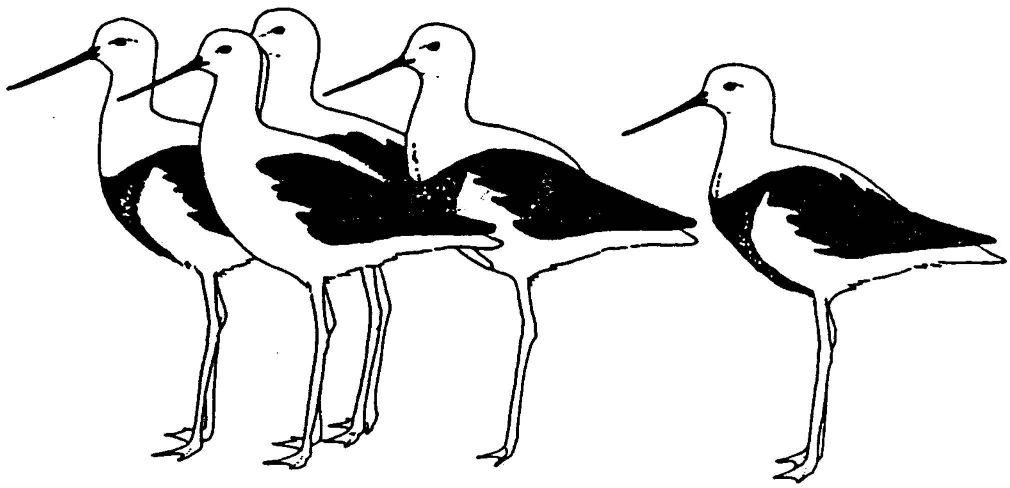
The Stilt



ISSN 0726-1888

BULLETIN OF THE AUSTRALASIAN WADER STUDIES GROUP

OF THE

ROYAL AUSTRALASIAN ORNITHOLOGISTS UNION

Number 26 APRIL 1995

OBJECTIVES OF THE AUSTRALASIAN WADER STUDIES GROUP OF THE ROYAL AUSTRALASIAN ORNITHOLOGISTS UNION

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, feeding 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.

Subscriptions for 1994/95:

Australasia	AUS $15
Overseas	AUS $20
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Stilt No. 7 contains the Index for Nos. 1-6
Stilt No. 13 the Index for Nos. 7-12
Stilt No. 19 the Index for Nos. 13-18.
Stilt No. 25 the Index for Nos. 19-24

ALL ENQUIRIES SHOULD BE DIRECTED TO BRENDA MURLIS, ADMINISTRATIVE SECRETARY.

NEWS VIEWS REVIEWS NEWS VIEWS REVIEWS

CHAIRMAN'S REPORT FOR 1994

1994 was a year of important milestones, amongst them participation by members in two Russian expeditions, publication of an AWSG project report and the longest expedition to the Broome-Port Hedland area, yet.

At the invitation of the Russian Academy of Sciences, three AWSG members took part in two expeditions to Siberia. Clive Minton and Danny Rogers went on the Swedish-Russian expedition "Tundra Ecology 94", the largest ever scientific expedition to the Russian Arctic. It involved the use of ice breakers to traverse the whole of the north Russian coastline, with parties being landed by helicopter at regular intervals to study the flora and fauna. Mike Weston spent seven weeks in the south-eastern Taimyr Peninsular studying breeding waders with Russian and Norwegian colleagues. Accounts of both expeditions have been written up elsewhere. Whilst in Russia, Clive Minton held discussions with Russian Government representatives, on behalf of the Australian Nature Conservation Agency (ANCA), to further the proposed Russia-Australia Migratory Birds Agreement.

A particularly significant event was the publication of a major report based on data from the AWSG Regular Counts Project, which was co-ordinated by Richard Alcorn. Production of the report was underwritten by ANCA and this funding enabled us to provide free copies to the counters involved in the 5-year project.

Within the next 12 months, we plan to publish another report containing an analysis of the 15 years of population monitoring data collected to date by the RAOU and AWSG. Work will begin in March 1995.

The March-April expedition to north-west Australia spanned the entire northward migration departure period. Activities included counting, recording visible migratory departures, banding and colour leg-flagging. A Canadian team led by Professor Allan Baker collected blood samples from 35 waders for DNA classification purposes. People from eight countries were involved in the expedition.

Doug Watkins and I attended an international workshop in Japan to discuss the conservation of migratory waterbirds and their wetland habitats in the East Asian - Australasian Flyway. The meeting was funded by ANCA and the Japan Environment Agency. The major outcome, the "Kushiro Initiative", and the timetable for a flyway agreement and preparation of strategies and shorebird action plans, is detailed elsewhere in this issue.

During the year, great strides have been made in getting the AWSG's banding data onto a database. This will be of great assistance when we begin the job of analysing the data collected over the last 13 years of activities in north-western Australia. We would certainly like to hear from people who are interested in assisting with data analysis.

An examination of the Group's accounts shows that our routine expenditure in recent years has been partially underwritten by sales of reports. This is an unsound situation and the committee is investigating the need to increase subscriptions. If they do increase. it will be for the first time since 1988.

Further examination of the accounts, this time of the Income column, reveals the extent of the assistance we are receiving from ANCA. In addition to that already mentioned, we obtained funds from them to assist with the expenses of our Russian expeditioneers, underwrite Pavel Tomkovich's ongoing studies of Great Knot breeding biology, cover the on-ground costs of two Korean participants on the north-west Australia expedition, pay for the attendance of two representatives at the Kushiro meeting and to employ a consultant to analyse the population monitoring data. This is magnificent support for a wide range of very important activities and acknowledges the role that organisations like ours can play in providing cost-effective results.

As is customary, I must thank the committee and others for their unflagging work during the year to keep the Group running effectively. A number of us have been around for a while now and I feel that the time has come to bring in fresh blood and, with it, new ideas and ways of doing things. Otherwise we'll stagnate. So, I'm issuing a strong plea for people to come forward, from anywhere within Australia, to continue the work and build on the achievements of the AWSG during its 15 years of existence. Opportunity for change occurs in mid-1996, with the election of the new two-year Committee.

Mark Barter

CHANGE OF ADDRESS

Please note change of address for Editor to:

4 Molden Street
East Bentleigh Vic 3165

TREASURER'S REPORT FOR 1994

AWSG finances continue to remain in a healthy position. Costs associated with the production and distribution of *Stilt* were similar to those in 1993, as were sales of *A National Plan for Conservation of Shorebirds in Australia*, but revenue from subscriptions dropped by about 15%.

The AWSG received four grants from the Australian Nature Conservation Agency. $2,000 was provided for studies of the Great Knot in Siberia and $4,000 was given to Pavel Tomkovich to assist with wader studies in Siberia (the AWSG donated 10 Pesola balances for use in these studies). A grant of $2,000, deposited in the AWSG Expeditions account, helped meet the expenses of the three AWSG members involved with the "Tundra Ecology '94" expedition to the Russian Arctic. $10,000 was contributed to enable Mark Barter and Doug Watkins to attend an International Workshop on the "Conservation of Migratory Waterbirds and Their Wetland Habitats in the East Asian-Australasian Flyway" held in Kushiro, Japan. Not all expenses associated with the Kushiro Workshop have yet been paid, hence the inflated end-of-year balance in the AWSG account.

The AWSG's Conservation Officer, Sandra Harding, attended a meeting in Melbourne aimed at developing an action plan for the RAMSAR Convention to be held in Brisbane in March next year. The Asian Wetland Bureau contributed about half of Sandra's travelling costs.

Donations to the Research Fund were about 20% lower than in 1993. A grant from ANCA enabled the production and distribution of *Wader Movements in Australia*, and revenue from the sale of this report will be deposited with the Research Fund. The purchase of computer software for use in analysis of wader survival rates, personal accident insurance for people involved in wader research and payment for drawings used in *Wader Movements in Australia* were major expenditures from the Research Fund.

David Henderson

Australasian Wader Studies Group
Statement of Receipts and Payments for the period
1 January 1994 - 31 December 1994

RECEIPTS	
Balance b/f	5581.00
Subscriptions	3491.67
Sale of *Stilt* Back Nos.	270.00
Sales of *National Plan*	1646.17
AWB Subscriptions	557.00
WSG Subscriptions	240.00
Payments from ANCA	16000.00
Payment from AWB	259.00
Donation	25.00
Bank Interest	124.36
	$28198.00

PAYMENTS		
Stilt	- typing & layout	630.00
	- printing	1525.00
	- postage	1389.10
	- envelopes & labels	141.85
Tattler	- layout	30.00
	- printing	114.00
Great Knot studies		2000.00
Expedition to N. Russia		4000.00
Pesola Balances		980.00
Airfare for Conservation Officer		492.10
Kushiro Workshop expenses		3034.03
AWB subscriptions		839.00
Printing membership forms		86.00
Postage - *National Plan*		26.40
Secretary's expenses		494.00
Chairman's expenses		93.35
Treasurer's expenses		96.85
Bank charges		94.00
State Government Tax		10.14
Transfer to Research Fund		62.83
Balance c/f		12059.35
		$28198.00

RAOU Research Fund (ASWG)
Statement of Receipts and Payments for the period
1 January 1994 - 31 December 1994

RECEIPTS		PAYMENTS	
Balance b/f	1140.72	Printing *Wader Movements*	2471.00
Donations	387.83	Payment for drawings of waders	170.00
Payment from ANCA	2473.00	Personal Accident Insurance	323.00
Bank Interest	24.91	Purchase of computer software	301.86
Sales of *Wader Movements*	225.00	Purchase of tide timetables	24.95
		Postage & telephone	52.39
		Bank charges	24.00
		State Government Tax	1.80
		Balance c/f	882.46
	4251.46		**4251.46**

AWSG Expeditions
Statement of Receipts and Payments for the period
1 January 1994 - 31 December 1994

RECEIPTS		PAYMENTS	
Balance b/f	428.92	Reimbursement of expedition costs	2000.00
Payment from ANCA	2000.00	Purchase of printing fluid	8.85
Bank interest	16.85	Postage	9.60
		Bank charges	52.83
		Government tax of debits	1.70
		Government duty of deposits	1.75
		Balance c/f	371.04
	2445.77		**2445.77**

HELP FROM ESSO & BHP

Esso and BHO recently provided the AWSG with financial support towards the work done by the AWSG and VWSG in the way of research and promoting conservation of shorebirds in the Corner Inlet ara. The members of both wader groups with to acknowledge their thanks to ESSO and BHP for recognising the work done by the groups and supporting ongoing research in one of the most important wader sites in Australia.

RECENT LITERATURE

The following is a selected list of articles dealing with waders taken from recent publications. Reprints of items of interest to be included would be welcome, please forward same to the Editor.

Dann, P. 1994. The distribution and abundance of Palearctic and Australasian waders *(Charadrii)* in coastal Victoria. Corella 18:148-154. (Penguin Reserve Committee of Management, PO Box 97, Cowes, Phillip Island, Vic. 3922, Australia). Report on a survey of the distribution and numbers of waders in coastal Victoria carried out in December 1979.

Dann, P., R.H. Loyn & P. Bingham. 1994. Ten years of waterbird counts in Western Port, Victoria, 1973-83. II. Waders, gulls and terns. Australian Bird Watcher 15:351-365.

Ferns, P.N. & H.Y.Siman. 1994. Utility of the curved bill of the Curlew *Numenius arquata* as a foraging tool. Bird Study 41: 102-109. (School of Pure and Applied Biology, University of Wales, Coll. Cardiff, P.O. Box 915, Cardiff CF1 3TL, U.K.).

Gratto-Trevor, C.L. 1994. Banding and foot loss: an addendum. Journal of Field Ornithology 65: 133-134. (Prarie and Northern Wildlife Centre, Canadian Wildlife Service, 115 Perimeter Road, Saskatoon, SK, Canada S7N OX4).

Goss-Custard, J.D., R.T.Clarke, R.W.G.Caldow & S.E.A. Durrel. 1993. Modelling the effect of winter habitat loss on shorebird populations. Institute Terrestial Ecology Report, pp. 72-74. (Institute Terrestial Ecology, Furzebrook Research Station, Wareham, Dorset BH20 5AS, U.K.).

Lawler, W. 1994. Shorebird counts on New South Wales north coast estuaries from the Shorebird Habitat Study. National Parks & Wildlife Service, Environment Survey & Research Branch. (C/. Ecopix, PO Box 67, Scarborough, Qld. 4020, Australia). Report on counts of waders carried out between 1991 and 1994 at nine New South Wales North Coast estuaries.

McLean, J.A. 1994. The Charadriiformes of the lower Endeavour and Annan rivers, North Queensland. The Sunbird 24:49-60. (Box 203, Cooktown, Qld. 4871, Australia). 48 species listed, four breeding in Cooktown region.

Miller, E.H. 1992. Acoustic signals of shorebirds. A survey and review of published information. Victoria: Royal British Columbia Museum. (Royal British Columbia Museum, 675 Belleville Street, Victoria, British Columbia, V8V 1X4, Canada).ISBN 0-7718-93132.

Moreira, F. 1994. Diet, prey-size selection and intake rates of Black-tailed Godwits *Limosa limosa* feeding on mudflats. Ibis 136: 349-355. (Department of Zoological Anthropology, Faculty Ciencias, Bloco C2, Campo Grande, P-1700 Lisboa, Portugal).

Owens, I.P.F., T. Burke & D.B.A.Thompson. 1994. Extraordinary sex roles in the Eurasian Dotterel: female mating arenas, female-female competition, and female mate choice. The American Naturalist 144:76-100. (Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, U.K.)

Piersma, T. A. Koolhaas & A. Dekinga. 1993. Interactions between stomach stucture and diet choice in shorebirds. Auk 110: 552564. (NIOZ, P.O. Box 59, 1790 AB Den Burg, Texel, Netherlands). *Calidris canutus* and *Limosa lapponica*.

Rose, A.B. 1994. Predation of Little Terns by Whimbrels. Australian Birds 28:1-4. (61 Boundary Street, Forster, NSW 2428, Australia). *Numenius phaeopus* taking eggs and young of *Sterna albifrons*.

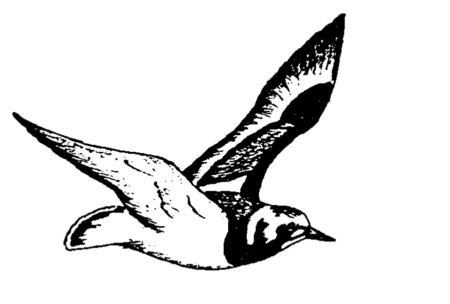
Thompson, J.J. 1993. Patterns of shorebird abundance in eastern Moreton Bay, Queensland. Wildlife Research 20: 193-201. (Department of Environment and Heritage, Southwest Region, G.P.O. Box 2771, Brisbane, Queensland 4001, Australia).

Turpie, J.K. & P.A.R. Hockey. 1993. Comparative diurnal and nocturnal foraging behaviour and energy intake of premigratory Grey Plovers *Pluvialis squatarola* and Whimbrels *Numenius phaeopus* in South Africa. Ibis 135:156-165. (Percy FitzPatrick Institute, University of Cape Town, Rondebosch 7700, South Africa).

Wilson, J.A. 1993. Pied Stilts pursue an eel. Notornis 40:178. (280 Wakari Road, Helensburgh, Dunedin, New Zealand). *Himantopus leucocephalus*.

WIWO. 1994. Forward plan 1994-1998. Zeist: Foundation Working Group International Wader and Waterfowl Research, 45 pp. (Stichting WIWO, C/. Driebergseweg 16C, 3708 JB Zeist, Netherlands). Aims and planned methods of WIWO, review of projects carried out between 1980 and 1993, plus current knowledge and future research priorities.

Jeff Campbell



NEW PUBLICATIONS

The Taxonomy and Species of Birds of Australia and its Territories. Les Christidis and Walter E.Boles. RAOU Monograph 2. RAOU, Melbourne. 1994. Available from RAOU, 415 Riversdale Road, Hawthorn East, Vic. 3123, Australia. A $18 plus p&p.

This publication is the long-awaited update of the *Checklist of Australian Birds, Part 1, Non-passerines* (Condon 1975) and amendments (RAOU 1976, 1978a), and the *Interim List of Australian Birds, Passerines* (Schodde 1975). The monograph presents a taxonomic list of all extant and recently extinct species (including vagrants) currently recognised as occuring in Australia and its territories. The recommended English names for each of these species is also given.

Listed below are the seventy-two wader species catalogued in the publication. Names which differ from those given in *Recommended English Names for Australian Birds* (RAOU 1978b) are here underlined. In addition to changes to both scientific and common names the taxonomic order of these species has also been altered.

Plains-wanderer	*Pedionomus torquatus*
Latham's Snipe	*Gallinago hardwickii*
Pin-tailed Snipe	*Gallinago stenura*
Swinhoe's Snipe	*Gallinago megala*
Black-tailed Godwit	*Limosa limosa*
Hudsonian Godwit	*Limosa haemastica* *
Bar-tailed Godwit	*Limosa lapponica*
Little Curlew	*Numenius minutus*
Whimbrel	*Numenius phaeopus*
Eastern Curlew	*Numenius madagascariensis*
Upland Sandpiper	*Bartramia longicauda*
Spotted Redshank	*Tringa erythropus* *
Common Redshank	*Tringa totanus*
Marsh Sandpiper	*Tringa stagnatilis*
Common Greenshank	*Tringa nebularia*
Lesser Yellowlegs	*Tringa flavipes* *
Wood Sandpiper	*Tringa glareola*
Terek Sandpiper	*Xenus cinereus*
Common Sandpiper	*Actitis hypoleucos*
Grey-tailed Tattler	*Heteroscelus brevipes*
Wandering Tattler	*Heteroscelus incanus*
Ruddy Turnstone	*Arenaria interpres*
Asian Dowitcher	*Limnodromus semipalmatus*
Great Knot	*Calidris tenuirostris*
Red Knot	*Calidris canutus*
Sanderling	*Calidris alba*
Little Stint	*Calidris minuta*
Red-necked Stint	*Calidris ruficollis*
Long-toed Stint	*Calidris subminuta*
White-rumped Sandpiper	*Calidris fuscicollis* *
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Sharp-tailed Sandpiper	*Calidris acuminata*
Dunlin	*Calidris alpina*
Curlew Sandpiper	*Calidris ferruginea*
Stilt Sandpiper	*Micropalama himantopus* *
Buff-breasted Sandpiper	*Tryngites subruficollis*
Broad-billed Sandpiper	*Limicola falcinellus*
Ruff	*Philomachus pugnax*
Wilson's Phalarope	*Steganopus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Grey Phalarope	*Phalaropus fulicaria*
Painted Snipe	*Rostratula benghalensis*
Comb-crested Jacana	*Irediparra gallinacea*
Pheasant-tailed Jacana	*Hydrophasianus chirurgus*
Black-faced Sheathbill	*Chionis minor* *
Bush Stone-curlew	*Burhinus grallarius*
Beach Stone-curlew	*Esacus neglectus*
Pied Oystercatcher	*Haematopus longirostris*
Sooty Oystercatcher	*Haematopus fuliginosus*
Black-winged Stilt	*Himantopus himantopus*
Banded Stilt	*Cladorhynchus leucocephalus*
Red-necked Avocet	*Recurvirostra novaehollandiae*
Pacific Golden Plover	*Pluvialis fulva*
Grey Plover	*Pluvialis squatarola*
Ringed Plover	*Charadrius hiaticula*
Little Ringed Plover	*Charadrius dubius*
Kentish Plover	*Charadrius alexandrinus* *
Red-capped Plover	*Charadrius ruficapillus*
Double-banded Plover	*Charadrius bicinctus*
Lesser Sand Plover	*Charadrius mongolus*
Greater Sand Plover	*Charadrius leschenaultii*
Caspian Plover	*Charadrius asiaticus*
Oriental Plover	*Charadrius veredus*
Inland Dotterel	*Charadrius australis*
Black-fronted Dotterel	*Elseyornis melanops*
Hooded Plover	*Thinornis rubricollis*
Red-kneed Dotterel	*Erythrogonys cinctus*
Banded Lapwing	*Vanellus tricolor*
Masked Lapwing	*Vanellus miles*
Oriental Pratincole	*Glareola maldivarum*
Australian Pratincole	*Stiltia isabella*

* not in *Recommended English Names for Australian Birds* (RAOU 1978b)

In addition to the above a further ten wader species are included in a Supplementary List (see below). These are either vagrant species not yet validated or records in the literature which are now not accepted. It follows that any records of these species within Australia or its territories should be carefully documented and submitted to the RAOU Records Appraisal Committee.

Bristle-thighed Curlew	*Numenius tahitiensis* *
Eurasian Curlew	*Numenius arquata*
Green Sandpiper	*Tringa ochropus* *
Nordmann's Greenshank	*Tringa guttifer* *
Long-billed Dowitcher	*Limnodromus scolopaceus* *
Western Sandpiper	*Calidris mauri*
Temminck's Stint	*Calidris temminckii* *
Cox's Sandpiper	*Calidris paramelanotos* *
American Golden Plover	*Pluvialis dominica*
Eurasian Golden Plover	*Pluvialis apricaria*

* not in *Recommended English Names for Australian Birds* (RAOU 1978b)

REFERENCES

Condon, H.T. 1975. Checklist of the Birds of Australia. Part 1. Non-passerines. RAOU, Melbourne.

RAOU. 1976. First amendments to the 1975 RAOU Checklist. Emu 76:216-218.

RAOU. 1978a. Second amendments to the 1975 RAOU Checklist. Emu 78: 80-87.

RAOU 1978b. Recommended English Names for Australian Birds. Emu 77, Supplement: 245-313.

Schodde, R. 1975. Interim List of Australian Songbirds. Passerines. RAOU, Melbourne.

Jeff Campbell

Close to the edge: energetic bottlenecks and the evolution of migratory pathways in Knots. Theunis Piersma. Ph.D. thesis dissertation, University of Gronigen. Available from BibliotheekNIOZ, Netherlands Institute for Sea Research, P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands. Dfl 60 or US $30 or UK P20 in cash or cheque for US $40 or UK P25.

Close to the edge is a 366 page compilation of papers, many hitherto unpublished, which together form the Ph. D. thesis dissertation (awarded *cum laude* in May 1994) of Wader Study Group Vice-Chairman Theunis Piersma. This book is produced as a high quality journal-style softback in B5 (265x195 mm) format with a full-colour cover, and illustrated throughout with graphs, diagrams and photographs.

The 18 papers (involving international collaboration with 27 other authors) are grouped into five main sections, each introduced by an overview. The volume starts with an introduction that sets out the questions that need answering and the reasons for the choice of the Knot as a study species; and concludes with a general discussion.

The five main sections are: Evolution of Knots, Energy intake, Energy expenditure, Nutrient store dynamics, and Metabolic adjustments. Together they provide a wealth of new information and insights into the key factors driving the evolution of Knots and what this means for the ways in which they find, use and store nutrient reserves and manage their energy metabolism.

But the work reported here is of much wider value than to just those interested in Knots - there is much in the volume of great interest to all those involved in the worldwide study of the ecology and energetics of migrant birds.

Draft Management Manual for Migratory Shorebird Feeding Habitat in New South Wales Estuaries. Wayne Lawler, Environment Survey & Research Branch, NSW National Parks & Wildlife Service, Sydney. 1994. Available from the author, c/- Ecopix, P.O. Box 67, Scarborough, Qld. 4020.

Research on 106 intertidal flats in 22 NSW estuaries identified attributes of habitats selected by six common species of migratory shorebird and associations with less common species. Important habitat attributes to manage are inferred. Guidelines for management and habitat construction are given from habitat models for the six common species. These and other values given can be used as targets in habitat conservation and management. Assessment keys based on the same attributes of habitats are provided to determine likely conservation value of existing intertidal flats for these species. Disturbance buffer widths, depending on species and disturbance type, are given. A matrix of human activities and resultant effects on the estuarine environment identifies impacts on shorebird feeding habitat. The impacts are described and management strategies are suggested. Techniques for measuring the attributes of the intertidal habitat are described for assessment and monitoring. References to further information on management issues are given.

Comments on the draft would be welcomed by the author.

REPORT: Shorebirds At Xuan Thuy Reserve, Red River Delta, Vietnam in March/April 1991

This report, which describes the results of an AWSG banding and counting expedition, is available from Brenda Murlis, 34 Centre Road, Vermont, 3133, at a cost of $3 to cover handling and postage. Only limited copies are available - first come, first served.

THE "KUSHIRO INITIATIVE" - DEVELOPING AN INTERNATIONAL SHOREBIRD CONSERVATION PROGRAM

Background to the Kushiro Workshop

The conservation of migratory shorebirds requires action on an international basis because the birds depend on species protection and habitat management over a number of countries. Comprehensive management needs to address all three phases of the annual life cycle: breeding, migration and non-breeding. The responsibility for this rests with the governments and people of each of the countries in the flyway.

Over the past two decades there has been increasing recognition by governments and non-government groups of the need for international co-operation. Governments have started to develop formal agreements for the conservation of migratory species and for specific habitat protection such as wetlands.

The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) has been developed as a multilateral treaty to promote wetland conservation. In the East Asia/Australasia region 15 of the 23 range states have joined the convention. Over 30 wetlands of international importance for shorebirds are presently listed under the Ramsar Convention (25 of these being in Australia).

In the East Asia/Australasia flyway there are now seven bilateral agreements for the conservation of migratory birds involving six countries. Japan, for example, has bilateral agreements with four countries. Bilateral agreements have enabled the Government agencies in Australia and Japan to provide funding to non-government groups to conduct international conservation programs. Much of the shorebird surveys and training activities conducted by Asian Wetland Bureau over the past 10 years have been from projects funded by the Australian government.

In 1983 a new multilateral convention came into force called the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). A multilateral convention is the most viable international framework for conservation of migratory species because it enables a large group of nations to make common agreements.

In Africa/Europe there have been three major initiatives under the Bonn Convention. These are the preparation of a Western Paleartic Waterfowl Agreement, a general Management Plan for Western Palaearctic Waterfowl and an Action Plan for migratory species of Anatidae. These documents are now being formally considered by range states.

The Bonn Secretariat has commenced similar work for the Asian/Australasian region. The limitation of using the Bonn Convention in this region of the world is that as yet only India, Australia, the Philippines and the USA are signatories. Most other nations have not formally considered signing the Convention. Presently Japan does not support the Convention.

While it is possible for non-member nations to be parties to management and action plans developed under the Bonn Convention, it does seem premature to use the Convention when so few nations in East Asia/Australasia have joined. However, given the desirability of a multilateral convention and the support the Bonn Convention has in Europe and Africa it would appear prudent to develop conservation plans for this region in a complementary way to the Bonn Convention. As such, if in the future there develops significant support in this region for the Bonn Convention, then, it will require minimal effort to revise the conservation plans.

In 1994, the Australian Nature Conservation Agency (ANCA) contracted the Asian Wetland Bureau to develop a conservation action plan for migratory shorebirds in the East-Asian/Australasian Flyway. As the project was discussed in greater detail it was recognised that the potential of the Action Plan would be greatly increased if it was sponsored by more than one nation and that there was a high level of regional input.

At the Japan-Australia Migratory Bird Agreement meeting, in November 1993, ANCA formally proposed that a regional workshop be convened to discuss shorebird conservation in the flyway. The Japan Environment Agency supported the initiative and proposed that the conference be held in Kushiro in late 1994. Two non-government organisations, AWB and the International Wetland Research Bureau - Japan, were asked to be responsible for the organisation of the conference.

In East Asia waterbirds such as cranes, ducks and geese are regular migrants between countries and their conservation has a higher profile than shorebirds. In response to the concerns of the Japan Environment Agency, for greater international co-operation in the conservation of cranes, ducks and geese, the agenda of the workshop was broadened.

The Kushiro Workshop

The five day workshop was attended by 92 representatives of government and non-government organisations from 16 nations in the East Asian/Australasian flyway. Papers were presented on the status of shorebirds and shorebird conservation in the following areas: Alaska, Far East Siberia, North Korea, South Korea, China, Hong Kong, Cambodia, Thailand Myanmar, Malaysia, Singapore, Indonesia, New Guinea, Australia, New Zealand and the Pacific Islands.

Following the presentation of papers there were five workshop sessions which discussed:

- Domestic policy and legislation for wetland sites and species,
- International Co-operation,
- Training and institutional strengthening, public education and involvement,
- Studies and research - shorebird species,
- Studies and research - habitat and sites.

The workshops were then bought together and focused into a workshop statement (see attached "Kushiro Initiative"). To ensure that conservation actions were to follow the workshop, delegates called for the preparation of three specific documents to further waterbird conservation in the flyway: a Migratory Waterbird Conservation Strategy, a Migratory Shorebird Action Plan and a Shorebird Site Network Proposal.

It was intended that the Migratory Waterbird Conservation Strategy would initially take the place of a formal agreement. It was to provide; an overview of the conservation issues, priorities for action, mechanisms, resources, implementation and review. Key mechanisms identified for the Strategy were the development of family-group Action Plans and Site Networks. The Japan Environment Agency has undertaken to prepare this document.

The third document called for by the workshop was for a proposal for Shorebird Site Network to be developed, modelled on a Western Hemisphere Shorebird Reserve Network (WHSRN). This was to take up the initiative outlined in the Migratory Shorebird Action Plan and contain proposals for the operation of a network.

Implementation of the "Kushiro Initiative"

By mid-March, implementation of the "Kushiro Initiative" had reached the following stage:

a) Workshop Proceedings - final stages of editing, publication in June. Available from AWB.

b) Migratory Waterbird Conservation Strategy - being prepared by the Environment Agency of Japan,

c) Migratory Shorebird Action Plan - draft report for Australian Government in April,

d) Shorebird Site Network Proposal - draft proposal for Australian and Japanese Governments in May.

The challenge in all planning exercises is to translate the documents into agreements that are implemented. This initiative is opportune because there are several important international meetings over the next year. These meetings are very important because they provide a forum to make formal agreements and important announcements. Governments can be seen to be taking action. These meetings are:

a) Ramsar Regional Meeting in New Delhi in April 1995. Japan will report on the Kushiro workshop and the action that is to follow,

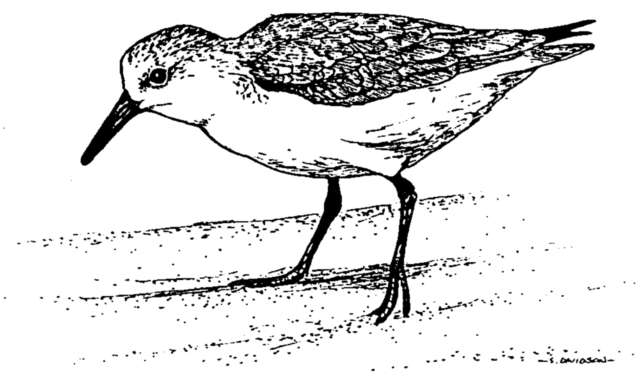
b) Western Hemisphere Shorebird Reserve Network meeting in Ottawa in May 1995. Report on the Kushiro workshop and the potential for sites in Alaska to be listed in both the site network in the Americas and a future network in East Asia/Australasia,

c) JAMBA and CAMBA meeting in Australia in June 1995. It is hoped that formal consideration of the three conservation documents prepared follow the workshop.

d) Wetlands and Development Conference and IWRB/AWB/WA meeting in Malaysia in October 1995. One of the workshops at this conference will consider the role of international conventions and site networks in conserving migratory species.

e) Ramsar Conference in Brisbane in March 1996. Provides an opportunity for the Australian and Japanese Governments to announce a site network for the conservation of migratory shorebirds in the East Asian/Australasian Flyway

Doug Watkins



THE KUSHIRO INITIATIVE

SUMMARY STATEMENT FROM THE INTERNATIONAL WORKSHOP ON CONSERVATION OF MIGRATORY WATERBIRDS AND THEIR WETLAND HABITATS IN THE EAST ASIAN AUSTRALASIAN FLYWAY

2 DECEMBER 1994
KUSHIRO, JAPAN

The "International Workshop on Conservation of Migratory Waterbirds and their Wetland Habitats in the East Asian-Australasian Flyway", held in Kushiro from 28 November to 2 December 1994, was attended by 92 experts and government representatives from the following states and territories: Australia, Cambodia, China (People's Republic), Hong Kong, Indonesia, Japan, Malaysia, Myanmar, New Zealand, Papua New Guinea, The Philippines, Korea (Democratic People's Republic of), Korea (Republic of), Russia, Singapore, Thailand, USA, and representatives of Asian Wetland Bureau, Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), Convention on Migratory Species of Wild Animals (CMS), and Wetlands for the Americas. The meeting was organized under the auspices of the Environment Agency of Japan, the Australian Nature Conservation Agency, with assistance from the Asian Wetland Bureau, and the International Waterfowl and Wetlands Research Bureau Japan Committee: partial financial support was received from UNEP Regional Office for the Asia Pacific, and the Convention on Migratory Species of Wild Animals (CMS). It was held at the invitation of the Preparatory Committee for the Kushiro International Wetland Centre.

The meeting expressed its thanks to the local organisers and supporters for the excellent arrangements.

The meeting also congratulated the initiative of the Kushiro and other local governments in concluding a twinning agreement between Ramsar sites in the Kushiro region and Kooragang Ramsar site in New South Wales, Australia, which is a model for establishment of a network of sites linked by migratory waterbirds.

This workshop discussed and exchanged information on the conservation of migratory waterbirds and their wetland habitats in the East Asian-Australasian region. Waterbirds are an important component of most wetlands ecosystems. They are of great value economically, culturally, socially and scientifically, and this value must be maintained through proper management. Thus it is important to properly conserve waterbird species and their wetland habitats. However, for migratory waterbirds, it is inadequate to take such actions in individual countries or regions. Rather, conservation actions require international cooperation throughout the flyway.

The workshop agreed the following aim:

The current decline in the numbers of migratory waterbirds in the flyway and the degradation and loss of wetland habitats on which these species depend, should be stopped and reversed.

To achieve this, the workshop:

1. Recommended that countries in the flyway should enhance mechanisms for collaborative action to conserve waterbird species; identify and establish a network of sites critical for waterbirds conservation; and ensure the species are managed on a sustainable basis according to the "wise use" principles;
2. Noting the important role of the Ramsar Convention in protecting wetland sites of importance to waterbirds, urged the Contracting Parties in the flyway to designate additional sites of importance for migratory waterbirds in accordance with recommendation C.5.1 of the 5th Conference of Contracting Parties;
3. Noting the success of the Western Hemisphere Shorebird Reserve Network in facilitating the conservation of this group throughout the Americas, recommended the immediate establishment of an Asia-Australasian Shorebird Reserve Network, linking sites important for shorebirds on their annual migration between North Asia and Australasia;
4. Recognizing the need for an improved mechanism for coordination of conservation action between flyway countries, recommended the development of a legally-binding, multilateral agreement;
5. Endorsed the framework for a Migratory Waterbird Conservation Strategy for the East Asia-Australasia Region that will describe the principal issues and identified mechanisms to be addressed in preparation of an action plan for particular groups of waterbirds (see Annex 1);
6. Approved the development of an Action Plan for the conservation of migratory shorebirds prescribing particular actions necessary to conserve the shorebird populations in the flyway;

7. Adopted a timetable for implementation, and requested that parties report on progress by the time of the Conference of Contracting Parties to the Ramsar Convention in March 1996; and,

8. Requested the organisers, on behalf of the Workshop, to convey and commend these recommendations to the countries in the flyway; and to assist in the location of resources for their implementation.

ANNEX 1:

FRAMEWORK FOR MIGRATORY WATERBIRD CONSERVATION IN THE ASIA-AUSTRALASIA REGION

The Strategy for migratory waterbird conservation in the Asia-Australasia Region will include the following principal proposals:

1. Coordination of activities in the flyway.
The establishment of a formal multilateral agreement between the countries in the flyway is recommended.

2. Preparation of Action Plans for groups of species.
Separate Action Plans should be prepared for certain groups of key species including shorebirds, cranes and ducks/geese. These should be prepared as soon as possible with the deadline for the shorebird plan set at June 1995. These Action Plans will identify needs to establish networks of linked sites/states.

3. Establishment of flyway reserve networks.
Flyway reserve networks will be proposed as required under Action Plans for key species groups. These networks will include sites nominated by countries in the flyway. The network for shorebirds is planned to be established by March 1996. Consideration should be given to develop a similar network for migratory cranes in the flyway.

4. Review and enhancement of legislation and policy.
A review is proposed of legislation and policies in the flyway countries related to waterbird and wetland habitat protection and management. Proposals will be made to harmonise legislation and policy frameworks to ensure minimum standards of protection in all range states, and implementation should be enhanced.

5. Implementation of Conventions and Agreements.
Parties in the region should fully implement their obligations under the relevant conservation agreements and conventions (including Ramsar, CMS, and migratory bird agreements). In particular, Ramsar parties should ensure they conserve waterbird habitat; including the designation of additional Ramsar sites as appropriate and the incorporation of the "wise use" principle or wetland management into landuse planning.

6. Institutional strengthening and training.
Adequate resources should be allocated to strengthen appropriate research and management agencies especially in developing countries through provision of funds, equipment and training.

7. Education and Public Awareness.
Efforts to promote public awareness and education in waterbird and wetland management need to be supported, especially in developing countries. Consideration should be given to supporting development of regional information networks, such as the Asia-Pacific Wetland Education Centre Network.

8. Research and Monitoring.
Encourage research to establish flyway populations sizes and trends, and appropriate details of migration routes and of priority species. Systems for data collation, analysis and dissemination (including databases), need to be enhanced and made compatible. The Asian Waterfowl Census and other monitoring programmes should be supported and enhanced. Updated inventories of wetland sites should be prepared to clarify the status of sites. This may also provide input into activities such as preparation of directories of important bird conservation areas.

9. Implementation agencies.
The strategy should be implemented by governmental, non-governmental and local community organisations and private sector groups.

10. Implementation and Evaluation.
It is proposed that the Strategy will be implemented over an initial period of five years (1995-2000). Significant resources will need to be identified to ensure successful and timely completion of actions. Innovative funding schemes, such as through wetland habitat stamps, or public-private sector partnerships should also be considered.

Progress in implementation of the strategy should be reported to the 1996 Conference of the Parties to the Ramsar Convention, and further progress, if any, to the 1997 Conference of Parties to the Convention on Migratory Species.

FORMAT FOR EAST ASIAN-AUSTRALASIAN MIGRATORY SHOREBIRD ACTION PLAN

1. INTRODUCTION
   - Mission statement and objectives.

2. BACKGROUND
   - Nature of flyways and shorebird species.
   - Range states.
   - Existing policies and legislative frameworks.
   - Existing major conservation initiatives.

3. STATUS AND ISSUES
   - Status of species and sites.
   - Threats and problems.
   - Other issues.

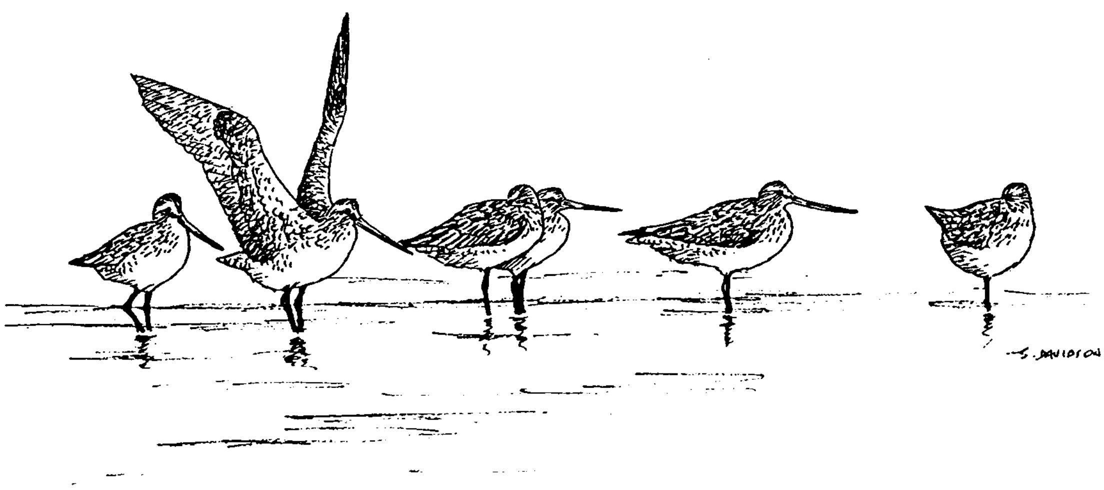
4. PRIORITIES FOR ACTION
   - Regional cooperation and framework.
   - Species.
   - Sites.
   - Institutional and training needs.
   - Education and awareness.

5. MECHANISMS
   - Flyway coordination and agreements.
   - International site networks.
   - Species conservation action plans.
   - Legislation and policy.
   - Institutional strengthening.
   - Habitat conservation actions and enforcement.
   - Control hunting.
   - Research and monitoring.
   - Information/awareness campaign.
   - Training.

6. RESOURCES
   - Agencies (national/international) responsible for coordination, implementation and monitoring.
   - Finance.
   - Personnel

7. IMPLEMENTATION AND REVIEW
   - Timetable
   - Monitoring progress
   - Reporting and evaluation of progress

8. APPENDICES
   I. List of range countries
   II. List of species covered and status
   III. List of species not covered
   IV. List of relevant agreements



A PERSONAL REFLECTION ON THE KUSHIRO MEETING

In early December 1994, Doug Watkins and I joined with more than 90 wader researchers and government representatives to discuss the problems facing waders in the East Asian - Australasian Flyway and how these could be minimised. Seventeen countries were represented, along with staff from such organisations as Asian Wetland Bureau, Ramsar Bureau, Bonn Convention and Wetlands for the Americas. The meeting was organised under the auspices of the Australian Nature Conservation Agency and the Environment Agency of Japan, and was run by AWB and the International Waterfowl and Wetlands Research Bureau Japan Committee.

Almost all countries in the Flyway were represented, including Papua New Guinea, North Korea, Russia and the USA (Alaska).

Lots of people, many "heavies"!! Are waders going to be any better off because of it? Or was it just another talk-fest? I'm reasonably optimistic that the eventual outcomes will be good, but it will need hard work, require considerable resolve - and patience will be a very necessary virtue.

In essence, the meeting ran in two parallel sessions. The pollies burnt the midnight oil determining exactly what the scope of the proposed Agreement and, thus, the meeting outcome should be, whilst the technocrats discussed research and management problems and needs.

Whilst we mere mortals may be cynical about the involvement of the bureacrats, it has to be accepted that without them little will come to pass. The problem of getting as many of the flyway countries as possible to formally accede to the Agreement is considerable, and it is anticipated that this will take some years, perhaps five, to achieve. Such is the pace of diplomatic negotiations.

The final document from the meeting prescribes a three-tiered approach to conserving shorebirds in the East Asian-Australasian Flyway: the formal Agreement, a Migratory Waterbird Strategy and a Migratory Shorebird Action Plan. The latter is the first of a number of separate plans to be prepared to cover a variety of waterbird families.

Whilst the Agreement may take some time to achieve, the important point is that there is no reason why the Strategy and the Action Plan shouldn't proceed at full speed. Drafts of both are to be prepared by mid-1995, the first by the Japanese Environment Agency, the second by AWB. In order to keep the whole process moving, milestones have been set - the June 1995 JAMBA meeting, the IWRB Meeting in Malaysia in October 1995 and the RAMSAR meeting in Brisbane next March, being the major ones. At these meetings Australia and Japan will be reporting on progress. So, the whole process shouldn't just disappear into busy people's intrays.

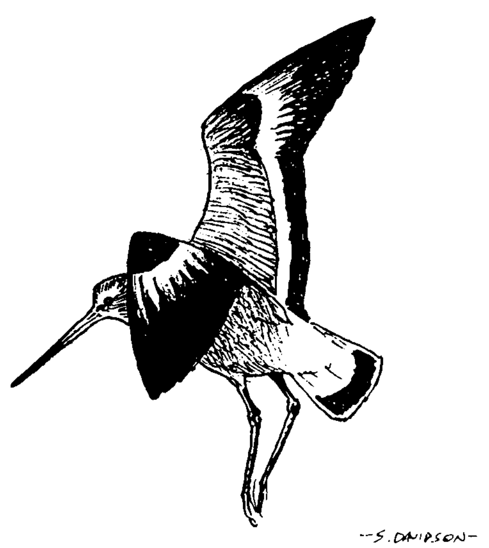
In my view the crucial test, following the endorsement of the Shorebird Action Plan, will be the willingness of countries, such as Australia and Japan, to provide the substantial resources necessary to support the research, institutional and training needs for successful implementation of the plan. Few other countries in the flyway have the money and requisite skills.

The weather was a bit of a shock, coming from tropical Melbourne. A few of the twitchers amongst us, mainly Poms, met in the hotel lobby at 6 most mornings and slipped and skated across the frozen puddles to nearby woodlands and the shore. It was all very worthwhile, with excellent views of Harlequin Duck being amongst the many highlights.

Our hosts, the Kushiro International Wetland Centre, were excellent, meeting our various needs with true Japanese hospitality and efficiency. One of the five days involved visits to a number of waterbird sites in Hokkaido, amongst them three Ramsar areas. The visitor centres at the Ramsar sites were a bit different to what we're used to in Australia, even having remote cameras to enable reluctant birders to see distant parts of the wetlands, whilst still ensconced in the comfort of the centre. These aids certainly helped in enabling us to keep somewhere near the stopwatch schedule set for us by our hosts.

Perhaps the overiding memory I have of the meeting was the splendid opportunity it created to meet with a large number of like-minded people from throughout the Flyway to share information and ideas. It is important that these types of contacts continue, as so much can be gained from them.

Mark Barter



ESTIMATING INTERNATIONAL WATERFOWL POPULATIONS : Current Activity and Future Directions

(Reprinted from the Wader Study Group Bulletin 73: 19-26)

Paul Rose & David Stroud

Rose, P. & Stroud, D.A. 1994. Estimating international waterfowl populations : current activity and future directions.

A small international workshop was recently organised by the International Waterfowl and Wetlands Research Bureau (IWRB) and the UK Joint Nature Conservation Committee (JNCC) which considered current activity and future needs for the estimation of international waterfowl population sizes in the Western Palearctic and the uses of these data, especially with respect to the requirements of the Ramsar Convention. The workshop was held at Kalø, Denmark from 11-13 January by the kind invitation of the Danish National Environmental Research Institute. It had two principal objectives.

First, it considered the current mechanisms for the co-ordination of information necessary to assess international population sizes of waterfowl. This concentrated especially on the identification of the different uses of these data and the basic requirement of the different groups of date 'users' (e.g. researchers, national and international NGOs, government conservation bodies, conventions and ministries). The meeting made recommendations for further improvements to current mechanisms, especially in the light of the Ramsar Convention's recent recommendation that international waterfowl population estimates be updated every three years in line with meetings of the Contracting Parties.

Second, the workshop considered comments made on the draft report prepared in 1993 by IWRB, Asian Wetland Bureau (AWB) and Wetlands for the Americas (WA) which aimed to summarise current estimates for waterfowl populations world-wide. Since there was a need to finalise these waterfowl estimates for the Western Palearctic, the meeting considered outstanding issues. The meeting also addressed options for further improvements in the future reporting of international waterfowl estimates in the light of this first report, and made recommendations for such improvements.

The meeting recommended two cycles of review to be undertaken:

- a three year cycle of revision of population estimates for Western Palearctic waterfowl (i.e. for every Ramsar Conference); and
- a nine year cycle of revision of 1% thresholds for Western Palearctic waterfowl (every third Ramsar meeting), unless major population change occurs.

In undertaking these reviews, a two stage model is proposed:

- first, published taxa-related reviews (produced e.g. by IWRB Research Groups/Database co-ordinators and others to an agreed forward plan); and
- second, a global summary report drawing on review papers (produced by IWRB/AWB/WA).

The meeting noted the great importance of ensuring that one internationally-agreed set of officially reported population levels were available for use by the Ramsar and Bonn Conventions, and other international treaties. IWRB should co-ordinate the establishment of common protocols on the use and revision of these data.

The meeting focused on the issues surrounding waterfowl population estimates in the Western Palearctic, but through the meeting it became clear that many of the points under discussion were relevant also to other parts of the world, and that future discussions should include representatives from other regions. The outcome of the meeting will be taken forward in the planning of the March 1996 meeting of Ramsar Contracting Parties in Brisbane, Australia.

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Introduction

The 1% criterion has for many years been used to identify wetlands of international importance for their waterfowl populations, especially those which should be brought within the list of sites conserved under the Ramsar Convention.

The criterion identifies sites as of international importance if 1% of the waterfowl of a particular migratory flyway or population regularly make use of a wetland at any time during their annual cycle. This simple, and globally applicable criterion, to which other criteria have more recently been added, has played a major role in the identification and listing of sites under the Ramsar Convention.

There is no fundamental biological reason to take 1% of a population as the threshold level for establishing international importance of a site. However, this percentage has been found by long experience and evaluation to be useful in giving an appropriate degree of protection to many populations except when widespread and dispersed, and in the definition of ecologically appropriate sites. The criterion has, therefore, gained worldwide acceptance.

The wide use of this numerical criterion in site selection depends crucially however, on the establishment of the size of the international waterfowl populations concerned. This provides the necessary baseline from which the 1% threshold is derived for any species or population.

The long-term collection of baseline data has been undertaken through the International Waterfowl Census (IWC) of IWRB - itself working with and alongside other national (e.g. WeBS in the UK) or international counting schemes, and specialist surveys for particular taxa.

The revision of international population estimates has, until now, been undertaken previously on an *ad hoc* basis, with the last major reviews of Western Palearctic waders and Anatidae being presented at the 1987 Ramsar meeting in Regina (Smit & Piersma 1989; Pirot *et al.* 1989). There has formerly been no internationally agreed timetable for the revision of population estimates and 1% thresholds.

The meeting noted the great importance of ensuring that one internationally agreed set of officially reported population levels were available for use by the Ramsar and Bonn Conventions, and other international treaties, as well as other users such as national convention agencies and non-governmental organisations.

Current Revision of International Population Estimates

A report was prepared by IWRB, AWB and WA for the Kushiro Ramsar Conference in June 1993. This consultation draft brought together for the first time all data on waterfowl population estimates from all over the world and has now been published (Rose & Scott 1994). The report suggested 1% threshold for some populations, and where possible, indicated trends in the development of populations. It also updated population levels and 1% thresholds where these exist.

There was an urgent need to finalise these estimates for waterfowl populations occurring in the Western Palearctic, as well as to consider the comments made on their presentation by interested parties. There was also a need to consider in detail the future co-ordination and timetable for the preparation and revision of international waterfowl population estimates, involving strategic consideration of data collection, analysis and use by a variety of partner organisations and bodies. The meeting considered the current and future development of this key area of conservation science, drawing on the expertise developed in north-western Europe and especially in those countries with sophisticated systems for waterfowl monitoring and conservation delivery.

Common Directions In International Population Estimation

The collation of data for the draft report highlighted a number of areas where review was necessary. This follows experience in some countries active in the designation of large numbers of Ramsar sites and their subsequent defence through complex legislation and legal planning processes.

In some European countries (as well as other areas outside the Western Palearctic), the Ramsar designation gives an additional level of strict protection for a wetland over and above that provided by domestic legislation. In this regard, the designation attracts particular attention from developers and others whose activities may be damaging to the site. There are often challenges to the designation, not only at the time it is made, but on a continuing basis. This may involve the legal defence of the site through courts, planning inquiries and other procedures. The consequence of this is that population estimates used in site selection must be defensible to the greatest degree possible, and their derivation must have involved the highest possible scientific standards.

In other parts of the world, lack of adequate domestic legislation places a heavy reliance on site protection through international designations such as Ramsar listing. In some areas, the quality and quantity of data may be such that only 'best estimates' are available for some waterfowl populations. Even these data provide a vital basis throughout much of the world for providing a basis for flyway site safeguard and for driving nature conservation forward.

The workshop considered the development and use of population data specifically as related to the Western Palearctic region. It was noted that although many of the issues related to data were especially acute in NW Europe (from where workshop participants came), population estimation had to relate to appropriate biographical units - in this case the Western Palearctic or East Atlantic Flyway. It was also noted that issues involved were often common throughout the world and there would be benefits for other regions in undertaking similar review exercises.

The challenge faced in deriving one global report is to ensure that both situations with a well developed information base and those areas where detailed extensive counts were not available can be catered for, bearing in mind that the current experience of the former situation may be useful in guiding the development and growth of counting in the latter.

Underpinning the collection and interpretation of waterfowl population data is the need for a common and agreed terminology. In the light of confusion over the taxonomic scope of the terms "waterbird" and "waterfowl", the meeting considered these, and other definitions, as outlined in the Appendix.

Data collection and collation

The workshop addressed the processes involved in waterfowl population estimation in the Western Palearctic, especially with regard to the uses and users of information generated.

For the Western Palearctic, the meeting reviewed the structures for current collection of data on waterfowl population size, and the adequacy of present collection procedures. Particular attention was given to seabirds as some of these species are now classified (in some definitions - see Appendix) as waterbirds. It was noted that principal population census was through breeding season census, especially of colonial species, and that there were currently only weak structures for the regular collation of such data at an international level.

Most data for most non-breeding waterfowl are collated through the International Waterfowl Census. There is sometimes interpretation of this information by IWRB's Research Groups (e.g. for seaducks, geese and waders).

Regularity of revision of totals

Resolution 5.9 of the 1993 Kushiro Ramsar meeting requested IWRB to update population figures used to derive 1% thresholds on a three year cycle in line with meetings of the Contracting Parties.

Concerns were expressed that full revision of international 1% thresholds every three years is too frequent. The value of the 1% thresholds is that they provide a medium term, consistent base-line against which to evaluate sites in an international context, set priorities for species planning etc. If they change too frequently, this stability is lost and no sooner have one set of criteria been produced, and disseminated through governmental systems to a local level, than another revision is due. This could cause considerable practical problems in a number of countries, for example, with the constant need to revise national lists of sites qualifying as of international importance, and with sites coming on or off shadow lists of qualifying sites as populations alter in size through the effects of natural changes in productivity and mortality.

Many waterfowl undergo substantial natural year-to-year population change, owing to variations in breeding success and/or winter survival. A too frequent revision of 1% thresholds is especially a problem for these populations since changed 1% thresholds may only reflect short-term natural variation rather than real population change.

There is generally an inverse relationship between frequency of population revision and geographical scale. At the level of the individual site, at least annual, if not more frequent, assessments are necessary in order to fine-tune site-management. At national and international levels, the currency used by conservation practitioners (the population estimate) needs to change *less* frequently to be most useful. At a national level, we probably need to review populations about every 3-5 years, and at the scale of the international population estimate and for 1% thresholds, a frequency of change in the order of nine years has been suggested.

This is obviously something for the Ramsar Parties themselves to consider in due course, but the meeting considered it desirable in future revisions of the report to update international *population levels* (where necessary/appropriate) every three years, but to aim to avoid changing *1% thresholds* on this timetable unless there has been a change of significant magnitude (c. 20% - guidelines to be agreed) that makes this likely to be a real change and thus really necessary.

The process has two separate elements:

a) the desirable frequency of revision of 'true' population totals; and

b) the desirable frequency of revision of 1% thresholds (i.e. the nominal totals which may vary slightly from time to time from the true total).

This in turn led to a consideration of the use of these two elements by a variety of parties. There are a number of potential user-groups, including:

- international conservation agencies (e.g.IWRB, BirdLife International, IUCN etc.);
- Convention and international bureaux (e.g. Ramsar Bureau, Bonn Convention Secretariat, European Commission etc.);
- academics and specialist research groups (e.g. Wader Study Group);
- government ministries responsible for the designation and protection of sites and species; and
- governmental and non-governmental conservation bodies involved in the identification of sites and their management for species.

Different users have different needs from the population totals. The system of revision must be flexible enough to satisfy most users most of the time (recognising that it may not be possible to please all users, all of the time!).

For conservation scientists, knowledge of annual year-on-year population changes is important to monitor the health of populations (and to give data for modelling etc.). For advising governments and conservation practitioners there is no need for a full new set of published international population levels to be made each year.

Timetabling and Planning of Future Population Revisions

The meeting agreed a parallel programme of scientific dissemination of population estimates (detailed taxa reviews e.g. for geese, waders, seaducks) slightly ahead of the timetable for the global summary report. These reviews will be published *in advance* of their use in a global summary.

Such dual dissemination (review papers and global report) would not only show how data were derived (the review papers for particular taxa), but at the same time give a global vehicle for presenting 'best-estimate' information where these are the only sources (much of the world). The workshop gave consideration as to how such planning might take place, and how to integrate with other groups (e.g. those concerned with seabirds) for maximum effectiveness.

The result is a system which gives a scientifically sound international benchmark, especially inasmuch as this ensures that all international data ultimately used to underpin site selection at a national level are clear, published and open to critical inspection by third parties.

Conclusions

Mechanisms for future revisions of international waterbird population levels

OBJECTIVE

To prepare one agreed, and recognised, source of information in the world, documenting waterbird population levels to a regular reporting timetable, whilst accommodating, to the greatest extent possible, the requirements of international conservation bureaux, and governmental and non-governmental users.

TIMETABLE

The meeting recommended that two cycles of review would be most appropriate:

- a three year cycle of revision of population estimates for Western Palearctic waterfowl (i.e. for every Ramsar Conference);
- a nine year cycle of revision of 1% thresholds for Western Palearctic waterfowl (every third Ramsar meeting), unless there has been a change of significant magnitude (*c.* 20% - guidelines to be agreed) within a three year period. (The separation of revision of population estimates from 1% thresholds and their use in applying the 1% criterion is important to avoid rapid changes of lists of qualifying sites consequential on short-term population changes.)
- It was understood that the regions may wish (or need) to change 1% thresholds every three years as in other parts of the world there is a much more dynamic rate of change of information.
- A timetable for next decade was agreed (Table 1).

FORMAT

In undertaking these reviews, a two stage model was suggested:

- firstly, published taxa related reviews (produced to an agreed forward plan - Table 1); and
- secondly, a global summary report drawing on review papers (produced by IWRB/AWB/WA for Ramsar Convention).

Published global summary reports on waterfowl population levels should have the following format:

- All primary estimates will be directly sourced or have a clear audit trail.
- Wherever possible, estimates will be derived from published or other reviewed data - *not* taken direct from databases (i.e. databases help to form the basis of the taxa related reviews).
- It would be useful to include maps showing the geographic extent of estimates; however this will need further investigation

PROCESS

- Revision of the global report will be undertaken every three years for meetings of Ramsar Contracting Parties.
- Official 1% thresholds for the Western Palearctic species in the global report will normally be updated every nine years, although with 'emergency' revision of 1% thresholds possible at three yearly intervals if rapid changes of population occur (i.e. population levels are

changed every three years, but 1% thresholds are changed only every nine years unless they change by greater than a specific magnitude (yet to be defined)).

- There is a need to define rules of change. What are the natural limits within which a population can fluctuate before there is a need to revise 1% threshold? A change of >20% was discussed as a rule of thumb. This will need to be discussed at next workshop meeting. [Note that there are conceptual links to the framework of 'alert limits' currently being developed in the UK for waterfowl species].
- It was agreed that there would be no changes of 'official' international population levels or 1% thresholds within three year periods except in an emergency.
- The Workshop recommended that the Ramsar Bureau disseminate 'official' 1% thresholds for use in application of Criterion 3c, possibly as a booklet, and adopt a resolution at the next Ramsar Convention meeting to confirm use of these official 1% population thresholds. This will require the 1996 draft report to be circulated as a Conference paper to Contracting Parties in advance of the next meeting to allow endorsement at the meeting., as was the 1993 report (Resolution C.5.9).

Future workshops/activity

- The need for advances in ecology and conservation science to be fed into the process of data collation, interpretation and use at national and international levels was highlighted. There are current scientific advances that should be fed into the future conservation agendas. The desirability of a review outlining the scope and possible use of recent ecological advances to this field of waterfowl conservation was noted.
- It was noted that although the present workshop considered the Western Palearctic, this experience may be useful to other global regions in establishing similar and forward-linked programmes of activity. The outcome of this meeting, especially underlying principles, should be disseminated more widely by IWRB (to its global partners) and Ramsar Bureau. There would be merits in Ramsar Bureau convening a wider group to encourage and endorse international co-ordination at a global level.

Achieving necessary coverage

- For waders, existing datasets are limited by two types of gaps - restricted geographical coverage in some parts of the flyway, and lack of information for non-coastal areas. WSG would need to work to enhance coverage in both these situations. (For the former, and probably the latter, there is a major role for WIWO type expeditions).

Conservation

- Future meetings need to assess how information can best be used and what other sorts of data would enhance information on waterfowl populations and their conservation. For example, there is little knowledge of the proportion of populations using protected sites on a flyway basis (but see Davidson & Piersma 1992 for an example). IWRB and its Research Groups could derive and disseminate such information, although the process should be detached from the timetable of international population review and reporting.
- There is a need to define nature conservation targets and processes for waterbird species especially with respect to advances in the theory of metapopulations and the application of this to conservation, as well as the importance of turnover, the significance of the loss of sites along a flyway chain, distance between protected sites for species with different migratory patterns etc. This could be a theme for a future international workshop.

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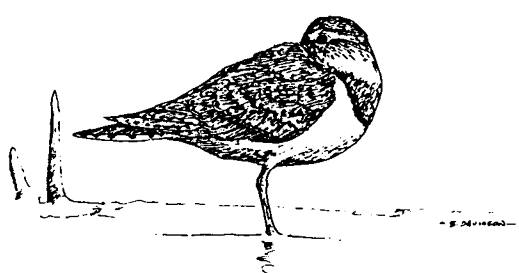
The meeting was attended by Nick Davidson (WSB/IWRB, liaison), Tony Fox (Danish National Environmental Research Institute - NERI), Colin Galbraith (JNCC), Karsten Laursen (NERI: IWRB Seaducks Research Group), Jesper Madsen (NERI:IWRB Goose Research Group), Stefan Pihl (NERI: IWRB goose and seaducks databases), Marc van Roomen (SOVON), Paul Rose (IWRB), Derke Scott (IWRB consultant), David Stroud (JNCC), Cor Smit (IWRB wader database), Mark Tasker (JNCC/Seabird Group), and Janine van Vessem (IWRB). Although unfortunately not able to be present, Birdlife International (Colin Bibby, Melanie Heath, Graham Tucker and Zoltan Waliczky), and the Ramsar Bureau (Mike Smart) sent written submissions which were considered by the workshop and aided deliberations.



APPENDIX: Definition

Terms used are fundamental in the process of designation and conservation of wetlands and their waterfowl. The meanings of the following terms were discussed and agreed.

Population

Biographic populations are normally defined as a more or less discrete group of birds which live in a particular area or group of areas, which interbreed freely within the group and rarely breed or exchange individuals with other groups (Mayr 1970).

Sub-species/races

Biogeographical populations defined above, sufficiently discrete in time and space to facilitate morphological or other distinguished features as determined by taxonomists.

The flyway concept

A 'flyway' is a concept developed to describe areas of the world used by migratory animals such as waders. Flyways can be defined as the migration route(s) and areas used by wader populations in moving between their breeding and wintering grounds. Each wader species and population migrates in a different way and uses a different suite of breeding, migration staging and wintering sites. Hence a single flyway is composed of many overlapping migration systems of individual wader populations and species, each of which has different habitat preferences and migration strategies. From knowledge of these various migration systems it is possible to group the migration routes used by waders into broad flyways, each of which is used by many species, often in a similar way, during their annual migration.

There are no hard and fast separations between flyways, and their use is not intended to imply any major biological significance. Rather the use of the flyway concept is valuable for the convenience of its approach in permitting the biology and conservation of waders, as with other migratory species to be considered in broad geographical units into which the migrations of species and populations can be more or less readily grouped.

Recent research into the migrations of many wader species throughout Europe and Asia indicates that in this part of the world the migrations of waders can broadly be grouped into five flyways: from west to east being the East Atlantic Flyway, the Mediterranean/Black Sea Flyway, the West Asia/Africa Flyway, the Central Asian/Indian sub-continent Flyway, and the East Asia/Australasian Flyway (source: Odessa Protocol *Wader Study Group Bull.* 65: 12)

Waterfowl/waterbirds/wildfowl

A long discussion was held as to the different legal and vernacular definitions of these terms. The conclusion was that such confusion now existed over the different forms of national and international usage (especially with respect of the term 'waterfowl') that it was best to taxonomically define the scope of use of these terms every time they are adopted (especially for quasi-legal documents).

Regularity

The Conference of Contracting Parties to the Ramsar Convention has defined the term "regularly" as used in the Ramsar site selection criteria. A wetland regularly supports a population of a given size if:

a. the requisite number of birds is known to have occurred in a least three quarters of the seasons for which adequate data are available, the total number of seasons being not less than three; or

b. the mean of the seasonal maxima, taken over at least five years, amounts to the required level (means based on three or four years may be quoted in provisional assessments only).

However, in establishing long-term 'use' of a site by birds, there needs to be a full awareness of the ecological needs of the populations protected at that site. Thus in some situations (e.g. sites of importance as cold weather refuges), the arithmetical average number of birds using a site over several years may not adequately reflect the importance of the site. In these instances, a site may be of crucial importance at certain times ('ecological bottlenecks'), but hold lesser numbers at other times. Thus, as always, there is a need for interpretation of data by qualified conservation scientists in order to ensure that the importance of sites is fully assessed (Stroud *el al.* 1990).

There is a need to further refine our definition of 'regular use' of a site with respect to currently available datasets - especially with respect to our letter understanding of cold weather needs in northwest Europe.

Seasonality

Population estimation at the level of the sub-species may be valid for populations that are assumed to be discrete in both summer and winter (e.g. for sedentary species, and some well known migratory species (especially e.g. geese)). However, many separate breeding populations mix in the non-breeding season, making year-round population distinction difficult, if not impossible.

The meeting agreed that in presenting population estimates, the provenance of data should always clearly be stated. With mixed, non-breeding populations, there would usually be a need to clearly indicate the areas and seasons for which a 1% criterion would be valid.

Site

The last semi-formal definition of 'site' was that of Atkinson-Willes (1976) who presented a study "based on the general rule that a 'site' should not cover more than 25 km of coast, shore or river". Atkinson-Willes *et al.* (1982) provided greater elaboration and stressed also the key importance of the continuum of habitat (as also reflected in the definitions of Grimmett & Jones 1989 - below). Thus many major estuaries have a shoreline of more than 25 km, but clearly should be considered one site on ecological grounds, linked not only hydrologically but also by the movements of birds within the site.

Grimmett & Jones (1989), in their review of important bird areas in Europe defined a site:

" . . . so that, as far as possible, it should:

1. be different in character or habitat or ornithological importance from the surrounding land or sea; and
2. exist as an actual or potential protected area, with or without buffer zones, or be an area which can be managed in some way for nature conservation; and
3. alone or with other sites, be a self-sufficient area which provides all the requirements of the birds (that it is important for) which use it during the time they are present.

Important areas in which the habitat is protected for bird conservation should be large enough to provide all the requirements of the birds using them, while they are present." (Grimmett & Jones (1989) modified to incorporate marine sites).

In the identification of marine 'sites' information on relative densities over the sea surface is more important for the identification of important sites than selection approaches based on 1% population thresholds.

1% criterion

The Ramsar convention established site selection criteria. One such criterion (currently numbered Criterion 3c indicates that a site is identified as of international importance if it holds 1% or more of a population of waterfowl. A change in the 1% criterion would be if the selection threshold changes to, say, 2% of a population (= the 2% criterion) or 0.5% of a population (= the 0.5% criterion). The term thus relates to the *proportion* (1%) that is used as a criterion of internationally important site selection.

1% threshold

This logically derives from the above and relates to the *number* of birds that are used as the nominal 1% of the population for the purposes of site selection. Thus , an international population of 75,000 Knot *Calidris canutus* has a derived 1% threshold of 750.

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Table 1. Forward plan of activity relating to international estimation of waterfowl population levels, and reporting to Ramsar Convention.

Year	Activity for Ramsar Convention and Ramsar Bureau	Actions for individual countries	Action for IWRB, its Research Groups, database co-ordinators, and others	Action for IWRB HQ (with AWB & WA)
1994			Full taxa reviews for Western Palearctic prepared by IWRB Research Groups	Kushiro report published.
1995	September/October: circulate draft global report to Contracting Parties as Conference paper	Provide advice and data as required. Meeting of Steering Group - summer/early autumn 1995	Full taxa reviews finalised: deadline for submission to IWRB HQ - May 1995	May-August: prepare second global report and transmit to Ramsar Bureau in September (for Western Palearctic: first full nine yearly review of population levels and 1% thresholds)
1996	March: endorse global report at 6th Ramsar meeting and disseminate 'official' 1% levels	Implement revised 1% thresholds in selection of Ramsar sites for all species		
1997		Provide advice and data as required	Limited taxa reviews for Western Palearctic prepared	
1998			Taxa updates finalised and published	Prepare third global report and transmit to Ramsar Bureau (for Western Palearctic: only population levels changed)
1999	Circulate draft global report to Contracting Parties as Conference paper Endorse global report at 7th Ramsar meeting and disseminate 'official' 1% levels	Implement any revised 1% thresholds in the selection of Ramsar sites		
2000		Provide advice and data as required	Limited taxa reviews for Western Palearctic prepared	
2001			Taxa updates finalised and published	Prepare fourth global report and transmit to Ramsar Bureau (for Western Palearctic: only population levels changed)
2002	Circulate draft global report to Contracting Parties as Conference paper Endorse global report at 8th Ramsar meeting and disseminate 'official' 1% levels	Implement any revised 1% thresholds in selection of Ramsar sites		
2002-3		Ensure co-ordination of adequate species/geographic coverage e.g. single species surveys, seabird surveys, seabird colony counts, rocky shore counts etc.	Co-ordination of period for major survey work to ensure complete international coverage of flyway populations for the Research Group reviews (e.g. expeditions to Western Sahara for waders), and also occasional extensive surveys (e.g. some seabird studies/rocky shorebird counts etc.)	
2003			Full taxa reviews for Western Palearctic prepared by IWRB Research Groups	
2004		Provide advice and data as required	Full taxa reviews finalised and published	Prepare fifth global report and transmit to Ramsar Bureau (for Western Palearctic: second full nine yearly review of population levels and 1% thresholds)
2005	Circulate draft global report to Contracting Parties as Conference paper Endorse global report at 9th Ramsar meeting and disseminate 'official' 1% levels	Implement revised 1% thresholds in selection of Ramsar sites for all species		

AUSTRALIAN SECTION

POPULATION MONITORING COUNTS: WINTER 1994

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The Winter 1994 Count was completed around the weekends of 18/19 and 25/26 June. A total of 112 count sheets was supplied for 23 sites. For the first time details from the NW coast of Tasmania are included. This is an important site for wader numbers and will be included in the future depending on the availability of counters and the suitability of the weather. The count results are set out on the following page.

Table 1. Results of the Winter 1994 Wader Count	NSW					VIC						QLD			SA			WA		TAS				WA		NT	
	Clar	Hunt	Parr	BotB	Shoal	Cnr In	Wport	EPPB	Alt	Wbee	BellMI	Cns	Mky	MoreB	WestEP	SECst	StV	Alb	Swan	EDPitt	MarBy	CpPort	NWTas	Broom	80 MI	Dwin	TOTAL
Bush Stone-Curlew																											0
Beach Stone-Curlew	2													4													6
Painted Snipe																											0
Pied Oystercatcher	11	5		59		727	261	45	23	35	51		1	439		4		54		597	29	25	680	10	4		3060
Sooty Oystercatcher				7		192	4				2							8		52	2	12	220	9			508
Masked Lapwing		38	2	37		15	97		45	123	216	51		51		13				338	79	100	20				1225
Banded Lapwing																							50				50
Grey Plover						108					31			3				20						111	115	1	389
Pacific Golden Plover						8	1					3		3				3					5		5	3	31
Red-kneed Dotterel		10	4					14		97	57			34													216
Hooded Plover						12														4	32	33	20				101
Lesser Sand Plover	6										4	12	74	161								1		120	142	1	521
Double-banded Plover	6			88		365	743	5	450	731	537			167						384	61	139	1200				4876
Greater Sand Plover						3						4	36	10				7						530	1310	350	2250
Oriental Plover																											0
Red-capped Plover	1	38		20		26	69	12	553	100	438	24	2	338		14		3	2	207	40	128	200	655	1039	12	3921
Black-fronted Dotterel		31	13					142	8	48	13			10						7							272
Black-winged Stilt	30	190	19	6				74	173	327	370	10		1165				2	40					162	3		2571
Banded Stilt									200	884	1220							160		2							2466
Red-necked Avocet		2000					780	202	812	971	731			447				1	18					137	9		6108
Ruddy Turnstone				6		21	47			2	45		7	69		17		5				20	300	54	122	8	723
Eastern Curlew	47	146		32		198	139				25	19		625						10			9	100	85	4	1439
Whimbrel	47	29				20					5	13		538						1				240		10	903
Little Curlew														2													2
Wood Sandpiper																											0
Grey-tailed Tattler	10					2						77		675										156	240		1160
Wandering Tattler																											0
Tattler sp.																		4									4
Common Sandpiper																								3			3
Common Greenshank	1					15	2		7	10	57	6		13						2				196	219		528
Marsh Sandpiper								2	2	1		1															6
Terek Sandpiper	2													13										90	18		123
Latham's Snipe																											0
Snipe sp.																											0
Black-tailed Godwit		9								6														217	450		682
Bar-tailed Godwit	97	260	84	161		1017	84			1	14	42	4	1588				11		21			2	3280	5990		12656
Red Knot	30	1				1240	28			39				43						1			16	563	3870		5831
Great Knot	28											60		563										625	3630	60	4966
Sharp-tailed Sandp.										1																	1
Pectoral Sandpiper																											0
Red-necked Stint	5			22		1184	1255	38	1075	803	440	75	25	2845				30		103	21	24	80	738	685	8	9456
Long-toed Stint																											0
Curlew Sandpiper		61				1	647	80	218	230	320	1		762						1			40	400	860		3621
Sanderling																							1			6	7
Ruff/Reeve																											0
Broad-billed Sandp.																								3	1		4
Oriental Pratincole																											0
Australian Pratinc.																											0
Unidentified small																								1500			1500
Unidentified medium																											0
Unidentified large	30																										30
Spotted Redshank																								5			5
Hudsonian Godwit																											0
Asian Dowitcher																								3	1		4
Total Number	353	2818	122	438	0	5154	4157	614	3566	4409	4576	398	149	10568	0	48	0	308	60	1730	264	482	2843	9907	18798	463	72225
Total Species	16	13	5	10	0	19	14	10	12	18	20	15	7	25	0	4	0	13	3	15	7	9	15	26	21	11	308

EASTERN CURLEW BIOMETRICS: BASED ON BIVARIATE SEPARATION OF THE SEXES

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SUMMARY

Separating the sexes means estimating measurement parameters for each sex for a species in which the sexes differ in size but not in plumage. This paper describes a bivariate (i.e. using two measurements) method for doing this; it is an extension of the univariate method of Rogers (1995). A key feature of the method is the identification of outlying data points enabling the estimates to be based on cleaner data. The use of these estimates to estimate parameters of other measurements is described. Data on the Eastern Curlew *Numenius madagascariensis* are used to illustrate the method using culmen length and wing length for the bivariate separation and estimating head-bill lengths and weight from them. Weight estimates for adults are given separately for each sex by month up to the time of northward migration. The paper comments on the need for such a method and the conservation implications of the results.

INTRODUCTION

Barter (1990) summarised published estimates of Eastern Curlew *Numenius madagascariensis* biometrics. He also gave culmen length and head-bill length estimates for each sex based on separation of the sexes using early versions of the univariate methods of Rogers (1995) on a sample of 142 adult birds. Estimates by sex of wing length, tarsal length, and weight were obtained assigning sex to birds with a minimum of 95% confidence. The sexing criterion Barter used adjusted for measurement precision but not for sample size.

There are four reasons for revisiting the subject:

- more data (489 birds) are now available which allow the possibility of examining seasonal variations in weight; this was not possible for Barter with the sample available to him.
- a bivariate method for the separation of the sexes, which is described here, has been developed;
- use of the bivariate method allows identification of badly measured data points allowing estimation of distributional parameter estimates on cleaner data;
- a better method is available for estimating "other" measurements based on this separation than by the attribution of sex to individual birds.

The term "separating the sexes" means estimating the measurement parameters of each sex for a species which differs in size but not in plumage by analysis of the measurements of a sample of birds. The univariate problem (i.e. using a single measurement) was addressed by Griffiths (1968) using the method of Harding (1949). Rogers (1995) describes a computerised maximum likelihood approach to the univariate problem. This requires one of two assumptions: either that the standard deviation of the measurement is the same for each sex or that the coefficient of variation (ratio of standard deviation to mean) is the same for each sex. Rogers argues that the latter is more likely to apply.

There appears to be no ornithological literature on how this problem might be addressed using more than one measurement. The general problem has been addressed in the statistical literature by Day (1969) and Macdonald and Pitcher (1979) who give solutions assuming the same variation in size about the mean (standard deviation) for each sex (in our terms). Neither paper considers the assumption of equal coefficients of variation. A solution to the bivariate problem, i.e. using two measurements, is described here.

The first step in any statistical analysis is to examine the data to identify "bad" data points whose inclusion in the analysis would bias the results. These outliers are then considered separately. With univariate data, only exceptionally large or exceptionally small measurements can be identified as outliers. Measurements in the area of size overlap between the sexes may have been badly taken or recorded but there is no way of knowing if this is so; for example, in a species in which females tend to be larger, a badly under-measured female wing length might be a typical male wing length. If two measurements are considered together, both have to be consistent with one sex or the other, or with both sexes in the area of overlap. This consistency can be assessed using the parameters obtained from bivariate separation.

Barter's (1990) method for estimating "other" measurements will give unbiassed estimates only if the "other" measurements are uncorrelated with that on which the separation is based. If there is correlation, the "other" estimates will be under-represented in the area of overlap and their estimation will not be unbiassed. Such correlation may well occur as birds which are large in some biometrics can be expected to be large in others. A method is given here which gives unbiassed estimates of "other" measurements. This paper does not address the development of bivariate sexing criteria as discussed in the univariate case in Rogers (1995).

METHODS

A brief summary is given here of the bivariate separation method, the identification of outliers, and parameter estimation for "other" measurements. Further details are given in the appendix. Readers without statistical interests may, at some loss, skip this section and go straight to the results.

Bivariate Separation

Eleven parameters are needed to describe a sample which is a mixture of two bivariate normal distributions:

- the sex ratio;
- the mean of each measure for each sex;
- the standard deviation of each measure for each sex;
- the correlation coefficient of the two measures for each sex.

Rogers (1995) shows for the univariate case that the sex ratio, means, and standard deviations can be estimated if the number of birds in one sex and the mean of one sex is known and an assumption made concerning the standard deviation. The univariate method works by taking initial guesses of the sex ratio and mean required, calculating the other distributional parameters, calculating the goodness of fit (maximum likelihood), and refining the guesses until no better fit to the data can be obtained. This approach also applies in the bivariate case. In this, initial guesses of two means are required and an additional assumption is made concerning the correlation coefficient. The only possibility that has been entertained for this additional assumption is that the correlation coefficient between the two measures is the same for each sex. Any other assumption would imply structural differences between the sexes which would be unexpected and difficult to explain.

There is one problem with this method. For comparison with observed data, it requires estimates of the expected proportion of a sample in each possible combination of, say, culmen length and wing length. The literature (e.g. Press *et al* 1986, Thisted 1988) notes the importance of this problem of bivariate quadrature, the fact that it has not been resolved, and leaves the analyst to his own devices. The algorithm (i.e. the mechanism used for obtaining approximate estimates) used is described in the appendix but improvement to it is almost certainly possible. The effect of inaccuracies in the algorithm has not been examined.

The quadrature problem is avoided if the measurements can be considered as being points on a continuous scale. Unfortunately they are not; they are limited by both measurement techniques and measuring instruments and can, in practice, only take certain values.

Both approaches are examined here. A systematic grid search (Thisted 1988) was used to find the best estimates of the three parameters required. Initial estimates were obtained by the univariate methods of Rogers (1995).

Outlier Identification

The bivariate separation method gives the parameters which describe each sex. These can be used to estimate the probability that each individual bird in the sample is from each sex. If both probabilities are unacceptably low, then it is possible that one of the measurements is in error. Deciding whether to reject or accept a particular point requires judgement; there is no easy rule. Four principles can be offered to help the analyst:

- exclusion of the data point should be considered if resultant parameter estimates would change materially by so doing;
- confidence limits for rejection should, on Bonferroni considerations, be a half of those used on univariate data (i.e. use 2.5% as the level for rejection in the bivariate case where you would use 5% in the univariate case);
- lower confidence levels for rejection are appropriate for larger samples. A paradox of statistics is that, at a given confidence level, more points will be identified as outliers with a large sample where they have a small effect on parameter estimates than with a small sample where their effect is large;
- the educated eye is often better at identifying outliers in bivariate data than statistical tests (Hawkins 1980).

Having decided that particular points should be excluded as outliers, they are excluded and the calculations are repeated until no further outliers are identified.

Parameter Estimation for "Other" Measurements

Once the sexes have been separated, the probability that each bird with known culmen length and wing length is a male (say) is calculated using the final (best) parameter estimates. The appropriate proportions indicated by these probabilities are allocated to each bird and the distributional parameters of other measurements, e.g. head-bill length, readily calculated.

The proportions can also be allocated to e.g. head-bill length intervals to build up histograms of the measurement for each sex. It is good practice to examine these estimated histograms to check for outliers. These can arise for the same reasons as given above with the additional possibility that the "other" measurement is right but that both culmen length and wing length are wrong - not that we can do anything about the latter. Should such points be identified, the usual univariate considerations apply to including them in, or excluding them from, the calculation of the final results.

There are two unavoidable consequences of this method. The first is that it is not possible to give the range that the "other" measurements might take for each sex; the second is that the method effectively calculates the sex ratio indicated by the samples of the "other" measurement; this may not equate exactly to a whole number of birds but the confidence limits around it, calculated on the binomial distribution, will encompass integer values.

RESULTS

Results were calculated for two groups of birds, adults and birds in their first year (Age 1). Second year birds (Age 2) remain in Australia for at least their first austral winter (D. Rogers, pers. comm.). They are distinguishable from adults until November of their second year (Barter 1990). After this time, some (not all) might have been identified on feather wear but most will be indistinguishable from adults. The adult sample (Ages 2+ and 3+) will inevitably contain some second year birds.

All lengths are in millimetres, all weights in grammes. Wing lengths are maximum chord, culmen lengths are the straight line distance between the tip of the bill and the tip of the feathers on the frons, head-bill (also known as total head) lengths are the straight line distance between the tip of the bill and the back of the skull. Methods used are described in Rogers (1989).

Validation of Separation Method

The simplest way of validating the method is to apply it to a sample for which the answers are known. This can be done either by using a large sample of birds of known sex or by randomly generating a mixed sample of "birds" of each "sex" for which the parameters are known and seeing how well they are estimated by the method. The latter method is used here. It is perhaps preferable as large samples can be generated and measurer accuracy does not have to be considered.

Table 1 shows the bivariate histogram of such a sample. Each cell of the table gives the number of birds falling in each combined interval of the two measurements. This sample provides a fairly hard test. Neither of the univariate histograms is bimodal and the bivariate one only just is. Sample specifications and calculated sample parameters are given in Table 2 which also gives the parameter estimates given by both quadrature and continuous scale estimation. No examination for outliers was made on these data. The two methods give similar estimates which are close to the known values and so provide validation of the method. Quadrature seems to give the better results being closer on both number of birds and within sex correlation. Accordingly it is used in the remainder of the paper.

Outliers

For the adult analysis, of the sample of 489 birds, 148 were excluded before analysis: 31 because they were retraps; a further 62 because they were not aged unequivocally as adults (age codes 2+ and 3+); a further 43 because one or both of culmen length and wing length was not recorded; and a further 9 because they were moulting their longest primary (p10). A further three birds were excluded: two because the wing lengths were grossly atypical and one because the combination of wing and culmen lengths was.

TABLE 1. RANDOMLY GENERATED MIXED BIVARIATE NORMAL DISTRIBUTION

Mid-Points 1st Meas Intervals	Mid-points of 2nd Measurement Intervals 76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	1st Meas Frequency
43.0											1			1				2
42.5									1	1	2	2	2	2	1			11
42.0							1		1	4	5	2	1			1		15
41.5									3	2	6	12	6	3	1		1	34
41.0				1			1	5	8	10	16	13	8	6	4	4		76
40.5						1	3	5	9	19	19	12	17	8	3	2		98
40.0					1	1	4	11	23	16	19	15	9	12	4			115
39.5				2	3	4	10	12	19	30	24	14	12	8	4			142
39.0		1	1	2	7	5	9	22	13	17	14	13	8	3	1	1		117
38.5			1	7	8	8	16	13	14	19	15	7	4	1	2			115
38.0			3	7	6	11	15	17	14	5	7	1	1	1				88
37.5	2		4	4	10	15	19	15	10	6	3							88
37.0				5	11	12	10	7	4	5		2						56
36.5		1	3	1	8	4	5	7	1									30
36.0					1	4	2	3		1								11
35.5				1				1										2
2nd Meas Frequency	2	2	12	30	55	65	95	118	120	135	131	93	68	45	20	8	1	1000

TABLE 2. RANDOMLY GENERATED SAMPLE - DISTRIBUTIONAL PARAMETERS

n_1	m_{11}	s_{11}	m_{12}	s_{12}	rho_1	n_2	m_{21}	s_{21}	m_{22}	s_{22}	rho_2
Sample Specification											
400	82	2.05	38	0.95	0.2	600	86	2.15	40	1.00	0.2
Calculated Sample Parameters											
400	82.038	2.052	37.900	0.936	0.2089	600	85.945	2.149	39.991	1.003	0.2042
Quadrature Estimates											
399	81.974	2.007	37.933	0.974	0.2087	601	85.981	2.105	39.965	1.027	0.2087
Continuous Scale Estimates											
397	81.974	2.014	37.944	0.987	0.2212	603	85.967	2.112	39.951	1.039	0.2212

Notes (1) n, m, s, rho are number, mean, standard deviation, and correlation coefficient. The first subscript is 1 for the smaller sex, 2 for the larger sex. The second subscript is 1 for the first measurement, 2 for the second measurement.
(2) Estimates are given to three or four decimal places except for number which is necessarily integer. Other figures are inputs to accuracy used.

Table 3 gives the bivariate histogram for the remaining 341 adult birds (and the measurements of the gross outliers). Observations identified as statistical outliers are bracketed. There are 14 of these; this seems a lot but nine of them are obviously atypical (seven with wing lengths less than 292.5mm, two with culmen lengths greater than 207.5mm) and could perhaps have been excluded initially. Those with small wing lengths may have had damaged wing tips that were not noted, may have been wrongly aged, or may be due to measurer error. Whatever the reason, there can be no surprise at their identification as possible outliers.

Birds were identified as outliers if they could be attributed to neither sex with a probability greater than 2.5%. The outliers were identified in three cycles of the data cleaning process.

For the analysis of Age 1 birds, one was recorded in February with a weight of 1,200 grams. This is a pre-migratory weight and quite inexplicable for a non-migrating first year bird. The bird was probably wrongly aged; it was excluded from the analysis. Table 4 gives the bivariate histogram for the remaining 29 Age 1 birds. This is not a large sample to work with yet bivariate separation was possible. Three birds (indicated) were candidates for outliers at the 10% level but, given the small sample and its spread, this seemed insufficient reason for excluding them.

Parameter Estimates

Table 5 gives details of the three estimates obtained by the bivariate separation method. All other parameter estimates, including the common within sex correlation coefficient, are derived from these and the sample data. The information given might seem somewhat obscure but is essential for some purposes for which the results may be used, such as estimating sexing criteria (Rogers 1995 discusses the relevant considerations with univariate data; similar considerations apply in the bivariate case).

Three items of information are given:

- the central estimates for the smaller sex (males) of number of birds, mean culmen length, and mean wing length;
- the asymptotic standard errors of these estimates which reflect how well they are estimated. They are called "asymptotic" because they cannot be estimated precisely but approach the true values under certain conditions;
- the matrix of correlation coefficients between the estimates which reflect the fact that the estimates are not independent.

The table shows similar mean male culmen lengths for age 1 birds and adults; wing length is appreciably lower for age 1 birds. The asymptotic standard errors show that the adult parameters are much more precisely estimated than those for age 1 birds, hardly surprisingly given the difference in sample size. The two correlation matrices are similar and show high correlations between number and culmen length mean.

Table 6 presents the complete set of parameter estimates obtained in a more familiar form. Culmen and wing length parameters are estimated by the bivariate separation method, head-bill and weight parameters by the "other" measurement method. For adults, because of the large weight gains prior to migration, weight estimates are given by calendar month.

TABLE 3. BIVARIATE HISTOGRAM OF WING LENGTH AGAINST CULMEN LENGTH - ADULT BIRDS

Mid Point Wing	Total Wing	Mid Point Culmen 130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220
350	1											(1)								
345	1											1								
340	8									1	1	3	2	1	1					
335	31							1		2	4	5	4	5	5	3	1			(1)
330	60			(1)		2	1	1	1	4	5	13	12	10	6	2	2			
325	56						4	5	3	7	7	7	10	6	4	3				
320	56			1	2	4	5	3	1	3	10	7	8	6	2	4				
315	45	2		1	3	4	5	2	4	2	4	6	7	1	1	3				
310	42	{2}	2	4	3	6	10	1	5	2	1		2	2	1			(1)		
305	27				5	6	8	2	1	1	1		3							
300	6					1	2			1	(1)	(1)								
295	1						1													
290	4				(2)		(1)	(1)												
285	2					(1)			(1)											
280	1				(1)															
Total Culmen		4	2	7	16	24	36	17	16	23	33	44	48	31	20	15	3	1	0	1

Notes (1) Statistical outliers are bracketed. Only one of the birds in the wiggly brackets was identified as an outlier.

(2) Gross outliers not shown above had the following measurements:

Wing	Culmen
226	184
218	176
330	260

TABLE 4. BIVARIATE HISTOGRAM OF WING LENGTH AGAINST CULMEN LENGTH - AGE 1 BIRDS

Mid Point Wing	Total Wing	Mid Point Culmen 140	145	150	155	160	165	170	175	180	185	190	195	200	205
330	1										(1)				
325	0														
320	2									1				1	
315	2			1							1				
310	5										1	2		2	
305	6				3			1				1		1	
300	7	1					1	1			3				1
295	2		1		1										
290	3			2						(1)					
285	0														
280	1					(1)									
Total Culmen		1	1	3	4	1	1	2	0	2	6	3	0	4	1

Note. Bracketed points were identified as potential outliers at the 10% level. They were not excluded due to the small size of the sample.

TABLE 5. DETAILS OF BIVARIATE SEPARATION ESTIMATES

		Number	Culmen	Wing
ADULTS				
Central Estimate (males)		106	153.005	312.521
Asymptotic Standard Error		1.938	0.280	0.190
Correlation Matrix	Number	1		
	Culmen	0.8672	1	
	Wing	0.6120	0.4190	1
AGE 1 BIRDS				
Central Estimate (males)		12	153.829	298.390
Asymptotic Standard Error		0.883	1.272	0.840
Correlation Matrix	Number	1		
	Culmen	0.9465	1	
	Wing	0.5686	0.5136	1

TABLE 6. PARAMETER ESTIMATES

Age	Measure	No. of Birds	Sex Ratio (% Males)	Males Mean	Males S.D.	Females Mean	Females S.D.
Adult	Culmen	327	32.4%	153.0	8.11	183.1	9.71
	Wing	327	32.4%	312.5	7.38	325.5	7.69
	Head-Bill	129	33.7%	198.5	9.03	231.6	9.58
	Weight						
	- AUG	26	31.7%	699.8	63.39	828.4	50.63
	- SEP	71	33.5%	721.0	38.07	816.3	58.25
	- OCT	80	36.2%	696.6	52.86	796.7	43.44
	- NOV	91	33.8%	732.2	39.99	813.7	54.26
	- DEC	18	21.6%	697.2	9.32	807.9	45.03
	- JAN	5	39.9%	760.1	30.14	976.1	137.53
	- FEB	19	13.5%	1089.3	73.18	1224.5	69.27
	- MAR	1	0.0%	-	-	1250	-
	- APR	-					
	- MAY	10	29.1%	737.0	12.36	806.2	42.10
	- JUN	-					
	- JUL	-					
Age 1	Culmen	29	41.4%	153.8	7.55	189.1	9.28
	Wing	29	41.4%	298.4	9.07	308.1	9.36
	Head-Bill	4	50.0%	199.5	0.52	244.0	7.11
	Weight	27	35.3%	712.5	41.54	810.0	40.75

Note. Within Sex Culmen/Wing Correlation Coefficients
Adult 0.1054
Age 1 0.0536

These are listed starting from August, the conventional beginning of the southern hemisphere wader season being deemed the first of this month. The weight gain is clearly demonstrated. It is not known how old Eastern Curlew are when they make their first northward migration (D. Rogers, pers. comm.) which makes the 10 adults caught in May interesting. If they were correctly aged, it suggests that first northward migration does not take place until at least their third year, at least for some birds. Alternatively, these birds may have been adults which did not, for some unknown reason, migrate when they should have or they were incorrectly aged. First year birds do not migrate and separate estimates by month and sex were not estimated for them.

Table 7 gives the "histograms" of male and female head-bill lengths constructed by assigning a proportion of each bird to each sex. There are no obvious outliers here (e.g. males with very large head-bill lengths) and the shapes of the histograms are consistent with the measurement being normally distributed for each sex. More birds would be expected in the interval centred on 200 millimetres; perhaps measurers tend to avoid such a round number.

Figure 1 illustrates the main aspects of the solution presented here to the problems of separating the sexes and estimating "other" measurements. See the figure caption for explanation.

DISCUSSION

This paper presents a new method for separating the sexes of size dimorphic species using a sample of unsexed birds. An obvious question to ask is: How good is the method? There are two issues here. The first concerns the assumptions underpinning the method. Examination of publications which present measurement information by sex

TABLE 7. EXAMPLE OF "OTHER" ESTIMATE HISTOGRAM - ADULT HEAD-BILL

Estimated "Number"	Interval Mid Point																
	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255
Males	1.0	2.0	2.0	4.0	12.8	4.9	11.2	4.2	1.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Females	0.0	0.0	0.0	0.0	0.2	0.1	0.8	1.8	2.0	7.8	12.8	21.0	18.0	9.0	7.0	3.0	2.0
Combined	1	2	2	4	13	5	12	6	3	8	13	21	18	9	7	3	2

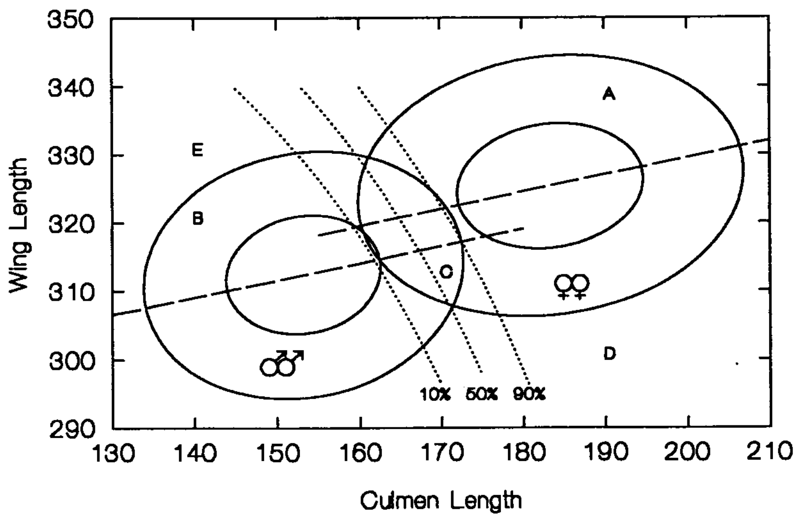

Figure 1. The figure is based on the estimates of Table 6 for adult Eastern Curlew. Shown are the probability contours for each sex within which 50% and 95% of observations are expected to fall. The major axes of the ellipses (straight dashed lines) illustrate the correlation between culmen and wing length; they have the same gradient for each sex. The larger ellipses for females reflect the greater variance implicit in the equal coefficient of variation assumption. Examples of acceptable observations and outliers are indicated: A, almost certainly female; B, almost certainly male; C, may be from either sex; D, female on culmen, male on wing, possible outlier; E, female on wing, male on culmen, possible outlier. Birds whose measurements lie on any point of one of the curved (dotted) lines have the same probability of being a male. Curves (they are quadratic) are drawn for probabilities of 10%, 50% and 90%. Only if equal standard deviations of each measurement for each sex apply would these lines be straight.

and of many data sets suggests that the assumption of equal coefficients of variation of a measurement for each sex is more likely to be right than that of equal standard deviations. No such evidence is readily available to inform on the assumption of equal correlation coefficients for each sex but, as noted, it would be hard to think of any other. Should both assumptions apply, the method used does a good job of separating the sexes. The separation approach used is not dependent on what assumptions are made (it can readily be modified to accommodate different ones) but it does require that some assumptions be made.

The second issue is which of the quadrature and continuous scale methods is more appropriate. The results given here suggest that quadrature (an approximate solution to the right problem) is to be preferred to continuous scale estimation (an exact answer to the wrong problem). An improved method for quadrature, which is almost certainly possible, would strengthen the case for this method.

A related issue concerns the estimation of asymptotic standard errors and the correlation between the estimates. The methods used for this are approximate and should be treated with caution as, at this stage, the approximation errors are unknown. This caution relates to any subsequent use of the parameter estimates. The parameter estimates of the separation method are unaffected.

This paper does not give a sexing criterion which would enable Eastern Curlew of known age, culmen length, and wing length to be sexed at a specified level of confidence. This can be done using the same principles applied by Rogers (1995), the main difference being that limiting values of wing length (say) have to be given for each value of culmen length that may occur.

One obvious feature of the results presented here is that culmen length size dimorphism is much greater than that for wing length. This begs the question: Why bother with all the complication? There are three answers. First, in any species, one measurement is likely to show more size dimorphism than others but the contribution of the second measurement will not always have such an apparently small effect as wing length in the Eastern Curlew. Secondly, consideration of two measurements allows a data cleaning process that is not possible by consideration of a single measurement. More than two measurements can be used in data cleaning; Johnson and Wichern (1988) argue that this is best done by bivariate consideration of each pair of variables which is facilitated by graphical plots (the SHEBA programs of Rogers (1995) include a utility program for plotting bivariate histograms). Thirdly, many bird banders, particularly wader banders, will have large data sets of measurements on unsexed birds. In a related context, Fatti *et al* 1982, citing O'Neill 1978, report that, "in the statistically interesting range ..., the information in an unclassified (i.e. unsexed) observation varies from approximately one fifth to two thirds of that of a classified (i.e. sexed) observation." In other words, more can be learned of the size differences between the sexes from a sample of 500 unsexed birds than from a sample of 100 to 300 sexed ones, depending on the size dimorphism between the sexes. Samples of sexed birds - such as are required for the frequently used and, in some respects, suspect multivariate linear discriminant analysis (which this paper does not have room to address) - are not essential for describing size differences between the sexes.

Perhaps the most interesting feature of these results (D. Rogers, pers. comm.) is the imbalanced sex ratio with males only representing one third of the sample. It is interesting to speculate why. It is known that Grey Plover are territorial when feeding (Wood 1986). Eastern Curlew have been observed to be well spaced whilst feeding (Lane 1987). Preliminary results of a radio tracking study of Eastern Curlew in Moreton Bay (Queensland) suggest that they too are territorial when feeding (P. Driscoll, pers. comm.). If so, a given feeding ground can only support a limited number of birds. Given the differential timing in migration between adult males, adult females, and juveniles, it is possible that the preferred feeding grounds are first occupied by the first arrivals, adult males, with the later arriving adult females finding it hard to find a place so having to move on. This is speculation but the hypotheses can be evaluated by banding studies. This species has, however, proved difficult to catch and perhaps a case can be made for field observations on feeding grounds throughout Australia. The difference in culmen length between the sexes is so large that it should, with practice, be possible to assign sex with reasonable confidence to most birds in the field. The importance of the concern is to do with conservation. It may be insufficient to protect the feeding ground supporting the largest number of Eastern Curlew if a number of feeding grounds are necessary to support both sexes, and possibly different ages, of a population.

Acknowledgements

For many years, Eastern Curlew proved an elusive prey to the extent that when a catch of 23 birds was made after several years of effort, it led to immediate publication of the results (Rogers 1982). It is only due to the indefatigable efforts of the Victorian Wader Study Group, led by Clive Minton, that sufficient birds were caught to support this paper. Long may it thrive.

Thanks to Mark Barter and Danny Rogers for persistently asking nasty questions over the years which provoked me into trying to find answers. Bastards. They also made constructive comments on a draft of this paper. Special thanks are due to Les Underhill who has never seen a draft of this paper but who gave me encouragement and direction when I needed it.

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APPENDIX. STATISTICAL DETAILS

This appendix assumes some knowledge of statistical concepts; bits of it require rather more. Hopefully, sufficient information is given to provide an understanding of how the results are obtained.

SEPARATING THE SEXES

The sample of birds available comprises two sub-samples, one for each sex. We know, or can readily calculate for the whole sample:

- the total number of birds;
- the sum of each measurement (e.g. wing length, culmen length) over all observations;
- the sum of the squares of each measurement over all observations;
- the sum of cross products (e.g. wing length multiplied by culmen length) over all observations.

Clearly, these sums must equal the sum of the corresponding sums for each sex separately. The estimation of the distributional parameters for each sex is in three steps in the univariate case with an additional step required in the bivariate case.

Numbers of Birds

If N is the total number of birds and n_1, n_2 the number in each sex, then

$$N = n_1 + n_2$$

Assuming n_1, n_2 can be calculated.

Means

The sum of observations (X) for the whole sample can be calculated from the data. The corresponding sum for each sex is the product of the number of birds and the mean (average) value. If m_1, m_2 are the means for each sex, then

$$X = n_1.m_1 + n_2.m_2$$

Assuming n_1 and m_1, n_2 and m_2 can be calculated.

Standard Deviations

The sum of squares of observations (XX) for the whole sample can be calculated from the data. The corresponding sums for each sex (xx_1, xx_2) can be found by manipulating the terms in the usual expression for standard deviation as

$$xx_i = (n_i - 1).s_i^2 + n_i.m_i^2$$

If s_1 and s_2 are unrelated, they cannot be estimated by matching the sums of squares i.e. by setting $XX = xx_1 + xx_2$ since there will be two unknowns in one equation. If a relationship is assumed, this problem is overcome. Assuming that the coefficient of variation (the ratio of standard deviation to mean) is the same for each sex i.e.

$$k = s_1 / m_1 = s_2 / m_2$$

$s_1 = k.m_1$, $s_2 = k.m_2$ are substituted in the expressions above and the equation $XX = xx_1 + xx_2$ solved for k whence s_1 and s_2 are readily calculated.

Other assumptions can be considered for relating s_1 and s_2 e.g. that they are equal. These will change the algebra but not the approach.

Correlation Coefficients

The correlation coefficient is a measure of the strength of association between two variables. For the whole sample, it is given by

$$R^2 = \{N.XY - X.Y\}^2 / \{(N.XX - X^2).(N.YY-Y^2)\}$$

where XY is the sum of cross products and X, Y, XX, YY are the sums and sums of squares of observations of the two variables.

Similar expressions can be set up for r_1 and r_2, the within sex correlation coefficients for each sex. With the exception of the sum of cross products, all the terms in the equations can be calculated from the parameters already estimated. Since, however,

$$XY = x_1y_1 + x_2y_2$$

x_2y_2 can be substituted by $XY - x_1y_1$ in the expression for r_2 and, by setting $r_1 = r_2 = r$, i.e. assuming the same within sex correlation coefficient for each sex, x_1y_1 can be estimated and r readily found.

Asymptotic Standard Errors

There is no way of clarifying briefly the estimation of standard errors of the estimated parameters for those with little statistical background. What follows is a summary of what was done for those with an interest in the subject with a bit of additional information to stimulate the interests of those who might like to find out more.

The Hessian matrix is the matrix of the second derivatives of the log-likelihood function (see below). The inverse of the Hessian matrix is the asymptotic variance/covariance matrix; the asymptotic standard errors of the parameter estimates are given by the square root of the diagonal elements of this matrix. The asymptotic correlation matrix is derived directly from the variance covariance matrix. So, if the Hessian matrix is known, so are the elements of the asymptotic variance/covariance matrix, $v_{i,j}$, and the i,j'th element of the asymptotic correlation matrix, $c_{i,j}$, is given by;

$$c_{i,j} = v_{i,j}/(v_{i,i}*v_{j,j})^{.5}$$

The problem is calculating the Hessian matrix. Due to the difficulty, if not impossibility, of differentiating the log-likelihood function once, let alone twice, approximate methods are used. First, first derivatives are estimated by finite differences and, secondly, second derivatives are estimated by Gauss's approximation.

If e_i is the final estimate of the i'th parameter, let

$$d_i = k.e_i$$

where k is sufficiently small. k = 0.0005 has been used in this paper; a lower value was considered to run the risk of underflow in intermediate calculations. The first derivative with respect to i, l(i), is estimated approximately as

$$l(i) = \frac{L\{e_i + d_i\} - L\{e_i - d_i\}}{2.d_i}$$

where L{f(i)} is the value of the log-likelihood at the point f(i) and other estimates are held at their final values.

The Gaussian approximation to the Hessian (see Sadler 1975) gives the i,j'th element of this matrix, $h_{i,j}$ as

$$h_{i,j} = 2.l(i).l(j)$$

QUADRATURE

Quadrature is the name given to the estimation of the proportion of a distribution which falls within any given interval. Most people who have used statistics will be familiar with the cumulative normal distribution (mean=0, standard deviation=1) tabulated in nearly all statistics books. A convenient numerical algorithm is given for calculating these numbers. Bivariate quadrature is rather harder.

Area Under Univariate Normal Distribution

A convenient numerical algorithm, readily computerized. For a normal distribution with zero mean and unit variance, the area, A, between the point x (>0) and + infinity is given by:

$$A = r.t.EXP(-x^2 / 2).((((b_5.t + b_4).t + b_3).t + b_2).t + b_1)$$

where

$$t = 1 / (1 + p.x)$$

and

r = 0.398942	b_3 = 1.78148
p = 0.231642	b_4 = -1.82126
b_1 = 0.319382	b_5 = 1.33027
b_2 = -0.356564	

Area Under Bivariate Normal Distribution

The conditional distributions of a bivariate distribution are themselves normal. In other words, the distribution of total head length observations for any given wing length will be normal. Univariate methods can be used if the parameters of the conditional distributions are known.

If m_w, s_w, m_c, s_c are the parameters of the univariate distributions of wing and culmen length and r is the common sex correlation coefficient, then the required parameters of the conditional distribution of culmen length for a wing length measurement of wg are:

$$mean = m_c + (wg - m_w).r.s_c / s_w$$

$$s.d. = s_c.(1 - r^2)^{0.5}$$

The required area (expected value) for a bivariate histogram interval is found (in terms of the two variables used above) by:

- calculating the proportion of the wing length distribution in the wing length interval;
- calculating the parameters of the conditional distribution of culmen length corresponding to the mid-point of the wing length interval;
- calculating the proportion of the culmen length distribution in the culmen length interval using the parameters of the conditional distribution;
- multiplying the two proportions.

The required proportions can be found using univariate methods. More precise estimates could be obtained by sub-dividing each wing length interval into smaller sub-intervals. This seems unrealistic given the aggregate nature of observed values in an interval. It would also add to the already substantial computation time.

MAXIMUM LIKELIHOOD

Quadrature

Given estimates of the 11 parameters which define a mixture of two bivariate normal distributions, expected values in each interval of the bivariate histogram can be calculated (see above). The likelihood function can then be calculated.

Following Macdonald and Pitcher (1979), the function to be maximized is:

$$L_1 = N.\sum_{i=1}^{m} o_i.\log_e(e_i)$$

where o_i and e_i are the observed and expected values in the i'th bivariate histogram interval and m is the number of intervals with non-zero values.

As Macdonald and Pitcher note, this is equivalent to minimizing:

$$L_2 = -2.N.\sum_{i=1}^{m} o_i.\log_e(e_i/o_i)$$

They also note that L_2 can be used as a chi-squared statistic for testing goodness of fit. This aspect has not been considered in this paper.

Continuous Scale

Following Day 1969, and using the notation of this paper, the function to be maximized is:

$$L_3 = \sum \log_e\{n_1.N(m_{1,1},m_{2,1},s_{1,1},s_{2,1},r,wg,cl) + n_2.N(m_{1,2},m_{2,2},s_{1,2},s_{2,2},r,wg,cl)\}$$

where the summation is over all pairs of measurements of wing (wl) and culmen (cl) length.

OUTLIER IDENTIFICATION

The method given does not "prove" that particular points are outliers; it only identifies them as potential outliers for consideration by the analyst. Visual examination of data plots materially helps this consideration (Hawkins 1980).

The method is based on the discussion of chi-square plots given in Johnson and Wichern (1988). It uses the result that the squared generalised distance of each sample point should behave like a chi-squared random variable. The squared generalised distance is a statistical concept of how far, in probabilistic terms, a point is from the point defined by the two means of the bivariate normal distribution. This distance is calculated twice for each point to see how likely it is, first, to be a male and, secondly, a female. If a particular point is unlikely to be from either sex, it is considered to be a potential outlier.

The squared generalised distance, g^2 of the point x_1, x_2 for the bivariate normal distribution with means m_1, m_2, standard deviations s_1, s_2, and correlation coefficient r is given by

$$g^2 = (A + B - C) / D$$

Where

$$A = \{(x_1 - m_1) / s_1\}^2$$
$$B = \{(x_2 - m_2) / s_2\}^2$$
$$C = 2 * r * \{(x_1 - m_1) / s_1\} * \{(x_2 - m_2) / s_2\}$$
$$D = 1 - r^2$$

For a given probability contour within which a proportion p of the sample is expected to lie, the appropriate value of chi-squared is given by:

$$\text{chi-squared} = -2. \log_e(1-p)$$

PROBABILITY THAT A BIRD IS OF A PARTICULAR SEX

In the univariate case, defining:

- $f_i(x)$ as the probability that a bird of sex i has a measurement x of a morphometric;
- n_i as the number of birds in sex i;
- $P_i(x)$ as the probability that a bird with measurement x is from sex i;

Then, for the sample birds

$$P_1(x) = n_1.f_1(x)/[n_1.f_1(x) + n_2.f_2(x)].$$

In the context of this paper, bivariate normal distributions are assumed for the calculation of f_i.

"OTHER" ESTIMATES

Defining:

$p_{1,j}$	as the probability that bird j is from sex 1
N_i	as the "number" of birds in sex i
x_j	as the value of some "other" measurement on bird j, i.e. one not used in the calculation of $p_{1,j}$
X_i	as the sum of x_j for sex i
XX_i	as the sum of x_j^2 for sex i
M_i	as the mean of measurement x for sex i
S_i	as the standard deviation of measurement x for sex i

Then:

$$p_{2,j} = 1 - p_{1,j}$$

$$N_i = \sum_j p_{i,j}$$

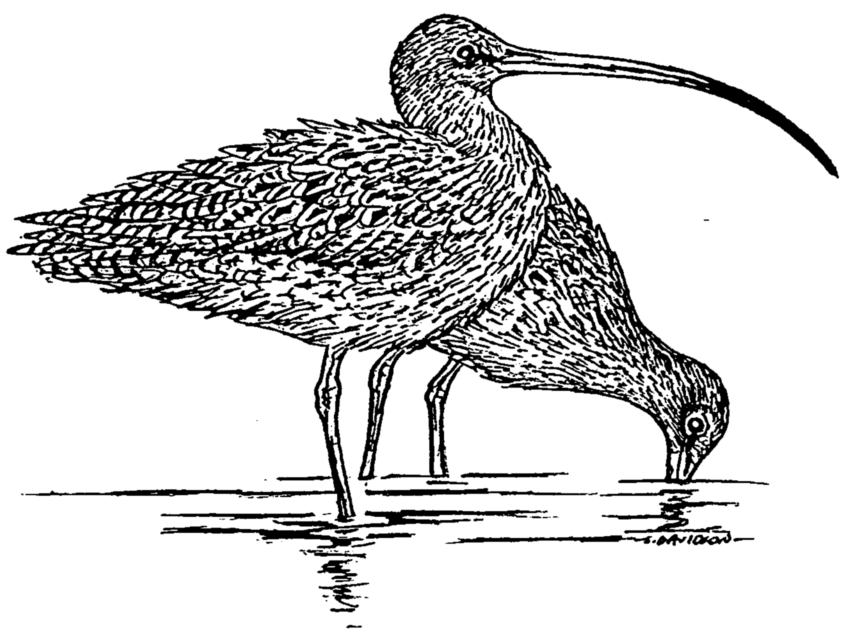
$$X_i = \sum_j x_j . p_{i,j}$$

$$XX_i = \sum_j x_j^2 . p_{i,j}$$

$$M_i = X_i / N_i$$

$$S_i = [XX_i / N_i - M_i^2]^{0.5}$$

Histograms of x_j can be compiled by sex by accumulating $p_{i,j}$ into predefined histogram intervals.



PROLONGED AGGRESSION BETWEEN EASTERN CURLEWS *Numenius madagascariensis*

Frank Harrison, 4/6 Albert St. Cranbrook, Qld 4814

On 1 September 1994, during a tour of the Queensland coast, my wife requested a break from our driving. I pulled up at Illawong Beach, Mackay and whilst Di took a snooze in the car, I decided to take the telescope onto the sands for an hour's casual birdwatch. As I was setting up the instrument (Kowa TSN 3 with x20-60 zoom eyepiece) I had noticed some disturbance out of the corner of my eye, approximately 150 metres distant on the sandflats. The time was just after 1430 hours

As soon as I was able I focussed in on the commotion which resolved into a pair of Eastern Curlews. It was obvious that an altercation was in progress with one bird, (A) initiating proceedings whilst the other bird, (B) seemed to be only defensive in attitude. Both birds appeared male, having bill lengths at the shorter end of the normal range.

I have observed aggression amongst this species on many occasions, usually taking place when space becomes restricted by incoming waters at a high tide roost or often by females reacting, while feeding, to an encroaching bird (usually male). These episodes however have been only fleeting affairs lasting a few seconds and consisting of a flurry of wingbeats, short chase or a quick "cut and thrust" of bills. Here the action was an ongoing affair with a range of postures and tactics implemented by both birds.

I initially watched the abovementioned birds confront each other with an outspread wings posture. After several seconds bird A would clash with bird B by leaping up and towards it. On occasion, B would mirror the leap and both would meet approximately 30 centimetres off the ground, striking each other with wings and feet. It is unsure if the leap was designed as a kick, or a strategy to gain height over the opponent, or, perhaps both. These clashes had a duration of between two and five seconds, after which both birds would part to a distance of around a metre to a metre and a half. A short rest would be taken for a couple of seconds before an outstretched wings pose would be initiated again by bird A, and bird B would immediately follow suit.

I had no watch for accurate timing, but some two minutes later tactics changed and both birds took up a crouch posture akin to that used by the Silver Gull *Larus novaehollandiae*. Keeping approximately a metre apart they walked a straight line, parallel to each other, heads bowed, and with tails pulled down, slightly fanned and pointing to the ground. The tail of A seemed to be vibrating. This could have been due to breeze out on the sandflats but it was not noticed happening to bird B's tail. During this posture B had its wings raised slightly, 3 or 4 centimetres away from its body. After a dozen or so steps, A suddenly ran sidewards, 90 degrees into the flank of B, delivering a "broadside" or, in human terms a shoulder charge. At this bird B flew off some ten metres but was pursued and rejoined by the persistent protagonist.

Hostilities continued but, it was obvious that both were tiring and more postures than actual clashes occurred over the next few minutes. However, during this time something remarkable happened. Bird A picked up what seemed to be the lid of a bi-valve shell, approximately eight centimetres in diameter. This it threw away and it struck bird B. It is suggested that this trajectory was purely chance as, the same bird picked up two more objects, this time stick like, approximately twelve centimetres long and these flew in entirely different directions.

After a final half-hearted charge by A, B flew off some hundred metres plus down the beach. This time A did not follow but turned 180° and charged a pair of feeding Grey-tailed Tattlers *Tringa brevipes* some eight metres away. These birds took flight when the Eastern Curlew was approximately two metres away from them. The Curlew then rammed its bill some 50% into the soft substrate twice within a second, which suggested more displaced aggression than hunger. After this the bird began preening tensely for a few seconds before relaxing and finally preening at a more sedate rate.

This whole episode impressed me not only for the spectrum of events but, also by the stamina of the two birds involved. I would have watched them for well over five minutes and though they did take several recuperating breaks of five seconds or so, stress hormones would still have been pumping quite freely through their systems for the whole conflict. As to how long they had been engaged before I noticed them, this is open to pure conjecture. I would be glad to hear of similar behaviour or enquiries from other interested parties.

UNUSUAL FEEDING MODE FOR EASTERN CURLEW

Clive Minton, 165 Dalgetty Road, Beaumaris, Vic. 3193

At 0630 on 8 December 1994 I was surprised to see a flock of 70 Eastern Curlew *Numenius madagascariensis* feeding in a recently mown hayfield beside the South Gippsland Highway about one kilometre from the eastern shore of Westernport Bay, near Lang Lang in Victoria.

Feeding at inland sites, particularly pastureland, is a common occurrence in Western Europe for the Eurasian Curlew *N.arquata.*

Recently harvested hayfields are particularly popular there, especially near the breeding areas in northern Scotland, but I have never previously seen such habitats used for feeding in Australia.

Presumably pastureland is generally too hard for Eastern Curlews to probe in Australia. However in harvested hayfields feeding is probably more related to worms, slugs and other invertebrates exposed (and possibly damaged) by the cutting operation. This feeding mode is thus more akin to that of the Straw-necked Ibis *Threskiornis spinicollis* than normal wader probe-feeding.

It was high tide at the time of my observation and this had probably helped provoke this unusual feeding activity. Early morning is also the most likely time for such habitat to contain exposed and accesible prey. When I passed the area again one hour later (when the tide would still have been covering the intertidal feeding grounds) the birds were no longer present.

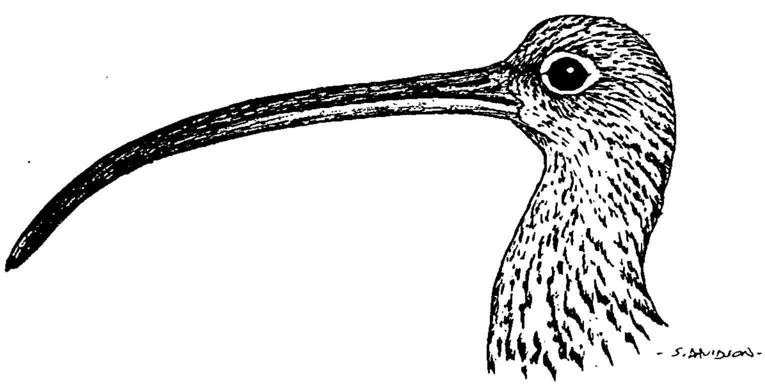
FOR THE RECORD - Large Numbers of Red-necked Stint and Banded Stilt at Lake Reeve, Gippsland, Victoria.

Mark Barter, 21 Chivalry Avenue, Glen Waverley, Vic. 3150

On 1 January, 1995 I found a large flock of waders at Lake Reeve, immediately east of the Seacombe Trig Point, (38°07'S, 147°30'E) which included 8,000 Red-necked Stints and 1,800 Banded Stilts. The number of stint considerably exceeded the previous highest published total of 5,397. I have not been able to find a published record of any Banded Stilt seen on Lake Reeve. Is this the largest, most easterly occurring flock of Banded Stilts ever recorded in Victoria? Perhaps there are records of higher numbers for both species hidden away in notebooks. If so, I'd be interested to hear of them.

Lake Reeve is a very shallow wetland, some 60km long and varying up to 1.5km in width. During summer, large areas can be dry and winds may move the water around. The location of flocks is difficult to predict. When I returned to Lake Reeve in mid-March, there were no waders at all at the Seacombe Trig point, the area being almost dry with the little water present being hypersaline. However, there were around 2,000 Red-necked Stint at the westernmost part of the Lake, but no Banded Stilts. A cursory glance at the most eastern end, often favoured by waders, did not turn up any birds there.

I record this note as encouragement to others to place on record their more interesting observations, especially where the numbers exceed previously published data, so that they can be included in the planned update of the National Plan for Shorebird Conservation in Australia.



SIGHTINGS OF LEG-FLAGGED WADERS BANDED IN NW AUSTRALIA

Rosalind Jessop, PO Box 97, Cowes, Vic. 3922 and Clive Minton, 165 Dalgetty Road, Beaumaris, Vic. 3192

Listed below are all sightings of yellow leg-flagged waders reported (up to the end of January 1995) since the commencement of leg flagging in north-west Western Australia in August 1992. Over 10,000 waders have been yellow leg-flagged during this period at the following locations: Roebuck Bay, Broome: Roebuck Plains Station/ Lake Eda (30 km inland from Broome); 80 Mile Beach/Anna Plains Station and Port Hedland Saltworks.

Greater Sand Plover

DATE	LOCATION	FINDER
240493	Mai Po, **Hong Kong**	P. Leader
250493	Mai Po, **Hong Kong**	P. Kennerley
080593	Mai Po, **Hong Kong**	V. Picken
080593	Mai Po, **Hong Kong**	P. Leader
090494	Mai Po, **Hong Kong**, (half breeding plumage)	A. Rowland, C. Bradshaw
110494	Mai Po, **Hong Kong** (full breeding plumage)	P. Leader
250494	Red River Delta, **Vietnam**, 19° 57'N 106° 07'E	S. Nielsen, A. Pedersen

These sightings are from similar locations to band recoveries and support the concept that Large Sand Plover migrate through southern China and Vietnam on their northward migration to the breeding grounds. This is a more westerly route than used by most of the Siberian breeding waders.

Black-winged Stilt

DATE	LOCATION	FINDER
081094	Peel Inlet, Mandurah, W.A.	P. Benstead

This is an incredible movement, some 2,000 km for a nominally "resident" wader species and the greatest recorded for this species to date.

Ruddy Turnstone

DATE	LOCATION	FINDER
240594	Ma Gong, **Taiwan**, 23° 35'N 119° 34'E	Taiwan Banding Scheme

There have been few band recoveries for this species so it is nice to receive a report of a leg-flagged bird.

Eastern Curlew

DATE	LOCATION	FINDER
130994	Yocha-ri, Kanghwa Island, Kyunggi Province, **Republic of Korea**	Jin-Young Park

This is the first overseas sighting of an Eastern Curlew banded in NW Australia and the second Australian Eastern Curlew to be reported from Korea. It is also noteworthy that it was on southward migration as most recovery reports/leg-flag sightings are of birds on northward migration.

Grey-tailed Tattler

DATE	LOCATION	FINDER
231192	North Stradbroke Island, Moreton Bay, Queensland	P. Driscoll, A. Geering

A surprising cross continent movement within three months of being banded.

Bar-tailed Godwit

DATE	LOCATION	FINDER
121293	Jordan's, Kaipara Harbour, **New Zealand**	S. Hayes
260494	Maehyang-ri, Hwasong-gun, Kyonggi Province, **Republic of Korea**, 37° 02'N 126° 42'E, 2 birds	Jin-Young Park
150794	Indigirka Delta, **Russia**, (adult male, faded breeding plumage in flock of 1,000) 72° 13'N 149° 00'E	D. Rogers, B. Gill
210894	Unnam-dong (Unnam-ri), Yongjong Island, Kyunggi Province, **Republic of Korea**	Jin-Young Park

A wonderful selection of reports. The bird in northern Siberia is the greatest movement of any Bar-tailed Godwit from Australia. The reports in Korea (again 'firsts') contain birds on both northward and southward migration. They are part of the increasing evidence that the west coast of Korea is an extremely important stopover site for waders from Australia on their way to/from their breeding grounds.

It is surprising that a Bar-tailed Godwit from NW Australia should travel to New Zealand (there is strong evidence that those from eastern Australia have a close link with New Zealand).

Red Knot

DATE	LOCATION	FINDER
310195	Miranda, Firth of Thames, **New Zealand**	K. Woodley

This is the first Knot movement from NW Australia to anywhere else in Australasia.

Great Knot

DATE	LOCATION	FINDER
270394	Mai Po, Hong Kong, (full breeding plumage)	R. Hogg, D. Clugston
310394	Mai Po, Hong Kong, (full breeding plumage), 3 birds	R. Hogg, D. Clugston

These are the first Great Knot from NW Australia to be reported from Hong Kong. The first record of three birds, followed heavy visible departures of Great Knot from NW Australia on March 21-24 1994. The birds were probably forced down prematurely in Hong Kong (normal destination Shanghai!) by a tropical cyclone.

Red-necked Stint

DATE	LOCATION	FINDER
140493	Mai Po, Hong Kong	L. Young
140493	Mai Po, Hong Kong, (full breeding plumage)	G. Carey
220493	Mai Po, Hong Kong, (full breeding plumage)	G. Carey
240493	Mai Po, Hong Kong, (full breeding plumage)	P. Leader
250493	Mai Po, Hong Kong	P. Kennerley
300493	Mai Po, Hong Kong	D. Close
040593	Mai Po, Hong Kong, (full breeding plumage)	G. Carey
070593	Toyonaka Matsushige-Machi, Itano-Shi, Tokushima Pref., Japan, 34° 08'N 134° 36'E	Hirotake Sora, Bird Migration Research Center
230994	Avalon Saltworks, Geelong, Victoria, 2 birds	Jon Starks

These sightings strongly support evidence from recoveries that Hong Kong is an important stopover site on northward migration and that some birds from south-east Australia pass through NW Australia on migration.

Curlew Sandpiper

DATE	LOCATION	FINDER
221192	Stockyard Point, Western Port, Victoria	Jeff Campbell
15-160393	Sandy Point, Shallow Inlet, Victoria	Joan Mc Dowell
090493	Mai Po, Hong Kong	Geoff Carey
120493	Mai Po, Hong Kong	Lew Young
130493	Mai Po, Hong Kong	Geoff Carey
140493	Mai Po, Hong Kong, (three quarters breeding plumage)	Geoff Carey
140493	Mai Po, Hong Kong, (half breeding plumage)	Geoff Carey
??0493	Mai Po, Hong Kong, (winter plumage)	Wendy Young
220493	Mai Po, Hong Kong	Geoff Carey
240493	Mai Po, Hong Kong, 3 birds	P. Leader
260493	Mai Po, Hong Kong	D. Close
280493	Mai Po, Hong Kong, 2 birds	Geoff Carey
280493	Mai Po, Hong Kong	D. Close
280493	Mai Po, Hong Kong	V. Picken
040593	Mai Po, Hong Kong, 2 birds	G. Carey
040593	Mai Po, Hong Kong, (mist-netted)	
060593	Mai Po, Hong Kong, (winter plumage)	G. Carey
060593	Mai Po, Hong Kong, (three quarters breeding plumage)	G. Carey
080593	Mai Po, Hong Kong	V. Picken
120593	Mai Po, Hong Kong	G. Carey
090494	Mai Po, Hong Kong, (half breeding plumage)	P. R. Stevens
090494	Mai Po, Hong Kong, (full breeding plumage)	A. Rowland, C. Bradshaw
230494	Mai Po, Hong Kong, (half breeding plumage)	P. J. Leader
230494	Mai Po, Hong Kong, (quarter breeding plumage)	P. J. Leader
260494	Mai Po, Hong Kong, (half breeding plumage)	P. J. Leader
300494	Mai Po, Hong Kong, (half breeding plumage)	V. B. Picken
297794	Kirk Point, Werribee, Victoria	C. Minton *et al.*

Again these sightings emphasise that Hong Kong is an important stopover site on northward migration and that some birds from south-east Australia pass through NW Australia on migration.

Broad-billed Sandpiper

DATE	LOCATION	FINDER
220493	Mai Po, Hong Kong, (fresh plumage)	G. Carey
240493	Mai Po, Hong Kong	P. Leader
280493	Mai Po, Hong Kong	George
270494	Mai Po, Hong Kong, (full breeding plumage)	H. M. Thomson
250894	Saltpan Sheyang Saltworks, China	F. Jiguet, P. DuRau, W. Hui

The records from Hong Kong in 1993 may all refer to the same bird. Taiwan and Hong Kong are the only overseas recovery locations so far for Broad-billed Sandpipers marked in Australia.

SIGHTINGS OF LEG-FLAGGED WADERS BANDED AT OTHER LOCATIONS AND SEEN IN NW AUSTRALIA.

Rosalind Jessop, PO Box 97, Cowes, Vic. 3922 and Clive Minton, 165 Dalgetty Road, Beaumaris, Vic. 3192

Ruddy Turnstone

DATE	FLAGGING LOCATION	BANDER	LOCATION SEEN	FINDER
181094	Victoria	VWSG	Broome	P. Collins

This is the first movement of this species between NW and SE Australia.

Great Knot

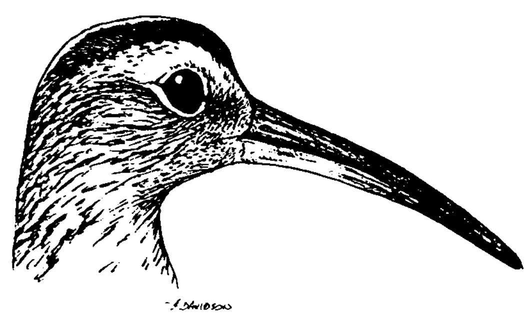
DATE	FLAGGING LOCATION	BANDER	LOCATION SEEN	FINDER
090994	Balaganchik River, NE Siberia, 64^0 55' N 168^0 35'E	P. Tomkovitch	Broome	B. Hayward

This bird, which had an individual colour flag combination, had been marked as a breeding female on June 18 1994. Pavel Tomkovitch's studies of Great Knot in north east Siberia are being financed by the Australian Nature Conservation Agency. This is the first Russian banded Great Knot recovered in Australia.

Red-necked Stint

DATE	FLAGGING LOCATION	BANDER	LOCATION SEEN	FINDER
120892	Victoria	VWSG	Broome	BBO
040993	Victoria	VWSG	Broome	BBO
060993	Victoria	VWSG	Broome	BBO
100994	Victoria	VWSG	Broome	BBO
230494	Victoria	VWSG	Anna Plains, 80 Mile Beach, W.A. (2 birds in flock of 30 on inland pool)	Adrian Boyle, Clive Minton, Roz Jessop *et al.*
201094	Japan	Migration Research Center	Beagle Bay, 130 km north of Broome	G. Swann

These are further strong evidence of the use of NW Australia as a migratory staging post by birds on their way to/from south east Australia. Note that all the dates of sightings in NW Australia were in migration seasons.



SIGHTINGS OF WADERS LEG-FLAGGED IN MORETON BAY, SOUTH EAST QUEENSLAND.

Peter Driscoll, Fahey Road, Mount Glorious, Qld 4520

Between 19 January 1991 and 23 January this year, 2553 migratory waders have been leg-flagged around Moreton Bay by members of the Queensland Wader Study Group. The flags are the same design and material as used in other regions and are placed around the right tibia. They are dark green, a flag colour specific to south east Queensland. The standard metal band is placed on the bird's left tarsus. Occasionally, birds were accidentally flagged and released with the flag on the left tibia.

The numbers of the different species leg-flagged are:

Lesser Sand Plover	*Charadrius mongolus*	39
Greater Sand Plover	*Charadrius leschenaultii*	5
Ruddy Turnstone	*Arenaria interpres*	32
Eastern Curlew	*Numenius madagascariensis*	112
Whimbrel	*Numenius phaeopus*	79
Grey-tailed Tattler	*Heteroscelus brevipes*	87
Bar-tailed Godwit	*Limosa lapponica*	1175
Red Knot	*Calidris canutus*	147
Great Knot	*Calidris tenuirostris*	660
Curlew Sandpiper	*Calidris ferruginea*	217

Below are the sightings of birds over 100 km from Moreton Bay.

Bar-tailed Godwit

28/4/92 Arao city, Ariake Sea, Kyushu Island, Japan. Jeremy Thompson and K. Komizo.

29/4/92 Ashley Estuary, near Christchurch, New Zealand Sheila Petch and Kathleen Harrison.

1/10/93 Kolan River mouth, north of Bundaberg, Queensland Peter Driscoll.

December 1993 to March 1994
Homebush Bay, Sydney Ian Taylor.

8/2/94 - 22/2/94
Brooklands Lagoon, Christchurch, New Zealand Johanna Pierre.

1/4/94 Brooklands Lagoon, Christchurch, New Zealand Johanna Pierre.

22/5/94 Miranda, New Zealand Tony Harraken.

Red Knot

7/6/93 Karaka, South Manukan, Auckland, New Zealand D. Lawrie & Tony Habraken.

23/10/94 Manawatu Estuary, New Zealand Colin Miskelly.

1/1/95 Karaka, South Manukan, Auckland, New Zealand Tony Habraken.

Great Knot

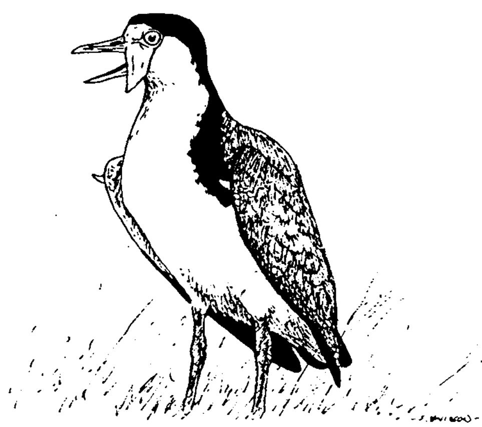
8/5/94 Ikawatsu, Alsumi-gun , Aichi Prefecturo, Japan Yoshimitsu Shigeta and Masuo Watarai.

21/5/94 Yahagifurukawa Estuary, Ishiki-cho, Hazu-gun, Aichi Prefecturo, Japan Yoshimitsu Shigeta and Masuo Watarai.

Eastern Curlew

11 to 23/5/94
Yoshinogawa Estuary, Okisu-machi, Tokushima-shi, Tokushima Prefecturo, Japan Yoshimitsu Shigeta and Masuo Watarai.

4/1/95 Stockton Bridge, Hunter River, New South Wales David Geering



Map Ref.	Date	Location	Observer(s)
		Bar-tailed Godwit	
b1	28-4-92	Ariake Sea, Japan	Jeremy Thompson & K. Komizo
b2	29-4-92	Ashley Estuary, Canterbury, NZ	Sheila Petch & Kathleen Harrison
b3	1-10-93	Kolan River north of Bundaberg, Qld	Peter Driscoll
b4	Dec '93/Mar '94	Homebush Bay, Sydney	Ian Taylor
b5	8-2-94 to 22-2-94	Brooklands Lagoon, Christchurch, NZ	Johanna Pierre
b6	1-4-94	Brooklands Lagoon, Christchurch, NZ	Johanna Pierre
b7	23-4-94	Sth of Access Bay, Firth of Thames, NZ	Barry Heather & Folkert Nieuwland
b8	22-5-94	Miranda, NZ	Tony Harraken
b9	20-11-94	Kirks, Manukau Harbour, NZ	B. Woolley
		Red Knot	
r1	7-6-93	Kidd's Karaka, Manukau Harbour, NZ	D. Lawrie & Tony Habraken
r2	23-10-94	Manawatu Estuary, NZ	Colin Miskelly
r3	1-1-95	Kidd's Karaka, Manukau Harbour, NZ	Tony Habraken
r4	2-1-95	Jordan's, Kaipara, NZ	D. Lawrie
		Great Knot	
g1	8-5-94	Ikawatsu, Ise Bay, Japan	Yoshimitsu Shigeta & Masuo Watagai
g2	21-5-94	Yahagifurukawa Estuary, Ise Bay, Japan	Yoshimitsu Shigeta & Masuo Watagai
		Eastern Curlew	
e1	11 to 23-5-94	Yoshinogawa Estuary, Tokushima, Japan	Yoshimitsu Shigeta & Masuo Watagai

Table 1. Sightings of waders leg-flagged in Moreton Bay and seen more than 100 km away. The map reference is to Figure 1 where all but 2 sightings (Kolan River and Homebush Bay) are shown on maps of Japan and New Zealand.

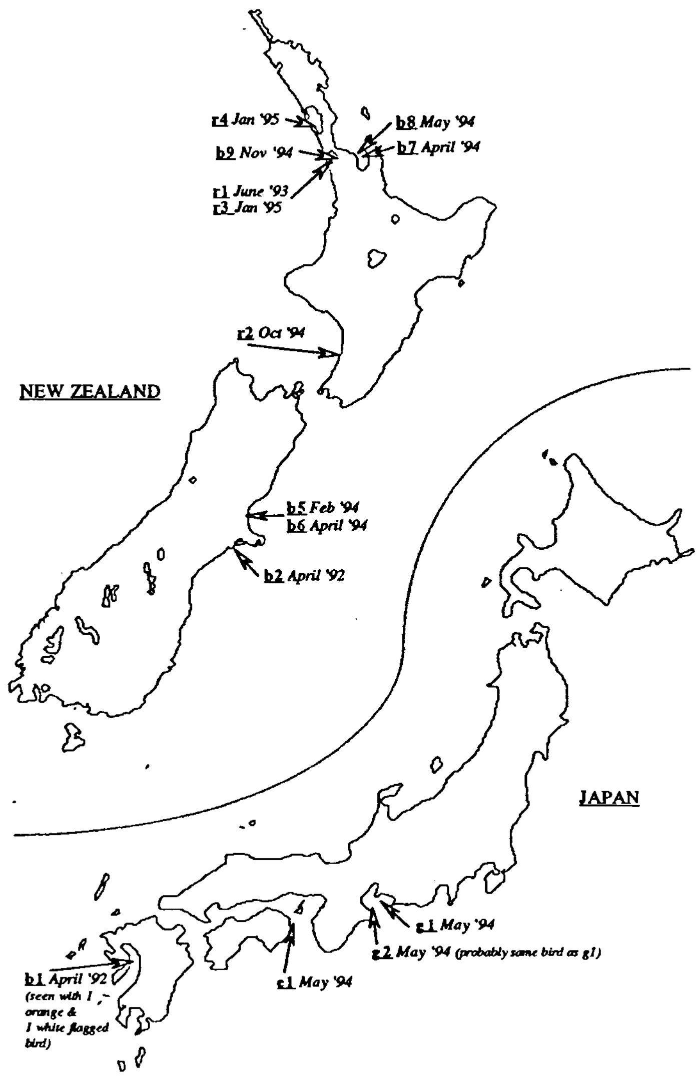


Figure 1
Sightings of green flagged birds in Japan and New Zealand. Refer to Table 1 (maps not to scale)

INLAND RECORD OF THE SOOTY OYSTERCATCHER *Haematopus fuliginosus*

Martin Schulz
Faculty of Resource Science and Management, Southern Cross University, PO Box 157, Lismore, NSW, 2480.

The Sooty Oystercatcher *Haematopus fuliginosus* is regarded as a strictly marine coastal shorebird, usually occurring within 50 m of the shoreline (Blakers *et al.* 1984, Lane 1987, Marchant and Higgins 1993, Watkins 1993). There appear to be no published records of this species occurring inland of rocky and/or sandy shorelines (eg. Blakers *et al.* 1984, Marchant and Higgins 1993).

On Kangaroo Island the Sooty Oystercatcher is a common resident species (Baxter 1989). A survey of the entire coastline of Kangaroo Island between 16 September and 13 October 1994 revealed a total count of 236 individuals (M. Schulz, unpubl. records).

On 16 October 1994 while walking along the northern edge of Murray Lagoon (35°54'S, 137°27'E) two Sooty Oystercatchers were observed wading in shallow water in an open mudflat situation. This locality was approximately 11 km inland of the nearest shoreline at Bales Bay on the south coast of Kangaroo Island. These birds were kept under observation for a period of fifteen minutes. During this time both birds were constantly foraging by probing into the mud, and on two occasions undertook short flights, returning both times to the same stretch of mudflat

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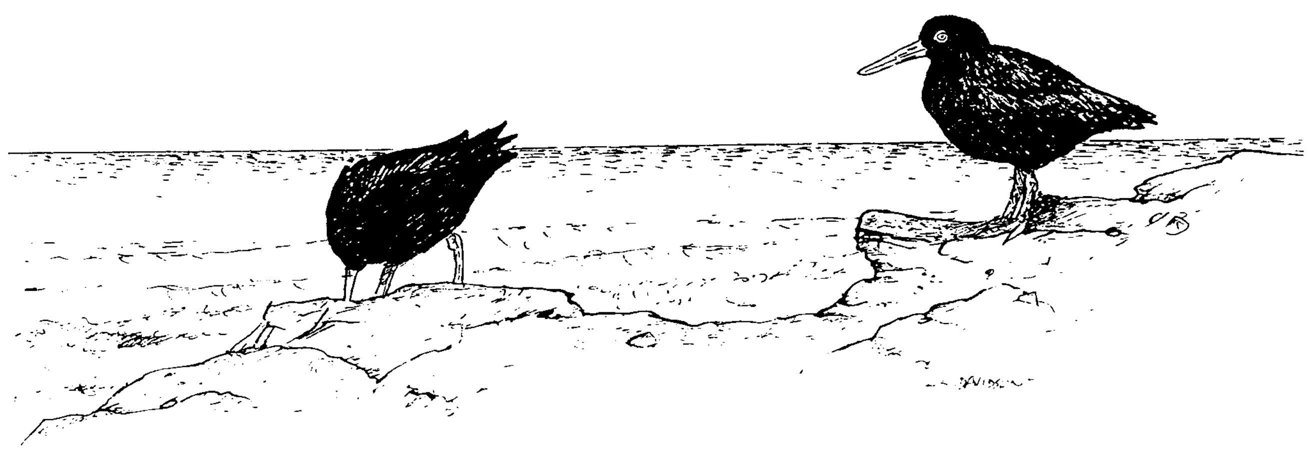

AN ESTIMATE OF THE PROPORTION OF PIED OYSTERCATCHER PAIRS OVERWINTERING ON OPEN OCEAN BEACHES IN EASTERN VICTORIA, AUSTRALIA.

M. Weston, 28 Craig Rd., Donvale, 3111
D. Heislers, 21/77 Dover Rd., Williamstown, 3016.

"I saw the oyster-bird with red cockade-like beak;
White, blue-black, like a tricolour; plump as a chef-"
(J. Blight)

Introduction

Victorian Pied Oystercatchers *Haematopus longirostris* mostly breed along open ocean beaches in spring and summer, and most then move to embayments for the winter, although some are said to remain on the beaches year round (Minton 1991).

Although there has been some analysis of Pied Oystercatcher numbers counted during National Wader Counts (e.g. Hewish 1990), these counts refer mainly to embayments and estuarine systems. Little use has been made of the substantial Pied Oystercatcher data collected during surveys of open ocean beaches which are designed to monitor Hooded Plovers *Thinornis rubricollis*. This paper analyses the data from one of these counts, in combination with data from an autumn count of eastern Victoria, in order to estimate the proportion of Pied Oystercatchers which remain on the open beaches all year.

Methods

Count data used in the current paper are those from the AWSG's November 1992 Hooded Plover count (described by Weston 1993a). In addition, data from an autumn survey (April and May) of the eastern Victorian coastline is used (this count is described by Heislers & Weston 1993). Neither survey aged Pied Oystercatchers. Slightly different methodologies were employed by each count, however this is not considered to have significantly affected the comparability of the counts. Coverage was comparable between counts for all coastal regions except for Corner Inlet (see Heislers & Weston 1993). In order to improve count comparability, the few embayment and inlet areas that were counted in late spring 1992 were excluded from the analysis. The localities defining the coastal regions are presented in Figure 1 of Weston (1993b).

By comparing the breeding season population, counted in late spring 1992, with the post-breeding population counted in autumn 1993, an estimate of the proportion of pairs which remained on the open beaches throughout the 1992/93 season can be made. However, in order to do this several assumptions must be made.

Assumptions

(1) All Oystercatchers that move away from the open ocean beaches to non-breeding quarters had done so by the time they were counted by the autumn survey. The autumn count was made in April and May. At this time of the year the number of Oystercatchers in estuaries and embayments are at, or near, their maximum (e.g. at Werribee, Port Phillip Bay, Weston 1991). This suggests that the movement to non-breeding quarters was complete by the time of the autumn survey.

(2) Victorian Pied Oystercatchers were on their breeding territories by the time the late spring count was conducted. The count was held in November, well outside the period of non-breeding flocking (January to August, Marchant & Higgins 1993).

(3) Birds in pairs are on territories, and those that are alone or in flocks have dispersed from their territories.

(4) The pairs remaining on the beaches were a subset of the larger population occurring on the beaches in late spring.

(5) Other abiotic factors (such as weather conditions during the counts) did not affect the results.

Results

Pied Oystercatchers were classified according to the social units in which they occurred.

Non-paired Birds

Of the 134 Pied Oystercatchers counted in autumn, 110 (*c.* 82%) were not in pairs. These birds were mostly recorded in flocks of 3-28 birds (although some flock sizes were estimates), which accounted for *c.* 41% of social units encountered. Five single birds were also counted (*c.* 17% of social units). Many of these birds were not truly associated with the open ocean beach, indeed, the four largest flocks recorded in autumn (accounting for *c.* 67% of non-paired birds located) were observed within inlet entrances or sheltered estuaries (see Heislers 1994). These birds were not considered to be remaining on their territories over winter.

Pairs

Comparison between the number of pairs in each coastal region in late spring and in autumn gives the proportion of the breeding population that probably remains on the open beaches as pairs throughout the year. Because the proportion of Pied Oystercatchers in pairs varied between coastal regions in both late spring (12-100%) and in autumn (0-44%), the results for each coastal division are presented (see Table 1). It is also apparent that pairs were less widespread in autumn: in late spring they were found throughout eastern Victoria, whereas in autumn they were only found East of Paradise Beach.

Table 1. The Proportion of Oystercatchers Remaining in Each Coastal Region in Autumn (* = incomplete count, - = area not counted, # = no result applicable).

Coastal Region	Number of Pairs in Late Spring	Number of Pairs in Autumn	Proportion Remaining in Autumn
NSW Border-Point Hicks	8	4	50%
Point Hicks-Marlo	23	4	17%
Marlo-Ninety Mile Beach	2	4	150%
McLaughlin's-Snake I.	106	0*	0%
Wilson's Promontory	None Counted*	None Counted	#
Darby Beach-San Remo	1	0	0%
Phillip I.	3	0	0%
Point Leo-Point Nepean	None Counted	None Counted	#
Queenscliff-Cape Otway	13	-	#
Cape Otway-Warrnambool	2	-	#
Warrnambool-SA Border	70	-	#

The proportion of the breeding population remaining year round as pairs on the open beaches of eastern Victoria ranged locally from 0-50%, with the exception of one region which showed a 50% increase in autumn! Overall, in eastern Victoria, of 143 pairs counted in late spring 1992, only 12 pairs remained in autumn. However, in order to reasonably compare counts, Corner Inlet (McLaughlin's Beach to Snake I.) should be excluded from the analysis because coverage of this area in autumn was relatively low. Thus, of 37 pairs counted in eastern Victoria excluding Corner Inlet, 12 remained in autumn i.e. it is estimated that 32% of the breeding pairs remained on the beaches in the non-breeding season (a surprisingly high figure).

Limitations of the Estimate

There are potential violations of the assumptions made by the current analysis. These are briefly discussed in terms of each assumption.

Assumption 1 and 5. The weather on the autumn count was very good, and this may have delayed the movement of Pied Oystercatchers from the beaches. With regard to this analysis it would have been ideal to count in early winter rather than autumn (although the high chance of poor weather would have been problematic). Nevertheless, it is considered that most birds had moved by the time the autumn count was conducted.

Assumption 3. The current analysis of the proportion of pairs that overwinter on Victoria's open ocean beaches is likely to be an under-estimate because groups counted in autumn could have consisted of pairs plus juveniles (neither count aged birds). These birds would have been classified as non-paired birds, although they were in fact pairs plus young. Another problem with using social units to classify birds as paired and non-paired (or for that matter into any categories) is the tendency for social units to combine when disturbed by the counting process (see Heislers & Weston 1993 for a brief discussion in regard to Hooded Plovers). In both counts the initial (or primary) social units were counted rather than the new (or secondary) social units. This is possible because secondary social unit formation ocurred almost exclusively within the visual range of counters, and it almost always involves primary social units that are also well within the visual range of counters. In addition, secondary social units tend not to be large, so counters can easily keep track of the primary social units involved. For example, in the autumn count, secondary social units generally consisted of 4-6 birds. The problem of secondary social units is not considered to have significantly affected the results.

This analysis is considered preliminary as it is only based on the results of one late spring and one autumn count. It is likely that the proportion of Oystercatcher pairs overwintering on the beaches of eastern Victoria varies between years. Weather, food supply and disturbance are just a few variables that might affect the proportion of birds overwintering on beaches, and these factors might vary between years. In addition, it is possible that breeding success might affect whether a particular pair will remain on the open beach or move elsewhere. A pair with young might move to more suitable estuarine environments, whereas a pair without young might remain on the beach on or near the next seasons breeding territory. These and many other possibilities require investigation.

Discussion

As mentioned by Minton (1991), and supported by the current analysis, a proportion of Victorian Pied Oystercatcher pairs remain on open ocean beaches, probably throughout the year. Therefore, although most of the population is mobile, moving between breeding and non-breeding areas, a small percentage is likely to be more or less sedentary. This represents an important difference in movement strategies within the species. Assuming that the mobile birds can be considered truly migratory, Pied Oystercatchers can be considered partially migratory. There is considerable theoretical interest in partial migration (for a summary see Lundberg 1988), and Victorian Pied Oystercatchers might be an appropriate species on which to examine the phenomenon. The advantages and disadvantages of remaining on the beaches year-round are yet to be examined, however, the difference in movement strategies is likely to be related to territory quality (specifically, habitat quality and food availability).

It is likely that the proportion of sedentary breeders in a population is likely to vary between areas. Unfortunately, the current analysis appears to be the only quantification of the sedentary proportion of *H. longirostris* populations. In Tasmania, breeding adults seldom move more than a few kilometres from their territories at any time, though at least some still occur in non-breeding flocks (see Newman 1992). On Rottnest Island, Western Australia, pairs are considered resident (Saunders & de Rebeira 1993). Further research would reveal any sedentary component of populations in other areas.

It should be noted that if the birds remaining all year on the beaches are sedentary from year to year, then cannon-netting non-breeding flocks will not result in the capture of these pairs. Saturation banding of flocks does increase the possibility that colour-banded birds will be recruited into the population of sedentary pairs, provided that members of sedentary pairs spend at least some part of their life-cycle in flocks (for example, when they are young, or during very poor weather conditions). Colour-banding birds by the use of nest-traps, and subsequent observation, will help to confirm the status of the Pied Oystercatcher pairs that remain on the beaches outside the breeding season. Such banding will also determine whether the same pairs spend the winter on the beaches each year, or whether some pairs overwinter on the beaches in some years but not in other years.

It would be useful to replicate this study in western Victoria, where there are more pairs, and fewer suitable estuaries or embayments (C.D.T. Minton pers comm.). A comprehensive analysis of Pied Oystercatcher movements is required. This analysis would use the colour-band data collected by the VWSG.

Acknowledgments

The authors wish to thank the AWSG, all counters and organisers for the use of the data generated by the AWSG's Hooded Plover Project. This paper illustrates further benefits of counting open ocean beaches for Hooded Plovers.

The autumn count was a major objective of the Eastern Victorian Coastal trek. It could not have been achieved without support from the major trek sponsors which included Australian Geographic, Westpac, Comalco, Plastics Industry Association and Paddy Pallin. Special thanks to Ian Bell (Sorrento Youth Hostel) for the guided tour through the Nepean Peninsula. D.P. Hart and C.D.T. Minton made helpful comments on an earlier draft of this paper.

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A SURVEY OF SHOREBIRDS OF KANGAROO ISLAND, SOUTH AUSTRALIA

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This paper presents a summary of the shorebirds recorded while systematically traversing the entire coastline of Kangaroo Island, South Australia. The survey was undertaken over a period of twenty-seven days from 16 September to 13 October 1994. The methods used in this survey are outlined in Schulz (1995). The grid references for all localities identified in the text are listed in the attached appendix.

Annotated Species Account

Bar-tailed Godwit *Limosa lapponica*

The only record was of two individuals foraging on intertidal mudflats south of the Cygnet River mouth in Western Cove on 13 October 1994.

Whimbrel *Numenius phaeopus*

This species was only recorded on four occasions on Kangaroo Island up until 1989 (Baxter 1989). In the present survey the only sighting was of six individuals east of Salt Creek mouth in the Bay of Shoals on 17 September 1994.

Eastern Curlew *Numenius madagascariensis*

This species was only recorded from Pelican Lagoon (1) on 11 October 1994 and Western Cover (3) on 13 October 1994. Baxter (1989) noted that this species occurred in small numbers on the sheltered eastern shores and associated tidal flats.

Marsh Sandpiper *Tringa stagnatilis*

The only record was of a single individual feeding with three Sharp-tailed Sandpipers on mudflats adjacent to a small creek outlet in the far southern end of Pelican Lagoon on 11 October 1994. This species is a rare visitor to Kangaroo Island and is mostly encountered as single individuals on inland salt lagoons (Baxter 1989).

Common Greenshank *Tringa nebularia*

A total of 78 individuals was recorded, all from intertidal mudflats or adjacent beaches on the north coast of Kangaroo Island. The largest concentrations were of 41 individuals in Western Cove on 13 October 1994, 17 individuals in Pelican Lagoon on 11 October 1994 and 15 individuals on the southern shoreline of the Bay of Shoals on 17 September 1994.

Terek Sandpiper *Xenus cinereus*

Not previously recorded from Kangaroo Island (e.g. Baxter 1989). A single bird was observed roosting on the edge of a mixed-species flock of shorebirds at Cape Rouge on 17 September 1994.

Common Sandpiper *Actitis hypoleucos*

This species is infrequently recorded on Kangaroo Island (Baxter 1989). A total of six individuals was recorded in the present survey: 1 on rocky coastline at Cape D'Estaing on 18 September 1994, 1 on a reef platform east of Springy Water Creek on 19 September 1994, 1 on a rocky shore adjacent to American Beach on 10 October 1994 and 3 on a boulder shore at Point Morrison on 12 October 1994.

Grey-tailed Tattler *Heteroscelus brevipes*

A total of five birds was recorded: 1 on rocky shoreline at Kingscote on 16 September 1994, 2 on rocky tidal flats in the Bay of Shoals on 17 September 1994, 1 amongst a flock of Ruddy Turnstone on a reef south of Point Tinline on 4 October 1994 and 1 on a small rock stack in Pelican Lagoon on 11 October 1994.

Ruddy Turnstone *Arenaria interpres*

Scattered along the shoreline of Kangaroo Island. The largest concentrations recorded were of 110 individuals at Cape Rouge on 17 September 1994, 119 individuals south of Point Tinline on 4 October 1994 and 22 individuals at Western Cove on 13 October 1994. Small numbers were encountered elsewhere such as 4 Emu Bay on 17 September 1994. 1 Smiths Beach on 18 September 1993, 7 Cape Cassini on 18 September 1994, 2 Inner Casuarina Islet on 24 September 1994, 4 D'Estrees Bay on 4 October 1994, I Cape Hart on 8 October 1994 and 2 Pelican Lagoon on 11 October 1994. The flocks encountered at Cape Rouge and south of Point Tinline were higher than the largest concentration of 70 birds reported in Baxter (1989)

Red Knot *Calidris canutus*

Baxter (1989) only cited three records of this species from Kangaroo Island. The present survey located the Red Knot at two sites: a flock of 11 individuals was recorded at high tide roosting amongst a flock of shorebirds at Cape Rouse on 17 September 1994 and 14 individuals were observed foraging on exposed mudflats in Western Cove on 17 October 1994. It is suspected that this species occurs more regularly than the few records suggest.

Red-necked Stint *Calidris ruficollis*

The Red-necked Stint was the most numerically abundant shorebird species encountered on the Kangaroo Island coastline in the present survey. A total of 1573 individuals was recorded with 94% located on low energy shorelines with extensive mudflats. The largest concentrations recorded were 911 Western Cove on 13 October 1994 and 429 Bay of Shoals on 17 September 1994. The only individuals observed on the south coast were 84 amongst the beach-cast seagrass south of Point Tinline on 4 October 1994 and 12 amongst seaweed on D'Estrees Bay on 4 October 1994.

Sharp-tailed Sandpiper *Calidris acuminata*

A total of 186 individuals was recorded, all from low energy shorelines with extensive intertidal mudflats; 182 on exposed mudflats and tidal pools in saltmarsh in Western Cove on 13 October 1994 and 4 on the southern shoreline of Pelican Lagoon on 11 October 1994.

Curlew Sandpiper *Calidris ferruginea*

Surprisingly uncommon, with a total of 139 individuals recorded. Only encountered on low energy shorelines with extensive mudflats at Western Cove (115) on 13 October 1994 and Cape Rouse (23) on 17 September 1994. A single bird was located at the Harriet River mouth on the south coast of Kangaroo Island on 17 October 1994.

Bush Stone-curlew *Burhinus grallarius*

Two birds were spotlighted at night on exposed mudflats in Pelican Lagoon, adjacent to Picnic Point at 2230 hrs on 10 October 1994. This species is occasionally spotlighted on low energy beaches in Eastern Cove (Baxter 1989, T. Dennis, pers. comm.). Heard calling at night at four localities behind the shoreline: Emu Bay on 17 September 1994, Vivonne Bay on 28 September 1994, east of Pennington Bay on 5 October 1994 and The Red Banks on 12 October 1994.

Pied Oystercatcher *Haematopus longirostris*

A total of 472 individuals was recorded, with the largest concentrations encountered on sheltered north coast beaches with extensive intertidal flats. For example, 107 Bay of Shoals on 17 September 1994, 134 Eastern Cove beaches on 10 October 1994, 71 Pelican Lagoon on 11 October 1994 and 71 Western Cove on 13 October 1994. Present in low numbers on the high energy ocean beaches of the south coast, with the only birds recorded at : 1 South-West River mouth on 26 September 1994, 2 Harriet River mouth on 28 September 1994, 2 Vivonne Bay on 29 September 1994, 4 Bales Bay on 30 September 1994, 3 south of Point Tinline on 4 October 1994 and 3 D'Estrees Bay on 4 October 1994. No Pied Oystercatchers were recorded on the high energy ocean beaches of the west coast or on the beaches of the north coast between Point Marsden and Cape Borda. No individuals were recorded from any section of rocky coastline.

A total of 24 nests were located during the survey, predominantly on low energy beaches of the north coast. The highest nesting concentration was in the Bay of Shoals where 4 nests containing eggs were located within a distance of 600 m on 17 September 1994. Two nests were located on sand between saltmarsh plants on an island at the entrance of Pelican Lagoon on 11 October 1994. Two nests were located on the high energy south coast beaches : at Bales Bay on 30 September 1994 and south of Point Tinline on 4 October 1994. The Bales Bay nest was located in a dune blowout 25 m from the beach edge. An additional 22 pairs of oystercatchers on the north coast were observed displaying in a manner that indicated nests were present. However, these nests were not located due to the difficulty of location, prevailing weather conditions and limited time available. Fresh four-wheel drive tracks were located within 10 m of 15 nests (63% of all nests located). It is likely that on many low energy north coast beaches a proportion of Pied Oystercatcher nests are run over each year due to frequent vehicular traffic.

Sooty Oystercatcher *Haematopus fuliginosus*

A total of 247 individuals was recorded, with 49% of the total number located on the high energy south coast beaches. Only small numbers were present on low energy beaches with extensive intertidal mudflats. The largest group sizes recorded were 11 Kingscote on 16 September 1994, 19 Cape Rouge on 17 September 1994 and 8 Black Point on 6 October 1994. No nests were located in the present survey. However, breeding was suspected on a rock stack east of Pennington Bay and on islands in Pelican Lagoon.

Black-winged Stilt *Himantopus himantopus*

Two individuals were observed at low tide on mudflats in Pelican Lagoon on 11 October 1994. Not recorded elsewhere along the shoreline of Kangaroo Island in the present survey. A widespread and common species on inland swamps and saltmarshes on Kangaroo Island, occasionally visiting river estuaries (Baxter 1989).

Pacific Golden Plover *Pluvialis fulva*

Present in much smaller numbers than the Grey Plover, with a total of 11 individuals recorded. Three individuals were located on a rocky reef with large amounts of beach-cast seagrass south of Point Tinline on 4 October 1994. All other sightings were on low energy shorelines with extensive intertidal mudflats; 6 Western Cove on 13 October 1994 and 2 Bay of Shoals on 17 October 1994.

Grey Plover *Pluvialis squatarola*

The Grey Plover was only recorded on low energy shorelines with extensive mudflats; 170 Western Cove on 13 October 1994 and 59 Bay of Shoals on 17 September 1994. The number encountered in Western Cover was higher than the largest concentration of 100 birds previously reported on the island (Baxter 1989). Many individuals were in near full to partial breeding plumage.

Red-capped Plover *Charadrius ruficapillus*

Although reported as widespread and extremely common (Baxter 1989), this species was surprisingly uncommon with a total of 71 individuals recorded. Predominantly encountered on low energy beaches, with the largest concentrations being 21 Western Cove on 13 October 1994 and 15 Pelican Lagoon on 11 October 1994. Infrequently encountered on high energy ocean beaches of the west and south coasts. The only records were: 1 Breakneck River mouth on 23 September 1994 and 8 Bales Bay on 30 September 1994. The only indication of breeding was displacement behaviour observed in a female bird on a shell grit beach in Pelican Lagoon on 11 October 1994.

Lesser Sand Plover *Charadrium mongolus*

The only record was of two individuals on exposed mudflats south of the Cygnet River mouth in Western Cove on 13 October 1994. This species is rarely encountered on Kangaroo Island (Baxter 1989)

Black-fronted Dotterel *Charadrius melanops*

The only record was of two individuals on the edge of Middle river estuary, 200 m from the beach on 19 September 1994.

Hooded Plover *Thinornis rubricollis*

A total of 177 individuals was recorded, significantly higher than a previous count of 104 birds (Watkins 1993). A detailed account on the distribution, nest location and other observations of this species recorded in the present survey is given in Schulz (1995).

Banded Lapwing *Vanellus tricolor*

Widespread throughout pastureland, particularly in eastern Kangaroo Island (Baxter 1989). The only record of this species in the present survey was of two birds flying overhead at night, south of Kangaroo Head on 9 October 1994.

Masked Lapwing *Vanellus miles*

A total of 211 individuals was recorded, with 49% of the total number located on sheltered shorelines with extensive mudflats. Only small numbers were present on the high energy south coast beaches.

Twelve species of shorebirds have been recorded on Kangaroo Island but were not located in the present survey (Baxter 1989, Ford 1989). These species are the Painted Snipe *Rostratula benghalensis*, Red-kneed Dotterel *Erythrogonys cinctus*, Double-banded Plover *Charadrius bicinctus*, Greater Sand Plover, *C. leschenaultii*, Banded Stilt *Cladorhynchus leucocephalus*, Red-necked Avocet *Recurvirostra novaehollandiae*, Wood Sandpiper *Tringa glareola*, Latham's Snipe *Gallinago hardwickii*, Black-tailed Godwit *Limosa limosa*, Pectoral Sandpiper *Calidris melanotos*, Long-toed Stint *C. subminuta* and the Sanderling *C. alba*. All of these species with the exception of the Double-banded Plover and Red-necked Avocet, are either rare visitors to Kangaroo Island and/or are confined to inland hypersaline lagoons and wetlands (Baxter 1989). The latter group of shorebirds include the Red-kneed Dotterel, Banded Stilt and Latham's Snipe. None of these species would have been expected to be located in this entirely coastal survey. The Red-necked Avocet is occasionally sighted in tidal estuaries and saltmarshes but was not located in such situations in the present survey. The Double-banded Plover is a regular winter migrant frequently found in small groups on sheltered coastal beaches on Kangaroo Island (Baxter 1989). Lane (1987) reported that this winter migrant departs Australia from mid-August to as late as early September. Therefore the absence of this species in the present survey was the result of it being conducted outside the time when Double-banded Plovers would be expected to occur on Kangaroo Island.

Significant Findings.

1. Kangaroo Island was listed in Watkins (1993) as supporting internationally significant populations of six species of shorebirds. These species are the Pied and Sooty Oystercatchers, Hooded Plover, Ruddy Turnstone, Red-necked Stint and Sharp-tailed Sandpiper. In the present survey markedly higher total counts were recorded for the first three species than listed in Watkins (1993). This indicates that the significance of the Kangaroo Island populations of these species has previously been underestimated.

   a. An additional 232 Pied Oystercatchers were recorded above the count of 240 individuals listed in Watkins (1993). An overall total of 472 individuals recorded in the present survey places Kangaroo Island as the fifth (rather than the eleventh) most important identified site for this species (Watkins 1993). A minimum of 46 breeding pairs indicates that Kangaroo Island supports an internationally significant breeding population of this species.

   b. An additional 137 Sooty Oystercatchers were recorded above the count of 110 individuals listed in Watkins (1993). An overall total of 247 individuals recorded in the present survey places Kangaroo Island as the fourth (rather than the tenth) most important identified site for this species (Watkins 1993).

In the present survey the count totals of the three internationally significant migratory shorebird species was lower than reported in Watkins (1993). This was in part attributed to the fact that no inland lagoons or wetlands were surveyed and that the full complement of birds may not have yet arrived on the island during the present survey.

2. Kangaroo Island was listed in Watkins (1993) as supporting nationally significant populations of two species of shorebirds. These species are the Grey Plover and Common Greenshank. An additional 105 Grey Plovers were recorded above the count of 124 individuals listed in Watkins (1993). An overall total

of 229 individuals recorded in the present survey places Kangaroo Island as a site of international significance for this species in Australia (Watkins 1993). A lower count of Common Greenshanks than reported in Watkins (1993) was partially due to the lack of sampling of inland lagoons and wetlands where this species is common (Baxter 1989).

3. Despite searches of all migratory shorebirds and oystercatchers where possible, no banded or leg-flagged individuals were located.

4. The present survey recorded a single Terek Sandpiper, a species that had not previously been recorded on the island (e.g. Baxter 1989).

Acknowledgements

Special thanks to Terry Dennis for assisting with the planning and logistics of the expedition. Thanks to Graham Reece, David and Linda Dowie and Adele Cox for looking after food drops, and to Bernice Dowling for assisting with the north coast logistics. This survey would not have been possible without a grant from "Australian Geographic".

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APPENDIX. Grid References of Localities Identified in the Text

American Beach	35°45′	137°52′
Bales Bay	35°59′	137°21′
Bay of Shoals	35°37′	137°35′
Black Point	35°53′	137°58′
Breakneck River mouth	35°57′	136°34′
Cape Borda	35°45′	136°34′
Cape Cassini	35°34′	137°19′
Cape D'Estaing	35°35′	137°29′
Cape Hart	35°53′	138°03′
Cape Rouge	35°36′	137°36′
Cygnet River mouth	35°41′	137°35′
D'Estrees Bay	35°56′	137°36′
Eastern Cove	35°48′	137°50′
Emu Bay	35°36′	137°30′
Harriet River mouth	35°59′	137°10′
Inner Casuarina Islet	36°04′	136°42′
Kangaroo Head	35°43′	137°53′
Kingscote	35°38′	137°38′
Middle River estuary	35°40′	137°04′
Pelican Lagoon	35°48′	137°47′
Pennington Bay	35°50′	137°44′
Picnic Point	35°48′	137°46′
Point Marsden	35°33′	137°37′
Point Morrison	35°43′	137°46′
Point Tinline	35°59′	137°37′
Salt Creek mouoth	35°37′	137°33′
Smiths Beach	35°35′	137°26′
South-West River mouth	36°00′	136°51′
Springy Water Creek mouth	35°37′	137°09′
The Red Banks	35°43′	137°43′
Vivonne Bay	35°58′	137°11′
Western Cove	35°43′	137°34′

HOODED PLOVERS :

A SPECIAL REQUEST

Have you ever seen Hooded Plovers away from the open ocean beach? If so how many, when and where? We are very interested in any such records (current or historical), even if they are only a short distance away from the beach.

Please write the details to Michael Weston, 28 Craig Road, Donvale 3111.

Help us to help Hoodies!

COLOUR BANDING HOODED PLOVER *Thinornis rubricollis* IN EAST GIPPSLAND, VICTORIA

Andrew McIntyre, Harry Hines[1] and Alexander Pollock[2].

Department of Conservation and Natural Resources, PO Box 260, Orbost, Victoria, 3888.

1. Present address: New South Wales National Parks and Wildlife Service, Armidale, New South Wales, 2350.
2. Present address: Queensland Department of Environment and Heritage, PO Box 623, Mackay, Queensland, 4740.

Introduction

Hooded Plovers *Thinornis rubricollis* are rare in Australia (Garnett 1992) and listed as Vulnerable in Victoria (Conservation and Natural Resources 1993). Some of the Victorian populations are thought to be declining (Weston 1993a). Studies in Australia on the Coorong (Buick and Paton 1989) and Kangaroo Island (Terry Dennis pers. comm., Bransbury 1991) in South Australia and at Point Nepean, Victoria (Bernice Dowling pers. comm.) have investigated the ecology of the species and the effects of predation by foxes, dogs and cats, and the human and other disturbance on breeding success. Some of these areas have high levels of visitor use and are in relatively disturbed environs such as the Coorong and Point Nepean. In contrast the beaches of East Gippsland have relatively low visitor use and are surrounded by expanses of coastal forests, woodlands and heaths and consequently provide an opportunity to study the ecology of this species in a relatively undisturbed environment.

In the winter of 1991 we noticed that Hooded Plovers were congregating in small groups of up to ten birds on the beach between Cape Conran and the Yeerung River mouth, on the East Gippsland coast, 20 km east of Orbost. We decided that these congregations provided an opportunity to catch several Hooded Plovers at one time, whereas during the breeding season they disperse in pairs along the beach and provide only limited trapping opportunities. Trapping during winter also eliminates any risk of disturbing breeding birds. This paper critically assesses the trapping technique and presents the results of the banding work.

Study area and methods

East Gippsland is about 400 kilometres east of Melbourne and most of its coastline is pristine. The study area comprised a 25 kilometre stretch of coastline between Marlo and the mouth of the Yeerung River (Figure 1). It included the entrance to the Snowy and Yeerung Rivers, a rocky headland - Cape Conran and a sandy point - Point Ricardo. It is part of a more extensive series of sandy beaches extending from Wilson's Promontory in the west to the NSW border in the east.

Parties of 2 to 6 people searched stretches of beaches on foot for Hooded Plovers at night using spotlights. In some cases daytime searches were undertaken to determine the presence of Hooded Plovers before spotlight searches that night. The trapping method involved using a hand net with spotlight (Dennis pers. comm.). The net used was a white, fine-mesh entomological net with a 1 metre handle extendable to 1.5 metres. The net was 45 cm in diameter. The spotlights used were 35 or 55 Watt sealed beam lamp using 12 V sealed lead-acid batteries. Head mounted caving lights were also used to allow free use of hands while banding the birds.

The technique involved spotlighting the birds and approaching them quietly, keeping them in the beam of the spotlight, until the net handler was close enough to attempt to place the net over the bird. In most cases two people were involved, one person handling the net the other the spotlight. Care was taken to keep the net handler out of the spotlight beam. If birds were flushed then the spotlights were turned off to let the birds settle. In some cases the entire operation was done by one person, though it proved difficult to manipulate both the net and spotlight at the same time.

Banding involved the standard metal bands provided by the Australian Bird and Bat Banding Scheme (Australian Nature Conservation Agency) and their colour combinations provided for the project. The colour combinations were the master colour (light green) over metal on the left leg and two colour bands on the right leg, using combinations of six colours. Colour bands were sealed using super glue by the A-Class bander (H.H.). When H.H. left East Gippsland in 1991 the banding was discontinued.

Records of banded birds were collected in an ad hoc manner from 1992 to 1995. Sandy Pollock undertook surveys of beaches from July to September 1992, banded birds were recorded during RAOU Victorian Hooded Plover counts in 1992 and 1994 (Weston 1993; in prep.) and banded birds were recorded incidentally by a number of observers.

Results

Trapping and banding

Seven searches were done from 1 to 17 August 1991 covering approximately 23.5 kilometres of beach (Table 1). Fifteen Hooded Plovers were sighted and six were caught and banded. Five adults and one sub-adult were caught.

Table 1: Details of shore bird trapping in August 1991, from Marlo to the Yeerung River mouth, East Gippsland.

Date	No. People	Search Area*	Dist. km	Hooded Plover seen/ banded	Red-capped Plover seen/ banded	Pied Oystercatcher seen/ banded
1/8/91	6	A	4.5	3/0	1/1	
		C	1			
3/8/91	3	A	2		1/0	
		B	3			
13/8/91	3	A	1	6/6		
14/8/91	1	A	na	2/0	2/1	2/0
		C	500m	4/0		
15/8/91	4	D	6		26/1	8/1
16/8/91	2	E	3		15/10	2/0
17/8/91	2	B	na			
		C	2			
		D	400m			2/0

* A-east of Cape Conran to Yeerung River mouth; B-Pt. Ricardo; C-west of Cape Conran; D-east of Snowy River mouth (Marlo) to French's Narrows; E-west of Snowy River mouth to 'the slips' (see Figure 1).

Table 2: Details of Hooded Plovers colour banded at the Yeerung River mouth, East Gippsland 13 August 1991.

Bird,colour bands	Age	Head-bill (mm)	Wing-length (mm)
Bird 1, light green/red	adult	46.4	147
Bird 2, light green/blue	sub-adult	45.8	137
Bird 3, light green/yellow	adult	45.4	135
Bird 4, light green/light green	adult	46.4	143
Bird 5, light green/orange	adult	44.5	135
Bird 6, light green/black	adult	44.0	135

Their morphometrics are presented in Table 2. Other wader species were also observed with some individuals captured using the same technique, and these were also banded; 13 Red-capped Plovers *Charadrius ruficapillus* and one Pied Oystercatcher *Haematopus longirostris* (Table 1). On a number of occasions Hooded Plovers were seen on beaches during the day but were not sighted that night.

Hooded Plovers proved to be in low numbers, being sighted on only four of the twelve searches. They were the most shy of the three species of shorebirds detected and were readily flushed. On the single occasion that we caught Hooded Plovers it was raining with gale force winds and the birds were sheltering in the lee of a minor dune near the Yeerung River mouth. The weather was so bad that they were reluctant to fly and when they did were blown down the beach some considerable distance. In one case a bird was caught by hand. Other shorebirds were also more approachable in such conditions.

Sightings of the banded birds

Of the six colour banded Hooded Plovers four have been sighted in the area on nine separate occasions (Table 3, Figure 1). On the first occasion (25 July 1992) birds 1, 4 and 5 were seen together 200 metres east of Cape Conran.

Table 3 Sightings of colour banded Hooded Plovers in East Gippsland.

Bird	Date observed	Distance & direction from banding site	Observer	Notes
Bird 1	25/07/1992	3km west	AP	seen with birds 5 & 4
	26/08/1992	200m east	AP	seen with bird 5
	02/1994	at banding site	JW	seen with unbanded bird
Bird 4	25/07/1992	3km west	AP	seen with birds 5 & 1
	06/09/1992	200meast	AP	alone
	26/01 - 11/02/1994	2km west	JW	alone
Bird 5	25/07/1992	3km west	AP	seen with birds 1 & 4
	26/08/1992	200m east	AP	seen with bird 1
	07/11/1992	300m east	GO	seen with unbanded bird
	05& 11/11/1994	300meast	AM,SH	seen with unbanded bird
	07/01/1995	300m east	AMcI	seen with unbanded bird
Bird 6	02/09/1992	13km west	AP	with unbanded bird
	05/11/1994	100m west	AM	with unbanded bird

Observers: AM Andrew Murray, AMcI Andrew McIntyre AP Alexander Pollock, GO Gerard O'Neill, JW Jim Whitelaw, SH Stephen Henry.

Birds 1 and 5 were seen near the banding site 200 metres east of the Yeerung River mouth a month later on 26 August 1992. Bird 4 was seen alone at this same site on 6 September 1992. These sightings may be of the congregations of birds that occur over winter. Bird 5 was seen with an unbanded bird at roughly the same site, east of the Yeerung River mouth, on 7 November 1992 during a Victorian Hooded Plover survey. Two years later on 5 November 1994 bird 5 was seen at the same site with an unbanded bird during a Victorian Hooded Plover count and again a week later.

Jim Whitelaw(JW) (pers. comm) observed banded birds on a number of occasions on the beach between Cape Conran and Yeerung River mouth. The first banded bird was seen on 11 June 1993 with a group of five unbanded birds, 2 kilometres east of Cape Conran. Weather conditions did not allow for individual identification, however, green bands and a metal band were observed, sufficient to indicate that it is probably one of our birds. Bird 4 was observed alone nearly every day over a seventeen day period from 26 January 1994, usually near the Banksia Bluff camping ground, but was also one kilometre to the west towards Cape Conran and one kilometre to the east towards the Yeerung River mouth. JW also observed bird 1 with an unbanded bird on four occasions at the mouth of the Yeerung River. (note: there maybe some confusion between birds 1 (green/red) and 5 (green/orange) which was seen at the same area with an unbanded bird two years earlier).

Bird 6 was seen at Point Ricardo, 13 kilometres west of the banding site, with an unbanded bird on 2 September 1992. It was observed with an unbanded individual at the

Yeerung River mouth on 5 November 1994 during the Victorian Hooded Plover count.

During the Victorian Hooded Plover survey on 7 and 8 November 1992, 18 birds were counted on 30 km of beach between Pearl Point, 10 kilometres east of the trapping site, and the Snowy River estuary at Marlo (Weston 1993b). One banded bird was observed (Table 3). On the 1994 Hooded Plover count, 5 and 6 November 1994, 13 birds were counted on the same stretch of beach (Weston in prep.). Two banded birds were observed (Table 3).

Discussion

The low numbers of Hooded Plovers seen during the spotlight searches is consistent with the results of the surveys carried by AWSG every two years (Weston 1993a and b). East Gippsland has a substantial total population which is widely spread over extensive stretches of beach, particularly in the breeding season.

Trapping technique

The trapping technique was effective at catching Hooded Plovers but time consuming, with just one bird banded for every 15 person kilometres (number of people x number of kilometres searched / number of banded birds). The difficulties with the technique include the dispersed nature of the birds (eight out of the twelve searches found no Hooded Plovers) and their relative shyness (Hooded Plovers were sighted on three occasions but not caught). In addition one could not guarantee that the presence of Hooded Plovers in an area during the day would ensure that they could be found at night. They either moved elsewhere between the day and night or they had sheltered out of sight of spotlighters. Weston (1991) had similar experience finding significantly fewer Pied Oystercatchers at sites during the night compared with the day. The most likely explanation was the reduced searching range at night. Based on the experience of seven nights work the best nights were those with strong winds where birds are forced to take shelter and resist taking flight, to the point that they could be caught by hand. An alternative approach, not explored, would be to use four wheel motorbikes to traverse large stretches of beach quickly (Dennis pers. comm.).

Sightings of banded birds

With such a small number of birds banded and relatively few follow up sightings limited conclusions can be drawn. The winter congregations of birds observed in East Gippsland appear to be of birds that disperse over the local area for breeding during summer. Some birds exhibited a degree of fidelity to the banding site; birds 1, 4 and 5 seen on the same stretch of beach between Cape Conran and the Yeerung River one year later. Birds 1 and 5 used that area during the summer of 1993/94 and bird 5 again in November 1994. Bird 6 used the area around Pt. Ricardo in the summer of 1992/93 but was seen near the banding site in November 1994. These results are similar to the findings of Bransbury (1991).

Any future colour banding of Hooded Plovers requires a commitment to regular follow up surveys. While useful data has been collected opportunistically more systematic surveys and detailed observations of the birds behaviour, such as breeding would maximise the value of the banding work. The distance of the study area from large centres such as Melbourne and the few experienced birdwatchers in East Gippsland limited the opportunity to organise a large volunteer effort.

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Details of any future sightings of banded birds should be sent to Andrew McIntyre C/- DCNR, P.O. Box 260, Orbost, Victoria, 3888.

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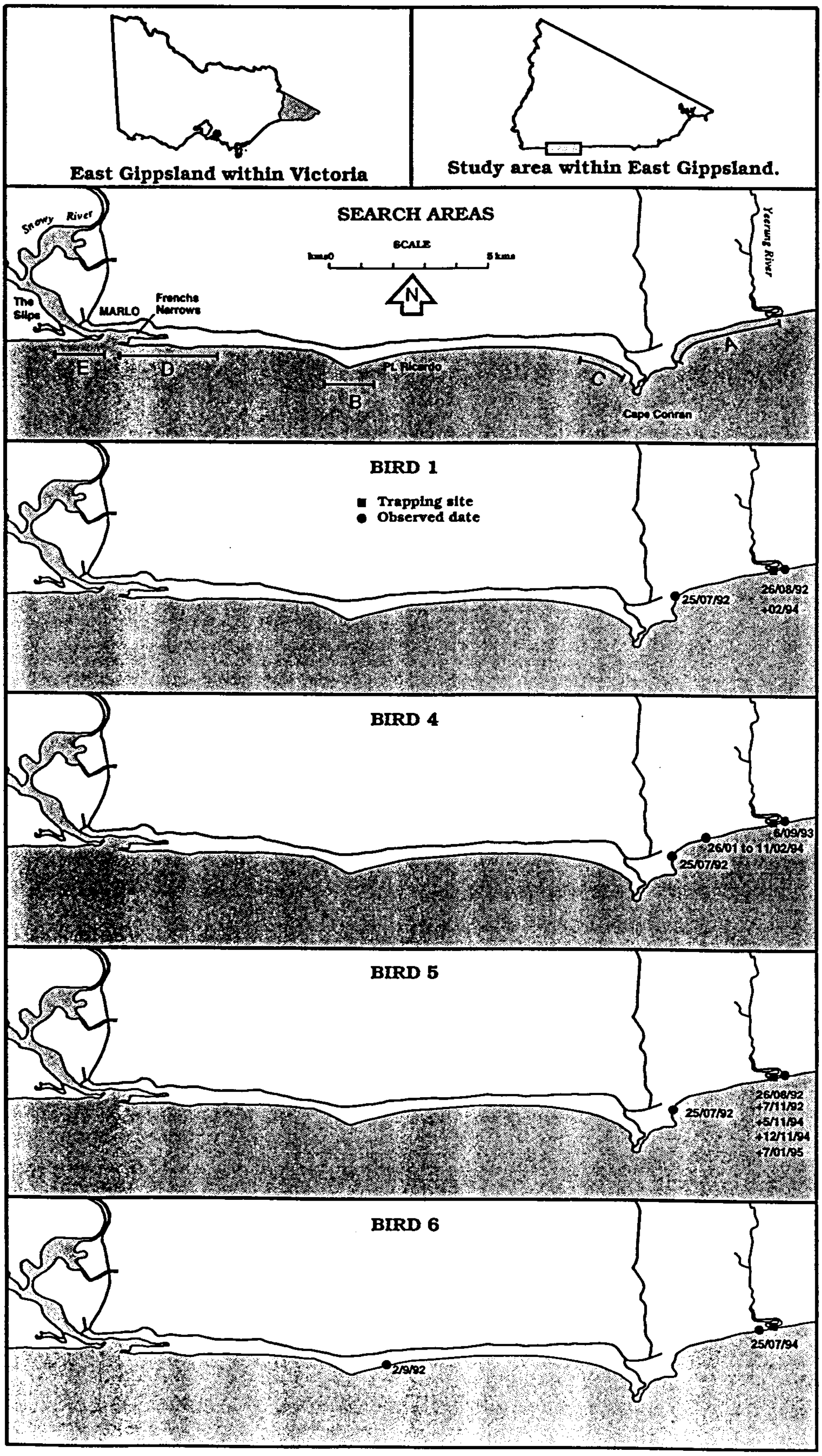
Figure 1: Location of the study area, East Gippsland Victoria, the areas searched for Hooded Plovers and the sightings of banded birds.



OBSERVATIONS ON THE HOODED PLOVER *Thinornis rubricollis* ON KANGAROO ISLAND, SOUTH AUSTRALIA

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Introduction

The Hooded Plover *Thinornis rubricollis* is widespread on Kangaroo Island, frequenting most sandy beaches and visiting inland lagoons principally in the non-breeding season (Baxter 1989). This paper presents a summary of observations on the Hooded Plover while systematically traversing the entire coastline of Kangaroo Island in September and October 1994.

Methods

The survey was conducted over a period of twenty-seven days from 16 September to 13 October 1994 during which time the entire coastline of Kangaroo Island, a distance of approximately 509 km, was systematically sampled travelling in a clockwise direction around the island. All sand beaches, comprising 112 km or 22% of the coastline were surveyed. In addition all rocky shorelines were traversed with the exception of small sections deeply incised with impassable gulches backed by steep cliffs. The extensive tidal flats of Western Cove, Bay of Shoals and Pelican Lagoon were surveyed at high to mid tide to reduce the possibility of missing Hooded Plovers. The shorelines of estuaries were investigated up to at least one kilometre inland.

The census method employed was similar to that described in Schulz (1995) and involved walking at a slow pace in the storm tide zone of the shoreline whilst continually scanning ahead for Hooded Plovers. When individuals were detected care was taken to minimise disturbance and individuals were only counted when passed. Due to the distance, the nature of the terrain and the amount of gear carried it was not possible to complete this section of coastline over a one or two day period as is the case with the biennial Hooded Plover surveys such as conducted in Victoria (e.g. Weston 1993). In order to avoid confusing count results, each beach was surveyed from the beginning to end in the one observation period. It is possible that some Hooded Plovers may have moved ahead of the observer and were counted on more than one occasion. However, the lack of multiple sightings of colour-banded individuals suggested the possibility of double-counting was small.

Where conditions permitted indications of breeding activity on each beach was investigated. Nests were primarily located by observing and noting the location of adults when first sighted and then following visible tracks in the vicinity of this sighting. At each nest site the following details were recorded: nest substrate, distance to the most recent high tide mark, distance to the nearest primary dune vegetation, approximate length of the beach, beach aspect, number of eggs, distance to the nearest vehicle tracks and human footprints where present.

Results and Discussion

Total Count

A total of 177 Hooded Plovers was counted around the entire coastline of Kangaroo Island. This total represents 3.5% of the estimated Australian population of 5000 birds and is higher than an earlier Kangaroo Island population count of 104 individuals (Watkins 1993). The present survey's higher count elevates the importance of Kangaroo Island for the Hooded Plover to within the top ten identified areas of international significance and is the most significant site for the species in South Australia (Watkins 1993). In 1987 surveys of the entire South Australian coastline indicated a total Hooded Plover population of 321 to 540 birds (Bransbury 1988). The total Hooded Plovers recorded in the present survey suggests, based on this estimate, that Kangaroo Island supports between 32.8% and 55.1% of South Australia's Hooded Plover population.

It is likely that the present survey underestimated the total population on Kangaroo Island due to:

1. Few inland saltwater lagoons or wetlands were surveyed. The Hooded Plover regularly frequents such lagoons, particularly inland of D'Estrees Bay (Baxter 1989, T. Dennis, unpubl. records). Elsewhere in South Australia the Hooded Plover is regularly recorded on ephemeral hypersaline lagoons and lakes (Marchant and Higgins 1993). Three individuals were recorded at high tide on the shoreline of a salt lagoon (35°49′ S, 137°4′ 'E) 0.5 km inland of Pelican Lagoon on 11 October 1994. It is likely that additional individuals occurred on salt lagoons during the period of the survey.

2. Hooded Plover numbers are known to be lower in late spring than in autumn on central and eastern Victorian beaches (Schulz and Lumsden 1983, Heislers and Weston 1993). Similar trends in numbers also occur in western Victoria, such as Discovery Bay (Schulz, in prep.). Heislers and Weston (1993) proposed that the observed trend was due to nesting

behaviour. In spring some adults are engaged in nest-centred activities, with a proportion of nests located in the dunes. The siting of nests in the dunes will result in attendant individuals being overlooked. Although few fairs appear to breed in the dunes on Kangaroo Island (see below) it was possible that some individuals may have been overlooked.

3. On three small beaches, less than 100 m in length, fresh Hooded Plover tracks were clearly discernible in the sand. However, no birds were sighted when surveying these beaches. A second search of these beaches revealed single pairs of Hooded Plovers on all three occasions on rock platforms up to 100 m from the nearest sand. The presence of other Hooded Plovers on intertidal rock platforms may have been overlooked due to the difficulty of locating one or two individuals on an extensive rock platform, individuals hiding behind rocks and the difficulty of paying undivided attention while walking on uneven and slippery rock surfaces.

Group Size

The dominant social unit recorded in the survey were pairs, comprising 78.9% of social units encountered and 63.3% of all birds seen. Pairs were also recorded as the dominant social unit on The Coorong throughout the year (Bransbury 1983, Buick and Paton 1989).

The second most frequently encountered social unit was single birds, comprising 11.3% of social units recorded and 4.5% of all birds seen. This is lower than the frequency of single birds encountered on The Coorong beaches, comprising 25% of observations (Buick and Paton 1989). This difference is attributed to the lower incidence of dune nesting in the Kangaroo Island birds (see below).

Groups of three individuals were recorded on five occasions, comprising 7.0% of social units recorded and 8.5% of all birds seen. In four of these groups all individuals were in full adult plumage, while in one group one individual was in immature plumage. Only two groups were encountered of more than four individuals :

1. Six individuals, Bales Bay (35°59′ S, 137°23′ E), all in adult plumage.

2. Eight individuals, D'Estrees Bay (35°54′ S, 137°36′ E), all in adult plumage.

Habitat

The Hooded Plover predominantly occurred on or within 100 m of sand beaches, comprising 98.3% of all birds seen. The overall density of Hooded Plovers on the beaches on Kangaroo Island was 1.6 individuals/km. A surprising finding was the number of Hooded Plovers encountered on short beaches. For example, 49 individuals (27.7% of all birds seen) were encountered on or adjacent to beaches less than 200 m long and 17 individuals (9.6% of all birds seen) were encountered on or adjacent to beaches less than 100 m in length. On these short beaches the dominant social unit were pairs (94%) with the only other social unit encountered being single individuals (6%). In two localities, Boxing Bay (35°34′ S, 137°36′ E) and Cape Cassini (35°34′ S, 137°19′ E), pairs of Hooded Plovers were encountered on stretches of sand less than 80 m in length dotted with numerous rocks and boulders. Such localities would not normally be regarded as beaches or as typical Hooded Plover habitat. Such sites would not normally be included in Hooded Plover surveys.

Eight pairs were located on short beaches, less than 200 m in length, backed by cliffs or steep slopes over 10 m high. All these localities must be regarded as temporary Hooded Plover sites since these beaches were completely awash during storm wave conditions. This was indicated by accumulations of flotsam and jetsam banked up against the base of the cliffs and/or step slopes.

No Hooded Plovers were detected on rocky shorelines more than 100 m from adjacent sand beaches. For example, no Hooded Plovers were located on the rocky north-west coast of Kangaroo Island between Snelling Beach (35°40′ S, 137°04′ E) and West Bay (35°53′ S, 137°33′ E). In this stretch of coastline only 0.5 km of beach, all less than 100 m in length, was present in approximately 73.5 km of coastline. All Hooded Plovers encountered on rock platforms adjacent to sand beaches were either foraging or conducting distraction displays.

Three Hooded Plovers were located on intertidal mudflats in Pelican Lagoon at low tide and on the following high tide had moved to a nearby hypersaline lagoon. Two individuals were observed on a low energy shell grit beach approximately 70 m in length at the head of Pelican Lagoon.

Nesting

A total of seventeen nests was located (Table 1.). In addition, two runners were observed accompanied by two adults west of False Cape (35°53′ S, 138°00′ E) on the south coast of Kangaroo Island on 6 October 1994. Sixteen nests were located on the beach at a distance of 2 to 26 m from the closest primary dune vegetation and a distance of 9 to 45 m from the most recent high tide mark. Only one nest was located in the primary dunes, 6 m from the edge of the beach on a steep slope in a dune blowout. The low incidence of dune nest sites was in contrast to populations in central Victoria where few nest sites were located on the beach (B. Dowling, unpubl. records).

The clutch size varied between one and three eggs (Mean = 2.0), slightly lower than the average clutch size of 2.56

(Marchant and Higgins 1993). The slightly lower average clutch size may have been due to some females still being in the process of laying when the nests were located.

Nests are typically constructed as depressions in the sand, unlined or lined with pebbles, seaweed, fragments of shell or stone (Marchant and Higgins 1993). Three nests were located on piles of washed up seagrass deposited on the beach. These nests were extremely difficult to locate, as it was not possible to follow the Hooded Plover tracks to the site. In all cases no nest depressions were excavated, rather the egg(s) were laid directly on top of the seagrass mat. The height of the mat of seagrass varied from 0.2 to 0.5 m above the beach. The location of nest sites in such a situation has not previously been recorded (Marchant and Higgins 1993).

Four separate Hooded Plover nests were located within 40 m of Pied Oystercatcher nests. There has been a suggestion that there may be a breeding association between the two species (Schulz 1988, Newman 1992). It was beyond the scope of the present survey to test this suggestion.

Nest Loss

Nest predation was observed on one occasion and the following account was taken from my field notebook. "At 1406 hrs on 10.10.94 a goanna *Varanus rosenbergii* was observed emerging from the primary dune on to the beach about 14 m from a Hooded Plover nest, east of Rocky Point (35°47′ S, 137°51′ E). A Hooded Plover was incubating. Conditions: NE wind (20 knots), cloud cover 1, sunny, warm and very bright conditions. The goanna moved from a clump of partially buried seagrass to a clump of seagrass in the upper part of the beach. It was within 10 m of the Hooded Plover nest. The incubating bird had been sitting tight, slightly crouched. However, this distance must have been too close and the Hooded Plover leapt up from the nest and ran toward the high tide mark. It started executing a pitiful broken wing displacement act, calling loudly. The goanna did not appear to pay any attention but must have either seen the Hooded Plover depart or smelt the eggs. The goanna with tongue flickering moved slowly straight toward the nest. The Hooded Plover came closer undertaking a desperate broken-wing act. The goanna paid no attention as it had found the nest. It lunged, picked up an egg and swallowed it, with little chewing. It looked around. The Hooded Plover was very close trying to distract it. The goanna again grabbed another egg and swallowed, then the last. With tongue flickering it looked about and then after about half a minute continued moving along the upper part of the beach. The Hooded Plover was still executing a broken-wing act. The goanna was now some 15 m away moving slowly. The Hooded Plover stopped its broken-wing act. The goanna kept moving away. The Hooded Plover moved over toward the nest scrape and within two minutes it was at the nest. Here the bird confirmed there were no eggs present, did not even bother to sit down but walked towards the water's edge where the other Hooded Plover was stationed".

V. rosenbergii is commonly encountered on the Kangaroo Island shoreline and is probably an important factor in the nesting success of the Hooded Plover on the island.

At the nest east of Seal Bay (35°59′ S, 137°19′ E) a fresh Australian Sea-lion *Neophoca cinerea* track was recorded within 4 m of the nest. At this secluded beach small numbers of *N. cinerea* regularly haul out and rest on the beach or in adjacent low primary dunes. It is likely that at times on this beach and other beaches on Kangaroo Island nests are occasionally crushed by *N. cinerea* en route to resting sites.

One nest at Nepean Bay Conservation Park (35°44′ S, 137°37′ E) was within one metre of being run over by a four wheel drive vehicle, a common cause of nest failure on The Coorong (Buick and Paton 1989). Five nests (29%) were located within 10 m of the nearest footprints and it is likely that on occasions nests are crushed by people walking along beaches.

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Table 1. Details of Hooded Plover nests located on Kangaroo Island, September and October 1994.

Locality	Grid References	Beach Length (km)	Beach Aspect	Nest Location	Nest Substrate	Distance from Dune Vegetation (m)	Distance from last High Tide Mark (m)	No. of Eggs	Nearest Vehicle Track (m)	Nearest Footmark (m)
Point Marsden	35°34′ S 137°38′ E	0.25	NE	Beach	Sand	8	12	2	-	-
Emu Bay	35°36′ S 137°31′ E	0.50	NW	Beach	Sand	25	15	2	-	-
King George Beach	35°39′ S 137°06′ E	0.35	NW	Beach	Sand	14	25	3	-	10
S. of Rocky River mouth	35°59′ S 136°40′ E	0.90	SW	Dune	Sand	-	-	2	-	-
Hanson Bay	36°01′ S 136°51′ E	0.80	SW	Beach	Sand	10	15	1	-	5
W. of Stunsail Boom River mouth	36°01′ S 137°00′ E	0.20	SW	Beach	Sand	4	15	2	-	25
Stunsail Boom River mouth	36°01′ S 137°01′ E	0.20	SW	Beach	Sand	6	45	2	-	5
E. of Cape Kersaint	36°01′ S 137°09′ E	0.12	S	Beach	Sand	4	12	2	-	-
E. of Seal Bay	35°59′ S 137°19′ E	0.06	SE	Beach	Sand	10	12	1	-	-
Bales Bay	36°00′ S 137°21′ E	1.60	SW	Beach	Sand	2	15	2	-	15
S. of Point Tinline	35 59′ S 137°36′ E	1.10	SE	Beach	Sand	26	20	2	-	20
D'Estrees Bay	35°57′ S 137°36′ E	8.80	E	Beach	Seagrass	20	25	2	-	15
American Beach	35°45′ S 137°54′ E	0.80	NW	Beach	Seagrass	7	12	1	-	8
High Sandhill	35°46′ S 137°52′ E	1.30	W	Beach	Seagrass	6	18	2	-	-
High Sandhill	35°47′ S 137°52′ E	1.30	NW	Beach	Sand	15	9	3	-	7
E. of Rocky Point	35°47′ S 137°51′ E	2.50	NW	Beach	Sand	8	11	3	-	-
Nepean Bay Conservation Park	35°44′ S 137°37′ E	11.80	N	Beach	Sand	16	10	2	-	-

ASIAN SECTION

SECOND REPORT ON RESEARCH ON THE GREAT KNOT *Calidris tenuirostris* ON THE BREEDING GROUNDS

Dr Pavel S.Tomkovich, Curator of Birds, Department of Ornithology, Zoological Museum of Moscow State University

Introduction

Reproduced below is the edited report of Pavel Tomkovich on his continuing research on breeding Great Knots (for first report see *Stilt* 24). This study has again been funded by the Australian Nature Conservation Agency (ANCA).

Project participants

Pavel S.Tomkovich and Dmitry E.Te (Assistant), student of the Zoology Department, Moscow Pedalogical Museum.

Study area

Studies continued in the same are where the project was initiated in 1993; on the eastern spur of the Shchuchy Mountain Range, north-eastern Siberia (64° 55'N 168° 35'E).

Logistics

It was planned to reach the base camp at the mouth of the Balaganchick River, a tributary of the Anadyr River, on about 20 May 1994 - before or at the time of arrival of Great Knots, in order to obtain data on the ecology of these birds before the commencement of breeding, as this has not previously been studied. However, because bad weather conditions prevented plane and helicopter flights, it was not possible to reach the base camp until 31 May. As a result it took a total of 20 days to travel from Moscow to the base camp, thus reducing the time available for studies during the pre-breeding period and restricting the general Great Knot studies to the period 1 June to 2 August. With travel time included the expedition lasted from 11 May to 8 August 1994.

It was necessary to use a helicopter to reach base camp from Markovo village as no other transport method was possible at the time. It was possible to travel up the river by motor boat (a much cheaper form of transport) just one week later, but by that time the majority of Great Knots had begun breeding.

RESULTS

Site faithfulness and mate fidelity

The individual colour-marking of 12 adult breeding Great Knots (one known female and 11 supposed males) from the study area in 1993 made it possible to record a degree of their site faithfulness. Nine of these birds (75%) were found back in the study area ;and individually within the same parts of the area, with a presumed relationship to defended pre-breeding areas. It is inferred from this that most, if not all, surviving adult males return anually to their former breeding sites.

Both adults of a colour-marked pair returned to their former territory, nesting some 125 metres from the nest site of the previous season. As only one known female was marked it is not possible to draw any definite conclusions about female site faithfulness from this. Additional birds, including females, were marked in 1994, thus it may be possible to obtain more reliable results in 1995.

As would be expected of a species which is presumed not to breed until at least the age two, none of the 29 Great Knot chicks banded in 1993 were seen in the natal area in 1994. However one chick banded in 1993 was recovered on 3 June 1994 from Aniva Bay in Southern Sakhalin, therefore at least some one year old Great Knots undertake a northward migration and probably over-summer on the shores of the Sea of Okhotsk.

Breeding density

The same study area as that of 1993 of 9.5 to 10 km^2 of montane lichen tundra was used for density calculations. In 1993 the area was occupied by 13 broods and in 1994 twenty-four broods, and two unsuccessful nests were found. The most intensively studied area, a plateau of *circa* 1 km^2 near the base camp, was inhabited by three broods in 1993, and by six pairs and three unpaired territorial males in 1994. Flocks of feeding birds were also noted to be larger throughout the 1994 season.

Taking into account the known strong site-faithfulness of this species it is presumed that the dramatic increase in density of breeding birds was due to the immigration of first-year breeders into the local population. Such an immigration cannot however be explained by a good chick production year two years previously, on the contrary 1992 was a poor breeding season, and therefore these numbers must be attributed to local conditions. High falls of snow in the upper and middle reaches of the Anadyr River in 1994 probably led to a lack of suitable breeding habitats in that area, however, by luck, the mountain range within the study area was uniquely free from large areas of snow in early June 1994 and therefore probably attractive to first-year breeders. It is of interest to note that one marked male which had raised a brood in 1993 was left unpaired in 1994.

It is presumed that the increased breeding density of Great Knots in 1994 will continue in 1995, thus making further studies in 1995 even more attractive.

Phenology

It is known that egg laying began in early June however data on hatching dates are more precise and allow for comparisons to be made with the previous season and for accurately defining the breeding season. Hatching took place from about 25 June to 9 July, with most broods hatched in very early July. This is similar to the timing of hatching in 1993. More precise hatching dates will be obtained by back calculations from measurements of chicks from 21 broods.

Three nests were found with incomplete clutches, allowing intervals between the laying of succesive eggs to be determined about five days to complete a clutch of four eggs. Unfortunately only one of these nests survived to hatching, and this had an incubation period of 21 days for the last egg.

Repeated measurements of chicks revealed slower development in 1994 in comparison with 1993. In at least some broods fledging took 23 to 25 days in 1994, compared with 20 to 21 days in 1993.

Large scale movements of Great Knots began in late June 1994, however the majority of the population departed on 1 and 2 July. The first wave of migration consisted of birds which were recognised failed-breeders, unmated males, and females which had deserted their mates at the time of hatching. Successful breeding males mainly departed in the last third of July, after accompanying their chicks for 24 to 30 days. It would appear that the slower growth rate of chicks in 1994 resulted in the departure of young both separately from parent males, and somewhat later than in 1993 (33 days was the maximum age of ayoung bird in 1994 compared with 30 days in 1993).

Breeding success

In 1994 chicks hatched in three of five nests under observation. One nest was deserted (the female may have perished, the colourmarked male was observed later in predeparting flocks), and one was predated. It would appear however that the majority of clutches hatched successfully but this was not the case with broods. Eight of the 20 broods under more or less regular observation disappeared, most probably these chicks died. At the same time mean brood size at fledging or a few days later did not differ much between years (2.5 young per brood (n=8) in 1993, and 2.3 (n=12) in 1994). In total at least 29 juveniles fledged of the 62 chicks banded in 1994. These results show a slightly higher mortality rate of chicks in 1994, nevertheless the overall breeding success was fairly good. The higher losses of eggs and chicks in 1994 can be at least partly explained by the greater number of mammalian predators (*Mustella erminea* and *Martes zibellina*) following the increase in the rodent population in 1993 and 1994, however this can not explain all brood losses.

Food and food resources

Several adult and fledged young Great Knot were collected (under permit from the Russian authorities) outside the study area from mid June to early August 1994. Preliminary analysis of the stomach contents of these birds and of casulaties of downy young and colected droppings has given an unexpected result. It is apparent that to a large extent these birds were feeding on plants. Only small chicks feed exclusively on insects (Carabid beetles), while the food of chicks after one week of age and of adults consisted of berries (*Arctous alpina, Empetrum nigrum, Vaccinium uliginosum)*, old ones in June and new green ones in July/August. This appears to be unique among Calidrid species.

On the basis of this finding we can assume that (1) distribution and/or densities of Great Knots in alpine habitats can be directly related to the distribution of berry producing plants, and (2) fledging success of the species depends on the availability of surface-active insects and on the crop of berries.

If the latter supposition is correct, it provides an explanation for the reduced growth rate and increased chick mortality in 1994. It was hot in June and cool in July with rain periods for several days in 1994 in the study area, just the opposite to the situation there in 1993. As a result the pitfall traps set in 1994 revealed a peak in arthropod numbers, especially of beetles, in the second half of June and a marked decrease in early July. Thereforethe hatching of the chicks in 1994 did not coincide with the peak numbers of beetles - the main chick food. A lack of protein could result in the reduced growth rate of chicks. Measuring of arthropod abundance through the next season (1995) in the same place will help to check this hypothesis.

Crops of berries were not large in the alpine tundra of the study area in 1994, but this could have been different on other mountains. We can only speculate that the disappearance of broods in the study area was due to the low numbers of berries there in addition to the low abundance of beetles. No surveys of berries were undertaken in other areas in 1994 but it would be useful to do so in 1995.

Other activities

a) At least 270 adult waders of 18 species, mostly Great Knot, Common Sandpiper *Actitis hypoleucos*, Terek Sandpiper *Xenus cinereus* and Pacific Golden Plover *Pluvialis fulva*, were checked for colour-flags or bands near Anadyr airport; in Markovo; and in the vicinity of the base camp. One Great Knot wearing a foreign band (probably an Australian one) on the right tarsus was detected. The bird was an unmated male, holding a territory on the study area plateau. Observations of this bird revealed information on the local movements and behaviour of an unmated male Great Knot. It was last observed on 1 July, in a large flock before departure to the south.

b) A total of 224 birds of 26 species, mainly waders (122 birds of nine species) and passerines was banded. The waders banded were: Great Knot 82 (adults 20, chicks 62), Pacific Golden Plover 12, Ringed Plover *Charadrius hiaticula* 8, Terek Sandpiper 5, Temminck's Stint *Calidris temminickii* 4, Red-necked Stint *C.ruficollis* 4, Common Sandpiper 3, Solitary Snipe *Gallinago solitaria* 3, and Wood Sandpiper *Tringa glareola* 1. Most of these birds were fitted with red and white "Darvic" flags or colour pendants attatched to the metal bands.

c) The study of the poorly known local bird fauna was continued; 77 species were recorded in 1994, including 11 previously unrecorded. Breeding by three new species was also recorded. Of particular interest was the breeding record of a Red-necked Stint, on the edge of its known breeding range. Records of the Western Sandpiper *Calidris mauri* in May and August near the Anadyr airport are new for that area, and are outside the known breeding range of this Nearctic species.

d) Data on the distibution, numbers, and some aspects of the breeding biology of the Pacific Golden Plover and Solitary Snipe were obtained in the alpine tundra and adjacent habitats.

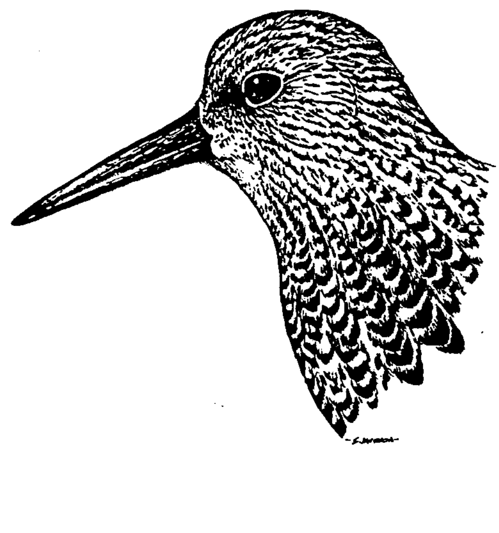
e) A note on the breeding record of Solitary Snipe in northeastern Siberia was published in ' Information Materials of the Working Group on Waders of the CIS. Two papers on the breeding range and migration of Great Knot in Russia are in preparation for possible publication in an international ornithological journal and a set of slides with a note about breeding distribution and biology of the Great Knot was submitted to ' Dutch Birding .

Further plans for studies

A unique knowledge of various aspects of the distibution and breeding biology of the Great Knot has been built up over the two years of the project. It has become clear that the mountains of the upper Anadyr River are ideal as an area for studies of the Great Knot at the breeding grounds. The species is a difficult one to study, primarily because the birds are scattered across many mountain tops or plateaus. Therefore it is necessary to undertake studies over several seasons in order to obtain meaningful results.

Some aspects of the breeding biology of the species are now fairly well understood (breeding and departure phenology, mating and parental care systems, growth of chicks, etc.), but others need further study. The main gap concerns the arrival dates and pre-breeding period, although other aspects of missing information have been raised in this report. Data on year to year variations in breeding phenology, distribution, density, and breeding success are such aspects which are of interest and importance.

Because of the above it is considered important that at least a third year of these studies be undertaken. Knowledge of the area and of the species requirements will lead to a greater understanding of what is necessary to ensure its continued survival.



BANDING ROUND-UP

Compiled by E. Belinda Dettmann, Australian Bird and Bat Banding Schemes, Australian National Parks and Wildlife Service, GPO Box 8, Canberra, ACT 2601.

The following is a selected list of recoveries found after the last date reported in *Stilt 20* and up to 28 February 1993. Permission must be sought from the banders and clearance given by the ABBBS before using these data in publications.

Layout Of Data:

Line 1 - band number; banding place; co-ordinates; date of banding; age; sex; bander
Line 2 - recovery method; recovery status; recovery place; co-ordinates; recovery date; age; sex; finder
Line 3 - distance and direction between banding and recovery places; time elapsed between banding and recovery

Symbols Used:

Age code:
U=unknown;
P =nestling;
J=juvenile;
1=within the first year of life;
+1=within the first year or older;
2=within the second year;
+2=within the second year or older; etc

Sex
U=unknown;
M=male;
F=female.

Method of encounter:
01=probably trapped;
02=trapped but device is unknown to the banding office;
03=trapped in a mist net;
04=trapped with a cage trap;
05=trapped with a cannon net;
25=bird sick or injured;
31=collided with a moving road vehicle;
40=band found on a bird, no further data on how encountered;
41=band returned, not reported if on a bird;
46=colour marking sighted in field, bird one of a cohort marked in this manner;
48=colour marking sighted in field;
54=beachwashed;
61=shot - reason unknown;
63=taken for scientific study;
67=taken for food or feathers;
68=shot for food or sport;
99-found dead, cause unknown.

Status after encounter:
00=status of bird and band is unknown;
01=status of bird unknown, band left on bird;
02=status of bird is unknown and the band was left on the bird;
03=bird is dead, status of band is unknown;
04=bird is dead, band left on bird;
05=bird is dead, band removed from bird;
09=rehabilitation attempted but bird died, band status unknown;
13=bird released alive with band;
14=bird released alive, band removed;
26=bird was alive in the wild with the band;
29=bird partially decomposed, band removed.

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130       Pied Oystercatcher                        Haematopus longirostris
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100-96760 01,WERRIBEE SEWERAGE FARM (SPIT, PT WILS 38d5m  S 144d31mE 890416   +2   U  VICTORIAN WADER STUDY GROUP
48 26     2F,ON THE BEACH AT CARPENTERS ROCKSA      37d55m S 140d24mE 950205   U    U  & MS P PERT
Distance: 361 km          Direction: 272 degs.            Time elapsed:   5 yrs 9 mnths 20 days

100-96888 06,BARRY BEACH CORNER INLETVIC            38d42m S 146d23mE 900610   +3   U  VICTORIAN WADER STUDY GROUP
48 26     7F,PELICAN POINT CARPENTERS ROCKSSA       37d54m S 140d22mE 950204   U    U  & MS P PERT
Distance: 532 km          Direction: 278 degs.            Time elapsed:   4 yrs 7 mnths 25 days

101-03556 11,RHYLL PHILLIP ISLANDVIC                38d21m S 145d19mE 920614   +3   U  VICTORIAN WADER STUDY GROUP
48 26     X6,SHIPWRECK POINT PERKINS ISLANDTAS      40d45m S 145d2m E 940624   U    U  LORD
Distance: 268 km          Direction: 185 degs.            Time elapsed:   2 yrs 0 mnths 10 days

101-03694 06,BARRY BEACH CORNER INLETVIC            38d42m S 146d23mE 940813   +3   U  VICTORIAN WADER STUDY GROUP
48 26     7F,SAND ISLAND WALLIS LAKE FORSTERNSW     32d11m S 152d29mE 950122   U    U  & NATALA BOWEN
Distance: 911 km          Direction: 39 degs.             Time elapsed:   0 yrs 5 mnths 9 days

101-03965 08,STOCKYARD PT, LANG LANG, WESTERNPORTV 38d22m S 145d32mE 940911   3    U  VICTORIAN WADER STUDY GROUP
48 26     1F,SHELL POINT STH SHORE OF BOTANY BAYNS 34d1m  S 151d7m E 941114   U    U  STRAW
Distance: 696 km          Direction: 48 degs.             Time elapsed:   0 yrs 2 mnths 3 days


153       Bar-tailed Godwit                         Limosa lapponica
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071-83884 06,BARRY BEACH CORNER INLETVIC            38d42m S 146d23mE 920324   2    F  VICTORIAN WADER STUDY GROUP
05 13     34,MIRANDA FIRTH OF THAMES NEW ZEALAND    37d10m S 175d19mE 941023   U    U  ZEALAND WADER STUDY GROUP
Distance: 2532 km         Direction: 95 degs.             Time elapsed:   2 yrs 6 mnths 29 days

072-44204 NB,NORTH END OF NUDGEE BEACH BRISBANEQLD 27d20m S 153d5m E 930904   +1   M  QLD WADER STUDY GROUP
47 26     X1,SANDRINGHAM BAY, BOTANY BAYNSW         34d0m  S 151d8m E 941002   U    U  NSW WADER STUDY GROUP
Distance: 764 km          Direction: 194 degs.            Time elapsed:   1 yrs 0 mnths 28 days


155       Grey-tailed Tattler                       Heteroscelus brevipes
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061-90862 01,BEACHES CRAB CK RD ROEBUCK BAY BRO     18d0m  S 122d22mE 930411   +2   U  AUSTRALASIAN WADER STUDY GROUP
67 05     OF,SOUTHERN AREA RED RIVER DELTA, VIETNA 19d57m N 106d7m E 940503   U    U  PEDERSEN
Distance: 4576 km         Direction: 336 degs.            Time elapsed:   1 yrs 0 mnths 22 days
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160 Terek Sandpiper Xenus cinereus

051-55254 03,SHORES OF THE 80 MILE BEACHWA 19d15m S 121d20mE 920926 +2 U AUSTRALASIAN WADER STUDY GROUP
03 13 02,UNBUK-DON (UNBUK-RI)YONGJONG IS KOREA 37d30m N 126d34mE 940906 U U PARK
Distance: 6332 km Direction: 5 degs. Time elapsed: 1 yrs 11 mnths 11 days

161 Curlew Sandpiper Calidris ferruginea

041-44138 08,STOCKYARD PT, LANG LANG, WESTERNPORTV 38d22m S 145d32mE 880626 1 U VICTORIAN WADER STUDY GROUP
05 13 01,BEACHES CRAB CK RD ROEBUCK BAY BRO 18d0m S 122d22mE 940911 +3 U AUSTRALASIAN WADER STUDY GROUP
Distance: 3188 km Direction: 309 degs. Time elapsed: 6 yrs 2 mnths 16 days

041-59524 05,YALLOCK CREEK NEAR KOOWEERUPVIC 38d13m S 145d28mE 901007 +3 U VICTORIAN WADER STUDY GROUP
05 13 01,BEACHES CRAB CK RD ROEBUCK BAY BRO 18d0m S 122d22mE 940911 U U AUSTRALASIAN WADER STUDY GROUP
Distance: 3173 km Direction: 309 degs. Time elapsed: 3 yrs 11 mnths 4 days

041-82139 NB,NORTH END OF NUDGEE BEACH BRISBANEQLD 27d20m S 153d5m E 930904 +1 U QLD WADER STUDY GROUP
05 13 03,INVERLOCH (ANDERSONS INLET & PT. SMYT 38d37m S 145d45mE 941126 +2 U VICTORIAN WADER STUDY GROUP
Distance: 1427 km Direction: 207 degs. Time elapsed: 1 yrs 2 mnths 22 days

UNK-00227 01,YANA DELTA, NE SIBERIA, RUSSIA 72d21m N 140d15mE 940805 J U LINDSTROM
46 26 X6,SHIPWRECK POINT PERKINS ISLANDTAS 40d45m S 145d2m E 941030 U U PLOWRIGHT
Distance: 12579 k Direction: 176 degs. Time elapsed: 0 yrs 2 mnths 25 days

162 Red-necked Stint Calidris ruficollis

032-53117 01,BEACHES CRAB CK RD ROEBUCK BAY BRO 18d0m S 122d22mE 920901 2 U AUSTRALASIAN WADER STUDY GROUP
68 04 6F,DE VRIES PENINSULA, VLADIVOSTOK 43d10m N 132d30mE 940829 U U TOMKOVICH
Distance: 6878 km Direction: 8 degs. Time elapsed: 1 yrs 11 mnths 28 days

033-76414 06,BARRY BEACH CORNER INLETVIC 38d42m S 146d23mE 910518 1 U VICTORIAN WADER STUDY GROUP
68 04 5F,USSURI BAY NEAR VLADIVOSTOK RUSSIA 43d10m N 132d30mE 940730 U U TOMKOVICH
Distance: 9208 km Direction: 350 degs. Time elapsed: 3 yrs 2 mnths 12 days

034-55063 05,YALLOCK CREEK NEAR KOOWEERUPVIC 38d13m S 145d28mE 921213 +2 U VICTORIAN WADER STUDY GROUP
05 13 01,BEACHES CRAB CK RD ROEBUCK BAY BRO 18d0m S 122d22mE 940906 U U AUSTRALASIAN WADER STUDY GROUP
Distance: 3173 km Direction: 309 degs. Time elapsed: 1 yrs 8 mnths 24 days

034-55664 08,STOCKYARD PT, LANG LANG, WESTERNPORTV 38d22m S 145d32mE 930102 +2 U VICTORIAN WADER STUDY GROUP
05 13 01,BEACHES CRAB CK RD ROEBUCK BAY BRO 18d0m S 122d22mE 940430 +2 U AUSTRALASIAN WADER STUDY GROUP
Distance: 3188 km Direction: 309 degs. Time elapsed: 1 yrs 3 mnths 28 days

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164       Red Knot                                 Calidris canutus
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051-15348 01,WERRIBEE SEWERAGE FARM (SPIT, PT WILS 38d5m  S 144d31mE 870118   1    U  VICTORIAN WADER STUDY GROUP
05 13     14,JORDANS F SE KAIPARA HARBOUR NEW ZEAL 36d34m S 174d26mE 941218   U    U  ZEALAND WADER STUDY GROUP
Distance: 2639 km        Direction: 96 degs.                Time elapsed:   7 yrs 11 mnths 0 days

GXR-81219 03,MAI PO MARSHES HONG KONG              22d29m N 114d2m E 910909   J    U  BTO/RINGING & MIGRATION SECTN
05 13     01,BEACHES CRAB CK RD ROEBUCK BAY BRO    18d0m  S 122d22mE 940911   U    U  AUSTRALASIAN WADER STUDY GROUP
Distance: 4591 km        Direction: 168 degs.               Time elapsed:   3 yrs 0 mnths 2 days


165       Great Knot                               Calidris tenuirostris
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061-45052 PR,SOUTH SIDE PRINCESS ROYAL HARBOUR ALB 35d5m  S 117d53mE 910316   +2   U  SMITH
05 13     01,BEACHES CRAB CK RD ROEBUCK BAY BRO    18d0m  S 122d22mE 940906   +3   U  AUSTRALASIAN WADER STUDY GROUP
Distance: 1950 km        Direction: 14 degs.                Time elapsed:   3 yrs 5 mnths 21 days

061-87275 BI,BISHOP IS MOUTH OF BRISBANE RIVERQLD  27d21m S 153d10mE 910303   +1   U  DRISCOLL
21 05     8F,MANILA BAY SEASHORE                   14d30m N 120d58mE 940501   U    U  ABAD
Distance: 5805 km        Direction: 319 degs.               Time elapsed:   3 yrs 1 mnths 28 days

062-09539 BI,BISHOP IS MOUTH OF BRISBANE RIVERQLD  27d21m S 153d10mE 930320   +1   U  DRISCOLL
21 05     8F,MANILA BAY SEASHORE                   14d30m N 120d58mE 940501   U    U  ABAD
Distance: 5805 km        Direction: 319 degs.               Time elapsed:   1 yrs 1 mnths 11 days

062-09854 NB,NORTH END OF NUDGEE BEACH BRISBANEQLD 27d20m S 153d5m E 930503   +1   U  DRISCOLL
21 13     8F,MANILA BAY SEASHORE                   14d30m N 120d58mE 940501   U    U  ABAD
Distance: 5798 km        Direction: 319 degs.               Time elapsed:   0 yrs 11 mnths 28 days

K50-00918 01,SOUTH SIDE OF YONGJONG ISLAND KOREA   37d27m N 126d29mE 931019   2    U  KOREAN BANDING SCHEME
05 13     PR,SOUTH SIDE PRINCESS ROYAL HARBOUR ALB 35d5m  S 117d53mE 940903   2    U  SMITH
Distance: 8112 km        Direction: 187 degs.               Time elapsed:   0 yrs 10 mnths 15 days

SP9-04986 35,BALAGANCHIK R (ANADYR R TRIB) NE SIBE 64d55m N 168d35mE 940622   +3   F  RUSSIAN BANDING SCHEME
48 26     X1,BEACHES CRAB CK RD ROEBUCK BAY BRO    18d0m  S 122d22mE 940909   U    U  BROOME BIRD OBSERVATORY
Distance: 10011 k        Direction: 223 degs.               Time elapsed:   0 yrs 2 mnths 18 days


166       Sanderling                               Calidris alba
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041-60356 23,KILLARNEY BEACHVIC                    38d21m S 142d20mE 910302   +2   U  VICTORIAN WADER STUDY GROUP
05 13     53,BROWN BAY, 15KM E OF PORT MACDONNELLS 38d3m  S 140d50mE 950206   U    U  VICTORIAN WADER STUDY GROUP
Distance: 135 km         Direction: 284 degs.               Time elapsed:   3 yrs 11 mnths 4 days
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ADVICE TO CONTRIBUTORS

The Stilt publishes original papers and short notes on the waders (shorebirds) of the Australasian/East Asian flyway.

Contributions will be accepted in any form. However where possible they should be typed,well spaced with generous margins and on one side of paper only. They may be submitted as either a computer disk and one hard copy or as hard copy only. Disks should preferably be saved as an ASCII file (text only). If an ASCII file cannot be provided the software used should be specified.Disks may be 3" or 5" and must be IBM compatible. For further advice on suitable software contact the Editor.

The style of presentation for *The Stilt* generally follows that given in 'Advice to Contributors in *Emu*. Briefly these are: Tables and figures should be numbered consecutively with Arabic numerals. Each table or figure should be presented on a separate sheet,be as simple as possible and designed to fit the width of a page or column,though exceptionally they may be printed lengthwise. Drawings and diagrams should be in ink or laser printed if by computer generation. Figures should be sized to allow for reduction (or enlargement) by up to 50%.

Scientific names of species and genera should be printed in italics or underlined. They should appear after the first mention of a species by its English name, not enclosed by brackets. Only one of the names need appear thereafter. English names for birds occurring in Australia are those in *The Taxonomy and Species of Birds of Australia and its Territories*, 1994, Christidis, L. and W. Boles, RAOU; for endemic New Zealand species those listed in *Annotated Checklist of the Birds of New Zealand*, 1970; and for South Asian birds not included in the above those given in *A Field Guide to the Birds of South-East Asia*, 1975 and reprints, King, B., M. Woodcock & E. Dickinson. Nomenclature and order of families should be those of *The Taxonomy and Species of Birds of Australia and its Territories*, or as above for New Zealand or South Asia. Where variation occurs in English or scientific names used in the above sources,or a species mentioned is not listed in any of them, the decision on naming will rest with the Editor.

References should be listed at the end of papers with titles of periodicals given in full. For style see those in this issue.

Dates should be written '1 October 1993' except in tables or figures where they may be abbreviated. The 24-hour clock should be used.

Manuscripts should be sent to the Editor, closing dates are 28 February and 31 August.

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Vignettes by Stephen Davidson

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