped Plover, *Charadrius ruficapillus*.
A common resident scattered widely throughout the wetlands in small groups. The Red-capped Plover breeds on Boundary Island. On 16 December 1995 an adult displayed the broken wing behaviour and one young runner was observed. At the Serpentine River reserve the Red-capped plover was regularly present.

Maximum number: 33
Months present: July, August, September, October, November, December, January, February, March, May

Black-winged Stilt, *Himantopus himantopus*.
Commonly found throughout the area. The samphire marshlands were the Black-winged Stilt's main stronghold. Present around Boundary, Creery and Channel Islands. Numbers gradually decreased in the wetlands during the early winter months. Totally absent in late winter (August) and early spring (September) when the Black-winged Stilt had presumably returned to the ephemeral lakes that were being replenished by the winter rains.

Maximum number: > 300
Months present: July, October, November, February, March, April, May, June.

Banded Stilt, *Cladorhynchus leucocephalus*.
The Banded Stilt inhabited the saltlakes on Creery Island and the large shallow inlet between Creery Island and the Creery wetlands. Their presence at the wetlands of the northern Peel Inlet was often unpredictable. Thousands of Banded Stilts were present before the cyclonic rains of February/March 1994 fell in the interior regions of Western Australia. After these rains the Banded Stilt moved inland to breed at Lake Ballard. Ever since their departure in February 1994 only one observation has been made of two Banded Stilts on 11 November 1995. Small groups of several hundred Banded Stilts did however show up on Lake Cooloongup in January 1996.

They had still not returned at the time of writing this article (October 1996). An observation made on 28 December 1993 reported 9350 Banded Stilts at Creery Island and this gives an indication of their abundance when present (Anon 1994a). The sheer number of Banded Stilts that intermittently inhabit the wetlands are indicative of the wetlands importance as a sanctuary and it is suspected that the Creery wetlands function as a final refuge when access to other sites is restricted.

Maximum number: >2000
Months present: November, December, January, February, April.

Red-necked Avocet, *Recurvirostra novaehollandiae*.
A favourite roosting site was on the sandbanks north of the Serpentine River Estuary where 20-40 often occurred. Further observations came from the shallow inlet between Creery Island and the mainland.

Maximum number: 5
Months present at Serpentine River Estuary: July, August, September, November, February, March, April, May, June.

Ruddy Turnstone, *Arenaria interpres*.
There are a few sightings from Boundary Flats and near Channel Island. It was likely that these Ruddy Turnstones originated from the Mandurah coastal areas. A few scattered observations exist from other sites around the Peel Inlet such as Austin Bay and Lake McLarty.

Maximum number: 3
Months present: September, November, January

Eastern Curlew, *Numenius madagascariensis*.
The Eastern Curlew was present in the northern Peel Inlet throughout most of the year. There were a number of solitary sightings during the winter months which indicated that at least one bird overwintered. In winter the Eastern Curlew was observed roosting on the island opposite Mandurah Quay. Eastern Curlews arrived in late September and could be found feeding in the deeper waters around Creery Island and at the edge of Boundary Flats.

They were usually solitary and occasionally in small groups up to 11 birds. Largest numbers present from October through to January. For seasonal changes in numbers see Figure 5. Observations also recorded from Mandurah boat harbour, between the Mandurah traffic bridges and in the samphire marshes. At Coodanup 16 Eastern Curlews were seen on 10 October 1992 (Anon 1992). This species was quite vocal when disturbed. Moult of primaries (numbers one to four missing) observed in mid September.

Maximum number: 11
Months present: July, August, September, October, November, December, January, February, March, May, June

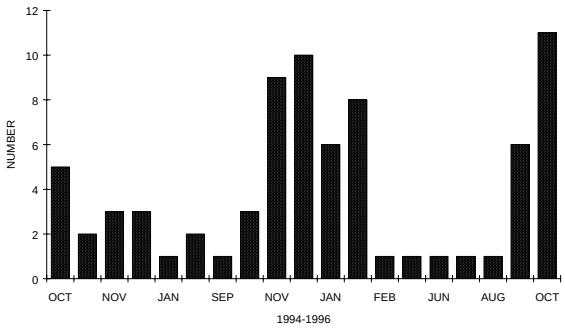

Figure 5. Seasonal trends in numbers of Eastern Curlew.

Whimbrel, *Numenius phaeopus*.
Details of the Whimbrel closely matched those of the Eastern Curlew. For seasonal trends in numbers see Figure 6. The habitat was very similar to that of the Eastern Curlew although Whimbrel stayed out of the deeper water. The Whimbrel was more numerous with up to 15 sighted and was often found in areas fronting onto Sticks Channel. A previous sighting of 17 Whimbrels was made at Creery Island on 10 October 1993 (Anon 1993).

Maximum number: 15
Months present: September, October, November, December, January, March, May.

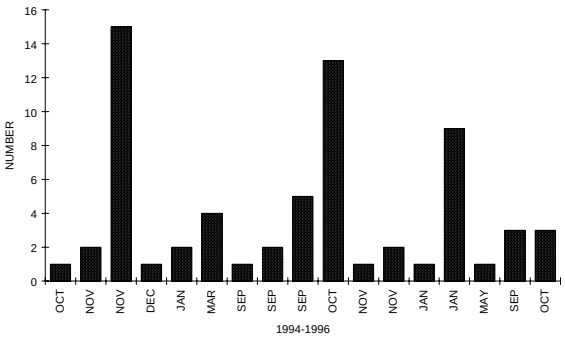

Figure 6. Seasonal trends in numbers of Whimbrel.

Grey-tailed Tattler, *Heteroscelus brevipes.*
The perimeter of Boundary Island consists of wide banks covered with sedges and samphire. At high tide these would flood and when the tide receded small pools were left behind among the sedges. This habitat was favoured by the Grey-tailed Tattler. Further sightings were made on the exposed mudbanks of Creery and Channel Islands. Solitary birds were usually seen although there are a number of sightings of more than ten Grey-tailed Tattlers in a group. Other locations that have produced sightings are the Mandurah estuary and Sticks Channel. Grey-tailed Tattlers are known to overwinter at Cockburn Sound 50 kilometres to the north of the Peel Inlet. There was a sighting of 14 Grey-tailed Tattlers at Sticks Channel on 6 January 1994 (Anon 1994).

Maximum number: 5
Months present: October, November, December, January, February.

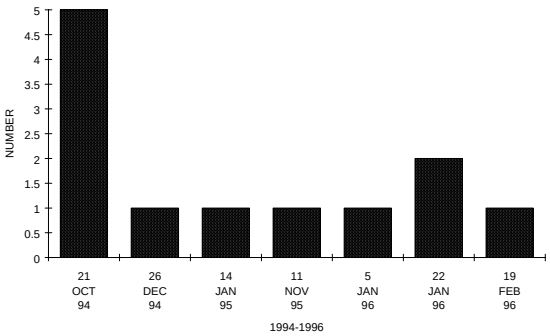

Figure 7. Number of Grey-tailed Tattler recorded in summer.

Common Sandpiper, *Actitis hypoleucos.*
Seen mainly on the sandy beaches along the Mandurah estuary, near the new traffic bridge and on the beaches and mudbanks of Channel Island. Further sightings come from the beach frontage near the Serpentine Estuary. Sightings were of solitary birds.

Maximum number: 1
Months present: September, November, January, February, March

Common Greenshank, *Tringa nebularia*.
The Greenshank was common throughout Peel Inlet and was found in a wide variety of wader habitats in the Creery wetlands. It was found feeding around the permanent pools in the samphire foreshore, along the mudbanks, on the sandy beaches and wading in shallow waters of the inlets.

When the Greenshanks first arrived in September they tended to remain in tight groups. Easily disturbed at this stage they would swarm to great heights, barely visible through binoculars, and then return to their original departure point. As the season progressed they dispersed widely throughout the Creery Wetlands and adjacent wetlands. Groups of 30-40 individual were common.

Greenshanks were occasionally noted forming groups and flying in formation before departing on their northward migration. An observation of 175 Greenshanks was made at Creery Island on 5 October 1993 (Anon 1994).

Maximum number: 122
Months present: September, October, November, December, January, February, March, April

Common Redshank, *Tringa totanus*.
One observed near Creery Island, Peel Inlet on 12 July 1985 by Jaensch and Blyth (Storr & Johnstone 1988).

Marsh Sandpiper, *Tringa stagnatilis*.
Absent during this survey. Only available details contained in Table 1.

Terek Sandpiper, *Xenus cinereus*.
Two sightings were made on the mudbanks of the channel between Creery and Channel Islands and another sighting comes from the lagoon on the north-east edge of the Peel inlet. An observation of 12 Terek Sandpipers was made on 6 April 1991 (Vervest 1991).

Maximum number: 4
Months present: October, April

Black-tailed Godwit, *Limosa limosa*.
In contrast with the Bar-tailed Godwit, the Black-tailed Godwit was not often seen. The fresh water lakes seemed it's preferred habitat. Only three observations were made during my visits. After their arrival at the wetlands the Black-tailed Godwit displayed some erratic flying behaviour such as a “zig zag” flight and a “spiralling down to the ground” flight. This behaviour was observed early in the season and similar aerobatics were also performed by the Pacific Golden Plover.

A sighting of 49 Black-tailed Godwits was made at the Creery Marshes on 28 December 1993 (Anon 1994a).

Maximum number: 14
Months present: September, October, November, December, January

Bar-tailed Godwit, *Limosa Lapponica*.
A common wader throughout the wetlands and found in all wader habitats. The Bar-tailed Godwit was often found feeding in the company of Greenshanks. The Bar-tailed Godwits arrived in September and some were still showing partial breeding plumage. Groups over a hundred were regularly found feeding on Boundary Flats.

A few Bar-tailed Godwits were in near full breeding plumage from mid February till early March. Could this be the contingent of Bar-tailed Godwits that were returning to their breeding grounds while those remaining kept their non-breeding plumage?

A moderate number of Bar-tailed Godwits overwintered in the northern Peel Inlet. For example groups of 15 to 45 were sighted during June and July 1996. They liked to roost on the small islands in Sticks Channel. Small numbers of Bar-tailed Godwit were seen during the winter months at the Serpentine River Estuary.

Maximum number: 145
Months present: July, August, September, October, November, December, January, February, March, April, May, June.

Red Knot, *Calidris canutus*.
Arrived at the Creery mudflats from mid September onwards in small groups of 20-50 individuals. Numbers peaked in November when slightly more than one hundred Red Knots were counted. After November numbers dropped off markedly and there were few observations after Christmas. Historical data seems to indicate that the Red Knot was more common in the past.

Maximum number: >100
Months present: September, October, November, December, January, March

Great Knot, *Calidris tenuirostris*.
The Great Knot arrived towards the end of September, usually as solitary birds. Numbers increased during October and peaked in November, after which time numbers decreased considerably. Great Knots appeared in small groups (30-50) again from mid-March to early May.

A small group of Great Knots (53) some in partial breeding plumage were seen at the Serpentine River Estuary on 12 May 1996. It was interesting to note that at Woodman Point, which is located on the coast and ten kilometres south of Fremantle, a corresponding increase in Great Knot numbers was detected during late April and early May.

Maximum number: >100
Months present: September, October, November, December, January, March, April, May

Sharp-tailed Sandpiper, *Calidris acuminata*.
First arrived at the Creery Wetlands in September in small groups. Congregations of less than one hundred were noted in September but the numbers increased to several hundred by November. Initially the Sharp-tailed Sandpiper kept to the exposed mudflats and island perimeters but dispersed to the samphire marshes later in the season when they became inundated.

Maximum number: >350
Months present: September, October, November, December, January, February, March

Red-necked Stint, *Calidris ruficollis*.
The advance parties of a couple hundred Red-necked Stints arrived in mid September. This soon turned into a "flood" and by the end of September there were thousands (3000) on the mudflats. These numbers remained till early December after which numbers drastically declined. It is known that the Red-necked Stints disperse to the ephemeral lakes on the Swan coastal plain at this time. The lakes produce large mudflats as they progressively dry out during summer. A number of these ephemeral lakes surround the Peel /Harvey Inlet. Lake Cooloongup to the north was showing extensive mudflats as it's lake bed dried out in early February 1996 and one count estimated the number of Red-necked Stints present in excess of 10000.

Large shallow lakes formed in the Creery wetlands towards the end of summer. The inundations were caused by a combination of high tides and strong winds. The shallow lakes were located where the Sheoak treeline adjoins the wetlands. Red-necked Stints and Sharp-tailed Sandpipers were commonly found around these lakes at the end of summer and early autumn.

The Red-necked Stint overwintered in small numbers in the northern Peel Inlet. In early June 48 Red-necked Stints were present at the Serpentine River Reserve. A sighting of 6 Red-necked Stints was made at Mandurah boat harbour in July 1991.

Maximum number: >4000
Months present: September, October, November, December, January, February, March, May.

Curlew Sandpiper, *Calidris ferruginea*.
The Curlew Sandpiper arrived in September in groups of several hundred. Some of the first arrivals still showed

remnants of their breeding plumage. Numbers peaked in November after which time numbers reduced considerably. Small groups of 60-100 remained till mid March when they departed.

Maximum number: > 1000
Months present: September, October, November, December, January, February, March.

Broad-billed Sandpiper, *Limicola falcinellus*.
Storr and Johnstone (1988) mention that the Broad-billed Sandpiper were found on the Creery Island mudflats in March. No observations made during survey.

Months present: March

Ruff, *Philmachus pugnax*.
Not observed during survey however one sighting at Coodanup in mid-January 1992 and again that same year in October, at the same location (Anon 1992, Davies 1992, Vervest & Burbidge 1992).

Maximum number: 1
Months present: October, January

Threats
There are many factors currently impacting on the Creery wetlands and these are likely to increase in the future. These threats include:

1. Residential development.
The City of Mandurah is experiencing rapid population growth. Over the 10 years 1981-91 it had the highest percentage of population growth of all municipalities throughout Western Australia. Resident population projections at 2026 are estimated to be 150000 (Ministry for Planning 1996) a three fold increase on present numbers. The main dangers associated with human population increase are the residential developments that are continually encroaching on the Creery Wetlands e.g. at Mandaruh Quay, Dudley Park and Coodanup. These have the potential to gradually erode the importance of the wetlands. Once that has occurred their conservation value will be much harder to defend. At present the Creery wetlands act as a buffer to the more important conservation areas around Creery Island. They also inhibit ready access the these sites.

Indeed the Creery wetlands have recently escaped from being turned into a canal development. Residential development at Mandurah Quay has had an impact on the wader roosts that lie just off shore from the resorts new marina, through increased traffic of pleasure craft and Jet skies. The draft Peel regional plan further shows that all the land around the Creery wetlands has been earmarked for future urban development (Anon 1996).

2. Perth's expansion.
The Peel Inlet abuts the South-West Corridor which is a major growth corridor for the Perth Metropolitan region, the capital city of Western Australia. Recreational pressures are quite intense as the Peel Inlet provides a major holiday and recreation destination for both Perth and adjacent towns.

3. Recreational activities
The City of Mandurah has put up signs restricting access to the Creery wetlands but this has not stopped trail bikes and four-wheel drive vehicles from entering and damaging the wetlands.

The shallow tidal waters around the edges of the Peel Inlet are the breeding grounds for the Blue Manna crab *Portunus pelagicus* which shares the same habitat as the waders. The Peel Inlet is a favourite fishing spot and during the summer holidays people crowd onto the mudflats and into the shallows in their search for crabs and prawns *Metapenaeus dalli* for private consumption.

4. Other factors
Aerial spraying takes place in summer in order to reduce the number of mosquitoes. The mosquitoes are carriers for the Ross River Virus and the wetlands are their main breeding grounds. "Abate" (active ingredient temephos) is used in both liquid and granular form when sprayed over the wetlands.

A future industrial park has been planned along the Serpentine River which empties into the northern Peel Inlet. Point Grey located near the Austin Bay reserve is earmarked for future tourist resorts. Important conservation areas around the Peel-Harvey estuary are in the hands of speculators and private developers.

Conclusion
The Creery wetlands and adjacent mudflats are a site of international significance. The area is one of the most important wader sites in south-western Australia by virtue of the diversity in wader species and the sheer numbers held. Although the wetlands remain vulnerable to future development, the existence of a strong community desire to protect and preserve the Creery Wetlands continues to be an important factor in it's favour. In addition, the original developer, Ceder Woods Properties Limited and the City of Mandurah are working together to rehabilitate degraded wetland areas.

This article aims to provide a basis for further research and to complement existing data. Continued conservation can be assisted through the provision and availability of evidence endorsing the wetlands environmental value.

ACKNOWLEDGMENTS
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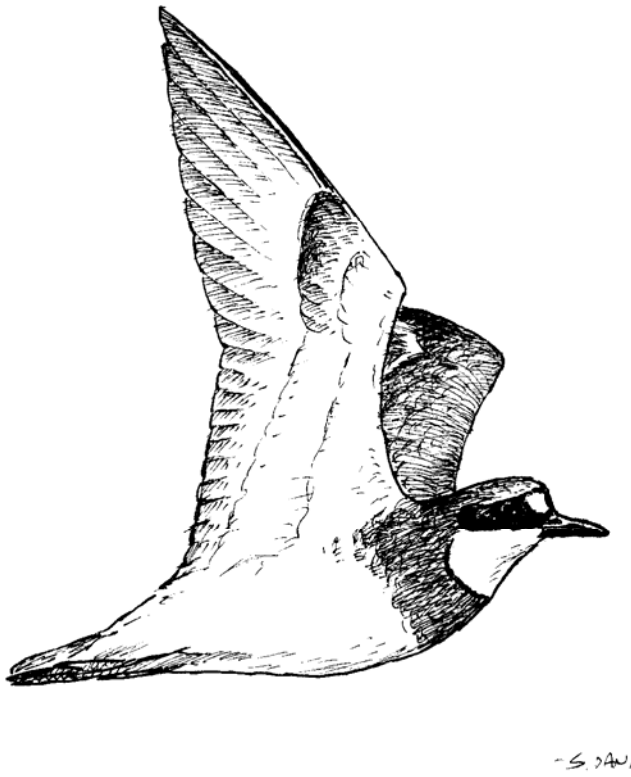

FOOT TREMBLING IN THE HOODED PLOVER *Thinornis rubricollis*

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The term foot trembling refers to the rapid vibration of the foot against a mud or sand substrate and has been observed in a number of species in the Family Charadriidae (e.g. Simmons 1961a,b; Sparks 1961; Pienkowski 1981; Osborne 1981; Schulz 1986). Foot trembling is postulated to enhance prey capture in situations of low prey availability such as low temperatures, high wind speeds or rain (Pienkowski 1981). In a preliminary study of the foraging behaviour in the Hooded Plover *Thinornis rubricollis* on Darby Beach and Venus Bay, central Victoria, Australia, foot trembling was not observed (Schulz *et al.* 1984). However, in a more detailed study of foraging behaviour in this species on Darby Beach on the west coast of Wilsons Promontory ($39^0$04'S, $146^0$22'E), from March to September 1984, foot trembling was observed on a number of occasions (Schulz 1984).

In the Hooded Plover, the actual trembling motion observed was a rapid vibration of one foot held slightly ahead of the other for no more than four seconds. Feet were alternated between trembles and up to four changes were noted before the bird directed a peck at a disturbed prey item. Foot trembling was observed at different ambient temperatures and wind conditions. However, foot trembling behaviour consistently followed periods of prolonged or heavy rain events and was always undertaken on saturated sand surfaces. Similarly, Osborne (1981) only noted foot trembling in the Ringed Plover *Charadrius hiaticula* on saturated surfaces. Foot trembling was observed on two sections of the beach:

1. Storm Tide Zone - This uppermost section of the beach only floods during spring high tides or large onshore swells. In this zone heavy or prolonged rain saturated the sand collected on top of large beachcast kelp clumps and a film of water developed on the surface. Foot trembling was only observed on these saturated sand surfaces in this zone. In these kelp clumps large numbers of the sand hopper *Orchestia* (Amphipoda) sheltered (Schulz 1984).
2. Mid-beach Zones - Sections of the beach that were covered during high tide. In these zones following rain, subsurface runoff from the backing sand dunes surfaced and flowed as a thin film of water down the beach. Foot trembling was only detected in this section of the beach at low tide when surface run-off was present. Dominant prey items in this section of the beach were isopods and amphipods (Schulz 1984).

No foot trembling was observed in the low tide zone of the beach. Similarly at night using a Noktron V S/NB-image intensifier no foot trembling was detected in foraging Hooded Plovers.

Foot trembling has been postulated to increase prey availability by:

1. The trembling vibration causes prey to move to the surface of the substrate where they become more conspicuous to a foraging bird (Simmons 1961a,b; Osborne 1981).
2. The action enhances the thixotrophic properties of damp sand, thereby causing buried prey items to float out of the substrate to the surface (Sparks 1961).

In a crude test to simulate foot trembling at Darby Beach I used the foot of a dead Flame Robin *Petroica phoenicea* that I had found beachwashed. This foot I vibrated lightly against the saturated sand. It was found in the storm tide zone that such a vibration resulted in sheltering *Orchestia* to move out on to the surface or to appear as slight mounds just below the surface. Such responses would result in *Orchestia* becoming more obvious to a visually-foraging Hooded Plover. Similarly, in the mid-beach zones the amphipod *Warreyus* and the isopod *Pseudolana* moved up to the surface.

Why would foot trembling vibrations cause prey to become more conspicuous? Jones (1970) found that in the isopod *Eurydice* mechanical stirring of the sand resulted in emergence. Perkins (1958) observed that amphipods responded to vibrations normally associated with the approaching tide edge. It is suggested that foot trembling may be used to simulate the action of an incoming tide, promoting activity in potential prey species and hence increase their availability to a visually-foraging predator such as the Hooded Plover.

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FALCON AVOIDANCE IN THE GREY-TAILED TATTLER *Heteroscelus brevipes*.

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In Australia, falcons have been recorded preying on a variety of shorebirds, including Latham's Snipe *Gallinago hardwickii*, Red-necked Stint *Calidris ruficollis*, Sharp-tailed Sandpiper *C. acuminata*, Painted Snipe *Rostratula benghalensis*, Black-winged Stilt *Himantopus himantopus*, Banded Stilt *Cladorhynchus leucocephalus*, Inland Dotterel *Charadrius australis*, Black-fronted Dotterel *Elseyornis melanops*, Hooded Plover *Thinornis rubricollis*, Red-kneed Dotterel *Erythrogonys cinctus*, Banded Lapwing *Vanellus tricolor*, Masked Lapwing *V. miles* and the Australian Pratincole *Stiltia isabella* (summarised from Marchant & Higgins 1993). Little has been written on falcon avoidance techniques used by shorebirds. Page and Whitacre (1975) noted that there was a lower success rate in attacking flocks of over 50 waders than smaller groups or single birds. In this note, I report on observed capture avoidance behaviour displayed by a single Grey-tailed Tattler *Heteroscelus brevipes* to repeated stoops from an Australian Hobby *Falco longipennis*.

At 18:32 Daylight Saving Time on the 20 March 1996 while surf skiing at Minnie Water in north-eastern New South Wales, Australia ($29^0$46'S, $153^0$18'E) a solitary Grey-tailed Tattler was observed to flush off the beach and fly out over the water calling loudly. Some 15 m above was an Australian Hobby, which arced down in pursuit of the tattler. The tattler flew very low (<0.5m), just above the surface of the water and headed out to sea. When the Australian Hobby had all but caught up the tattler dropped into the water and disappeared briefly from view. The hobby passed over the same area as where the tattler had dropped into the water, gained altitude to about 20 m and circled back in a wide arc. In the meantime after only one or two seconds the tattler reappeared and took off, again flying low over the water further out to sea and calling. The hobby took up the pursuit and as before, dropped in altitude and stooped at the tattler. Again at the very last moment the tattler dropped into the sea, disappearing from view and reappeared immediately after the swoop of the hobby. Once more the tattler took off from the water and flew low further out to sea calling . This sequence of events was followed in close succession on two more occasions. After four unsuccessful attempts at catching the Grey-tailed Tattler and some 400 m offshore the hobby gained altitude and flew back to the beach disappearing from view over adjacent coastal vegetation. In the meantime, the tattler circled back towards the beach and landed on an offshore rock platform apparently none the worse for the encounter. Conditions at the time of these observations were: north-east wind (10 kmh^{-1}), no cloud cover, gathering darkness following sunset and slight seas with a moderate easterly swell.

The Grey-tailed Tattler was easily outpaced in flight by the pursuing Australian Hobby. It appeared that the tattler would have been captured were it not for the strategy of flying out over the water and dropping into and below the sea surface when the hobby had almost caught up. Similarly in Australia, a juvenile Pied Oystercatcher has been recorded flying to the water and diving to avoid predators (Marchant & Higgins 1993).

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DISTURBANCE OF COMMON SANDPIPERS *Actitis hypoleucos* BY MOTOR-BOATS.

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Disturbance to waders and waterfowl has recently attracted considerable attention from researchers around the world (e.g. Davidson & Rothwell 1993). Indeed, an understanding of disturbance and its effects has both academic and applied benefits. Although much more research needs to be conducted, it is useful at this early stage, to simply document instances of disturbance (e.g. Retallick & Bolitho 1993, 1996). In this way managers or planners can at least be aware of some of the disturbance-wader interactions, and hopefully incorporate such considerations into the treatment of important wader sites.

The following observations were made in August 1996 while travelling to Taman Negara, a large National Park in the middle of Peninsular Malaysia. Access to the park is by long, motorised and rather noisy boats, which travel along the Tembeling River. These boats make a return trip to the Park twice a day (see Finlay & Turner 1994).

Additionally, it is almost certain that local inhabitants use boats on the river at any time of day. Typically the banks of the river have thick rainforest overhangs, though there are places with small beaches on the river banks. In addition, there are also large sandbanks on bends in the river, and sometimes in the middle of the river. Common Sandpipers *Actitis hypoleucos* were the only wader seen on my trip along the river, and only about ten were seen along 60 km of river. The Common Sandpipers were located on the larger sandbanks in the river. As our group of boats passed the birds, I noticed that most of them responded strongly to the disturbance. Typically, the bird would take flight and move to a section of river further from the boats. In one instance this involved a movement from a sandbank to a sandy edge, and then a flight from the edge back to a different sandbank in the river. A few of the Common Sandpipers did not take flight, but ran to the far side of the sandbank on which they were located. All Sandpipers seen made some response to the passage of the boats. D. Rogers (pers. comm.) made trips along the river in September 1994 and 1995, and on each trip noted Common Sandpipers and observed that at least some were disturbed by the boats.

We can only speculate about the effect of this disturbance. It is interesting that complete habituation to such regular boat traffic had not occurred, though it is possible that the birds on the river may have recently migrated from further north. Clearly, it is not only estuaries and shorelines where waders encounter disturbance!

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THE STATUS OF MARSH SANDPIPERS *Tringa stagnatilis* IN NORTH QUEENSLAND, AUSTRALIA.

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This note provides further information on the status of Marsh Sandpipers *Tringa stagnatilis* in the Townsville Region, North Queensland. Wieneke (1995) states that they " .... usually occur in small numbers from single birds to flocks up to twenty" This publication covers areas that are easily accessible to the general public (physically and legally) as it is intended for the recreational birdwatcher. However, the most significant wader habitats in the region, indeed throughout North Queensland, are either in areas requiring physical difficulty to access or are on privately owned, highly sensitive wetlands. Such sites are usually under the control of the government, military or large corporate organisations. Permits to access and work in these areas are hard won. Indeed, these areas are only identified in wider ranging scientific references (e.g. Alcorn *et al.* 1995 and ANCA 1996).

These wetlands hold greater numbers than quoted by Wieneke (1995). Groups in excess of 50 Marsh Sandpipers are the norm whilst flocks of 200 plus can be found during mid-summer (middle of the non-breeding season) when conditions permit. Perhaps the most interesting count last year was taken by Barry Nolan and myself on 12 November 1996 during a survey for the Queensland Department of Environment. The survey was undertaken at gazetted wetland BBN001QL (19°55'22"S, 148°02'25"E) where we counted 318 Marsh Sandpipers. Watkins (1993) estimates the population of Marsh Sandpipers in Australia as 9000 birds. The 1% criteria for this site to be regarded as of national importance (90 birds) was easily surpassed. It is at these significant sites, with large populations, that fishing behaviour of Marsh Sandpipers (recently reported by Wieneke & Cross 1996) can be observed.

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FISH FEEDING WADERS OF NORTH QUEENSLAND, AUSTRALIA.

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Wieneke & Cross (1996) described a new prey item for Marsh Sandpipers *Tringa stagnatilis*. In fact, Marsh Sandpipers have been previously recorded taking fish and the behaviour has also been previously documented. Indeed, all "Shanks" include fish in their diet, it is one of the idiosynchracies of the group. Other species of Tringini also ingest fish when the opportunity arises.

The most comprehensive reference is perhaps del Hoyo *et al.* (1996). In reference to the diet of Marsh Sandpipers, they state "at least fish" and proceed to describe in detail the fishing techniques used by "Shanks" especially *T. stagnatilis*.

Below I present a short list of wader species that I have seen eating fish in north Queensland. These records do not necessarily constitute undescribed prey items, and notes regarding the coverage of dietary items from Higgins & Davies (1996) and del Hoyo *et al.* (1996) are included. All observations were made at close range (within ten metres) with high resolution binoculars, or with a telescope, leaving no doubt as to the identification of the prey. The list is in chronological order of observations:

Black-tailed Godwit *Limosa limosa*.
Townsville Town Common (19°14'S, 146°45'E) on 14 October 1991. Took silver fish with dark vertical bars (about three centimetres long) from a shallow pool in mud. Higgins & Davies (1996) and del Hoyo *et al.* (1996) list only fish eggs.

Red-necked Stint *Calidris ruficollis*.
Cleveland Bay (19°16'S, 146°51'E) on 12 August 1994. Took small, silver fry (about two centimetres long) from surface of mud, and manipulated it in the bill for several seconds before swallowing. Neither Higgins & Davies (1996) nor del Hoyo *et al*. (1996) record fish in the diet.

Eastern Curlew *Numenius madagascariensis*.
Cairns Esplanade (16°54'S, 145°46'E) on 12 May 1995. Took small silver fish (about three centimetres long) from a shallow drainage channel. It washed the fish in a pool and afterwards gave a quick shake of the bill before swallowing. Fish as a dietary item is not mentioned by either Higgins & Davies (1996) or del Hoyo *et al.* (1996).

Great Knot *Calidris tenuirostris*
Cleveland Bay (19 16'S, 146°51'E) on 10 July 1995. The bird took a small garfish (about seven centimetres long) from a shallow drainage channel. It is not known whether the fish was alive as it did not appear to be moving. The flesh was peeled away from the bone, and occasionally the fish was shaken in the bill. Conspecifics attempted to pirate morsels. Fish is not recorded in the diet by either Higgins & Davies (1996) or del Hoyo *et al*. (1996).

Sharp-tailed Sandpiper *Calidris acuminata*.
Ingham Community Wetlands (18°40'S, 146°10'E), on 13 December 1996. Several birds took a number of small fish (1-2.5 cm long) from the surface of an ultraviolet sterilizing filter. Higgins & Davies (1996) list dead fish in the diet from outside the *HANZAB* region, while del Hoyo *et al*. (1996) does not mention fish but states that the diet is "highly variable"

Terek Sandpiper *Xenus cinereus*.
Seen at several locations in north Queensland and Broome, north-western Australia, taking fish (less than four centimetres in length) from surface water or shallow pools. Higgins & Davies (1996) and del Hoyo *et al.* (1996) do not mention fish in the diet but describe foraging techniques identical to fish-feeding species.

It is perhaps notable that all fish were taken in water less than five centimetres deep, and sometimes less than one centimetre deep.

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EDITORS NOTE: FISH FEEDING AND STATUS OF THE MARSH SANDPIPERS *Tringa stagnatilis* IN NORTH QUEENSLAND.

The previous two papers by Harrison were submitted as a single note, but edited into the two notes presented above. The Editor has corresponded with both Weineke and Cross, and with Harrison regarding the issues raised in the short notes above. A number of points made by the authors are worthy of publication, and are presented here.

- del Hoyo *et al.* (1996) is only a recent publication and Weineke and Cross did not have any real chance of referring to it. del Hoyo *et al.* (1996) summarizes other literature, and it does seem that there are earlier records of fish feeding in Marsh Sandpipers *Tringa stagnatilis* at least from Europe.
- The earlier records of fish feeding were not picked up by the referee of the Weineke and Cross paper, although he was an expert on the diet of waders.

- The Editor does not know of any records from this region, or indeed from the Flyway, of fish feeding of Marsh Sandpipers (except for the paper by Harrison given above). In this sense, it still appears to be a "new" prey item for the species in the region, and worthy of mention and publication.
- Weineke and Cross note that their account of the status of Marsh Sandpipers is qualified by the word "usually" and is based on a wide coverage in the area. Harrison makes the interesting point that many of the sites with higher numbers are difficult to access. Indeed, limited access to certain sites might distort our idea of population dynamics and even population estimates and it is worth bearing in mind!
- Nevertheless, the authors idea of the status of Marsh Sandpipers in the Townsville area is not mutually exclusive. Notwithstanding the inevitable problems with the definition of certain words (such as "flock") what is really needed is the generation of a frequency distribution of different sized social units, at all sites and habitats, at different times of the year. This is a massive task, and beyond the scope of the papers presented.

The Editor would like to thank the three authors involved for their contributions, and the constructive and positive attitude they have demonstrated here.

Michael Weston, *Editor*.

BELLY-SOAKING AND EGG-COOLING BEHAVIOUR IN A RED-CAPPED PLOVER *Charadrius ruficapillus*.

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The Gurdies, Westernport Bay, Victoria (Australia), was a blazingly hot place at 1300 hrs on the 19 January 1997. We had gone there to watch waders, but having misjudged the tide, found ourselves on a sandy beach separated from the sea by about 1 km of mudflats. We had just agreed that the temperature was over 40° C, that there was no shade and that in the absence of any breeze or interesting waders, we would do well to go elsewhere. At about this time we noticed an adult female Red-capped Plover *Charadrius ruficapillus* moving over the beach and adjacent sandy mudflats, running in short bursts and often pausing to look at us. From its agitated movements we guessed we were near to a nest, and kept an eye on the bird. After a minute or so of observation it crouched or sat briefly behind a clump of earth on the seaward edge of the beach. We investigated the site but it was not a nest; in retrospect the bird may have been "false-brooding" in order to lure us away from the real nest site, as has been reported for Hooded Plovers *Thinornis rubricollis* (Marchant & Higgins 1993). Cunning, but this bird was no match for us; we backed off for about 10 metres and resumed observations.

After a bit more aimless running about, the Red-capped Plover moved onto the sandy mudflats next to the beach. After one of its brief sprints, it slowed down in a shallow puddle (perhaps 2–3 cm deep) of seawater and after a look around, walked briskly in a crouched posture so that about a cm of its belly was immersed; it also crouched momentarily on the rear edge of its tarsi. It splayed its flanks and belly feathers as it did so, thus soaking a large proportion of its underparts. As soon as it had done this it ran onto the beach, moving directly to a small hollow in the dry sand where it crouched or sat for about half a minute; a small dune in front of the bird prevented us from seeing its exact posture. It then moved off, apparently still disturbed by our presence 15 metres away. Examining the point where it had been, we found a nest: two eggs set in a small cup in hot dry sand. We moved off and within a minute the bird had moved back to the nest; again, the hummocky sand prevented us from telling whether the bird was crouching over or sitting on the eggs.

One possible interpretation of this behaviour was that the bird was simply cooling itself down, and that it was coincidence that took it to its nest immediately afterwards. This seems inconsistent though, with DR's experience of cooling behaviour of waders in Roebuck Bay, north-west Australia; larger waders there, including Whimbrel *Numenius phaeopus*, Eastern Curlew *N. madagascariensis*, Grey-tailed Tattlers *Heteroscelus brevipes* and Grey Plovers *Pluvialis squatarola*, often crouch in hot weather with the rear edge of their tarsi immersed in small rock pools, but they have not been noticed splaying and soaking their flank and belly feathers. It seems more logical to conclude that the Red-capped Plover at the Gurdies was soaking its belly feathers in order to cool down its eggs. Belly-soaking behaviour has been reported in several other species of plover and lapwing nesting in tropical and subtropical environments (Reynolds 1985). Marchant & Higgins (1993) mentioned two reports of similar behaviour in two species of wader nesting in Australia: (1) A Hooded Plover has been seen dipping its belly in water and then standing over its eggs to shade them on a hot day (Bransbury 1991); (2) A Black-fronted Dotterel *Elseyornis melanops* has been seen placing small drops of water on its eggs in hot weather (Thomson 1917). We have been unable to find any published records of this behaviour in Red-capped Plovers but given that they often nest on surfaces that must become extremely hot when exposed to direct sunlight, it may be an important ploy to prevent their eggs from cooking. Certainly the bird we saw at the Gurdies seemed very anxious to return to its nest on a day when the eggs were surely not in urgent need of incubation.

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CAPE YORK PENINSULA, AUSTRALIA, AS A STOPOVER SITE FOR LATHAM'S SNIPE *Gallinago hardwickii*.

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Most Latham's Snipe *Gallinago hardwickii* leave south-eastern Australia by late February and all have left Tasmania by late March (Naarding 1983). Fat levels of birds caught in mid February suggest snipe there have built up enough fat to fly as far as Queensland before needing to feed. Birds caught in early March in coastal New South Wales (Frith *et al*. 1977), were heavy enough to fly to the Philippines (Lane & Forest 1984), though records from the Philippines are considered doubtful (Naarding 1985, Lane 1987). Lane & Forest (1984) thought it more likely that most snipe, particularly from southern Australia, stopped in Queensland before flying directly to Japan, and emphasised the importance of finding these pre-migratory fattening areas. They suggested that by late March, when southern swamps are nearly all dry, wetlands in northern Australia are likely to be at their peak of productivity following the summer wet season. Most snipe return to Japan in mid April (Naarding 1985).

Latham's Snipe were found by us on Artemis cattle station in central Cape York Peninsula south of Musgrave, northern Queensland, during each of 1993, 1994 and 1995. In 1993 they were also found 15 km north of Coen. Identification was confirmed by two specimens brought in by the station cat and several of the birds spread their tail as they flushed, revealing bold barring on the outer feathers. The habitat in which birds were seen was seasonally-inundated grassland dominated by the annual grasses *Eriachne burkittii* and *Ischaemum fragile* in association with a range of annual sedges and herbs. Apart from a single snipe seen by a farm dam on 18 August 1993, in the dry season, all records were during the late wet season from 21 March to 17 April. Sixteen individuals were seen in 1993 when approximately 8 km of suitable habitat was traversed regularly on foot while looking for Golden-shouldered Parrots *Psephotus chrysopterygius*. Five birds were seen in each of 1994 and 1995 but most patrolling during those years was by motorbike and suitable snipe habitat was largely avoided as it was untrafficable.

The snipe were always flushed singly, though 2 were once seen within 100 m of each other. They were never flushed from the same patch of habitat on successive visits. Both birds brought in by the cat had distended layers of subcutaneous and abdominal fat. One, a male caught on 31 March, weighed 183 g. Its gut was empty apart from a little gravel. As the station was over a kilometre from the nearest wetland it is thought the captured birds had been attracted to the station lights while in flight.

The presence of snipe at both Coen and Musgrave, 200 km apart, suggests that snipe are well-dispersed through the grasslands on Cape York Peninsula while on passage to Japan. The sole weight obtained is higher than for non-breeding birds (Frith *et al.* 1977) and suggests that birds on the Peninsula are putting on fat in preparation for migration, though the individual weighed would have had insufficient energy to fly all the way to Japan. However the timing of observations of snipe on Cape York Peninsula and their arrival in Japan suggests that the 6,500 km flight may be achieved in a single flight.

The grassland habitat occupied by Latham's Snipe on Cape York Peninsula occurs as long ribbons through tropical savannah woodland. This habitat is unfailingly inundated every January during the wet season, drying out again during the early dry season from May to July. South of Cape York Peninsula the reliability of rainfall is lower and the rains sometimes fail altogether (Garnett & Taplin 1990). Though grassland is currently widespread and the area of potential snipe habitat large, a change in fire regime is resulting in the replacement of grassland by woodland of broad-leaved ti-tree *Melaleuca viridiflora* at a rate of about 5% per decade (Crowley & Garnett in press). If the trend continues the carrying capacity of snipe on Cape York Peninsula may be reduced and the snipe counted among other threatened grassland birds of the region.

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A FURTHER RECORD OF RUDDY TURNSTONES *Arenaria interpres* EATING BREAD.

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Schipper *et al.* (1996) listed some published records of Ruddy Turnstones *Arenaria interpres* scavenging human food scraps. Saunders & de Rebeira (1993) also mention that Turnstones were feeding on bread crumbs on the beach at Geordie Bay, Rottnest Island, Western Australia. The details of this observation are presented here.

The incident took place on 27 March 1983 at a site where food scraps are regularly thrown out by holidaymakers to feed Silver Gulls *Larus novaehollandiae*. Attention was initially drawn to what appeared to be a self-propelled chunk of bread in the upper beach. When a clump of beach vegetation arrested the movement of the bread the Turnstone emerged from within. The soft centre and some of the side crust sections had been removed from the loaf. The movement of the bread along the sand reflects the force that was applied by the bird.

Two other Turnstones were noticed feeding nearby, possibly picking up crumbs, and these two then joined the first bird in vigorously attacking the loaf. Fragments were taken directly from the loaf or picked up from where they fell on the sand. It was noted at the time that a number of Silver Gulls were loafing nearby, either too well fed to share the food, or reluctant to compete for it with the Turnstones.

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REPORT ON THE 1996 NORTH WEST AUSTRALIA WADER STUDY EXPEDITION, 2 MARCH-20 APRIL.

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INTRODUCTION

The 1996 North West Australia Wader Expedition was the largest and most successful of the seventeen special visits made to study wading birds in the Broome/80 Mile Beach/Port Hedland area since the first expedition in August/September 1981. Eighty-three people from 16 countries participated, with an average of 30-35 people in the field at any one time. A total of 8512 birds (8135 waders) were caught during the seven week period 2 March-20 April.

This report summarises the main results of the expedition and highlights significant new developments and the new information which was gained. A more detailed analysis of the data has now commenced and this will be incorporated into various scientific papers and other articles.

BANDING

The principal fieldwork activity was a comprehensive catching and banding programme spanning the full period of the expedition. This was extremely successful in meeting most of its main objectives, in spite of some interference to plans by two cyclones and a tropical depression!

Cannon netting

A total of 40 cannon net catches (36 of waders, four of terns) and 5 mist net catches resulted in 8512 waders being caught, as detailed in Table 1.

Table 1. Number of birds and species captured.

Group	Number Caught	Number of Species Caught
Waders	8135	29
Terns	360	8
Others	17	4

Catching was uniformly productive throughout the expedition and at each of the localities visited, though the first visit to 80 Mile Beach had to be shortened to only two catching days because of cyclone 'Kirstie'. The breakdown of catches by date/location is detailed in Table 2.

The total of waders caught at the different locations was 4051 in Broome, 3460 at 80 Mile Beach and 624 at Port Hedland. The majority (323) of the terns were caught at Broome.

Wader cannot-net catches were consistently in the desired 150 to 450 range (average 215), with three larger catches of 736, 627 and 550. Only on two occasions was an attempted catch not successful; on 7 and 8 April at Broome when very high tides and winds associated with the second cyclone (although well offshore) combined to virtually eliminate beach roosting sites. A more frequent problem was having too many birds in the catching area to be safely handled in the hot conditions and a consequent need to 'twinkle' birds out of the catching area before a net could be fired!

New developments in the cannon-netting area were:

1. successful first catches on the outer sea wall/bank at Port Hedland Saltworks (Red-necked Stint), at Port Hedland Racecourse (Oriental Plover, Pacific Golden Plover and Turnstone), at Broome Port (terns - on the rising tide), and on a rocky area of Quarry Beach,

Table 2. Catches made by date and location.

Dates	Location	Waders	Terns	Others	Total
1-12 Mar.	Broome	1925	133	3	2061
13-14 Mar.	80 Mile Beach	324	-	-	324
16-20 Mar.	Port Hedland	624	2	2	628
22-29 Mar.	Broome	1091	92	12	1195
31 Mar-5 Apr.	80 Mile Beach	1374	34	-	1408
7-12 Apr.	Broome	992	98	-	1090
15-19 Apr.	80 Mile Beach	1762	1	-	1763
20 Apr.	Broome	43	-	-	43
TOTAL		8135	360	17	8512

Broome (two catches of Whimbrel).
2. two further visits by hovercraft to Bush Point, at the southern end of Roebuck Bay, producing our first significant catch of Sanderling (43) in north western Australia.
3. a successful extended trial of PVC 'duct tape' wrapped around the trace ropes on the net, to reduce wear by the metal shackle which attaches them to the projectile.
4. laying the cannon net on the surface (not in a groove) of the beach, treading it flat and then completely covering it with a layer of thin sand and/or shells. The perfect camouflage achieved resulted in birds showing no reluctance to enter, and remain settled in, the catching area. Use of 25 to 26 g of black powder gave perfect firing of the net, in spite of the weight of the camouflage material, because the additional drag associated with pulling a net out of a groove had been eliminated.

Mist netting

Wader mist netting at Port Hedland Saltworks returned to its former productiveness. The huge new intake pond (Pond 0) has now built up its own infauna, especially in the deposits of mud settling out of the pumped sea water. Thus, there is now plenty of food for waders, a special attraction when the nearby tidal shores are covered at high tide.

The number of suitable sites for mist netting is now larger than on the old intake area (Pond 1) - and the new area is likely to continue to improve in the future. Broad-billed Sandpipers have now returned in good numbers (*c*. 500). However Asian Dowitchers (less than 10) have not yet reached former levels (*c*. 100).

There were few opportunities for mist netting at inland ephemeral wetlands on Roebuck Plains or Anna Plains. After a good early wet season in December many locations dried up during an unusually dry February. Those areas which became flooded (e.g. Sandfire Flats) after the March rains were too extensive to be suitable for mist netting. One of the consequences of this was that this is the first AWSG North West Australia Expedition not to catch a single Sharp-tailed Sandpiper.

Wader totals

The totals of the top species which were captured, including both newly banded birds and retraps, are given in Table 3.

Table 3. The number of each species captured, for the main species caught.

Bar-tailed Godwit	1592
Great Knot	1582
Red-necked Stint	1354
Large Sandplover	912
Terek Sandpiper	762
Red Knot	509
Grey-tailed Tattler	443
Curlew Sandpiper	438
Broad-billed Sandpiper	138
Ruddy Turnstone	104

It is particularly pleasing that the top three species were those identified before the expedition as the three 'priority' species. The totals for Bar-tailed Godwit, Great Knot and Large Sandplover significantly exceeded the total for these species on any previous expedition (as did the expedition total of 8135 waders, the previous best was 6500 in March/April 1988).

At the other end of the scale noteworthy improvements on previous totals banded in north west Australia were made and are shown in Table 4.

Table 4. Totals of some other waders captured.

Species	**Number captured in 1996**	**Previous total banded in north west Australia**
Whimbrel	41	32
Grey Plover	47	123*
Pacific Golden Plover	2	6
Sooty Oystercatcher	19	8

* previous expedition best for Grey Plover = 32.

In contrast there were no opportunities to catch other sought-after species such as Little Curlew, Oriental Pratincole, Oriental Plover and Greenshank. The few flocks which were located in late February quickly dispersed after the heavy rain associated with cyclone 'Kirstie' during the period 7-12 March. It seems that opportunities to catch these species may be best before the wet season commences (i.e. October to December) and that subsequent to that there may only be infrequent *ad hoc* opportunities.

The 1996 Expedition catches brought the total of waders caught in north west. Australia since studies commenced there in 1981 to 51900 of 43 species (see Table 5). The ability to catch a wide range of species in significant numbers is illustrated clearly: 10 species with totals of over 1000 (max. 8202 Red-necked Stint and 8098 Great Knot) and a further 11 species with totals over one hundred.

Table 5. The number of waders caught by various groups in north west Australia.

Bander	Number of waders captured
12 major AWSG expeditions	46116
Broome Bird Observatory (since 1990)	5699
Doug Watkins (Derby 1993-4)	85
TOTAL	51900

Wader retraps and controls

In 1996, 1075 (13%) of the birds caught already carried bands. Four of these were banded overseas (controls), one (at least) elsewhere in Australia, and the remainder in north western Australia - some as long as 14.5 years ago, others just days earlier. Retrap rates were markedly higher at Broome (22%) than at 80 Mile Beach (5%) and Port Hedland (4%) due to the more sustained year round effort there over many years.

All retraps produce especially valuable data in relation to survival rates, faithfulness to particular sites, weight gain prior to departure, age of first northward departure (and hence age of first breeding) etc. Such information will be progressively analysed in the future and only a few examples will be included in this report.

Banding details have so far been received for two of the foreign controls and these are detailed in Table 6.

Banding details are still awaited for a Curlew Sandpiper from Taiwan (recaptured 4 Apr. at 80 Mile Beach) and a Terek Sandpiper from South Korea (recaptured 3 Apr. at 80 Mile Beach). One of the Japanese participants in the Expedition (Yukio Takeda) was standing right beside the person who took the Japanese Red-necked Stint out of a mist net. He was also present when the bird was originally banded in northern Japan!

Older Retraps

Twenty seven waders of 8 species had been banded 11 or more years previously. The oldest recaptures of Broad-billed Sandpiper were made; five birds banded together in 1988 at Port Hedland Saltworks and now still together.

Three birds emanated from the first wader banding at Broome in August/September 1981. These, a Great Knot, a Curlew Sandpiper and a Grey-tailed Tattler, are now at least 16 years old, as also are two Large Sandplovers banded in 1982.

Given the number of old birds still around it is going to be some years yet before it becomes clear just how long individuals of each species can live. Of more scientific/conservation importance however is the average lifespan of each species; to determine this needs a long succession of retraps over many years (in the absence of sufficient recoveries to analyse).

It is notable that all except one of these old retraps were recaptured at the original banding location. Site faithfulness is the norm for most migratory waders. The exception was a Curlew Sandpiper banded as an immature bird (just over 1 year old) in 1982 at 80 Mile Beach which was recaptured at Broome in 1996.

Leg flagging

All the birds caught in 1996 had a yellow plastic leg flag placed on their right tibia. This is to facilitate visual recognition of birds captured in north west Australia. Such information is particularly valuable in delineating migration routes and key stop-over sites.

The flagging of all birds was practicable because of the exceptionally large size of the 1996 team. It now brings to 21489 the number of waders yellow leg-flagged in north west Australia since this process was commenced in August 1992.

The benefits of leg-flagging, as an addition to metal banding, are illustrated in the comparative data presented in Table 7. Data are for palearctic migrant waders banded/flagged in north west Australia in the 1992-95 period and recovered (reported by the Bird Banding Office) or sighted (reported by a variety of people) in the same period (i.e. to the end of December, 1995)

Reports within Australia refer only to birds away from the north west Australia marking areas. The corresponding figures for palearctic migrant waders banded in Victoria, south east Australia are even more dramatic: 17 times for overseas reports and 39 times for interstate movements in Australia.

The Victorian figures differ from those of north west Australia mainly because:

1. recovery rates are higher for north west Australia birds because they are mainly medium and larger sized waders whereas those from Victoria are mainly small waders.
2. there is more opportunity for waders from south east Australia to be seen elsewhere in Australia.

Table 6. The details of the two foreign controls captured in 1996.

Species/Band	Age	Banding Details	Recapture Details
Red-necked Stint 3B48429	2+	10.8.95 Furen Lake, Hokkaido, Japan	19.3.96 Port Hedland Saltworks
Curlew Sandpiper NV67787	2+	22.4.93 Hong Kong	16.4.96 80 Mile Beach

Table 7. Comparison of recapture and leg-flag sighting rates for birds captured in north west Australia.

	Number	**Recovered**	
Banded		Overseas	within Australia
	15395	25 (0.16%)	1(0.0006%)
		Sighting	
Flagged		Overseas	within Australia
	12538	69 (0.55%)	8 (0.064%)
Ratio: Flag sightings to recovery reports		3.4 times	10.7 times

Although not directly connected to the north west Australia studies it was particularly interesting that Grant Pearson saw three yellow leg-flagged Banded Stilts at Port Hedland Saltworks when he made a brief visit there on 28 February. These birds had been banded as chicks at the huge colony on Lake Ballard, near Kalgoorlie, in April/May 1995 -1000 km to the south. It would appear that the Banded Stilts which occur in numbers of up to several thousand at Port Hedland Saltworks in 'dry' times may all be from the one West Australian population which breeds communally in the Goldfields or further south in the State when conditions are suitable. It was also notable that all three birds had quite well developed breast bands (it is still not clear whether lack of a band is purely related to age or whether it is also a non-breeding plumage).

Processing

The large team size facilitated much more 'processing', weighing, measuring, moult and plumage recording, than on any previous expedition. Overall 6388 waders were fully processed - 75% of the total caught.

Once birds had been extracted from the net and put into shaded keeping cages, seven teams of four people were usually employed as 'processors' with the rest of the team acting as 'flaggers' or 'fetchers/carriers/releasers'.

Only when catches were large, or the weather exceptionally hot, or there were many Bar-tailed Godwits, or a sufficient sample size of a species had already been obtained at that time, was processing curtailed. The aim was always to ensure that all birds were released within four hours of capture (often three hours) in order not to interfere significantly with their feeding routine. Temperatures were also constantly monitored. They were nearly always 34-37°C in the shade but occasionally it was over 40°C.

Fully processed samples of all the main species were obtained at regular intervals throughout the expedition thus facilitating a good understanding of the rate of weight build up before departure and actual departure weights. This data will complement that from previous expeditions but will be even more valuable because in so many cases weights can be judged in relation to other body size parameters rather than in isolation (in previous years weight data was often obtained without associated size data, because of staffing limitations).

A full analysis of weight and other biometric data will take some time but brief mention can be made of one or two highlights. In the small sample of Whimbrel, for example, was the recapture of a bird which had increased in weight from 520g to 590g between 28 March and 12 April. This is an average rate of weight gain of almost 1% per day. Red Knot were particularly interesting. Having been almost completely absent at 80 Mile Beach in the first week of April, there was a newly arrived flock of around 4000 birds close to the camp site when the expedition returned on 14 April. These were mostly adults in near full breeding plumage but many had low weights (down to 97g, with quite a few less than 120g) when caught on 15 and 16 April. Their average weight was significantly less than that of Red Knot caught at Broome on 10 April when most birds were in the 140-160g weight range. Thus a significant proportion, if not all, of these birds were newly arrived from some other location, presumably further south. One bird had previously been banded at Albany in the south west of West Australia, but this cannot account for all the arrivals as the Red Knot population in that area is only about 300. Another possibility is that they emanated from South Australia, where several thousand occur in summer. A search will be made there in summer 1996-1997 for yellow-flagged birds.

There was also strong evidence of an arrival of Red Knot at Broome in mid April. A sample of 86 was caught on 25 April after the expedition had ended, and almost all were at 150-160g; presumably at or close to their take off weight.

Weight loss experiments

Consideration has been given by various authors to the possible need to adjust recorded weights for losses which occur between capture of a bird and the actual time that a weight is measured during subsequent 'processing'. Recently one researcher published the results of experiments which indicated that the rate of weight loss after capture increased markedly with ambient temperature and that it could be quite significant, especially above 30°C.

An experiment was therefore carried out in north west Australia (at 80 Mile Beach on 5 April) on ten Large Sandplovers. The results are detailed in Table 8.

It is interesting that both adult and first year birds lost weight at approximately the same rate (measured in absolute terms) as each other over the three hour period of the experiment. Total weight loss averaged 4.6g (4.4%) for adults and 4.4g (6.5%) for juvenile/first year birds. The lower percentage rate for adults being a function of their higher average weights resulting from pre-migratory fat deposition.

As a comparison the average weight loss of 13 Red-necked Stints over a three hour period on 27 December 1995 in Victoria was 1.7g (5.7%). This is of the same order as that of the Large Sandplover in north west Australia in spite of the temperatures being markedly different (35°C compared with 16°C in Victoria). One possible explanation of these results is that most of the weight loss occurring in the first three hours after capture is gut emptying by defecation rather than evaporative loss (which would be more temperature dependent). One tentative conclusion is that weight loss after capture may not be significantly different between locations/temperatures in the timescale in which processing normally takes place (1-4 hours after capture). If this is so then adjustments, if required, may be simpler and may not even be necessary when comparing samples from various catches.

Further experimentation, on different species and at different temperatures, is needed. It had been planned to do this on the 1996 expedition but catches were generally too large (150+) and in conditions too hot for part of the team to be diverted from the main urgent task of extracting birds from the cannon net and getting them as quickly as possible into the shaded keeping cages.

Plumages

The extent of breeding plumage and the level of active breast moult (for the first time) were recorded in almost all birds captured. This will help understand how the energy consuming process of feather change is integrated into the other large energy demands, fat deposition prior to migration, and the migratory journey itself, at this time of year.

It appears that most species (Grey Plover excepted) assume an almost complete breeding plumage before departure from north west Australia. Some species commence this body moult very early - in late January/early February - and many individuals were in near full breeding plumage by early March. This is in marked contrast to waders 'wintering' in the Northern Hemisphere where breeding plumage is not assumed until April or May - their energy intake is required more for survival in the January to March period. Conversely waders spending the non-breeding season in the Southern Hemisphere find it advantageous to get this energy consuming process out of the way early so that their resources can then be devoted principally to the much larger migratory journey they have to undertake.

Subspecies

Considerable progress was made in using plumage data (sometimes allied with primary moult condition) to determine the age/sex/race of several species. The experience of the Russian members of the Expedition was particularly valuable in this regard. They were, for example, able to confirm that the Bar-tailed Godwits were all of the *menzbieri* race which breeds in the central north region of Siberia (Yakutia etc.). In the case of the Red Knot they were also confident that these were identical in plumage (and biometric measurements) to those which breed on the New Siberian Islands (sub-species *canutus*, but possibly classifiable as a separate race). This had already been suspected - and is supported by the sighting at Broome in October 1995 of a Red Knot colour banded there as a breeding adult - but it was valuable to have this further direct evidence.

An interesting situation now exists. The Red Knot (race *rogersii*) and Bar-tailed Godwit (race *baueri*) which visit New Zealand - their two most numerous migrant waders - are thought to be from breeding areas further to the east in Siberia (even Alaska for some Bar-tailed Godwits). There is banding evidence for quite a strong link between the populations of these species in eastern Australia and New Zealand. Where is the cut-off point between the non-breeding areas of the different subspecies? How much overlap in range is there? These current findings explain the almost complete lack of any records of these species moving between Victoria and north west Australia.

Sex

On the basis of plumage differences it is now practicable to differentiate between the sexes of Large Sandplover and Ruddy Turnstone, as well as Bar-tailed Godwit, in the hand in March/April provided the birds are well advanced into breeding plumage. Most field guides do not point out these significant sexual breeding plumage differences. On the other hand it appears that it is not possible to accurately sex all Curlew Sandpipers on the basis of males having uniform deep chestnut underparts and females having some areas of dark brown barring

Table 8. Results of weight loss experiments.

Age	n	Average weight at capture	Average weight after 1h.	Average weight after 2h.	Average Weight after 3h.	Total loss
Adult (2+)	5	104.2	102.2	101.2	99.6	4.6g (4.6%)
First Year (1)	5	71.2	69.8	68.2	66.8	4.4g (6.6%)

and some white flecking mixed in with the chestnut. Some males, probably second year birds coming into breeding plumage for the first time, also may have barred and less intensely chestnut underparts.

Age

Whilst it has been possible for many years to identify the majority of birds in their first year (age category '1') determination of the age of other 'immature' birds has been more difficult. This is particularly relevant in species such as Bar-tailed Godwit, Great Knot, Red Knot etc. where first breeding may be delayed even beyond the second year (one Bar-tailed Godwit was recaptured in non-breeding plumage at Broome in July when it was known to be four years old). Correct ageing of as many birds as possible is desirable in order to determine the age at which each species first breeds (a critical parameter in population dynamics assessments) and also because birds of different ages may behave differently (e.g. during migration).

During the 1996 expedition the team gradually became more competent and confident that most two-year old, and some three-year old, birds could be correctly aged in the hand by a combination of plumage and moult characteristics. The key criteria for March/April can be generalised as:

First year - age category 1

(a) retention of some unmoulted diagnostic juvenile contour feathers. Most frequently these were inner median wing coverts or tertials.

(b) no primary moult (0^{10}), partial (outer) primary moult (e.g. $0^5\ 5^2\ 3^1\ 0^2$), or less frequently a full primary moult (e.g. $5^7\ 3^1 1^1 0^1$). In the latter case it was rarely completed before the end of April. Confusion with late moulting birds of other age categories can be eliminated by looking for unmoulted juvenile secondaries or tail feathers, as some were always retained.

Second Year - age category 2

(a) negligible breeding plumage, no weight gain for migration, but none of the other characteristics of first year birds.

(b) primary moult completed (5^{10}) but feathers slightly older than those of full adult birds. 'Oldness' is apparent in three ways - development of slight fading/shading at the feather tips, slightly browner feathers (as opposed to blackish of new feathers on full adults) and very slight feather wear of the tips of the outermost one or two primaries. These differences have resulted from the primary moult of second year birds having started (and finished) earlier than that of fully adult birds.

Third year-age category 3

This is so far only determinable on Bar-tailed Godwits. It is probable that Great Knot and Red Knot (but probably not Eastern Curlew) all go into full breeding plumage, and depart on migration, by the time they are three years old.

(a) at most a partial breeding plumage is attained. No pre-migratory weight gain, but weights generally above those of first and second year birds.

(b) primary moult complete (5^{10}) and not normally separable from full adult birds because the timing of the moult is similar.

Adult - age Category 2+ (for species which breed in second year) or 3+ (for those species where breeding is generally delayed until at least the third year)

(a) assumption of full breeding plumage, with massive weight gain, from February onwards, prior to emigration.

(b) recently completed primary moult (5^{10}).

Recaptures in future years of known age birds banded during the 1996 expedition will add further to the understanding of plumage and moult variations associated with different ages of each species.

Breeding success

One of the key defined objectives of the 1996 expedition was to make an assessment of the productivity of the 1995 Siberian breeding season by measuring the proportion of first year birds in catches made before the northward migration of adults commenced.

Of the species sampled in adequate quantities for the results to be meaningful all catches made up to 29 March were used in the analysis, except for Great Knot and Large Sandplover in which adults are known to commence their departure on northward migration from about 21 March onwards. For these species only catches up to 20 March were therefore included.

Also for the purposes of this broad analysis samples from Broome, 80 Mile Beach and Port Hedland Saltworks were lumped together even though some variations between locations were apparent. There was a remarkable consistency with nine of the 12 species having between 10% and 20% first-year birds in the population. Lesser Sandplovers were highest at 30.2%. Red-necked Stints were also high (21.3%), and this corresponds well from data collected from Victoria in the 1995-96 summer which showed that this species had a good breeding season in the Arctic in 1995. In contrast with Victoria, where there was a very low number of first-year Curlew Sandpipers in the 1995-96 summer, there were reasonable numbers of juveniles of this species in north west Australia. Red Knot (8.9% juveniles) appear to have fared least well in the 1995 Siberian breeding season.

There is an insufficient history of this "% juvenile" data on most of the species sampled to rate the 1995 northern hemisphere/Arctic breeding season in absolute terms. But it would appear that it was at least a reasonably successful year for most species and certainly not the

"bad" year which was predicted by the "three-year predator/prey" cycle theory. Information provided by the Russian participants on the expedition also confirmed that lemming numbers had held up, and not crashed as expected, in the eastern parts of Siberia with a consequent better-than-forecast success for waders breeding there.

It will be a particularly important element of the ongoing Broome Bird Observatory wader catching programme to try and obtain reasonable samples of these main study species each summer in order to build up annual data on breeding productivity variations. Expeditions are not frequent enough for an adequate collection of such data, and also may not always take place at a suitable time of year.

Visible migration

Another key element of the expedition programme was the watch every afternoon from 16:00 to dusk (18:00) for waders departing on northward migration. This was undertaken at Broome every day from 3 March until 4 May led by the Broome Bird Observatory wardens (Jon Fallaw and Becky Hayward) and Volunteer Warden (Mavis Russell) and assisted when practicable by many members of the expedition.

A total of 24291 waders and 34 Gull-billed Terns were seen to depart, with an average flock size on most days of between 30 and 100 birds. Peak departures were on 4 April (1400 birds), 9 April (1170), 10 April (1299), 13 April (1746), 14 April (2289), 17 April (1835), 18 April (1335), 21 April (1113) and 28 April (1176).

Overall, the early parts of the migration were rather later and more sporadic than in previous years, almost certainly due to delays and disruptions caused by unusually unsettled weather. Cyclones from 7-12 March and 6-9 April produced almost complete cloud cover, periodic heavy bursts of rain, and strong winds from an unfavourable (northerly component) direction. A nearby tropical depression on 15-16 April also produced cloudy and sometimes wet conditions, although there was no wind.

Birds were sometimes seen departing, or trying to depart, in less than ideal conditions - conditions in which they would not have even attempted to depart in other years. One Bar-tailed Godwit flock tried to depart six times, over a period of an hour, before eventually giving up.

By the end of the third week in April birds were back onto their normal schedule with those later-departing species 'peaking' on almost exactly the same date as in 1994 and 1995.

Attempts were made to observe migratory departures from 80 Mile Beach, whenever the team was located there, but these proved to be largely unsuccessful. One problem was that the departure direction takes birds on a course which leads them away from the coast. Furthermore, if it is low tide in the late afternoon departures may commence from 1-2 km out on the mudflats. Looking against the setting sun makes identification very difficult. Finally departures seem to occur from all along 80 Mile Beach rather than tending to concentrate in one area as they do in Crab Creek Bay, adjacent to Broome Bird Observatory. It was eventually concluded therefore that departure observations from 80 Mile Beach were too unreliable to be worthwhile and that such studies are best concentrated at Broome in the future. An analysis of all the visible migration departure information collected in 1993-96 is now in progress and this will be published as soon as completed.

Terns

Terns have been caught, banded and processed on most previous expeditions to north western Australia but these have nearly always been ancillary to the main wader study programme.

In 1996 the opportunity was taken to make catches specifically targeted at terns, especially when Cyclone Kirstie disrupted the wader catching schedule during the second week of March. A new site close to the Port of Broome was used and a technique of setting a half-size (two cannon) net well below high tide mark and catching on a rising tide was employed. Four such catches were made and these gave the first significant samples of Common Tern (122) banded in north western Australia.

Coupled with terns captured during the wader banding programme, a total of 357 terns, of 7 species, were caught together with three Silver Gulls, as detailed in Table 9.

All four recaptures were banded locally during the last five years. Thirty-five of the birds were caught at 80 Mile Beach, two at Port Hedland and the remainder at Broome. The Common Terns were clearly of Northern Hemisphere origin, as probably were many of the Little Terns. Both species had commenced the moult into breeding plumage, with some Little Terns being well advanced.

The small sample of Gull-billed Terns showed a marked dichotomy of size and plumage indicating the presence of two races. There was almost no overlap in measurements of bill length, total head length and weight between the larger Australian *macrotarsus* birds and the smaller *affinis* race from Asia. All the adult birds of the *affinis* race had completed their primary moult and were in full breeding plumage. This is consistent with observation of migratory departures, in a similar manner to waders, from Crab Creek Bay during April. There is clearly enormous potential for Tern studies with 9 species (the above plus White-winged Black and Roseate

Table 9. The numbers of Terns captured in 1996. Figures in brackets are the number of retraps included in the total.

Lesser Crested Tern	124	(2)
Common Tern	122	
Little Tern	62	(2)
Crested Tern	28	
Gull-billed Tern	19	
Whiskered Tern	1	
Caspian Tern	1	
Silver Gull	3	
	360	(4)

Terns) occurring in significant numbers at various habitats/locations, many in thousands.

Counts

Broome Bird Observatory undertakes counts twice a year (part of the AWSG National Wader Monitoring Project) on the beaches on the north shores of Roebuck Bay and on a 15 km section of 80 Mile Beach. These are timed to determine the 'summering' population (Feb./early Mar.) and the 'overwintering' population (June/early July).

Counts at intermediate times have less value unless undertaken at closely spaced intervals (e.g. to determine arrivals/departures) in an easily defined discreet area. Thus no comprehensive counts were made this year at the main banding sites, except for 'special' species such as Broad-billed Sandpiper at Port Hedland Saltworks.

However, two visits were made by hovercraft to Bush Point at the south end of Roebuck Bay. Because of its isolation this site has rarely been visited (only about 10 times) even though at peak (in October) it holds over 100000 waders and is probably the largest single high tide roosting site not only in Australia but in the whole East Asian/Australasian flyway. Some 50000 waders were counted on the first visit, on 22 March, and there were still over 20000 on the second visit on 20 April. On the latter date notable totals were 800 Sanderling, 530 Pied Oystercatchers and 1200 Little Terns. All concentrations were rarely exceeded anywhere in Australia for these species.

Bush Point has now been added to the regular monitoring sites because it is threatened by exploration for, and possible mining of, diamonds. In the distant past the huge Fitzroy River used to flow into the sea at Roebuck Bay (200 km from where it currently reaches the sea, at Derby) and it is considered that diamonds may have been washed down from the Kimberleys and deposited there.

Other Studies

Invertebrates and Wader Feeding Ecology

Stimulated by the presence (from Holland) of Theunis Piersma, a world expert on wader food and feeding ecology, and Petra de Goej, who has already published the results of her studies on the feeding of Great Knot and Red Knot at Broome in 1991, several invertebrates sampling and feeding observation forays were made onto the mudflats at Roebuck Bay and 80 Mile Beach. A long term study programme of the invertebrates has now been initiated, some initial funding has been secured, and there are plans for a Ph.D. student to commence a wader feeding ecology study programme in 1997 and for construction of an associated laboratory facility at Broome Bird Observatory in the future. These are most welcome and important developments, beginning to fill the void in our knowledge of why these areas of north west Australia are able to support such a huge number and variety of waders.

Genetics

As in 1994 Prof. Allan Baker of Toronto University/Museum of Ontario, assisted again by Sarah Campbell (nee Sarrailhe) collected blood samples from a number of wader and tern species for subsequent use in DNA classification work. Particular attention was paid to species which were 'new' or where only small samples had previously been obtained.

Samples were also collected from Red Knot over an extended period to see if it is possible to detect any differences between the birds which had been present in north western Australia for some months and those which arrived on passage during April. By matching up the DNA patterns with those from blood samples taken from Red Knot on their breeding areas it should also be possible to gain further evidence on whether the Red Knot in north west Australia are predominantly from the New Siberian Islands.

Avian-borne viruses

John Curran, a veterinary officer with the Department of Agriculture in Broome, and a team from Perth and Darwin again joined the expedition for several days in order to collect blood samples for analysis in connection with avian-borne viruses. As in previous years a total of about 600 samples was collected from a wide variety of species.

Analysis of data from previous years has shown a very low level (less than 1%) of birds are acting as possible vectors for diseases such as Avian-Influenza and Newcastle Disease. This year tests will also be carried out for Japanese encephalitis.

Finances

Expenditure by the expedition on transport, food, equipment etc. totaled close to $54000. This is excluding the costs of travel of participants to/from north west Australia and of their camping/room accommodation costs when the expedition was based at Broome Bird Observatory.

Although expenditure is not quite complete yet (some equipment replacement and report production/distribution costs are not yet finalised) it appears that the 1996 expedition will approximately 'break even'. This is better than the budgeted loss (of $4500) and means that accumulated reserves from previous years will be carried forward intact for the future.

The final audited accounts will appear in the research section of the 1996 RAOU Annual Report (to be published in May 1997).

Participants

As already mentioned the 1996 expedition involved more people, from more countries, and with a greater average team size than on any previous visit to north west Australia. With 83 people involved (this excluded BBO staff, the team of vets from the Ministry of Agriculture and local people from Broome who assisted on a daily basis) it must have been one of the largest ornithological fieldwork events ever to be mounted in Australia (even in the world?).

Not only did the extra people enable more to be achieved but the considerable expertise of people from around the world facilitated greater progress and new developments. The first two weeks of the expedition were classified as a special "workshop" in recognition of the provision of funds by the Yamashina Institute for Ornithology in Japan to bring six Japanese ornithologists and people from four Asian countries together for a concentrated training session in wader studies. It was a unique experience to have the heads of the Japanese and the Chinese bird banding schemes, and the secretary of the Australian scheme, in the field at the same time. It was especially pleasing and beneficial for all to participate in such a multinational team and it considerably added to the enjoyment of the expedition overall. For the first time overseas visitors (42) outnumbered Australian participants (41)!

Future Plans

Many people expressed the wish, during and subsequent to the expedition, that further similar concentrated periods of fieldwork be organised in the future. There have also already been several additional unsolicited expressions of interest in future expeditions from others in Australia and overseas.

One of the strengths of the 1996 expedition was the number of people (23) who had participated in previous expeditions (some several times). It is desirable to maintain this tradition.

These periodic expeditions will continue to be the main means of gathering data on the huge and varied wader populations in north west Australia. Valuable supplementary data in intervening periods and at other seasons will continue to be generated by Broome Bird Observatory but it will be some time before this is of a volume to diminish the importance of special fieldwork visits by larger teams. And at present this is the only area in Australia where such a programme can be undertaken, partly because of accessibility problems at other potentially suitable sites.

Four of the last five major expeditions, and the last three minor visits, have been made in the March/April period (1992 was the exception). Excellent data on the period of northward departures from north west Australia has now been obtained - and is being digested/analysed/written up - and it now seems appropriate to switch attention again to other times of year.

Samples of non-breeding birds in the May to July period would be extremely valuable but may not be of sufficient potential to mount a full scale international expedition. Samples in the November to February period would also be most valuable, but being the hot/wet/sticky season this may need some further investigation and testing before a major expedition is mounted.

The August/September period of arrival of migrants returning from the breeding grounds seems the obvious choice for the next expedition. There has only been one expedition at that time of year in the last ten years. It could perhaps begin in July in order to sample the non-breeding population (and/or continue into October to catch the later-arriving species, and more juveniles). This time of year has the added advantage that temperatures and humidity are much more tenable than in March/April. It also gives those who find March/April a difficult time to get away the opportunity of a different time period - though for others it may be less convenient, interfering with other existing fieldwork programmes for example.

It is impracticable to organise another expedition as soon as 1997 and therefore 1998 has been chosen for the nest expedition.

THE NEXT AWSG EXPEDITION TO NORTH WEST AUSTRALIA, AUGUST TO OCTOBER 1998.

The next AWSG expedition to north west Australia will take place from Saturday 1 August 1998 to Saturday 31 October 1998. These dates have been chosen after substantial consultation with many people, particularly with former participants of the expedition series. The reasons are outlined in the section above.

An extended expedition (13 weeks) has been chosen in order to:

1. cover the whole arrival period, from Eastern Curlews in early August to the bulk of juveniles in late October.
2. to facilitate the participation of the maximum number of people, depending on their availability (including those involved in the International Ornithological Congress and Wader Study Group meeting in South Africa in August 1998).

During the early part of the expedition it will also be possible to sample the populations of waders which have remained in Australia throughout the northern hemisphere summer. The age categories of these birds are still not clear in several species.

As with previous expeditions time will be divided between Broome, 80 Mile Beach and Port Hedland Saltworks. There will be the usual banding and counting activities, and it is planned to conduct the first-ever ground count of 80 Mile Beach, in late October. The authors will be organising the 1998 expedition.

Expressions of Interest

Expressions of interest should be directed to Clive Minton (contact details are under the title of this report). A detailed program will be produced later in 1997. We sincerely hope that you can be involved in the 1998 expedition!

ACKNOWLEDGMENTS

The success and enjoyment of a large expedition such as "NWA'96" is inevitably due to the assistance of a large number of people in a wide variety of ways - practical, financial, physical.

Thanks are especially due to the Committee of Broome Bird Observatory and its wonderful wardens, Jon Fallaw and Becky Hayward, for hosting the expedition for half the total period. They did everything possible before and during our visit to maximise our 'comfort' - the new solar electricity system was a real bonanza - as well as to help our every need, to participate in a major way in our fieldwork activities and overall to make us feel so welcome.

We are also particularly grateful to Peter Griffiths, owner of Anna Plains Station, and John Stokes, the manager, for allowing us to base ourselves there during our three visits to 80 Mile Beach. Their assistance with cold storage, ice-making, meat (and other forgotten food items!), equipment and vehicle repairs was very, very much appreciated.

Cargill Saltworks were extremely kind in allowing us full access to their primary salt concentration facility, 30 km north east of Port Hedland. Mal Mackenzie, their Operations Manager, went out of his way to assist in every way possible including with keys, ice, water and bird recce information. Also his advice on a new site for our base camp was excellent.

A key component of all major north west Australia wader expeditions has been the free provision of a large equipment trailer by the WA Department of Conservation and Land Management (CALM), Perth, and the loan (at favourable rates) of a 4WD vehicle to bring this and our heavy equipment up from Perth. We thank them for their continued assistance, especially Jim Lane who loaned his personal vehicle. CALM in Broome (via Alan Grosse), the Broome Shire Council (via Bobby Telford) and the Dept of Agriculture in Broome (via John Curran) also kindly lent us trailers for the duration of the expedition, with CALM also assisting with a portable generator for our periods at 80 Mile Beach and Port Hedland.

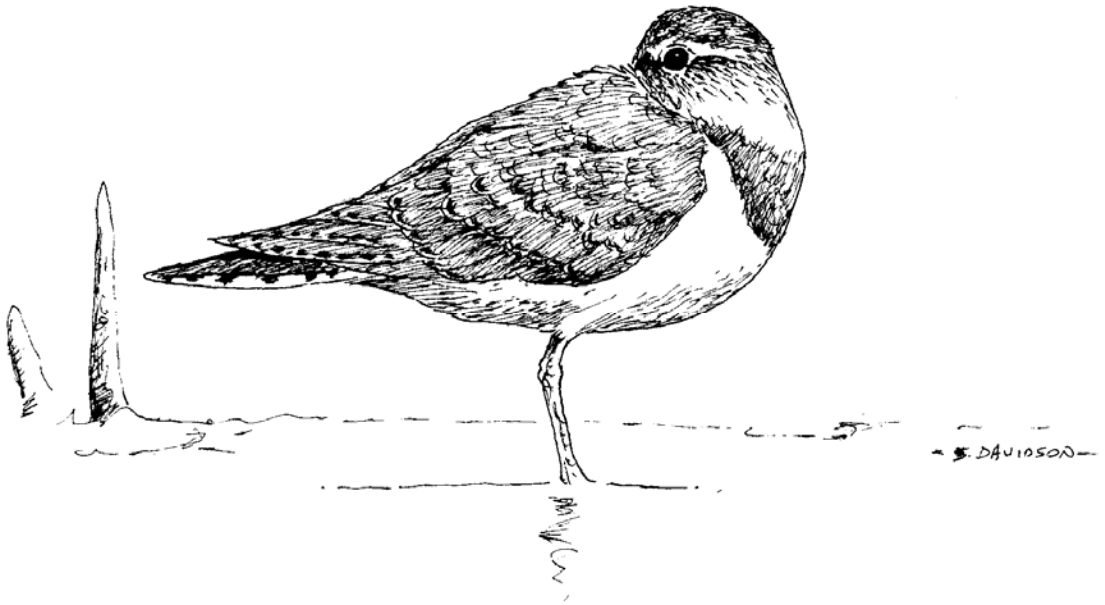
As for every major expedition since 1985 Myer Stores also very kindly shipped our cannon netting gear free-of-charge from Melbourne to Perth (and back). The volume of this should, hopefully, decrease in the future as the stock of equipment left at Broome gradually builds up. This year we left a full size cannon net and associated equipment up there to facilitate future medium-scale operations without the need for shipments from Melbourne.

On the financial side we thank enormously the two donors who made generous contributions to assist the long-term research programme on waders in north west Australia. This helped keep the personal financial contributions of participants to a level which enabled keen, experienced, but not particularly pecunious persons to still take part in the expedition. Someone present for the full seven weeks would have input around $1,300 in transport, food, BBO camping charges etc. - and this excludes their travel costs to/from Broome.

The Yamashina Institute for Ornithology (via its Director, Kiyoaki Ozaki) most generously paid for the participation of six Japanese wader banders and an appropriate person from Thailand, Vietnam, China and Indonesia. It is hoped that such collaborative and productive involvement becomes a tradition carried forward in future expeditions. The Australian Nature Conservation Agency again assisted in the participation of relevant persons from the Flyway - this time by providing most of the funds for the participation of three wader specialists from Russia. Wetlands International financed the attendance of another Russian (from the Kamchatka Peninsula in north east Siberia) and the Queensland Wader Study Group most generously raised the funds to bring two people from Sakhalin Island, eastern Siberia. Hopefully, in the future, there will be a return visit to jointly study waders in their areas.

This section of the report is in danger of becoming the longest! Thanks are still due to many more people/organisations which assisted NWA'96. In particular, all members of the expedition put in so much time and effort, both before and during the expedition, over and above their energetic contribution to normal activities. It is particularly appropriate to single out the team of Victorian Wader Study Group members who spent many hours over the previous six months in the exceedingly boring job of manufacturing 10,000 yellow plastic leg flags. We are delighted that the success of the expedition justified their efforts.

Those who took on special extra responsibilities for organising the catering, equipment maintenance, cartridge cleaning and loading, paperwork editing etc. during the expedition are also especially thanked. And no one will forget Helen Macarthur's "home cookies" and the visit to her beautiful house at Coconut Wells for a barbeque. Thanks are also due to Pat Minton and Renate Lipovas, who typed this report and Doug Watkins who helped with some of the tables. A great deal was achieved during the expedition and we hope many participants will return in the future. Thank you everyone.



ERRATA

Unfortunately, there were a number of errors in the last edition of *The Stilt*. The main ones were due to changes in the production process. Below are two tables that were omitted from Rogers *et al.* (pg 2-23).

In addition, a formatting problem resulted in the loss of a figure from columns in other tables. Enclosed are corrected tables to be glued or fixed over the incorrect ones. This method has been chosen as the most cost effective way of ensuring these errors are not perpetuated by other authors using the tables. For the record, the tables with the errors were: Table 2, page 10; Table 3, page 11 and Table 1, page 50.

There was also an error with the figures given in the summer 1996 National Count results for Queensland, Australia. A corrected version of the erroneous columns is presented below and supersedes those published on page 46 of *Stilt* 29.

Table 4. Geographical variation in the "base weights" of Red-necked Stints captured at times when they are likely to have had few or no nutrient stores.

LOCALITY	Base weights	Source of information
Tasmania	29.0 (s.d. = 1.76; n = 559)	November; Barter 1984
Victoria	29.21 (s.d. = 2.367; n = 2123)	November; this study
North-western Australia	28.75 (s.d. = 2.734; n = 217)	November; AWSG unpubl.
Peninsular Malaysia	Modal value 22–24 g (n = nearly 300)	D.R. Wells (pers. comm.)
Gulf of Siam, Thailand	25.6 (range 20.5-30.25; n = 52)	October to February; Melville 1981
Hong Kong	About 25 g	Early April; Melville 1981

Table 5. Potential flight ranges of Red-necked Stints on their northwards migration from Victoria. Values predicted by the flight range equations of Summers & Waltner (1978), Davidson (1984) and Castro & Myers (1989) are presented separately; see those works for information on the underlying assumptions. Departure mass (M2, in g) was calculated in this study; arrival masses (M1, in g) tried include the Victorian base weight of 29 g (this study) and the base weight of about 25 g in the tropics reported in, for example, Melville (1981) (see Table 4); flight speeds (S, in km/h) seemed to cover the range of reasonable guesses suggested by the review in Zwarts *et al*. (1990). Only the flight range equations of Castro & Myers take body size, as indicated by wing length (L, in cm) into account; except where stated, the average March/April wing length of 10.8 cm was used.

M1	M2	S	L	Summers & Waltner (1978)	Davidson (1984)	Castro & Myers (1989)
29	40	50	10.8	1658	1301	1818
29	40	60	10.8	1990	1561	2182
29	40	75	10.8	2488	1952	2727
25	40	50	10.8	2379	1883	2753
25	40	60	10.8	2855	2260	3304
25	40	75	10.8	3569	2825	4130
25	40	75	10.0			3647
25	40	75	12.0			4895

Corrected columns for table on page 46 of Stilt 29.

	Cairns	Tnsvlle	Mcky	Gldstn	Moretn Bay	Lockyer Valley	Tweed Est	Richmnd Est	Clrnce Est
Latham's Snipe									
Black-tailed Godwit		73	12		843				
Bar-tailed Godwit	65	135	761	956	11751		485	162	
Little Curlew		7							
Whimbrel	3	118	144	393	1440		48	54	
Eastern Curlew	8	208	375	409	3500		131	98	
Marsh Sandpiper		1	120	9	129		22	2	
Common Greenshank	4	45	60	198	408		83	35	
Wood Sandpiper									
Terek Sandpiper	46	2		184	19		2	79	
Common Sandpiper		5		1			2		
Grey-tailed Tattler	25	62	18	496	954		55	94	
Wandering Tattler									
Tattler sp.									
Ruddy Turnstone		2	6	2	161			41	
Great Knot	45	1913	747	95	1317			18	
Red Knot		223			268			3	
Sanderling		2						51	
Red-necked Stint	210	541	227	1581	1511			45	
Pectoral Sandpiper									
Sharp-tailed Sandpiper		65	260	90	482		3	31	
Curlew Sandpiper	25		4	21	5229		11	112	
Bush Thick-knee		7							
Beach Thick-knee		4	1	8					
Pied Oystercatcher		9	269	152	552		3		
Sooty Oystercatcher			5	3	1				
Black-winged Stilt		16	40	39	154			25	
Banded Stilt									
Red-necked Avocet					5				
Pacific Golden Plover		21		15	191		18	94	
Grey Plover		1	90		51				
Red-capped Plover		62		59	485			5	
Double-banded Plover									
Lesser Sand Plover	52	580	56	450	710		2	22	
Large Sand Plover	68	253	10		229			39	
Oriental Plover									
Black-fronted Dotterel		12	2				6		
Hooded Plover									
Red-kneed Dotterel			1						
Banded Lapwing									
Masked Lapwing	35	58	26	15	80		10	2	
Long-toed Stint									
Unidentified small									
Unidentified medium									
Unidentified large									
Spotted Redshank									
Broad-billed Sandpiper	1								
Ruff/Reeve									
Oriental Pratincole									
Asiatic Dowitcher									
Snipe sp.							2		
Total Number	587	4425	3234	5176	30470	0	883	1012	0
Total Species	13	27	22	21	24	0	16	20	0

Back Issues:

All volumes of *The Stilt* are available as back issues. Costs of volumes 1-28 (subject to review), including surface postage, are:

	Australia and New Zealand	**Other countries**
Single copies	$Aus 6.00	$Aus 7.00
Complete set	$Aus 90.00	$Aus 125.00

The cost of back issues for volumes 29 and later are currently being determined. Payment should be forwarded as a bank draft or money order in Australian currency or by *Visa/Bankcard* etc. (not *American Express*). All inquiries should be directed to the Secretary-Treasurer.

Indexes:

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

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

ADVICE TO CONTRIBUTORS

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

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

CHECKLIST FOR POTENTIAL CONTRIBUTORS

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

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

More specifically, contributors should ensure:

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

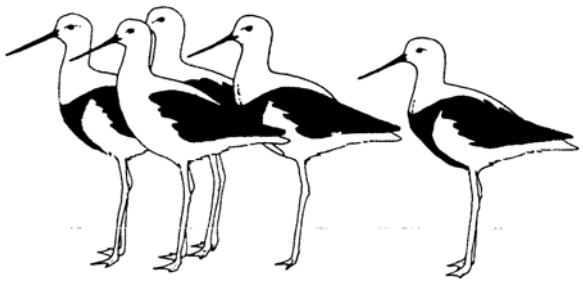
Failure to incorporate these considerations into contributions, especially when they are marked on the first draft but not incorporated into the final draft, will result in delays in publication as the Editorial Team will have to make these corrections. This is especially the case when poor referencing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

Computer Formats

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

Deadlines:

The closing dates for submission of material have been revised. They are 10 February and 10 August for the April and October editions respectively. **Extensions to these dates must be discussed with the Editor.** Contributors are reminded that they will probably have some comments to consider, and possibly incorporate, at some time after submission. It would be appreciated if this could be done promptly.



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