

ABSTRACTS

AUSTRALASIAN WADER STUDIES GROUP CONFERENCE

PHILLIP ISLAND, VICTORIA. 12 TO 13TH JUNE 1999

Compiled by

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Following the success of the first Australasian Wader Studies Group Conference in 1996 in Brisbane, Queensland, Australia, the second conference was held at Banfields Conference Centre, Cowes, Phillip Island, Victoria, Australia from the 12 to 13th June 1999. Over 70 delegates from Australia and New Zealand attended with participants from all states represented apart from South Australia and the Northern Territory. Abstracts of the twenty-seven papers and five posters dealing with a wide range of wader biology are given below.

The organisers would like to take this opportunity to thank the committee members of the AWSG for their support and their presence during the conference. In particular Phil Straw and Jim Wilson for their numerous phone calls. The organisers also thank the Phillip Island Nature Park Board of Management for their assistance in providing access to e-mail and computer facilities, stationary and photocopying and numerous other aspects that helped to make the conference run smoothly. The Phillip Island Nature Park also sponsored visits by delegates and their families to the Penguin Parade, Koala Conservation Centre and Churchill Island. Finally we would like to thank all the people who attended the conference without whose support the conference would not have been as enjoyable or as worthwhile.

MAPPING BUSH STONE-CURLEW HABITAT
PREFERENCES AROUND TOWNSVILLE,
NORTH QUEENSLAND 1998-2000

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The non-migratory Bush Stone-curlew *Burhinus grallarius*, is present in reduced numbers across much of its former range. In coastal north Queensland it is still relatively common and readily found close to urban areas. A Geographic Information System (GIS) was used to establish the presence or absence of the bird across the urban landscape based upon 40 sites generated by a random number system. These sites were categorized on land use and land management, vegetation cover, drainage patterns and disturbance factors and compared to 40 sites where birds occurred. Seasonal factors governing the movements of the Bush Stone-curlew within and between suitable habitat are also monitored. This will help identify habitat preferences and generate base-line data on the local population.

BREEDING BIOLOGY OF HOODED PLOVERS
ON PHILLIP ISLAND AND METHODS OF
INCREASING BREEDING SUCCESS

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The breeding biology of Hooded Plovers *Thinornis rubricollis* was studied on Phillip Island in Victoria between 1993-99. Breeding extended from August to March and usually peaked in December or January. A total of 27 breeding sites on 17 beaches were used and the types of nesting site were flat beaches (43%), stony terraces (33%) and ledges on eroding dunes (24%). Forty-four percent of breeding attempts occurred on only three of the beaches on the island.

The mean clutch size was 2.4 and hatching success was 17%. Predation by dogs and foxes, inundation by storm tides and trampling by sheep were the major causes of egg failure. Fledging success was 0.18 chicks per clutch and predation by dogs and foxes seemed the main cause of chick mortality.

In 1995, we started an experiment to determine if excluding predators and stock from nest sites would improve hatching success and have a corresponding effect on overall breeding success. We tested three types of exclosures and have developed what we believe to be an optimal design for excluding predators and stock as well as permitting access by the birds.

Twenty exclosures have been deployed to date and hatching success has been substantially increased as a result. So far overall breeding success has not been improved by the deployment of cages but the combination of the cages, improved enforcement of dog regulations and a dedicated team of volunteers has improved the plovers' breeding success substantially.

DIFFERENTIAL ORGAN REDUCTION DURING BIRD MIGRATION

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The 'aircraft refuelling paradigm', stating that migratory birds build up and deplete only their fat stores before and during long-distance flights, remained largely uncontested from its proposal in 1964. Recent work has demonstrated substantial changes in organ sizes before departure, but only one study has attempted to determine whether organs are broken down during flight.

To investigate changes in organ size and fat content in migratory birds, we studied Great Knots *Calidris tenuirostris* before and after a non-stop flight of 5,400 km from north-west Australia to coastal China. On average, birds lost 85% of the stored fat. They also lost 16% of lean tissue mass, with significant decreases in pectoral muscles, skin, intestine, liver, kidneys, salt glands and the remainder of the carcass. All other organs except the brain showed the same directional change. Reduction of functional components is reflected in a 46% decrease in basal metabolic rate. Organ reductions free nutrients for use

in flight, but also decrease the mass carried aloft. For long trans-oceanic flights such organ savings may be imperative. The implications of these findings for the latest models of fuel use in migrating birds will be discussed.

THE MOVEMENTS OF PIED OYSTERCATCHERS FROM WINTERING SITES IN VICTORIA

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In order to understand the biology of Oystercatchers in south eastern Australia Pied and Sooty Oystercatchers have been individually colour banded since 1989 by the Victorian Wader Study Group. Birds are caught at traditional winter roosts using cannon-nets, banded with stainless steel bands supplied by the Australian Bird and Bat Banding Schemes and colour banded with spiral darvic rings. The first phase of the study is looking at movements of individual birds. Individual colour banding is an essential element of the study and allows the movements of different age classes from different winter roosting sites to be followed.

In the past it has been assumed that individuals return to favoured wintering areas and that generally birds are 'site faithful' to that area. It has also been assumed that Oystercatchers are not 'long distance travellers'. This study shows that both these assumptions are incorrect. With the help of individuals and bird club members, over 4000 resighting have been gathered and the preliminary analysis of this data is presented.

FEEDING ECOLOGY OF EASTERN CURLEW IN WESTERN PORT BAY, VICTORIA

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Eastern Curlew are conspicuously sexually dimorphic in bill length and have the longest bills of all the curlew species. It has been speculated that the functions of both these attributes are related to habitat and sexual selection on the breeding grounds or to mechanisms of resource partitioning on the non-

breeding grounds. In this study, the foraging ecology of curlews was examined at Rhyll Inlet on Phillip Island for three years. Their diet was determined from observations of feeding birds, regurgitated pellets and prey remains. The curlews foraged largely on burrowing intertidal crabs and shrimps and showed both territorial and non-territorial patterns of dispersion while feeding. Territorial behaviour was related to habitat use and sex. Females were much more territorial than males. Both bill length and bill length dimorphism appeared to be related to feeding habitats during the non-breeding period.

Prey selection and habitat preferences were examined in relation to their profitability in terms of energy intake. The profitability of the frequented habitats varied and curlews were found to be more territorial in the more profitable ones. These preferred habitats were limited in size and prone to be rendered unusable by environmental conditions. The foraging of curlews appeared to be consistent with the theory that the net rate of energy intake was being maximised.

MANAGING A BREEDING POPULATION OF HOODED PLOVERS *THINORNIS RUBRICOLLIS* IN A HIGH USE NATIONAL PARK

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The Mornington Peninsula National Park is located 70 km south east of Melbourne and has an estimated 2.5 million visitor days annually. A breeding population of Hooded Plovers coexists with recreational users of the Park, which include walkers, surfers, swimmers, fishermen and dog walkers. In 1991, Parks Victoria, with assistance from a volunteer group 'The Friends of the Hooded Plover', commenced a monitoring program of the Hooded Plovers within the Park to determine if the Hooded Plover population was stable. The program also monitored breeding success and identified causes of breeding failure. Since 1991, The Friends have conducted 164 surveys along 24 km of ocean beaches to monitor the adult population. Two hundred and eleven clutches were monitored to determine clutch fate and fledging success. The information gathered during monitoring is used by Parks Victoria to implement management to protect breeding sites and increase fledging success.

Breeding success increased after the introduction of holistic management to breeding sites along the ocean beaches. In the five breeding seasons from 1991/92

to 1995/96 a total of 12 Hooded Plover juveniles survived to fledge. In the three breeding seasons from 1996/97 to 1998/99 a total of 31 juveniles survived to fledge, a 158% increase in breeding success. The adult Hooded Plover population increased by 30% from an average of 33 adult Hooded Plovers in the Park in the 1991/92 survey year, to an average of 43 adult Hooded Plover in the 1998/99 survey year. Colour banding of juveniles fledged from the Park identified a number remained within the Park to breed in subsequent breeding seasons.

Management introduced by Parks Victoria aimed to decrease nest trampling and decrease disturbance by Park visitors in breeding areas. Management actions included fencing walking tracks from car parks to the beaches and closing informal tracks. A small number of beaches with breeding Hooded Plovers have been temporarily closed to the public using signs and regular ranger patrols. Restricted access for dogs and diligent enforcement of dog regulations by parks staff have limited the influence of dogs on the birds. In conjunction with these management action, a community awareness program has been under taken. Posters and brochures have been provided to park visitors to assist them to identify Hooded Plovers and to understand management objectives. 'Friends of the Hooded Plover' talk to park visitors while conducting surveys and undertaking nest monitoring work. Excellent media coverage of the program has resulted in two television segments being broadcast and regular newspaper articles in the Melbourne and the local papers.

THE PLIGHT OF WADERS AROUND THE MOUTH OF THE BRISBANE RIVER. HOW BRIGHT IS THE FUTURE ?

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There is massive development of seaport and airport facilities at the mouth of the Brisbane River, yet about a fifth of the waders in Moreton Bay (8,000), occur within 12 kilometres of the River mouth. There is a high of diversity of wader species and feeding habitats in the area, but the birds are threatened by a scarcity of roosting sites. Since intensive monitoring of wader numbers began in 1992, Black-tailed Godwit, Bar-tailed Godwit and Great Knot have shown statistically significant declines in numbers around the mouth of the river. Grey-tailed Tattler and Pacific Golden Plover appear to have increased over the same period. In such a highly-impacted environment, there may be

many reasons for local population changes but "cleaner" sewage discharge from the mouth of the Brisbane River appears to have had major consequences. Local radio-tracking of ten species has shown their movements vary greatly, but have helped clarify appropriate management options.

HOW SHOULD WE VIEW THE GULF OF CARPENTARIA FOR WADERS? RESULTS FROM AN ONGOING SURVEY

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After the second year of a three study on waders in the south east Gulf of Carpentaria, it is still unclear why fewer birds, notably Black-tailed Godwit, are using the area than was the case ten years ago.

We are beginning to understand why local bird movements are more complex than elsewhere along the Australian coastline. Does this understanding suggest reasons for long term changes in numbers? For some species, is the Gulf a regular and reliable overwintering site and for others variable, at times unacceptable or second best, or at times ideal? Perhaps to understand monsoonal coastal habitats of the Gulf we must reflect upon inland Australia.

THE LOW TIDE DISTRIBUTION OF EASTERN CURLEW AT FEEDING GROUNDS IN MORETONBAY

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In order to identify and protect key feeding habitats of declining shorebirds, it is crucial to first develop an understanding of what types of intertidal environment are being utilised by the birds on their feeding grounds. We assessed the Eastern Curlew's use of feeding grounds in Moreton Bay by conducting low tide surveys in November 1998 and in January 1999. A total of 160 sites consisting of tidal flats of varying characteristics (eg. size, substrate, topography) were surveyed. A substantial proportion of Moreton Bay was covered, spanning a north-south distance of approximately 115 km, from the top end of Pumistone

Passage to the southern Moreton Bay islands. Data were collected by 51 skilled volunteers who counted the number of curlew within each site, during two days within each month. All site locations were predetermined on the basis of accessibility and coverage of the bay, and the sites varied in area from 0.44 to 310.75 ha. A site typically comprised a section of flat from high water to low water, or a sandbank or collection of banks.

The results from this survey provide the most comprehensive count of Eastern Curlew on their feeding grounds ever completed. There were 2388 and 2357 birds on 28-29 November 1998, 2216, and 2067 curlew counted on 30-31 January 1999 respectively. Curlew numbers at individual sites varied from zero to 160 with heterogeneity of flat area accounting for some of this variation. The relative numbers of curlew across different flats corresponded closely. There was a strong and significant correlation, across sites, between the counts on day 1 and day 2 in both November (Pearson's $r=0.93$) and January ($r=0.89$), and between the average number of curlew counted in November and January ($r=0.92$). This constancy of curlew numbers across sites may occur for several reasons, including the possibility that they are faithful to particular sites. It also suggests that short surveys can give fairly reliable results. Factors that may underlie the differences in curlew numbers among different sites will be discussed.

OBSERVATIONS OF FEEDING AND ROOSTING BEHAVIOUR OF LITTLE CURLEW *NUMENIUS MINUTUS* OVERWINTERING IN THE NORTH-WEST OF AUSTRALIA

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Most Little Curlew spend their non-breeding season in northern Australia and southern New Guinea. They have been seen on passage in Japan, The Philippines, eastern Indonesia and the Hung He delta in China. No detailed work has been conducted on the behaviour of Little Curlew on their non-breeding grounds.

We studied the feeding and roosting behaviour of Little Curlew in Broome, on Roebuck Plains Station, Anna Plains Station and the Dampier Peninsula in north west Australia.. Most observations of feeding behaviour were made at the Broome Golf course. Birds first arrived from their night time roosts around

05:30 hours, just after sunrise. During October and early November most individuals fed for the first five hours after arrival. As the daytime temperature increased, with the approach of the wet season, feeding periods were interspersed with visits to the nearby water treatment plant for drinking and bathing.

One night time roost was located. Birds first arrived at the roost at about 16:00 hours with the final arrivals about 30 minutes later. On arrival at the roost most birds would preen, and then feed. As the sun set, 18.30 hours, Little Curlew would walk into the long grass fringing the area and sit down. No birds left the roost for over an hour after sunset (viewed with an image intensifier).

THE INFLUENCE OF PAST CLIMATIC CHANGES ON THE EVOLUTION OF ARCTIC BREEDING WADERS (POSTER)

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This study links the present-day distribution of subspecies of four different wader species breeding in the arctic zone to the availability of suitable breeding habitat during the past 250,000 years. The genetic population structure of two of these species, Dunlin *Ca/idris alpina* and Red Knot *Ca/idris canutus*, as revealed by mitochondrial DNA sequence analysis, provides a powerful tool in unraveling the former distribution of these and similar species. Bar-tailed Godwit *Limosa lapponica* and Grey Plover *Pluvialis squataro/a*, occupy similar habitats as Dunlin and Red Knot, respectively, and patterns of subspecies distribution resemble each other. Generally, the breeding ranges of arctic waders were most restricted during warm phases in the earth's climate (interglacials), resulting in population bottlenecks in waders breeding in the high arctic zone. The last one of these occurred during the early Holocene, some 7,000 years ago and severely reduced the size of the world population of Red Knot. When the climate cools all species could spread over larger areas. However, the presence of ice-sheets, covering large areas of land during glacial times, fragmented tundra habitat into disjunct patches (refugia), which resulted in subspecies differentiation in at least those species breeding in the low arctic. Important refugia where distinct genetic groups formed were the North Sea basin, eastern Siberia and Beringia and southeastern USA. In Dunlin, the North Sea group split up into three groups after the last glacial. These are

morphologically distinct, yet so young that they can't be identified using mtDNA.

SEXING THE HOODED PLOVER

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Many of Australia's waders are not sexually dimorphic, making the sexes difficult to identify from each other. Sexing these birds has traditionally involved destructive or intrusive techniques, or relied on field observations of copulating birds. The former techniques are not suitable for threatened species such as the Hooded Plover, and the latter technique has proven very inefficient.

This talk describes the application of a new genetic-based sexing technique to the Hooded Plover. Blood samples were collected in the field and DNA was extracted from the blood and amplified. Over three months of laboratory trials have resulted in the development of a successful method of sexing Hooded Plovers. This technique and its results are presented. Some possible applications of sex-based analyses are discussed for the Hooded Plover, and it is suggested that genetic-based approaches to sexing waders will be the preferred approach in situations where direct field observations of copulations are difficult, and/or where there is a need to sex sexually immature or sexually inactive individuals.

PAINTED SNIPE- A CAUSE FOR CONCERN?

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The Painted Snipe *Rostratu/a bengalensis* is a medium-sized shorebird that inhabits non-tidal freshwater and saline wetlands. In this paper, we aim to review what is known about aspects of the species biology immediately relevant to its taxonomic and conservation status.

Information is presented on the plumage, measurements, anatomical characteristics and behaviour of the Australian and old-world subspecies. The differences described demonstrate that the Australia birds are distinct from their old world counterparts, are almost certainly reproductively

isolated and should be treated as a separate species, whether one follows the biological or phylogenetic species concepts.

Information is also presented on the distribution and abundance of the species. This shows that it tends to occur in the wetlands of south-eastern Australia's major inland river systems and in sub-coastal plains wetlands of south-eastern South Australia and southern and northern Western Australia. Most records in Australia are from the spring, summer and early autumn months. There are few documented winter records and it is not known where they move to at this time of year. Historical data from the Atlas of Australian Birds (since 1800) combined with records since then, suggest that the species has experienced a significant decline in the 1970's and 1980's. Some of the reasons for this are explored. It is recommended that the species status be upgraded from "Insufficiently Known" to "Endangered", to reflect the urgency of its plight.

A QUARTER CENTURY OF WADER COUNTS IN WESTERN PORT (THE BOCA SURVEY)

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The Bird Observers Club of Australia began counting waders and other water birds at high-tide roosts in Western Port as part of an environmental study in 1973. The survey continues and is the longest running of its kind in Australia. All water birds are counted simultaneously by volunteer observers at up to 20 roosts in three to five "seasons" each year. This paper discusses wader numbers from 1973-98. The bay supports over 10,000 waders, and 38 species have been recorded. The bay is a Ramsar site, and survey data were used in its nomination.

The three most numerous waders showed a cyclic pattern of abundance, with no long-term trends. High summer numbers of Red-necked Stints usually followed high winter numbers (reflecting breeding success in the previous Arctic summer). Increased numbers of Curlew Sandpipers wintered in the bay in recent years. Eastern Curlew recovered quickly from a decline in the early 1980s when there was extensive seagrass dieback. At a local level, two of the 20

roosts have been largely abandoned by waders probably because of a loss of seagrass.

Bar-tailed Godwits have increased and Grey-tailed Tattlers decreased over the years. Flocks of Red Knot use the bay irregularly. Pied Oystercatcher numbers increased steadily and have doubled over the last 25 years, breeding mainly on French Island where there are no Red Foxes. Hundreds of Red-necked Avocets now visit the east coast in winter and spring, in contrast to previous years when the species was only a rare vagrant.

AN ARTIFICIAL WETLAND-CHEETHAM WETLANDS, VICTORIA, AUSTRALIA.

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In 1924 the Cheetham Salt Company purchased 1200 acres of land along the western shoreline of Port Phillip Bay. Saltpans, pumping plants and circulation channels were constructed. The first harvesting took place in 1926 and salt production continued up until 1992. The land was eventually sold with the central proportion being transferred to the Victorian government. Today Cheetham wetlands is owned and managed by Parks Victoria. A fragile ecosystem and a noted Ramsar site, Cheetham is home to approximately 200 species of bird.

With the construction of a lagoon system and a maintained water flow, a suitable environment for birds has been constructed. Shallow ponds attract numerous birds to feed on accessible vegetation, insects and larvae. Salinity acts as a coagulant, allowing colloidal particles to settle to the bottom, leaving the water clear and any food in the water column easy to visualise. Due to saline and tidal influences a saltmarsh environment has been created. Wind and water flow have dispersed seed to various sites for germination, this has allowed a variety of plants to be scattered through out the wetlands, compensating for the needs for roosting, wind protection and nest building.

A region suitable for birdlife, Cheetham contains a wide variety of habitats, including: both saline and fresh water; intertidal mud flats; a creek system and beaches and coastal dunes. Vegetation is of great importance to the Cheetham ecosystem and approximately 197 species of plant have been recorded. The area supports some coastal vegetation

communities, which have been completely destroyed in many nearby coastal regions. Due to saltmarshes being defiant against weed invasion and the area being preserved by environmental management, the vegetation of the Cheetham wetland is still relatively intact. This allows the waders to maximise their feeding, breeding, and roosting capabilities.

Cheetham's is a unique and fragile ecosystem. The environmental management of the area, incorporating; water flow; salinity; and prohibition of possible destructive influences, is crucial to the maintenance and sustainability of this wetland system.

ROOST CHOICE IN THE WADERS OF ROEBUCKBAY: IS AVOIDING HEAT STRESS THEIR MAIN CONSIDERATION?

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Heat stress can be damaging or lethal to birds. In this presentation, several lines of evidence will be summarised which suggest that migratory shorebirds are particularly susceptible to heat stress. One of the main reasons for this is that their body composition changes markedly during the period of pre-migratory mass-gain. Their metabolic rate increases as a result of an increase in the lean mass of heat-producing organs. In the same period, their ability to lose heat may be impeded by their development of substantial fat deposits.

The roosting behaviour of shorebirds is currently being studied in Roebuck Bay, tropical north-western Australia. Early indications from this tropical site are that one of the main mechanisms used by shorebirds to avoid heat stress during high tides is roost choice. Shorebirds of Roebuck Bay show a strong preference for roosts where a damp substrate lowers the local temperature. This may have important conservation implications, because in some tide conditions the only roosts where shorebirds can experience a relatively benign microclimate are heavily disturbed beaches where the risk of predation is high.

INTERNATIONAL FRAMEWORKS FOR CONSERVATION OF MIGRATORY WATERBIRDS

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Conservation of migratory shorebirds requires the cooperation of the countries which these species visit. In the Asia Pacific region there is no effective formal multilateral conservation agreement in relation to migratory waterbirds. Nine bilateral agreements, including JAMBA and CAMBA, have provided the only formal basis for international cooperation. While these have been positive influences, they are relatively limited in their scope and in their capacity to foster truly multilateral approaches to migratory waterbird conservation.

The Asia Pacific Migratory Waterbird Conservation Strategy 1996-2000 has provided a valuable but non-binding regional framework. The Strategy has given rise to three Action Plans, including the Shorebird Action Plan to which Australia has committed substantial funding. The Strategy expires at the end of 2000.

Future shorebird conservation requires greater government ownership of shorebird conservation, better monitoring of shorebird populations, heightened public awareness throughout the region of shorebirds and their habitats, strategic, management-focussed research into the ecology of shorebirds, and better resourcing for shorebird conservation activities. Work is underway to develop a post-2000 framework that will incorporate these needs.

THE FORAGING ECOLOGY OF THE HOODED PLOVER IN EASTERN AND WESTERN AUSTRALIA

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The diet and foraging behaviour of the Hooded Plover *Thinornis rubricol/is* is poorly known. This is particularly true of the West Australian populations, at least some of which inhabit salt-lakes. These habitats are very different from the high energy beach environments which are used by Hooded Plovers in the eastern part of their range.

This talk presents preliminary comparisons between the foraging ecologies of eastern and western populations of Hooded Plovers. Data were collected from Lake Gore, south-western Australia, in 1995 and from various Victorian sites between 1994 and 1998. Comparisons of the foraging behaviour and of the diet

of the birds are made. Foraging behaviour was assessed using standardised observation techniques from concealed positions. Diet was determined by faecal analysis, and comparison with suitable reference collections.

HABITAT REMEDIATION- A LAST RESORT?

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With 86% of the Australian human population living in coastal regions, loss of wader habitat has been inevitable. An example is Botany Bay where about 900 ha of wetland habitat had been lost by 1950. Since then habitat loss has continued with the expansion of Sydney Airport, the construction of Port Botany. Other sites in NSW include the Hunter River estuary with the loss of a major part of Kooragang Island and estuary foreshores to industrial development. Similar situations exist near other major population centres around Australia.

There is an assumption by many people (especially developers and politicians) that waders will simply move "somewhere else" when wader feeding habitat is lost to development. If, despite all protests, wader habitat is to be lost, serious consideration should be given to replacing lost habitat with remediated or constructed habitat. However this alternative needs to be considered as early as possible so that sufficient lead-time exists for habitat construction and for the establishment of invertebrate populations on which the waders feed. This means that potential threats to wader habitat need to be identified as early as possible.

Wader feeding habitat has been created in the past in Australia, though largely accidental or incidental to other activities. I am referring to areas such as Port Headland Saltworks, the Tullakool salt evaporation ponds and Werribee sewage treatment works. However until now, purpose built wader habitats have been almost non-existent.

Fortunately, the attitude of some government agencies in NSW is moving towards a "no net loss" attitude towards habitat remediation during development. This means the creation of at least the same amount of habitat, of similar quality, to that which will be lost during development. Several major projects are currently under way in NSW to reverse losses of wetland habitat.

The design and construction of compensatory wader habitat must, wherever possible, result in a maintenance free system so that ongoing resources, which can rarely be guaranteed, do not have to be sought. For example, several successfully constructed sites have failed in the long term due to weed invasion and erosion.

Replacement might be second best to protecting original habitat, but if protection fails and habitat compensation has not been considered, we are faced with a "net loss". In some situations "moving" habitat to a less disturbed area can be of additional benefit to waders.

HOW WILL WADERS BENEFIT FROM THE NEW ATLAS OF AUSTRALIAN BIRDS?

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The work done by the various wader study groups in Australia has done much to identify migration routes, staging areas and over-wintering grounds of a large proportion of the waders using the East Asian-Australasian Flyway. We now have fairly good data on where the majority of migratory waders go during their stay in Australia. We are also finding out some interesting things about non-migratory waders, such as the phenomenal breeding events of the Banded Stilt due to the efforts of a few energetic individuals.

What we still need to know is which wetlands of the interior of Australia are important for migratory and non-migratory waders. We also need to identify many of the smaller coastal sites used by migratory waders which, collectively, account for thousands of birds. Information on the presence of waders, with the exception of some of the larger concentrations of birds, has been rather scant over the years due to the lack of observers able to identify and count these species. The data being collected by "Atlassers" will be available for analysis by members of the AWSG or Birds Australia and will provide us with much needed data on which important wader sites need protecting.

An example of a very successful, although much smaller, project is the Murray-Darling Waterbird Project where count data was obtained using volunteer observers over a three-year period providing some interesting results. In all, 26 sites of national importance and 19 sites of international importance for waders in the flyway were included in the survey.

Of these 20 sites of national importance and 14 sites of international importance had not been previously known. What can we find out with many more observers?

THE RESPONSE OF FORAGING WADERS TO HUMAN RECREATION DISTURBANCE AT RHYLL, PHILLIP ISLAND, VICTORIA

Iain R. Taylor and Adam Bester

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Australian wetlands support estimated minima of 1.1 million resident and 2 million migratory waders, the great majority of which occur in coastal areas which are increasingly threatened by habitat loss from development, reclamation, pollution and by disturbance from human recreation activities. There have been no quantitative studies of the impact of recreation activities on waders in Australia but research in Europe and North America has demonstrated serious negative impacts of some activities on some species, suggesting the need to develop management guidelines for particularly important habitats and species.

From November 1997 to March 1998 we examined the responses of a range of foraging wader species to the three main recreation activities at Rhyll: walking, dog-walking and bait digging. We quantified the distances at which birds stopped feeding, whether they ran or flew from the source of disturbance, the distances at which they took flight and the distances they flew, in response to simulated disturbance under controlled conditions.

The initial response of most individuals was to stop feeding and look at the source of disturbance. Thereafter, some species tended to walk or run away while others tended to take flight. Whimbrel and Eastern Curlew were the most likely to fly off and Masked Lapwing were the least likely to take flight. The mean distances at which birds stopped feeding and the mean distances at which they took flight were significantly positively correlated with body size among different species. Larger species such as Eastern Curlew responded at greater distances than small species such as Red-necked Stint. It is argued that this variation may be related to size differences in energy budgets and the amount of time devoted to foraging and/or to size differences in exposure to human hunting. Smaller species must devote most of their time to foraging and hence may minimise the time spent responding to potential danger, whereas

larger species that have to spend less time collecting food may be able to devote more time to the avoidance of danger. Human hunting also tends to be concentrated on larger species.

The distances to which disturbed birds flew also varied among species with Eastern Curlew and Whimbrel tending to fly farthest and smaller species such as Red-necked Stint flying shorter distances.

Most of the species studied at Rhyll tolerated much closer approaches of humans than did the same or equivalent species in European studies. For example, Eastern Curlews at Rhyll took flight at distances ranging from 30 to 100 m whereas Eurasian Curlews in the Netherlands flew off at distances between 120 and 550 m. Bar-tailed Godwits at Rhyll took off between 10 and 70 m, and in the Netherlands, between 90 and 225 m. The reasons for such differences are discussed.

The conservation implications of disturbance are likely to be of minor significance for the smaller species. However, for species such as Eastern Curlew and Whimbrel it is possible that disturbance may reduce the extent of suitable foraging areas, at least during daytime. The implications of this may depend on the extent to which the birds can compensate by nocturnal feeding.

THE EFFECT OF A CLAM *KATELYSIA* HARVESTING INDUSTRY IN TASMANIA ON A POPULATION OF PIED OYSTERCATCHERS *EMATOPUS LONGIROSTRIS*

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Commercial harvesting of clams *Katelysia* spp for human consumption began on several Tasmanian estuaries around 1987 and the main harvesting area has been Anson's Bay in north east Tasmania. *Katelysia* occur only in sheltered estuaries and bays, in areas that are also important feeding habitats for Pied Oystercatchers such as Anson's Bay. *Katelysia* populations in Anson's Bay showed no sign of recruitment in 1994/95 and little in 1995/96. The size distribution within the population in 1994 indicated a lack of recruitment for a number of years previously. The estimated standing crop of *Katelysia* declined by about 69% between 1994/95 and 1996/97.

The main prey of the Pied Oystercatchers in Anson's in 1993/94 and 1994/95 was *Katelysia* and the birds fed within the main harvesting areas. There were no other bivalve molluscs of equivalent size to serve as alternative prey. Between 1994/95 and 1996/97, the Oystercatcher population declined by 78%. By 1997 the Oystercatchers' diet had switched from 87% to only 9.5% *Katelysia* with the main prey having become the Southern Mud Creeper *Bittium lawleyanum*, a small gastropod mollusc.

It is estimated that the human harvesters, assuming they adhered to their quotas, would have removed approximately 16% of the standing crop of *Katelysia* annually and that the Pied Oystercatcher population would have removed about 22%. Together, these come close to the estimated reduction in standing crop observed over the study period.

It is suggested that the decline in the Pied Oystercatcher population was a result of harvesting in the absence of recruitment to the *Katelysia* population. The results are discussed in relation to the future of *Katelysia* harvesting in Tasmania and elsewhere and to the increasing incidence of human shellfish collecting within Oystercatcher habitats more generally in southern Australia.

SEX-RELATED DIFFERENCES IN THE FORAGING BEHAVIOUR OF BAR-TAILED GODWITS *LIMOSA LAPPONICA* IN NEW SOUTH WALES AUSTRALIA (POSTER)

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Bar-tailed Godwits show considerable sexual size dimorphism: male/female ratios are 0.94 for wing length, 0.76 for bill length, 0.93 for tarsus length and 0.81 for body weight. To test if such morphological differences are related to foraging, the habitat selection and foraging behaviour of male and female Bar-tailed Godwits were compared on the Parramatta estuary, New South Wales from November 1993 to April 1994. The birds could have fed in three types of habitat: shallow water close to the tide edge, exposed

intertidal dry sandy ridges and intertidal wet muddy troughs. Females spent almost all of their time foraging in the water, whereas males spent about 50% of their time foraging in water, 30% on dry ridges and 20% in wet hollows. Females tended to feed in slightly deeper water than males but in neither sex was foraging depth limited by leg lengths. Both sexes fed entirely on polychaete worms and there were no differences in the lengths taken in relation to habitat or sex of the birds. Prey capture rates of females when feeding in water were 41% higher than those of males. Capture rates were significantly lower in the dry ridges and lower still in the wet hollows with no significant differences between the sexes. Associated with their lower overall prey capture rates males spent a higher percentage of the low tide period feeding than did females. Aggressive encounters during foraging were frequent. Those involving females were most often over prey and individuals would run up to 5-7 m to steal them. Encounters involving males were equally over space and food items. Encounters were initiated by females more frequently than expected by chance and encounters also took place along the water's-edge feeding habitat more frequently than expected. Females were dominant over males. It is suggested that males may have been forced to feed in less profitable habitats through the aggressive behaviour of females feeding in the best quality habitat.

THE CARRYING CAPACITY OF WETLANDS FOR SHOREBIRDS: A CASE STUDY OF BLACK-WINGED STILTS *HIMANTOPUS HIMANTOPUS* IN SALINE LAGOONS (POSTER)

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The reclamation of coastal areas for industrial and agricultural purposes continues to accelerate. How will populations of shorebirds respond to this loss of feeding areas? Can higher densities be supported in remaining areas without reducing survival or migratory ability? Could wetlands be managed to support higher densities of shorebirds? At present there are few answers to such questions in the Asia-Pacific region and studies elsewhere are still inconclusive. Extrapolation of studies from the Northern Hemisphere to Australia may be difficult as the birds spend their non-breeding season in the north

under local winter conditions in which the prey neither breed nor grow and where severe weather is an important factor. In Australia migrant waders spend their non-breeding season in the local summer where prey biomass increases rather than depletes as the season progresses.

The central question of interest is the way in which the densities of feeding shorebirds are determined. This question was investigated in a study of Black-winged Stilts foraging in shallow coastal lagoons at Homebush Bay, Sydney, New South Wales. Three lagoons suitable for stilt foraging occurred within 4 km of each other. One lagoon, The Waterbird Refuge was consistently the most profitable feeding site for the birds, assessed by prey densities (chironomid larvae) and by the birds' prey capture rates. The density of feeding stilts was positively correlated with prey density: as prey density on the Waterbird Refuge declined so also did stilt density with birds moving out to the other lagoons. They moved out even when average prey capture rates on the Waterbird Refuge were still higher than on the other lagoons suggesting they may have been forced out rather than simply moving according to the balance of profitabilities of different feeding sites. Fluctuating water depths in the Waterbird Refuge caused changes in the extent of the feeding area there suitable for foraging stilts and as the size of the suitable area increased birds moved into the Refuge from the other lagoons. Thus birds moved into the most profitable lagoon when there was an increase in the feeding area available to them there and *vice versa*.

These observations suggest that the density and numbers of stilts feeding in the preferred area reached ceiling levels depending on the density of prey prevailing at the time and the extent of the suitable foraging space. What were the mechanisms underlying this apparent density limitation? The birds were found to be highly aggressive towards each other when feeding. They engaged in threat posturing, threat calls and overt attacks. When feeding they tended to be evenly spaced. There was a close correlation between spacing and threat call and attack rates. The density of birds may have been limited by their aggressive behaviour towards each other. This study suggests that the carrying capacity of the lagoon habitat was not fixed but was in a state of constant flux as prey densities and water depths changed through time.

THE DISTRIBUTION AND NUMBERS OF HOODED PLOVER AT WILSON'S PROMONTORY NATIONAL PARK

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The state's oldest national park, Wilson's Promontory is not generally recognised as an important site for Hooded Plover *Thinornis rubricollis*. Indeed, the recent edition of the *Victorian Naturalist*, which commemorates the centenary of the park, failed to mention this threatened species. This study summarises the distribution and numbers of Hooded Plover in the park.

The park provides habitat both for breeding and overwintering of a large number of birds. Distribution within the park is not uniform, being biased toward the north-western part. Two hypotheses are suggested to explain this: 1) physiogeographic differences that mean the northern part is more suitable habitat and 2) that pressure from recreationists has reduced the suitability of southern parts. These hypotheses require further investigation.

SHOREBIRD CONSERVATION IN THE EAST-ASIAN AUSTRALASIAN FLYWAY

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Migratory shorebirds are under significant threat, especially due to habitat destruction and human disturbance. Following an international meeting held in 1994, hosted by the Australian and Japanese Governments, a broad ranging strategy was developed to conserve migratory waterbirds in the Asia-Pacific region. The strategy called for the formulation of an Action Plan to identify priority actions for migratory shorebird conservation. The recently developed Shorebird Action Plan focuses on the establishment of a network of well-managed sites of international importance for shorebirds in the East Asian-

Australasian Flyway. The presentation will cover the Strategy and Plan development process, provide an outline of the Plan priority Actions and discuss ways in which Australia can assist with its successful implementation.

EFFECTS OF HUMAN DISTURBANCE ON THE BREEDING OF THE HOODED PLOVER

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It has been suggested that the response of breeding Hooded Plovers to human disturbance is a major threat to the species. This study examined the effects of human disturbance on breeding Hooded Plovers by observing disturbance and the bird's response to it. False eggs were used to measure egg temperature, and concurrent observations allowed us to examine the effect of disturbance on nest thermoregulation. Paris were monitored to determine nest outcome. We found a substantial spatial and temporal overlap between humans and breeding Plovers on beaches. High levels of disturbances resulted in a lower attendance of nests, because the Plovers behavioural response to the presence of humans. We found that nest attendance affected nest thermoregulation. Some data, such as the distribution of abandoned eggs, suggests disturbance could be implicated in at least some nest loss and further research into the relationship is required.

WADER COUNTS ON THE NORTH COAST OF THE YELLOW SEA

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The north coasts of the Yellow Sea were first anticipated in 1997 to be of major importance to migrating waders from Australia although observations on waders were almost entirely lacking. For the first time parts of the north Yellow Sea coasts of China were counted in May 1998 and April to May 1999. Two main areas were counted: the Liadong Wan and the Yalu Jiang. In the Liadong Wan 103,000 waders have been counted, including 10 species of international significance. The most numerous was

Great Knot with possibly 42,000. At Yalu Jiang 151,000 waders were counted in 8 days in 1999, including 8 species of international significance. The most numerous were Bar-tailed Godwit 52,000 and Great Knot 54,000. There were also 20-30% of the estimated world breeding population of Eastern Curlew present. The first flags from Australia and New Zealand have now been found on the north coasts of the Yellow Sea (18). It is possible that the final staging site for at least half of the New Zealand/East Australia Bar-Tailed Godwits was found on the Yalu Jiang. Also it may prove to be the final staging site for New Zealand Red Knots. The mudflats on the N. Korea side of the Yalu River are much more extensive than in China. It is provisionally estimated that about 1,000,000 waders could be using the Yalu River Estuary and adjacent coastlines. It is possibly one of the world's top 10 wader sites. The talk will be illustrated with slides, showing potential threats to the waders.

WADER POPULATION MONITORING IN AUSTRALIA

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The paper documents the purposes of monitoring wader populations and gives a brief review of the history of population monitoring in Australia. Peter Driscoll's report to Environment Australia on the AWSG population monitoring project (PMP), and its recommendations, are reviewed. The author's own ideas are presented on the form a new revised integrated monitoring project should take. The proposed procedures for putting a revised project into action are outlined.