Status and Conservation of Shorebirds in the East Asian-Australasian Flyway

Proceedings of the Australasian Shorebirds Conference
13-15 December 2003, Canberra, Australia

Edited by Phil Straw

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Foreword

The first Australasian Shorebird Conference (ASC) was held in Brisbane immediately prior to the 6th Conference of the Contracting Parties (COP6) of the Ramsar Convention in 1996. The 1996 ASC provided the impetus for the launch of the East Asian-Australasian Flyway Reserve Network during Ramsar COP6 and proved to be a milestone in shorebird conservation in the Flyway. The first ASC was attended by 145 delegates from 16 countries providing a truly international forum for shorebird conservation in the region. The proceedings from that conference have gone out of print long ago and were unfortunately produced before publications were automatically kept in electronic format.

A second ASC at Phillip Island, Victoria in June 1999 focused on national issues, the third ASC was held in 2000 taking advantage of the fact that the 2nd Southern Hemisphere Ornithological Congress was being held in Brisbane to maximise the number delegates at a combined event. This, the 4th ASC was held immediately after the second Southern Ornithological Congress in Canberra again to take advantage of a combined attendance. This ASC also took advantage of the meeting of the Shorebird Working Group of the East Asian-Australasian Flyway as well as a meeting of Flyway site managers. The success of the ASC is based on the fact that the AWSG is one of the most active specialist groups in the Asia Pacific Region, having worked in close liaison with shorebird specialists throughout the region for close to 25 years.

The decision to produce a comprehensive set of proceedings after a conference cannot be taken lightly. A great deal of work is involved in bringing together the efforts of authors once they have returned home to their invariably busy lifestyles. However it is felt that this conference contributed a wealth of information not previously published that is essential in providing an overview of what is known and, perhaps more importantly, providing a focus on what we do not know and the challenges facing researchers and conservationists in the Asia Pacific Region, in particular the East Asian-Australasian Flyway.

Another consideration in producing this document was the need to satisfy authors that papers would receive widespread exposure, equal to a prestigious internationally circulated journal. This publication satisfies that, in that it has been produced as a special publication of the International Wader Study Group and Wetlands International, and AWSG ensuring that it reaches as wide a circulation as possible among shorebird researchers and conservationists globally. Fortunately, in this case, electronic copies will be available well into the future at minimal cost. These proceedings will be available in time for the 5th ASC to be held in Nelson, New Zealand in December 2005.

Phil Straw
Conference Convenor

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What have we learned from banding and flagging waders in Australia?

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Abstract

More than a quarter of a million waders have been banded in Australia over the last 45 years, 95% being migratory species. Around 126,000 of these have also been colour leg-flagged since this process was introduced in 1990. There have so far been 534 recoveries and 3903 sightings of leg-flagged birds overseas, as well as 150 recoveries and 225 leg-flag sightings in Australia of waders marked overseas. Overseas recovery rates for species varied widely, between 0.03% for Red-necked Stints banded in NW Australia and 1.1% for Red Knot from SE Australia. The average recovery rates for migratory waders banded in these two regions were 0.32% and 0.12% respectively, and 0.21% for Australia as a whole. Overseas flag-sighting rates were on average 30 times higher for birds marked in SE Australia and 5.6 times higher for NW Australia than banding recoveries. Flag-sightings have now been reported from 16 different countries in the Flyway. There is a strong preponderance of flag-sightings in Asia, of birds on northward migration over birds on southward migration. Maps of recoveries and flag-sightings show the marked differences in migration routes and destinations between different species, and even between different populations of the same species. Other knowledge gained from banding activities is briefly outlined, and future priorities discussed.

Introduction

Waders comprise nine percent of the Australian avifauna. Of the 73 species recorded in Australia, 37 are migrants (36 being from the Northern Hemisphere), 17 are vagrants (again, all from the Northern Hemisphere), and 19 are residents (nine being endemic to Australia).

As in many parts of the world intensive studies of waders have lagged behind studies of other groups of birds, especially land birds, seabirds and waterfowl. Systematic widespread population censuses of wader populations in Australia only commenced in 1981. The chicks of some resident species of waders have been banded ever since the inception of bird-banding in Australia in 1953. However large-scale banding of adult waders, especially of the migratory species, only commenced in the 1970s, when mist-nets and cannon-nets were first employed to catch the birds.

This paper concentrates on information that has come out of banding and colour leg-flagging activities via recoveries and re-sightings of colour-marked birds in the last 25 years. Other knowledge (such as biometric and moult data, age data, survival and reproduction rate information) gained during catching and banding operations is only briefly covered.

History

In comparison with many other banding activities, wader banding is very much a team operation. This is partly because of the logistics of handling heavy and bulky catching equipment, often in difficult terrain, but also because, in both mist- and cannon-netting, quite large numbers of birds may be caught at once. To process these birds quickly and collect the maximum amount of data, a large team is needed.

Wader banding activities around Australia have resulted largely from the efforts of a few experienced and enthusiastic individuals who gathered teams together to carry out the fieldwork. These teams have operated at different periods in time and at different locations over the last 45 years. Some programs operated for just a few years whilst others have been sustained over more than 25 years.

The main programs are summarised below:

a) Dom Serventy and Lexie Nichols caught waders on the Swan Estuary, Perth, from 1958 to at least 1961, using walk-in style traps (Serventy *et al. 1962).*
b) Jim Lane continued wader studies on the Swan River using mist-nets from 1972 to 1978. In 1979 the WA Wader Study Group (WAWSG) took over responsibility for wader banding in the Swan River Estuary, later introducing cannon-nets. This activity is continuing under the guidance of Mike Bamford,
c) Fred van Gessell, assisted by others including Bill Lane, commenced cannon-netting and mist-netting waders in New South Wales in 1970, mainly on the Hunter Estuary near Newcastle. These activities have continued intermittently up to the present time. The NSW Wader Study Group was also active in cannon-netting waders from 1991-97, under the leadership of Phil Straw.
d) Wader mist-netting was commenced by David Robertson and others at Werribee Sewage Farm in Victoria in late 1975. These efforts were augmented in late 1978 when Clive Minton introduced large-scale cannon-netting, as developed in Europe. The Victorian Wader Study Group (VWSG) was formally constituted at this time. These activities have been consistently maintained over a 26-year period.
e) The Australasian Wader Studies Group (AWSG) held the first of its expeditions to Northwest Australia (NWA) in 1981. These visits have become almost

annual, covering Roebuck Bay (Broome), 80-Mile Beach, and Port Hedland Saltworks. Since the formation of Broome Bird Observatory (BBO) in 1988, BBO staff and other local enthusiasts have maintained wader banding operations between expeditions and in recent years these have been led by Chris Hassell.

f) Wader banding in the Hobart region, Tasmania, took place for about six years from 1979 to the mid-1980s, mainly employing cannon-nets. Mark Fletcher was the main co-ordinator.

g) Regular small-scale wader banding was commenced by Vic Smith in Albany, southern Western Australia, in 1985 and is continuing. Mist-nets were initially used and were later complemented with cannon-nets.

h) Extensive wader banding activities were carried out by the Queensland Wader Study Group (QWSG) in Moreton Bay, near Brisbane, between 1989 and 1999. Most birds were caught with cannon-nets. These activities terminated when the licensed cannon-netter, Peter Driscoll, became unavailable, then moved away from the area.

i) Attempts over the years to start regular wader banding in the Adelaide area, South Australia, have been unsuccessful. Max Waterman made a couple of good cannon-net catches of Red Knot in the Spencer Gulf in 1981-82, but activities then ceased. However since 1993 the VWSG has made annual visits to the southeast coast of South Australia, mainly to catch Sanderling and Ruddy Turnstone (see Tables 1 and 2 for scientific names). This is continuing, and is now supplemented by cannon-netting carried out by Maureen Christie, who lives in the area.

j) Some wader banding has taken place over the years in the Darwin region, Northern Territory. Occasional mist-netting by a number of people (Tony Hertog, Fred van Gessell) over the years has been augmented by short periods of cannon-netting, organised by Ray Chatto and assisted by visits of experienced people from elsewhere in Australia.

k) The WA Department of Conservation and Land Management carried out a major banding exercise on chicks at a Banded Stilt colony at Lake Ballard in 1995, with Grant Pearson the principal person involved.

Methods

Total numbers of individuals of each species banded in Australia were obtained directly from the groups and individuals (or their publications) involved in wader-banding activities over the last 45 years. This was necessary because some of the banding data submitted to the Australian Bird and Bat Banding Scheme (ABBBS) Office prior to the introduction of computerisation in 1984, have not yet been incorporated into its database. Also, several years of the most recent banding data are not yet incorporated into the database. I estimate that I have gathered at least 98% of the banding data on migratory waders but a smaller proportion of the banding data for resident waders, mainly because many of the latter were marked as chicks by very many individual banders over many years. Where the ABBBS figure for a species exceeds the total obtained from my direct approach to known major wader-banders, the ABBBS total has been used.

All recoveries have been provided by the ABBBS. A recovery is any report of a banded bird that can be identified individually, either by the number on the metal band, by unique colour-markings (e.g. multiple colour bands / leg flags), or by alphanumerically engraved leg flags. Recoveries may be of dead or injured birds, birds recaptured alive by banders away from the site of banding, or birds sighted as colour-marked individuals. Recoveries up to 29 November 2003 are included in this analysis.

The placing of a coloured PVC leg-flag on waders began, in Victoria, in December 1990. Leg-flagging in NW Australia began in August 1992 and leg-flagging has subsequently been introduced in other areas. To co-ordinate the introduction of flagging throughout the East Asian – Australasian Flyway, a Protocol was developed in the late 1990s under the auspices of Wetlands International and the ABBBS. The number of birds flagged each year in Australia, up to the end of 2003, has been collected from each wader-banding group or individual.

Flag-sightings have been gathered from a variety of sources, especially the groups and individuals responsible for the flagging. Since 2001 the AWSG has operated a centralised leg-flagging database on behalf of the ABBBS, with the financial support of the Federal Department of Environment and Heritage (previously Environment Australia). The numbers of birds flagged are provided up to the end of 2003. Flag-sightings (all of which relate to live birds) are provided up to 1 December 2003.

A recovery is a unique event (though very occasionally birds may be recovered more than once) but the number of flag-sighting reports doesn't necessarily equal the number of different flagged birds that have been seen, because a bird carrying a flag cannot be individually identified. For example, at regularly monitored migration stop-over locations, such as Mai-Po Marshes in Hong Kong, an individual bird may be re-sighted and recorded on a number of different days during its stop-over. Also, when a bird permanently changes its non-breeding area, for example from Victoria to an interstate location such as Moreton Bay or Roebuck Bay, it may be sighted several times over a period of months, or even years. Each sighting on a different day is added to the database as a new record. This potential multiplicity of records for a flagged bird needs to be considered when interpreting sightings data.

There is also potential for duplication of records when several flagged birds are present at a particular locality on the same day, often in the same flock. Many regular observers of flagged birds are skilled at determining the number of individual flagged birds present by using criteria such as the proportion of breeding plumage on the bird, its sex (determined by plumage or size), the position of the metal band, and the position of the flag(s). Duplication of records is more likely when two independent observers see a flagged bird on the same day at the same location. Follow-up discussion with the observers can often resolve this situation.

Results

Banding

The number of waders banded in Australia is shown in Tables 1 and 2. Overall, at least 254,953 migratory waders of 41 species have been banded. I consider that fewer than 2-4,000 banding records of migratory waders (around 1-2%) have been missed from this table. Around 10,698 resident waders, of 14 different species, have been banded. If the higher ABBBS database figures are used, then the minimum number of resident waders banded in Australia is at least 12,422, of 16 species. This figure will also be understated, perhaps by 1-2,000 (8-16%).

The banders and their main banding locations are also detailed in Tables 1 and 2. The VWSG, with 143,931 migratory waders banded, is the largest contributor (56% of the total). The AWSG, through its activities in NW Australia, has marked the greatest diversity - 36 species in a total of 80,381 migratory waders banded (32%). The VWSG has banded 32% of the resident waders, as recorded in Table 2, and is tied with the AWSG on diversity with 10 species.

Recoveries

A total of 534 waders banded in Australia have been recovered overseas (Table 3). A further 150 waders banded overseas have been recovered in Australia (Table 4).

Great Knot (143) have the most recoveries, followed by Bar-tailed Godwit (80), Red Knot (76), Curlew Sandpiper (66), and Red-necked Stint (53). Recoveries encompass 20 different species and have occurred in 16 different countries. By far the greatest proportion were in China (239) but a most valuable 111 recoveries have occurred in Russia (where most species breed), followed by 78 in New Zealand.

Almost half (73) of the overseas-banded birds subsequently recovered in Australia originated in New Zealand. This was an outcome of the intensive co-operative study of the Double-banded Plover (which migrates between these two countries) that was carried out by the VWSG and a range of New Zealand banders over a 10-year period from 1979 to 1988 (Pierce 1999). Sixty-six of the recoveries relate to this species alone.

Recovery rates

There have been 172 recoveries overseas of 11 species of migratory waders banded in SE Australia (Table 5). There have also been 59 controls in SE Australia of waders banded overseas, involving seven species.

Recovery rates ranged from 0.04% for Red-necked Stint to 1.12% for Red Knot. Overall the recovery rates averaged 0.12%, i.e. only one recovery overseas for every 800 birds banded.

No recoveries overseas have yet been reported for the 474 Common Greenshank, 347 Latham's Snipe, 236 Pacific Golden Plover, or 144 Grey Plover banded to the end of 2003 in SE Australia.

There have been 257 overseas recoveries, involving 12 species, of waders banded in NW Australia (Table 6). There have also been 49 controls there, relating to eight species, of waders banded overseas. The average recovery rate is 0.32%, ranging from 0.03% for Red-necked Stint to 0.80% for Great Knot.

No recoveries have yet occurred from the 1,244 Little Curlew, 1,089 Sharp-tailed Sandpiper, 649 Sanderling, 623 Black-tailed Godwit, 409 Lesser Sand Plover, 323 Oriental Plover, 278 Grey Plover, and 174 Common Greenshank banded in NW Australia up to the end of 2003.

Table 7 shows the overseas recovery rates on migratory waders from SEA and NWA in comparison with the rate for Australia as a whole (0.21%), and the rates for the Wash Wader Ringing Group (1.06%) which is the major wader-banding operation in the U.K. A comparison is also shown for Curlew Sandpiper banded in Australia (0.19%) and South Africa (0.13%), and with a similar sized species, the Dunlin (*Calidris alpina*), banded in the U.K (0.65%).

Leg-flagging

Numbers

The numbers of waders colour leg-flagged at the six locations in Australia where this procedure has been employed, appear in Table 8. Altogether 126,221 waders, of 50 different species, have been flagged up to the end of 2003. The largest numbers were flagged in Victoria (64,492), and in NWA (54,461). There is a good species spread, with more than a thousand having been flagged for each of 11 species. The largest total was for Red-necked Stint (just over 51,661), followed by 15,026 Curlew Sandpiper, 11,537 Great Knot, and 10,392 Bar-tailed Godwit.

Sightings

Up until 8 November 2003, there have been 3,569 sightings overseas of waders flagged in Australia (Table 9). Red Knot headed the list with 1,058 flag sightings, followed by Bar-tailed Godwit with 763, and Curlew Sandpiper with 528. So far there have been overseas sightings of 20 different species.

These sightings have occurred in 16 different countries (Tables 9 and 10). The growth in the number of overseas sightings reported annually can be clearly seen and reached a record 841 in 2003. A total of 1,642 sightings (42% of the total) came from New Zealand. Hong Kong produced 893 sightings, followed by Japan with 487 and Korea with 329.

A total of 225 waders flagged overseas have been reported in Australia (Table 11). This included 14 different species, with Grey-tailed Tattler (120 sightings) comprising more than half the total. Japan (143) was the main source of these overseas-flagged waders.

There have also been 1,588 sightings of waders within Australia away from their flagging location (Table 12). Sightings are spread widely through the different regions of Australia but Victoria predominates, with 1,242 flagged birds seen away from their flagging locations.

Table 13 details sightings of Australian-flagged waders in Asia during the migration period. Almost four times as many birds have been sighted during the northward migration (1,572) compared with the southward migration (451). This pattern is repeated in all of the countries where significant numbers of flagged birds have been seen, except for Japan (177 northward, 293 southward).

Sighting rates

The overseas sighting rates for birds from SEA have ranged from 0.38% for Sharp-tailed Sandpiper to 68.8% for Greater Sand Plover (Table 14). The overall average is 3.6%. No overseas sightings have yet resulted from 395 Common Greenshank and 278 Latham's Snipe leg-flagged in SEA.

Overseas sighting rates for birds from NWA are given in Table 15. Rates range from 0.7% for Sharp-tailed Sandpiper and Common Greenshank, to 50% for Common Redshank. The overall average is 1.8%. No overseas sightings have yet been reported from 890 Little Curlew, 256 Whimbrel and 238 Oriental Plover leg-flagged in NWA.

Valuable sightings, both within Australia and overseas, have occurred even when comparatively small numbers of a species have been flagged. Table 16 gives details of these, both for birds flagged in SEA and NWA. The prime example is Greater Sand Plover from SEA with 24 sightings (11 overseas and 13 in Australia), from only 16 individuals flagged. There have been four sightings of Black-tailed Godwit (two overseas and two in Australia), from only three individuals flagged in SEA. Also, the only Pectoral Sandpiper flagged in SEA was seen the next year in New South Wales.

Comparison of recovery and flag-sighting rates:

A comparison of overseas recovery rates and overseas flag-sighting rates for birds from SEA and NWA is shown in Tables 17 and 18. In both regions, and on all species, the flag-sighting rate is higher than the recovery rate.

In SEA overseas flag-sighting rates were on average 30 times higher than the overseas band recovery rate. The difference for individual species ranged from 1.5 times for Double-banded Plover to 371 times for Bar-tailed Godwit.

For NWA the overall proportion was 5.6 times, with a range from 2.4 for the Great Knot to 30 for the Red-necked Stint.

Selected recovery and flag-sighting information:

Tables and maps of recoveries and flag-sightings for a selected range of species are given below to illustrate some of the key migration information derived from banding and flagging activities.

Eastern Curlew

This species, the largest wader in Australia (and the world), has only been banded in modest numbers (1,267) in Australia, because of its extreme wariness and the consequent difficulty in making catches. There have been ten overseas recoveries (Figure 1), and 48 overseas flag-sightings (Figure 2).

Bar-tailed Godwit

Some 16,507 Bar-tailed Godwit have been banded in Australia, with 9,734 in NWA and the majority of the remainder in eastern Australia (Victoria, Queensland, and New South Wales). There have been 80 overseas recoveries and 763 overseas flag-sightings.

Table 19 shows the recoveries which have occurred in Asia during the migration period. Forty-six of these recoveries were of birds banded in NWA. The majority of recoveries were reported during the March-May northward migration season. Only three occurred in the August-September southward migration season, all being of birds from NWA.

Table 20 shows the corresponding data for leg-flag sightings in Asia during the migration periods. Again, reports during the northward migration period (278) dominate, with only 31 in the southward migration period. Furthermore, 30 of the latter relate to yellow-flagged birds from NWA.

All overseas recoveries of Bar-tailed Godwit banded in Australia are plotted on a map (Figure 3). Flag-sightings at Asian migratory stopover locations are also mapped (Figure 4). Flag-sightings on the breeding grounds, or at staging locations close to these, are shown in Figure 5.

Curlew Sandpiper

Figure 6 shows all the breeding location information deriving from catching, banding, and flagging Curlew Sandpiper in Australia (Minton *et al.* 2005a, in press). Also included is similar information from Curlew Sandpiper marked elsewhere in the world, in different flyways. This includes birds marked in, or reported from, India, South Africa, Western Europe, and Arctic Siberia. Of the 27 breeding grounds records, 11 relate to birds from Australia.

Other species

Figures 7 to 12 show maps of recoveries and flag-sightings for a further six species. In this case, recoveries and flag-sightings are plotted on the same map and a line links the origin location with the location of subsequent reports. The species covered are Red-necked Stint, Great Knot, Grey-tailed Tattler, Terek Sandpiper, Sanderling, and Double-banded Plover.

Photographs of flagged birds

With the recent explosion in the use of digital cameras, in conjunction with telescopes (digiscoping) many overseas flag-sighting reports are now accompanied by a photograph of the bird observed. A selection of these appears in Figure 13.

Discussion

Banding:

A striking feature emerging from the banding analysis is the low rate of overseas recoveries. This has resulted in a slow elucidation of migration patterns. The rate is particularly low for the smaller waders (Red-necked Stint, Curlew Sandpiper, Sharp-tailed Sandpiper, and Sanderling) which together account for two-thirds of the migratory waders banded in Australia. A greater proportion of the waders banded in NWA are of medium and large size, and this is the main reason for the overseas recovery rate of birds from there (0.32%) being almost three times higher than for birds from SEA (0.12%). However, even on the larger species of waders, recovery rates are not high, with Eastern Curlew for example only showing a 0.5% overseas recovery rate (of birds banded in SEA), and 0.68% for birds from NWA. Bar-tailed Godwit from NWA have a similar recovery rate (0.67%), but Bar-tailed Godwit from Victoria have an extremely low overseas recovery rate -only 0.07%. The recovery rate of SEA Red Knot (1.12%) is higher than that of NWA Red Knot (0.35%) and this may be a pointer to one reason for the overseas recovery rates of Australian-banded waders being so low. The principal reasons for the low recovery rate are considered to be:

a) It is a much greater distance from banding locations in Australia to "overseas" than for many other countries around the world. For example, it is a minimum of 700km from NWA to the nearest part of Indonesia, and 2,200km to New Zealand, or 3,000km to Papua New Guinea / Irian Jaya, from SEA. It is only 35km from England to France, and the shorter distance to an overseas country is one of the reasons why the Wash Wader Ringing Group has an overseas recovery rate five times higher than Australia.

b) Most of the countries which the waders visit in Asia on northward and southward migration use different languages and different scripts. Many bands may therefore go unreported because the inscriptions on the Australian bands cannot be understood.

c) Many of the habitats visited by waders on migration in Asia or utilised for breeding in Russia, are sparsely settled by humans (e.g. muddy/mangrove estuaries and shores). Preferences for habitats where humans are scarce are also probably the reason why the recovery rate of Sharp-tailed Sandpipers is so low, and why the 1,244 Little Curlew banded in NWA have so far not produced a single overseas recovery (or even a flag-sighting).

d) Dead birds decay rapidly in the warm tropical environment that many waders occupy in Australia and during their migration through Asia. This is in marked contrast to, for example, waders that spend their non-breeding season in the cooler parts of the Northern Hemisphere; there their remains may be preserved for a considerably longer period of time, resulting in many more being washed up and distributed in the debris along shorelines. It is also possible that there are more ground and avian predators and scavengers active along shorelines in the East Asian-Australasian Flyway, further reducing the chances of a banded bird being found by someone.

Overall, the low recovery rate means that the direct return on the investment of time and effort by wader banders is low if measured purely on the number of recoveries. It is interesting that the overseas recovery rate of Curlew Sandpiper banded in South Africa (0.13%) is even lower than that from Australia (0.19%), with almost all of the above possible reasons for low recovery rates being applicable to banded birds from that country too. It is not surprising, therefore, that the advent of colour leg-flagging was enthusiastically seized-upon by wader-banders in Australia, because of the huge increase in the rate of generation of information on movements (see later).

The high number of Great Knot recoveries overseas (143) is mainly the result of the intense hunting pressure in the Yangtze Estuary, near Shanghai, during the 1980s and the first-half of the 1990s. Bar-tailed Godwit were also intensively hunted in the same area, accounting for a significant proportion of the NWA recoveries. Local wader ornithologists were able to collect many of these bands from the hunters and reported them. The ban on hunting waders in China is now more effectively policed and hunting has almost completely ceased. Some of the Chongming Dao hunters are now even employed at migration times to catch waders for Chinese bird-banders on the Yangtze Estuary.

The 76 Red Knot recoveries overseas result largely from banding efforts in New Zealand, through which most of the 43 recoveries there have come. Similarly, almost all the 30 Double-banded Plover recoveries overseas have been live recaptures by banders in New Zealand, where intensive studies on this species were carried out over a long period of time.

The Curlew Sandpiper (66) and Red-necked Stint (53) recoveries were widespread in time and location and have resulted mainly from the large numbers of both species banded regularly each year in Australia over the last 25-30 years.

One of the most valuable features of the 534 overseas recoveries is that 111 of them came from Russia. This is the breeding location for most of the migratory waders that come to Australia and is the ultimate destination of their long migration. Hunting is still carried out widely across Siberia during the short period (late May to July), that waders are present there each year. Many Russian ornithologists have been instrumental in obtaining and reporting some of the bands from hunted birds. As a consequence, there is relatively more information on breeding areas of many species of waders than might be expected from the overall low recovery rates.

China naturally features strongly in the recovery locations (239 out of 534). Almost all wader species spending the non-breeding season in Australia pass through China on northward migration, and many do so also on southward migration. New Zealand features strongly too (78 recoveries) but, as already mentioned, this is mainly the result of the active wader-banding operations in that country, with most recoveries there being live recaptures of just two species.

Most of the 150 overseas-banded waders recovered in Australia are live recaptures by Australian banders. The

special co-operative study between Australia and New Zealand on Double-banded Plover was responsible for 66 of these. Otherwise, the countries and species involved are widely spread. The paucity of wader-banding in China (until very recently) is reflected in only one Chinese-banded wader having ever been recovered in Australia.

Flagging:

The much higher reporting rate of colour leg-flagged birds, compared with banding recoveries, became apparent very quickly after flagging was introduced in Australia in 1990. It is interesting that the overseas flag-sighting rate for waders marked in SE Australia (3.6%) is higher than the rate for birds marked in NW Australia (1.8%). The explanation is possibly that many of the smaller waders (which form the bulk of birds flagged in SEA), when on migration through Asia probably occupy habitats more easily observed by ornithologists. The larger waders, such as the Bar-tailed Godwit and Great Knot which form a higher proportion of the birds flagged in NWA, tend to occupy large open tidal mud-flats where they are less easily approached and viewed.

Flag-sighting rates of birds from SEA are also greatly influenced by the large number of sightings of Red Knot and Bar-tailed Godwit that have moved to New Zealand. It is clear from both recoveries and flag-sightings that there is a major interchange between the populations of both these species on the east coast of Australia and in New Zealand. This particularly results from young birds spending their first austral summer and austral winter in Australia and then moving to New Zealand and adopting it as their principal non-breeding area. With the large, highly skilled and enthusiastic band of wader-watchers in New Zealand (originally located mainly in the Auckland area of North Island but now all over the country including South Island); it is not surprising that so many sightings of leg-flagged birds occur. As many as 25 different Red Knot flagged in Australia have been seen at the one time in a flock in New Zealand. Because the majority of Red Knot that occur in NWA are from a different subspecies (*piersmii* - Tomkovich 2001) to the subspecies (*rogersi*) that forms the main population in eastern Australian and New Zealand, the flag-sighting rate for Red Knot from NWA (3.2%) is an order of magnitude less than that of Red Knot from SEA (36.2%). A similar situation exists, for the same reason, for Bar-tailed Godwit (2.4% menzbieri NWA, versus 26.0% *baueri* SEA).

Sanderling and Grey Plover are two species for which almost all current information on their movements has been derived from flag-sightings (191 and 22 respectively) rather than recoveries (4 and 0). In both species a high proportion of flag-sightings have occurred in Japan. Unusually, in comparison with other species, most Sanderling flag-sightings have been of birds on southward migration, when the Japanese coasts are clearly used extensively as a major stopover location.

Hong Kong has a high profile as a flag-sighting location for birds from both NWA and SEA. Although Curlew Sandpiper and Red-necked Stint flag-sightings predominate (480 and 133 respectively, of a total of 827), a wide variety of species (13) has been seen. The Mai-Po Marshes are intensively watched and, as in New Zealand, a large proportion of the flagged birds that visit them are probably observed. Japan and Korea have produced far more flag-sightings (481 and 329 respectively) than China (111), even though a greater proportion of waders that visit Australia probably use China as their major stopover. The low sighting rate in China probably results from the relative lack of skilled observers, and even suitable optical equipment, compared with Japan and Korea. However, this situation is changing, with active wader studies now occurring at a number of sites along the Chinese coast. Furthermore, there has been a drop-off in sightings reported from Japan and Korea in recent years, partly due to administrative overload in their banding offices. There was also a temporary lull in reports from China in 2003, but this was due to restrictions on the travel of ornithologists because of the SARS epidemic.

Japan has been flagging waders for longer, and in larger numbers, than any country in the Flyway outside Australia. This in part explains why 143 of the 225 overseas-flagged waders seen in Australia have come from Japan. However, another reason for this predominance of Japanese-flagged birds seen in Australia is that many Grey-tailed Tattler have been flagged in Japan and a high proportion of these birds seem to spend their non-breeding season in Queensland. The Moreton Bay area is particularly well covered by skilled wader-watchers and the Grey-tailed Tattlers there tend to occupy habitats and high-tide roosts that facilitate the sighting of flags on birds' legs. A total of 116 of the 143 Japanese birds seen in Australia were Grey-tailed Tattlers. Only four other overseas-flagged Grey-tailed Tattlers have been reported in Australia, all being from Taiwan.

It is interesting that comparatively few New Zealand-flagged Red Knot and Bar-tailed Godwit have been seen in Australia, compared with the huge numbers of both species flagged in Australia that have subsequently been seen in New Zealand. This suggests that only moderate numbers of adults of these species pass through Australia on their migration to/from non-breeding areas in New Zealand. However the discrepancy may result from many New Zealand-bound migrants using remoter areas, such as the Gulf of Carpentaria, as migration stopover sites in Australia. At such locations flagged birds are unlikely to be observed.

The preponderance of overseas flag-sightings on northward migration compared with southward migration, evident in most species and for most countries, mirrors the pattern for banding recoveries. The migratory strategy of most species - to make a long (3-6,000km) non-stop flight for the initial leg of their migration – is the principal reason for this. On northward migration, most depart the northern shores of Australia and make their next landfall on the coasts of China, Taiwan, Korea, and Japan. Bird-observers, wader researchers, and hunters tend to concentrate on these coastal areas during the April-May migration period thus maximising the chance of a flagged bird being observed. On southward migration, adult waders are not so concentrated on these coastal areas. Some probably take off from inland locations, and others depart from the more remote coastal areas in eastern Siberia, for their long overseas flight to Australia. Few seem to stop at intermediate islands/countries. Consequently, the chances of a flagged bird being observed during southward migration are greatly reduced. The exception to this is the Sanderling, for which the coasts of Japan seem to be a more important stopover region on southward migration

than on northward migration. With a good coverage of these areas by Japanese wader-watchers, a higher sighting rate for Sanderling on southward migration has resulted. The extreme example illustrating the overall pattern is that there have been 880 sightings of Australian-flagged waders on northward migration through Hong Kong but only 9 sightings reported there during the southward migration period. In contrast, in Japan the figures are 177 on northward migration, and 293 on southward migration.

Flag-sightings within Australia, but away from the flagging location, have provided a valuable insight into migration routes and strategies used by different species of waders at the commencement of their northward migration and during the latter stages of their southward migration. Nearly 90% of the sightings within Australia are of Victorian- or South Australian-flagged birds. This is because many birds which spend their non-breeding season in southern Australia make stopovers along the north coast of Australia on northward and/or southward migration. Also, on southward migration, quite a number of birds seem to trickle down the east coast rather than making non-stop movements directly across inland areas of the continent. The wide spread of different states in which Victorian- and South Australian-flagged birds have subsequently been seen, indicates that a range of routes are used by different species or even by different individuals of the same species. Many of the birds flagged in Northwest Australia and Queensland that have subsequently been seen elsewhere in Australia, were probably individuals that were flagged while still on migration.

A small number of flag-sightings of a range of species clearly show that some individuals may change their non-breeding areas in Australia from one year to the next. Almost all adult birds are resident at their non-breeding locations in the period between early November and the end of February. Sightings in this period away from southern flagging-locations in Australia are therefore almost certainly of individuals that are not planning to return to their previous non-breeding area. Some individuals appear to have changed their non-breeding location by up to 3,000km.

When leg-flagging was first introduced, consideration was given to flagging only those species that were caught in large numbers. It is now apparent that valuable sightings and information can derive from relatively small numbers of a species being flagged at any particular location. The strongest example relates to Black-tailed Godwit from SE Australia. Four sightings occurred when only two Black-tailed Godwit had been flagged there. The first sighting was on southward migration in Korea on 15 August 2000. The next was just over a month later, on 26 September, in Roebuck Bay, Broome. The following year, an orange-flagged Black-tailed Godwit was seen on northward migration, in late April in the northwest part of the Yellow Sea in China. By 20 September the flagged bird was back again in Broome. It seems likely that this bird had changed its non-breeding area to this region, which has a population of several thousand Black-tailed Godwit, rather than returning to Victoria where the summer non-breeding population is usually not more than 10-20. It is possible that all four sightings were of just one bird.

Comparison of recovery rates and flag-sighting rates:

As explained earlier, recoveries usually relate to a simple report of an individual bird but flag-sighting records will include a number of re-sightings of the same individual. This accounts for some of the difference between overseas flag-sighting and recovery rates, but it is only likely be a small factor. The main cause of the difference is the greater chance of a flagged bird being seen alive in the field than of a banded bird being found dead, killed, or re-captured by another bander.

The most extreme example, of Bar-tailed Godwit banded and flagged in SE Australia, results from two factors. Firstly, the overseas recovery rate, at 0.07%, is atypically low for such a large bird. There is no obvious reason for the overseas recovery rate of Bar-tailed Godwit from SE Australia being an order of magnitude lower than that of Bar-tailed Godwit from NW Australia (0.67%). The other factor is that the large movement of Bar-tailed Godwit from eastern Australia across the Tasman Sea to the well-watched areas of New Zealand results in a flag-sighting rate of 26.0%, exceptionally high even for a species of this size. The flag-sighting rate of Bar-tailed Godwit from NW Australia, few of which move to New Zealand, is only 2.4%. Red Knot show a similar "New Zealand effect" but, in this case, both the recovery rate (due to live re-captures) and the flag-sighting rate are equally affected. Nevertheless, the proportion of the overseas flag-sighting rate to recovery rate for Red Knot from SE Australia is 32.3. For Red Knot from NW Australia, which have only a small link with New Zealand, the proportion is 9.1.

The greatest benefits of leg-flagging (as a means of gathering information on migration routes, stopover sites, and destinations) are realised with the smallest species of waders, whose banding recovery rates are especially low. For Red-necked Stint, the proportion of overseas flag-sighting rates to recovery rates is 18.0 (for birds from SE Australia) and 30.0 (birds from NW Australia). For Curlew Sandpiper the corresponding figures are 21.1 and 22.9. Sanderling from SE Australia show a massive 42.7 proportion. It is not possible to calculate the proportion for NW Australia because there have been no banding recoveries of Sanderling from there, but the overseas flag-sighting rate of 3.8% suggests that a high proportion would be present.

Of the smaller waders, only Sharp-tailed Sandpiper fail to yield a particularly large benefit from flagging, with a proportion of 5.4. The overseas flag-sighting rate of birds from SE Australia is only 0.4% (and 0.7% for birds flagged in NW Australia). The latter is the lowest overseas flag-sighting rate for any species flagged in NW Australia. These low rates are probably because Sharp-tailed Sandpiper tend to inhabit inland marshy areas rather than coastal areas, and in such habitats flagged birds are rather less likely to be observed.

Selected recovery and flag-sighting information:

It is not the intention of this paper to detail for each species the knowledge gained about their migration from banding and flagging, but selected data are presented to illustrate some of the range of migration patterns that have become apparent for waders that visit Australia.

Eastern Curlew visiting Australia appear to breed in a limited area in south-eastern Siberia. Their migration path also appears to be narrow, with their main stopover locations being in south-western Japan and the Korean and Chinese coasts of the Yellow Sea. However some birds take a more westerly path, passing through Taiwan.

Flag-sightings and recoveries of Bar-tailed Godwit have revealed an almost complete dichotomy of birds spending the non-breeding season in NW Australia and eastern Australia. The birds from NW Australia (the *menzbieri* subspecies), migrate to the northern Yakutia region of Siberia to breed and their main stopover region on northward and southward migration is the coast of the Yellow Sea. The *baueri* subspecies from eastern Australia (and New Zealand) go to Alaska to breed. On northward migration they also use the Yellow Sea, and Japan, as stopover locations but on southward migration very few adult *baueri* occur in Asia, with most making a trans-Pacific migration from Alaska directly back to Australia and New Zealand. This is a distance of 10-11,000km and is the longest known non-stop migration of any species in the world. Banding recoveries, and especially leg-flag sightings, have also shown that there is a large interchange of Bar-tailed Godwit populations between eastern Australia and New Zealand.

In most migratory bird species, the populations that spend the non-breeding season in different areas usually migrate back to different breeding areas. This is well-documented in wildfowl, particularly geese (Boyd 2004). Where sufficient data exist for waders (e.g. Red Knot –Piersma and Davidson 1992, Eurasian Oystercatcher – Sitters 2002) the same pattern is apparent, i.e. discrete breeding areas are associated with discrete non-breeding areas.

Curlew Sandpiper do not seem to show such a strong segregation pattern (Underhill 1995). They have widely separated non-breeding populations in Western Africa, South Africa, India, and Australia but banding recoveries and flag-sightings in the breeding areas show a significant overlap in the breeding range of Curlew Sandpiper from these four main non-breeding areas. There is a tendency for those populations that breed furthest west to spend the non-breeding season furthest west, and similarly for eastern breeding/non-breeding area birds, but there is no complete segregation of these populations on the breeding grounds. As a result, no subspecies have been identified for Curlew Sandpiper and there is no marked clinal variation in biometric measurements. In spite of the overlap of breeding areas, so far there have so far been no definite interchanges of Curlew Sandpiper between one flyway and another. A Curlew Sandpiper banded in Victoria on 20 November 1976 and recaptured in southeast India on 29 August 1980, may possibly have changed flyways, but it could have been on its way back to its previous non-breeding area, albeit by a rather circuitous migration route.

The six maps on which all recoveries and flag-sightings for six different species are shown, illustrate the variety of paths taken by different species between Australia and their breeding grounds. The Red-necked Stint passes through Asia on a broad front and also uses stopover locations widely spaced around the Australian coast. The Great Knot migration is more focused on the Yellow Sea, with another important stopover in the southern part of the Sea of Okhotsk in eastern Siberia on southward migration. All the evidence suggests that Great Knot make an 8,000km non-stop flight back to Australia from there.

As mentioned previously, Grey-tailed Tattler spending their non-breeding season in eastern Australia, particularly Queensland, have a particularly strong link with migration stopover locations in Japan. Some Grey-tailed Tattler from NW Australia non-breeding areas also visit Japan, but some also occur further west along the whole length of the Chinese coast, and in Taiwan. Terek Sandpiper, on the other hand, seem to concentrate more on the coasts of the Yellow Sea when on migration, though there are also a number of records linking Australian birds with Japan. The dominance of Japan as a migratory stopover location for Sanderling from all around Australia is very clear. Also apparent from recoveries and flag-sightings, is the tendency for this species to change its non-breeding area quite widely around the coasts of the southern half of Australia.

The Double-banded Plover shows a recovery pattern totally different from all other migratory species of wader in Australia. It is a trans-Tasman migrant, moving between breeding areas in the centre of South Island, New Zealand, and the coasts of eastern and southern Australia (Pierce 1999). It is particularly interesting that only this segment of the Double-banded Plover population breeding in New Zealand makes this migration. Those that breed on lower ground around the coasts of South Island, and those that breed in North Island, remain in New Zealand for the winter.

The movements data presented and discussed in this paper so far may give a falsely optimistic impression of the extent of current knowledge. Huge gaps still exist. There has still not been a single recovery or flag-sighting on, or close to, the breeding grounds of a Red Knot marked in Australia (or New Zealand). The exact breeding areas of Curlew Sandpipers that occur in NW Australia have not been defined as a result of no recoveries of birds from the breeding region (in contrast to 11 from eastern Australia). None of the many Ruddy Turnstone marked in SE Australia have been reported from breeding areas. Only one Sanderling (from NW Australia) has been found in the high arctic. Neither of the Sand Plovers – Greater or Lesser – have had any marked birds reported from the expected breeding locations. Grey Plovers also have only produced flag-sightings at stopover locations in Asia, and there has not yet been a recovery anywhere.

The initial and primary objective of wader-banding in Australia was to develop an understanding of migration patterns; this objective was subsequently supplemented and greatly enhanced by the introduction of colour leg-flagging. Recoveries and flag-sightings of marked birds are the most tangible results of these activities and the ones most easily comprehended by the general public and non-specialists in the wader field. Many other benefits have derived from the additional data collected from birds in the hand and from re-traps of marked birds and much of these data have been published over the last 20 years, with much further analysis and papers in hand. Some key results in these ancillary areas are mentioned briefly below:

a) Measurements of bill length, total head length, wing length, and weight have been gathered on some 65,000 of the birds caught in Victoria, 50,000 of those from NW Australia, and many others from elsewhere. These data have enabled the biometric ranges for each age group and each sex of many species to be defined.
It has also revealed very unequal sex proportionns in some species. This is sometimes associated with the different timing of migration between the sexes. However, in some species, the unequal representation of sexes has occurred throughout the non-breeding season. The extreme example is the Grey Plover where close to 100% of the birds present in Australia are female (VWSG and AWSG data).

b) Weight data have shown that weights vary geographically and temporally during the non-breeding season. The most valuable data on weights relate to accumulation of fat prior to the northward migration departure (Barter and Minton 1998). The strategy of nearly all waders departing Australia seems to be to accumulate enough fat to fuel them for a non-stop journey of 3-6,000km to the Asian mainland coast, or to adjacent areas such as Taiwan and Japan.

c) Data collected on the primary moult have shown when this occurs in the annual cycle. Most species carry out a complete wing-moult at their main non-breeding location. Many first-year birds coming to Australia also carry out a partial, or sometimes a complete, wing-moult in their first year. The pattern and timing of moult in all age groups, particularly immature birds, differs among regions in Australia. Knowledge of the moult for each species is of considerable assistance in accurately aging birds in the hand.

d) Information on the age structure of wader flocks has revealed which age groups do not return to the Northern Hemisphere breeding grounds in the boreal summer. In almost all species, all one-year-old birds remain in Australia. Some then go north to breed for the first time at age two, but others, especially amongst the larger waders, do not go north to breed until they are three, four, or even five years old.

e) Measuring the proportion of first-year birds in banding catches is the best method available for obtaining an index of annual reproduction rates of a wide range of migrant species (see separate paper in this publication – Minton *et al. 2005b).* The reproductive rate is a very important parameter in any long-term study of waders for identifying their conservation problems and needs.

f) Measuring survival rate (or the converse, mortality rate) is important in understanding changes, particularly long-term, in the size of wader populations. To measure survival, birds have to be individually identified, either by the metal band number or by unique colour- or alphanumeric-marking combinations. The latter have only recently been introduced into the Australian wader-banding program and so currently, calculation of survival rates is dependent on the analysis of re-trapped birds. Only one analysis has so far been published on migrant waders in Australia (Double-banded Plover, Barter 1989). However, the volume of re-trap data now available on a number of species is sufficient for comprehensive survival rate analyses to be undertaken. These require quite sophisticated expertise and computer-modelling knowledge but they are the most pressing area for analysis in the voluminous data which have been accumulated on Australian waders.

Conclusions

Much knowledge has been gained during 45 years of wader-banding and 14 years of wader leg-flagging in Australia, and this includes data from the wide variety of studies associated with these activities,. Many preliminary analyses have been undertaken and a wide range of publications have ensued, particularly over the past 20 years. However much more comprehensive data are now available for analysis and an increased effort to produce major publications is now required.

There is also a need for carefully planned, further fieldwork. A key element of this is annual catches of sufficient size, on a range of species and at a variety of locations, to enable ongoing monitoring of reproduction rates (through the percentage of first-year birds), and survival rates. The latter could be calculated through re-traps, or preferably, by recording birds individually identifiable in the field by colour band/flag combinations or alphanumerically-engraved flags. There is also a need for more waders to be caught, banded, and flagged in regions of Australia that have not been adequately covered in the past, e.g. northern Queensland (especially the Gulf of Carpentaria), the Northern Territory, and South Australia. Furthermore, for many of the less numerous or harder to catch species, there is still little known about migration routes and stopover locations; for these species, further catches are necessary.

It is important to fully utilise new tools and techniques which have been developed overseas and which have application to wader studies in Australia. Satellite transmitters have already been used on the large Eastern Curlew (Driscoll and Ueta 2002) and as smaller and lighter versions are developed, it will be possible to use them on other, smaller species of waders. DNA techniques can assist in a variety of ways including sexing (thus aiding interpretation of biometric data) and identifying subspecies (thereby helping movements studies). Stable isotope analyses, using feather or blood samples taken from individuals, have the potential to give a much more detailed insight into the migrations of wader populations than is currently obtainable through banding and flagging. All three techniques have been applied, but need to be further exploited in the future.

Finally, banders need to continue to assist veterinary researchers who are examining the potential for avian-borne diseases entering Australia on migratory birds arriving from overseas. Blood and cloacal samples collected over the last 20 years have shown waders to be relatively 'clean', but with new viruses appearing, monitoring has been increased.

The knowledge already gained through banding and flagging waders in Australia has been a strong foundation for conservation initiatives throughout the Flyway. It is vital that this information base continues to grow, and especially that the monitoring element of fieldwork

programs continues and, preferably, is expanded. With 44% of the wader populations in the world showing major declines (Anon. 2003) it is more vital than ever that banding studies continue to generate information that assists the determination of conservation needs and actions.

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Table 2. Resident Waders Banded in Australia

	STATE	VIC	WA					NSW		TAS	QLD	NT		TOTAL	ABBBS
	Region		NWA	Lake Ballard	Perth	Perth	Albany								Totals
	Bander/s	VWSG	AWSG/BBO/ NWWSG	CALM	WAWSG	Serventy & Nichols	Vic Smith	Fred van Gessell	NSWWSG	BOAT	QWSG	Ray Chatto	Tony Hertog		
	Period	1975-	1981-	1995	1979-	1958-60	1985-	1970-	1991-97	1980-87	1989-99	1995-96	1978-85		
Species	*Scientific name*														
Pied Oystercatcher	*Haematopus longirostris*	2081	205		6					451	164		1	2908	2250
Red-capped Plover	*Charadrius ruficapillus*	631	884		546	108	47	188	86	245	12		7	2754	3124
Banded Stilt	*Cladorhynchus leucocephalus*	151	92	850	23		4							1120	265
Red-necked Avocet	*Recurvirostra novaehollandiae*	312	232		36			287	252					1119	704
Black-winged Stilt	*Himantopus himantopus*	24	409		51			218	205		6		28	941	601
Sooty Oystercatcher	*Haematopus fuliginosus*	638	50							14				702	484
Red-kneed Dotterel	*Erythrogonys cinctus*	135	192		2	1		84	3				9	426	615
Masked Lapwing	*Vanellus miles*	160	99					10	6	62	2		4	343	868
Black-fronted Plover	*Elseyornis melanops*	56	109		6			76	2	44			7	300	283
Hooded Plover	*Thinornis rubricollis*	26			10					24				60	439
Banded Lapwing	*Vanellus tricolor*							3	1	12				16	96
Painted Snipe	*Rostratula benghalensis*		6											6	4
Beach Stone-curlew	*Esacus neglectus*								1			1		2	15
Bush Stone-curlew	*Burhinus grallarius*												1	1	20
Comb-crested Jacana	*Irediparra gallinacea*														136
Inland Dotterel	*Charadrius australis*														13
TOTAL		**4214**	**2278**	**850**	**680**	**109**	**51**	**866**	**556**	**852**	**184**	**1**	**57**	**10698**	**12422***
Species		**10**	**10**	**1**	**8**	**2**	**2**	**7**	**8**	**7**	**4**	**1**	**7**	**14**	**16**
As at Dec. 2003															

ABBBS totals are ex their data bank as at Sept. 2003

* Summation using the higher figure for each species in the two "totals" columns

Table 8. Numbers of Waders Flagged in Australia

State (region): Bander/s: **Flag colour/s:**	**VIC** VWSG **Orange**	**WA (northwest)** AWSG **Yellow**	**QLD** QWSG **Green**	**SA** VWSG **Orange/Yellow**	**WA (southwest)** WAWSG Vic Smith **Yellow/Orange**	**NSW** NSWWSG **Orange/Green**	**TOTAL**
Species							
Latham's Snipe	278			4			282
Pin-tailed Snipe		1					1
Swinhoe's Snipe		5					5
Black-tailed Godwit	3	558					561
Bar-tailed Godwit	1753	6989	1647	3			10392
Little Curlew		890					890
Whimbrel	21	256	94				371
Eastern Curlew	524	137	206				867
Common Redshank		4					4
Marsh Sandpiper	2	95					97
Common Greenshank	395	135					530
Wood Sandpiper		41					41
Terek Sandpiper	10	3739					3749
Common Sandpiper		45					45
Grey-tailed Tattler	5	3703	189	1			3898
Ruddy Turnstone	1454	804	76	802			3136
Asian Dowitcher		95					95
Great Knot	290	10372	874		1		11537
Red Knot	2733	2884	258		1		5876
Sanderling	1488	640		1128			3256
Little Stint	5	1					6
Red-necked Stint	42078	8336		1013	230	4	51661
Long-toed Stint		45					45
Pectoral Sandpiper	1	1					2
Cox's Sandpiper	1						1
Sharp-tailed Sandpiper	3373	599		36			4008
Curlew Sandpiper	9241	5300	247	238			15026
Broad-billed Sandpiper	3	484					487
Ruff		1					1
Red-necked Phalarope		22					22
Painted Snipe		6					6
Pied Oystercatcher		192	79				271
Sooty Oystercatcher		45					45
Black-winged Stilt	6	253					259
Banded Stilt	151						151
Red-necked Avocet	84	133					217
Pacific Golden Plover	64	19		3			86
Grey Plover	75	237			2		314
Little Ringed Plover		1					1
Red-capped Plover	81	514		13			608
Double-banded Plover	282			10			292
Lesser Sand Plover	55	230	72				357
Greater Sand Plover	16	6113	33		1		6163
Oriental Plover		238					238
Black-fronted Dotterel	1	66		3			70
Hooded Plover				1			1
Red-kneed Dotterel	2	74					76
Masked Lapwing	17	72		4			93
Oriental Pratincole		75					75
Australian Pratincole		11					11
TOTAL	**64492**	**54461**	**3775**	**3254**	**235**	**4**	**126221**

Data to end of 2003
VIC total also includes some Sanderling and Ruddy Turnstone flagged orange (only) in S.E. of South Australia prior to April 1999

Table 15. Overseas Sightings of Waders Leg-flagged in N.W. Australia

Species	Number Flagged in N.W. Australia*	No. Flag Sightings Overseas**	Overseas Flag-sighting Rate %
Great Knot	10372	197	1.9
Curlew Sandpiper	5300	172	3.2
Bar-tailed Godwit	6989	167	2.4
Red Knot	2884	91	3.2
Red-necked Stint	8336	72	0.9
Greater Sand Plover	6113	53	0.9
Terek Sandpiper	3739	52	1.4
Grey-tailed Tattler	3703	51	1.4
Sanderling	640	24	3.8
Black-tailed Godwit	558	19	3.4
Broad-billed Sandpiper	484	17	3.5
Eastern Curlew	137	7	5.1
Ruddy Turnstone	804	7	0.9
Sharp-tailed Sandpiper	599	4	0.7
Grey Plover	237	3	1.3
Lesser Sand Plover	230	2	0.9
Common Redshank	4	2	50.0
Asian Dowitcher	95	1	1.1
Common Greenshank	135	1	0.7
Other species (migratory only)	1736		
TOTAL	**53095**	**942**	**1.8**

*to end 2003
**to 01/12/2003

Table 16. Sightings of Species where few have been Flagged

Victoria	No. Flagged	No. Resighted	Locations of Sightings (No. of re-sightings)
Red-necked Avocet	84	7	NSW (2), elsewhere in VIC (5)
Grey Plover	75	20	Japan (18), Korea (1), elsewhere in VIC (1)
Lesser Sand Plover	55	11	Hong Kong (1), QLD (9), NSW (1)
Greater Sand Plover	16	24	Hong Kong (9), Vietnam (1), Taiwan (1), QLD (12), NSW (1)
Terek Sandpiper	10	5	Korea (3), Hong Kong (1), QLD (1)
Grey-tailed Tattler	5	4	QLD (4)
Broad-billed Sandpiper	3	2	Taiwan (1), elsewhere in VIC (1)
Black-tailed Godwit	3	4	Korea (1), China (1), WA (2)
Pectoral Sandpiper	1	1	NSW (1)
Northwest Australia	**No. Flagged**	**No. Resighted**	**Locations of Sightings (No. of re-sightings)**
Black-winged Stilt	253	1	Perth – 2000km away (1)
Eastern Curlew	137	6	Korea (6)
Common Greenshank	135	1	Hong Kong (1)
Asian Dowitcher	95	1	Taiwan (1)
Common Sandpiper	45	1	Singapore (1)
Common Redshank	4	2	Hong Kong (2)

Data to Dec. 2003