Conservation Advice

Numenius madagascariensis

eastern curlew

Taxonomy

Conventionally accepted as eastern curlew *Numenius madagascariensis* Linnaeus, 1766, Scolopacidae. Other common names include Australian or sea curlew, far eastern curlew and curlew.

Monotypic, no subspecies are recognised (Bamford et al., 2008). Taxonomic uniqueness: medium (22 genera/family, 8 species/genus, 1 subspecies/species; Garnett et al., 2011).

Summary of assessment

Conservation status

Critically endangered: Criterion 1 A2,(a)

Numenius madagascariensis has been found to be eligible for listing under the following listing categories:

Criterion 1: A2 (a): Critically Endangered
Criterion 2: Not eligible
Criterion 3: Not eligible
Criterion 4: Not eligible
Criterion 5: Not eligible

The highest category for which *Numenius madagascariensis* is eligible to be listed is Critically Endangered.

Species can be listed as threatened under state and territory legislation. For information on the listing status of this species under relevant state or territory legislation, see http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Reason for conservation assessment by the Threatened Species Scientific Committee

This advice follows assessment of information provided by a committee nomination based on information provided in the *Action Plan for Australian Birds 2010* (Garnett et al., 2011), and experts from the University of Queensland.

Public Consultation

Notice of the proposed amendment and a consultation document were made available for public comment for 33 business days between 1 October 2014 and 14 November 2014. Any comments received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species Information

Description

The eastern curlew is the largest migratory shorebird in the world, with a long neck, long legs, and a very long downcurved bill. The wingspan is 110 cm and the birds weigh approximately 900 g. The head and neck are dark brown and streaked with darker brown. The chin and throat

are whitish and there is a prominent white eye-ring; the iris is dark brown. The feathers of the upper parts of the body are brown, with blackish centres, and have broad pale rufous or olive-brown edges or notches. The tail is grey-brown with narrow dark banding on the feathers. The underside of the bird is dark brownish-buff, becoming paler on the rear belly. There is fine dark-brown streaking on the fore-neck and breast, which becomes thicker arrow-shaped streaks and barring on the fore-flanks. The upper belly and rear flanks have finer and sparser dark streaking. The underneath of the wing is whitish, but appears darker due to fine dark barring. The bill is dark brown with a pinkish base and the legs and feet are blue-grey.

The female is slightly larger than the male with noticeably longer bill (Higgins & Davies, 1996).

Distribution

Australian distribution

Within Australia, the eastern curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern curlews are rarely recorded inland. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere.

In Victoria, the main strongholds are in Corner Inlet and Western Port Bay, with smaller populations in Port Phillip Bay and scattered elsewhere along the coast. Two thirds of the birds in the Victorian population are female (Nebel et al. 2013); given that the species is monogamous, it is likely there are male-skewed non-breeding populations elsewhere, but sex-ratios have not been studied outside Victoria. Eastern curlews are found on islands in Bass Strait and along the north-west, north-east, east and south- east coasts of Tasmania. In South Australia, the species is scarce between the Victorian border and Cape Jaffa and patchily distributed from the Coorong north-west to the Streaky Bay area, and has previously been recorded in Lake Alexandrina and Lake Albert, South Australia. In southern Western Australia, eastern curlews are recorded from Eyre, and there are scattered records from Stokes Inlet to Peel Inlet. The species is a scarce visitor to Houtman Abrolhos and the adjacent mainland, and is also recorded around Shark Bay. It is also recorded on Norfolk Island and Lord Howe Island (Marchant & Higgins, 1993).

Global distribution

The eastern curlew is endemic to the East Asian – Australasian Flyway. Eastern curlews breed in Russia in southern Ussuriland, the Iman River, scattered through south, west and north Kamchatka, the lower and middle Amur River basin, the Lena River basin, between 110° E and 130° E up to 65° N, and on the Upper Yana River, at 66° N. It also breeds in Mongolia and north-eastern China

The eastern curlew is a common passage migrant in Japan, Republic of Korea, China and Indonesia, and is occasionally recorded moving through Thailand and the Malay Peninsula. During the non-breeding season a few birds occur in southern Republic of Korea, Japan and China. About 25% of the population is thought to winter in the Philippines, Indonesia and Papua New Guinea but most (estimated at 73% or 28 000 individuals) spend the non-breeding season in Australia. Eastern curlews are regular non-breeding visitors to New Zealand in small numbers, and occur rarely on Kermadec Island and the Chatham Islands (Marchant & Higgins, 1993).

Relevant Biology/Ecology

Life history

The generation time is 10.1 years (Garnett et al., 2011).

Data extracted from the Australian Bird and Bat Banding Scheme (ABBBS) reports a longevity record of 19 years, 1 month (Australian Government, 2014).

Breeding

The eastern curlew does not breed in Australia.

Eastern curlews nest in the Northern Hemisphere summer, from early May to late June, often in small colonies of two to three pairs. They nest on small mounds in swampy ground, often near where wild berries are growing. The nest is lined with dry grass and twigs. The birds may delay breeding until three to four years of age (del Hoyo et al., 1996).

General habitat

During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes within the mangroves. The birds are also found in coastal saltworks and sewage farms (Marchant & Higgins, 1993).

Feeding habitat

The eastern curlew mainly forages during the non-breeding season on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The birds are rarely seen on near-coastal lakes or in grassy areas (Marchant & Higgins, 1993).

Roosting habitat

The eastern curlew roosts during high tide periods on sandy spits, sandbars and islets, especially on beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. They occasionally roost on reef-flats, in the shallow water of lagoons and other near-coastal wetlands. Eastern curlews have occasionally been recorded roosting in trees and on the upright stakes of oyster-racks (Marchant & Higgins, 1993). At Roebuck Bay, Western Australia, birds have been recorded flying from their feeding areas on the tidal flats to roost 5 km inland on a flooded supratidal claypan (Collins et al., 2001). In some conditions, shorebirds may choose roost sites where a damp substrate lowers the local temperature. This may have important conservation implications where these sites are heavily disturbed beaches (Rogers, 1999). It may be possible to create artificial roosting sites to replace those destroyed by development (Harding et al., 1999). Eastern curlews typically roost in large flocks, separate from other shorebirds (Marchant & Higgins, 1993).

Feeding

The eastern curlew is carnivorous during the non-breeding season, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects. In studies at Moreton Bay, south-east Qld, three species of intertidal decapod dominated the diet: soldier crabs (*Myctryris longicarpus*), sentinel crabs (*Macrophthalmus crassipes*) and ghost-shrimps (*Trypea australiensis*) (Zharikov and Skilleter 2004). In Victoria, ghost-shrimps are an important part of the diet (Dann 1986, 1987). In Roebuck Bay, Western Australia, the birds feed mainly on large crabs, but will also catch mantis shrimps and chase mudskippers (Rogers, 1999).

The eastern curlew is extremely wary and will take flight at the first sign of danger, long before other nearby shorebirds become nervous. The birds are both diurnal and nocturnal with feeding and roosting cycles determined by the tides. Eastern curlews find the burrows of prey by sight during the day or in bright moonlight, but also locate prey by touch. The sexual differences in bill length lead to corresponding differences in diet and behaviour (Marchant & Higgins, 1993). Eastern curlews usually feed singly or in loose flocks. Occasionally, this species is seen in large feeding flocks of hundreds (Marchant & Higgins, 1993).

Migration patterns

The eastern curlew is migratory. After breeding, they move south for the Northern Hemisphere winter. The birds migrate by day and night at varying altitudes (Marchant & Higgins, 1993).

Departure from breeding grounds

Eastern curlews leave Kamchatka Peninsula (Eastern Russia) from mid-July. There is a weak migration through Ussuriland, Russia, from mid-July to late September and birds pass through Kurile Island and Sakhalin, (Eastern Russia), from mid-July to late August (P.S. Tomkovich pers comm. in Marchant & Higgins, 1993). Fewer birds appear in continental Asia on the southern migration than on the northern migration (Dement'ev & Gladkov, 1951). Eastern curlews are commonly seen in Republic of Korea, Japan and China during August-October. Migration from the Yellow Sea to Australia is usually undertaken in a single direct flight (Minton et al., 2013). There are also records of migrants in Thailand, the Malaysian Peninsular, Singapore, the Philippines, and Borneo (Indonesia), broadly between August and December (Marchant & Higgins, 1993). The birds arrive in north-west and eastern Australia as early as July (Lane, 1987). In north-west Australia, the maximum arrival was recorded between mid-August and the end of August (Minton & Watkins, 1993). At least some birds stopover in northern Australia or Papua New Guinea before moving on to non-breeding grounds in southern Australia (Minton et al. 2013, Lane, 1987), either is a series of short flights or one long flight. Many birds arriving in eastern Australia appear to move down the coast from northern Queensland with influxes occurring on the east coast have suggested a general southward movement until mid-February (Alcorn, 1988); this is presumably dominated by late-arriving juveniles. Records from Toowoomba, Broken Hill and the Murray-Darling region in August and September suggest that some birds move overland (Marchant & Higgins, 1993) and arrival along the east and south-east Australian coasts suggests some fly directly to these areas (Alcorn, 1988). In southern Tasmania, most arrive in late August to early October; later arrivals, probably of juveniles, occur until December (Marchant & Higgins, 1993). When eastern curlews first arrive in south-eastern Tasmania they are found at a number of localities before congregating at Barilla Bay or Orielton Lagoon (BirdLife Tasmania unpubl. data).

Eastern curlews arrive in New Zealand from the second week of August until mid-November with median date mid-October (Marchant & Higgins, 1993). These relatively late arrivals suggest that the small NZ population (<20 birds) is dominated by immatures.

Non-breeding season

During the non-breeding season small numbers of eastern curlew occur in southern Republic of Korea, Japan, China and Taiwan. Unquantified numbers occur in Papua New Guinea, Borneo, and possibly Peninsular Malaysia and the Philippines (Marchant & Higgins, 1993). The majority of the eastern curlew population is found in Australia during the non-breeding season (Bamford et al., 2008), mostly at a few sites on the east and south coasts and in north-western Australia (Lane, 1987). Population numbers are stable at most sites in November or between December-February, indicating little movement during this period (Lane, 1987; Alcorn, 1988). Eastern curlews move locally between high-tide roost-sites and intertidal feeding zones (Marchant & Higgins, 1993).

Return to breeding grounds

In Australia, most eastern curlews leave between late February and March-April (Marchant & Higgins, 1993). The birds depart New Zealand from mid-March to mid-May (Marchant & Higgins, 1993). Satellite-tracking (Driscoll and Ueta 2002) and geolocation studies (Minton et al., 2013) indicate that it is usual for eastern curlew to migrate from south-eastern Australian non-breeding grounds to the northern Yellow Sea in a single flight, but that birds may take additional stops if they encounter poor migration conditions. The species has been recorded on passage in various locations mostly between March and May, arriving at Kamchatka, Russia, during May (Marchant & Higgins, 1993).

Most shorebirds including eastern curlew, spend their first and second austral (southern) winters in Australia, and some or all may also spend their third winter here before undertaking their first northward migration to the breeding grounds (Wilson, 2000). Eastern curlews probably have longer-delayed maturity than any other Australian shorebird, with many individuals not migrating north until their third year and some not migrating north until their fourth (Rogers et al. 2008).

Descriptions of migratory pathways and important sites

Internationally, the Yellow Sea is extremely important as stopover habitat for eastern curlews. It supports about 80% of the estimated flyway population on the northern migration. Counts on southwards migration appear to be lower (Barter 2002) but this probably reflects search effort and timing, given that preliminary geolocator results suggest the same staging sites in the Yellow Sea are used on both southwards and northwards migration (Minton et al., 2013). Relatively few eastern curlews pass through Japan. Thirteen sites of international importance have been identified in the Yellow Sea (six in China, six in Republic of Korea and one in North Korea). Twelve sites are known to be important during the northern migration and seven during the southern migration, with six sites (Dong Sha, Shuangtaizihekou National Nature Reserve, Ganghwa Do, Yeong Jong Do, Mangyeung Gang Hagu and Dongjin Gang Hagu) important during both (Barter, 2002).

Threats

Threats in Australia, especially eastern and southern Australia, include ongoing human disturbance, habitat loss and degradation from pollution, changes to the water regime and invasive plants (Rogers et al., 2006; Australian Government, 2009; Garnett et al., 2011).

Human disturbance can cause shorebirds to interrupt their feeding or roosting and may influence the area of otherwise suitable feeding habitat that is actually used. Disturbance to pre-migratory eastern curlews may adversely affect their capacity to migrate, as the birds will use energy reserves to avoid disturbance, rather than for migration. Eastern curlews take flight when humans approach to within 30–100 metres (Taylor & Bester, 1999), or even up to 250 metres away (Peter, 1990). Coastal development, land reclamation, construction of barrages and stabilisation of water levels can destroy feeding habitat (Close & Newman, 1984). Pollution around settled areas may reduce the availability of food (Close & Newman, 1984).

Formerly, eastern curlews were shot for food in Tasmania (Marchant & Higgins, 1993). The species has been hunted intensively on breeding grounds and at stopover points while on migration (Marchant & Higgins, 1993).

Eastern curlews are threatened by wetland degradation in the Yellow Sea where it stages on migration (Bamford et al., 2008; van de Kam et al., 2010; Murray et al., 2014). Threats along their migratory route include sea level rise, environmental pollution, reduced river flows, human disturbance and reclamation for tidal power plants and barrages, industrial use and urban expansion (Barter, 2002; Kelin and Qiang, 2006; Moores, 2006; Iwamura et al., 2013). Additional threats include disturbance at nesting sites and hunting on the breeding grounds (Barter et al., 1997).

How judged by the Committee in relation to the EPBC Act Criteria and Regulations

Criterion 1. Population size reduction (reduction in total numbers)
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered Very severe reduction	Endangered Severe reduction	Vulnerable Substantial reduction
A1	**≥ 90%**	**≥ 70%**	**≥ 50%**
A2, A3, A4	**≥ 80%**	**≥ 50%**	**≥ 30%**

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

Eligible under Criterion 1 A2 (a) for listing as Critically Endangered

The global population estimate was 38 000 individuals including 28 000 in Australia (Bamford et al., 2008), but numbers have recently declined (Garnett et al., 2011). This population estimate is out of date given the ongoing population declines.

Numbers appear to have declined on Eighty-mile Beach, WA by c.40% between 2000 and 2008, whereas numbers at Roebuck Bay, WA have remained relatively stable (Rogers et al., 2009). At Moreton Bay, QLD they declined by c. 2.4% per year between 1992 and 2008 (Wilson et al., 2011), across the whole of QLD they declined by c. 4.14% between 1992 and 2008 (Fuller et al., 2009), in Victoria by 2.2% per year between 1982 and 2011 (Minton et al., 2012) and in Tasmania by 80% between the 1950s and 2000 (Reid & Park, 2003) and by 40% across 49 Australian sites between 1983 and 2007 (BirdLife Australia *in litt.* 2011). An observation of over 2000 eastern curlews at Mud Islands, Port Phillip Bay in 1953 (Tarr and Launder 1954), *cf* current counts of fewer than 50 birds in Port Phillip Bay, suggests that population declines in eastern curlew may have begun well before regular shorebird counts were initiated in Australia.

An unpublished assessment of the numbers of eastern curlews at roost sites in Tasmania showed decreases of between 55% and 93%, depending on site (Woehler pers. comm., 2014). In the southeast, the decrease was 90% for the period 1964/65 – 2010/11, and in the north, the decrease was 93% between 1973/74 and 2010/11 (Woehler pers. comm., 2014). At both of these sites, and at other roost sites in Tasmania, the decreases have continued, with fewer birds seen in 2014 (Woehler pers. comm., 2014).

There are no clear trends in Japan between 1978 and 2008 (Amano et al., 2010), but this region lies outside the main migration route of eastern curlew.

A subsequent and more detailed assessment by a University of Queensland team (partly funded by the Department of the Environment under an Australian Research Council collaborative grant), puts the species into the critically endangered category (Fuller, pers. comm., 2014). Time series data from directly observed summer counts at a large number of sites across Australia

indicate a severe population decline of 66.8% over 20 years (5.8% per year; Fuller, pers. comm. 2014), and 81.4 % over 30 years which for this species is equal to three generations (Garnett et al., 2011).

In large part, the observed decline in eastern curlew numbers across Australia stems from ongoing loss of intertidal mudflat habitat at key migration staging sites in the Yellow Sea (Murray et al., 2014). As such, qualification under criterion A2 rather than A1 seems warranted. However, threats are also occurring in Australia including coastal development and recreational activities causing disturbance.

The Committee considers that the species has undergone a very severe reduction in numbers over three generation lengths (30 years for this assessment), equivalent to at least 81.4 percent and the reduction has not ceased, the cause has not ceased and is not understood. Therefore, the species has been demonstrated to have met the relevant elements of Criterion 1 to make it eligible for listing as critically endangered.

Criterion 2. Geographic distribution is precarious for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	**Endangered Restricted**	**Vulnerable Limited**
B1. Extent of occurrence (EOO)	**< 100 km²**	**< 5,000 km²**	**< 20,000 km²**
B2. Area of occupancy (AOO)	**< 10 km²**	**< 500 km²**	**< 2,000 km²**
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	**= 1**	**≤ 5**	**≤ 10**
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (number of mature individuals			

Evidence:

Not eligible

The extent of occurrence in Australia is estimated to be 30 000 km^2 (stable) and area occupied 8 500 km^2 (decreasing; Garnett et al., 2011). Therefore, the species has not been demonstrated to have met this required element of this criterion.

Criterion 3. Small population size and decline			
	Critically Endangered Very low	**Endangered Low**	**Vulnerable Limited**
Estimated number of mature individuals	**< 250**	**< 2,500**	**< 10,000**
AND either (C1) or (C2) is true			
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future	**Very high rate 25% in 3 years or 1 generation (whichever is longer)**	**High rate 20% in 5 years or 2 generation (whichever is longer)**	**Substantial rate 10% in 10 years or 3 generations (whichever is longer)**
C2 An observed, estimated, projected or			

	inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	**≤ 50**	**≤ 250**	**≤ 1,000**
	(ii) % of mature individuals in one subpopulation =	**90 – 100%**	**95 – 100%**	**100%**
(b)	Extreme fluctuations in the number of mature individuals			

Evidence:

Not eligible

The number of mature individuals in Australia was estimated at 28 000 in 2008 (Bamford et al., 2008; Garnett et al., 2011), but has declined since. There are no current data available to allow assessment against this criterion. Therefore, the species has not been demonstrated to have met this required element of this criterion.

Criterion 4. Very small population			
	Critically Endangered Extremely low	**Endangered Very Low**	**Vulnerable Low**
Number of mature individuals	**< 50**	**< 250**	**< 1,000**

Evidence:

Not eligible

The total number of mature individuals was estimated at 28 000 in 2008 (Bamford et al., 2008; Garnett et al., 2011), but has declined since. The estimate is not considered extremely low, very low or low. Therefore, the species has not been demonstrated to have met this required element of this criterion.

Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	**Endangered Near future**	**Vulnerable Medium-term future**
Indicating the probability of extinction in the wild to be:	**≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)**	**≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)**	**≥ 10% in 100 years**

Evidence:

Not eligible

Population viability analysis has not been undertaken

Conservation Actions

Recovery Plan

There should not be a recovery plan for this species, as approved conservation advice provides sufficient direction to implement priority actions and mitigate against key threats. Significant management and research is being undertaken at international, state and local levels.

An International Single Species Action Plan will be developed and implemented across the East Asian – Australasian Flyway. Additionally, BirdLife Australia coordinates Australia's national shorebird monitoring program, Shorebirds 2020. This volunteer-based program conducts national shorebird surveys twice per year.

Primary Conservation Objectives

International objectives

1. Achieve a stable or increasing population.
2. Maintain and enhance important habitat.
3. Reduce disturbance at key roosting and feeding sites.

Australian objectives

1. Achieve a stable or increasing population.
2. Maintain and enhance important habitat.
3. Reduce disturbance at key roosting and feeding sites.
4. Raise awareness of eastern curlew within the local community.

Conservation and Management Actions

1. Work with governments along the East Asian – Australasian Flyway to prevent destruction of key migratory staging sites.
2. Develop and implement an International Single Species Action Plan for eastern curlew with all range states.
3. Support initiatives to improve habitat management at key sites.
4. Maintain and improve protection of roosting and feeding sites in Australia.
5. Incorporate requirements for eastern curlews into coastal planning and management.
6. Manage important sites to identify, control and reduce the spread of invasive species.
7. Manage disturbance at important sites when eastern curlews are present – e.g. discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.
8. Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Monitoring priorities

1. Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia

Information and research priorities

1. More precisely assess eastern curlew life history, population size, distribution and ecological requirements particularly across northern Australia.
2. Improve knowledge about dependence of eastern curlew on key migratory staging sites, and wintering sites to the north of Australia.

3. Improve knowledge about threatening processes including the impacts of disturbance and hunting.

Recommendations

(i) The Committee recommends that the list referred to in section 178 of the EPBC Act be amended by **including** in the list in the Critically Endangered category:

Numenius madagascariensis

(ii) The Committee recommends that there should not be a recovery plan for this species.

Threatened Species Scientific Committee

4/3/2015

References cited in the advice

Alcorn, R. (1988). Australasian Wader Study Group Regular Wader Counts Project. Interim report to June 1987: migratory waders. *Stilt* 12, 7-23.

Amano, T., Székely, T., Koyama, K., Amano, H., & Sutherland, W.J. (2010). A framework for monitoring the status of populations: an example from wader populations in the East Asian-Australasian flyway. *Biological Conservation* 143, 2238-2247.

Australian Government, (2009). Draft significant impact guidelines for 36 migratory shorebirds. Draft EPBC Act Policy Statement 3.21, Canberra, ACT: Department of the Environment and Heritage.

Australian Government, (2014). Australian Bird & Bat Banding Scheme Database, accessed 25 July 2014. Department of the Environment, Canberra.

Bamford, M., Watkins, D., Bancroft, W., Tischler, G., & Wahl, J. (2008). *Migratory Shorebirds of the East Asian - Australasian Flyway: Population estimates and internationally important sites*. [Online]. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts, Wetlands International-Oceania. Available from: http://www.environment.gov.au/biodiversity/migratory/publications/shorebirds-east-asia.html.

Barter, M.A. (2002). *Shorebirds of the Yellow Sea: Importance, Threats and Conservation Status. Wetlands International Global Series No. 8, International Wader Studies 12*. Canberra, ACT: Wetlands International.

Barter, M., Fawen, Q., Sixian, T., Xiao, Y., & Tonkinson, D. (1997). Hunting of migratory waders on Chongming Dao: a declining occupation? *Stilt* 31, 19-22.

BirdLife International, (2014). Species factsheet: *Numenius madagascariensis*. Downloaded from http://www.birdlife.org on 23/06/2014. Recommended citation for factsheets for more than one species: BirdLife International (2014) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 23/06/2014.

Blakers, M., S.J.J.F. Davies & Reilly, P.M. (1984). *The Atlas of Australian Birds*. Melbourne, Victoria: Melbourne University Press.

Close, D.H., & Newman, O.M.G. (1984). The decline of the Eastern Curlew in south-eastern Australia. *Emu* 84, 38-40.

Collins, P., Boyle, A., Minton, C., & Jessop, R. (2001). The importance of inland claypans for waders in Roebuck Bay, Broome, NW Australia. *Stilt* 38, 4-8.

Dann, P. (1986). The ecology of birds feeding in intertidal areas in Southern Victoria. PhD Thesis, Department of Zoology, University of Melbourne.

Dann, P. (1987). The feeding behaviour and ecology of shorebirds. Pages 10-20 in B.A. Lane, editor. *Shorebirds in Australia*. Nelson Publishers, Melbourne.

del Hoyo, J., Elliott, A., & Sargatal, J., (eds) (1996). *Handbook of the Birds of the World. Volume 3, Hoatzin to Auks*. Barcelona: Lynx Edicions.

Dement'ev, G.P., & Gladkov, N.A. (eds) (1951). *Birds of the Soviet Union, Volume 3*. Jerusalem: Israel Program for Scientific Translations.

Draffan, R.D.W., Garnett, S.T., Malone, G.J. (1983). Birds of the Torres Strait: an annotated list and biogeographic analysis. *Emu* 83, 207-234.

Driscoll, P.V. & M. Ueta. (2002). The migration route and behaviour of Eastern Curlews *Numenius madagascariensis*. *Ibis* 144, E119-130.

Fuller, R. (2014). Personal communication by email, 14 July 2014. University of Queensland.

Fuller, R.A., Wilson, H.B., Kendall, B.E., & Possingham, H.P. (2009). Monitoring shorebirds using counts by the Queensland Wader Study Group. Report to the Queensland Wader Study Group and the Department of Environment and Resource Management, Melbourne.

Garnett, S.T., Szabo, J.K., & Dutson, G. (2011). *The Action Plan for Australia Birds 2010.* Birds Australia, CSIRO Publishing, Melbourne.

Harding, J., Harding, S., & Driscoll, P. (1999). Empire Point Roost: a purpose built roost site for waders. *Stilt* 34, 46-50.

Higgins, P.J., & Davies, S.J.J.F. (eds) (1996). *Handbook of Australian, New Zealand and Antarctic Birds. Volume Three - Snipe to Pigeons*. Melbourne, Victoria: Oxford University Press.

Iwamura, T., Possingham, H.P., Chadès, I., Minton, C., Murray, N.J., Rogers, D.I., Treml, E.A. & Fuller, R.A. (2013). Migratory connectivity magnifies the consequences of habitat loss from sea-level rise for shorebird populations. *Proceedings of the Royal Society B*, 281: 20130325.

Kelin, C., & Qiang, X. (2006). Conserving migratory shorebirds in the Yellow Sea region. In Waterbirds around the World. (Eds G Boere, C Galbraith and D Stroud) p. 319. The Stationary Office, Edinburgh, UK.

Lane, B.A. (1987). *Shorebirds in Australia*. Sydney, NSW: Reed.

Marchant, S., & Higgins, P.J. (eds). (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2 - Raptors to Lapwings*. Melbourne, Victoria: Oxford University Press.

Minton, C., & Watkins, D. (1993). The 1992 North-west Australia Wader Expedition. *Stilt* 22, 10-12.

Minton, C.D.T., Dann, P., Ewing, A., Jessop, R., Anton, P., & Clemens, R. (2012) Trends of shorebirds in Corner Inlet, Victoria, 1982-2011. *Stilt* 61:3-18.

Minton, C., Gosbell, K., Johns, P. Christie, M., Klaassen, M., Hassel, C., Boyle, A., Jessop, R. & Fox, J. (2013). New insights from geolocators deployed on waders in Australia. *Wader Study Group Bulletin* 120, 37-46.

Moores, N. (2006). South Korea's shorebirds: a review of abundance, distribution, threats and conservation status. *Stilt* 50, 62-72.

Murray, N.J., Clemens, R.S., Phinn, S.R., Possingham, H.P., & Fuller, R.A. (2014). Tracking the rapid loss of tidal wetlands in the Yellow Sea. *Frontiers in Ecology and the Environment.*

Nebel, S., Rogers, K.G., Minton, C.D.T., and Rogers, D.I. (2013). Is geographic variation in the size of Australian shorebirds consistent with hypotheses on differential migration? *Emu* 13, 99-111.

Peter, J.M. (1990). Bird Study in the Nooramunga: The Possible Effects of Oyster Farming. *RAOU Report Series* 74, 1-18.

Reid, T., & Park, P. (2003). Continuing decline of Eastern Curlew, *Numenius madagascariensis*, in Tasmania. *Emu* 103, 279-283.

Rogers, D. (1999). Roost choice in the waders of Roebuck Bay: is avoiding heat stress their main consideration? *Stilt* 35, 65.

Rogers, D., Hassell, C., Oldland, J., Clemens, R., Boyle, A., & Rogers, K. (2009). Monitoring Yellow Sea migrants in Australia (MYSMA): north-western Australian shorebird surveys and workshops, December 2008.

Rogers, D.I, Piersma, T., & Hassell, C.J. (2006). Roost availability may constrain shorebird distribution: exploring the energetic costs of roosting and disturbance around a tropical bay. *Biological Conservation* 133, 225-235.

Rogers, D.I., Minton, C.D.T., Boyle, A.N., Hassell, C.J. & Silcocks, A. (2008). Growing up slowly by the sea-side: Age of first northwards migration of shorebirds from Australian non-breeding grounds'. In D.I., Rogers, *Hidden costs: challenges faced by migratory shorebirds living on intertidal flats*. PhD Thesis, Charles Sturt University.

Tarr, H., & Launder, J. (1954). Bird Observer.

Taylor, I.R., & Bester, A. (1999). The response of foraging waders to human recreation disturbance at Rhyll, Phillip Island, Victoria. *Stilt* 35, 67.

Thomas, D.G. (1968). Waders of Hobart. *Emu* 68, 95-125.

Van de Kam, J., Battley, P.F., McCaffery, B.I., Roger, D.I., Hong, J-S., Moores, N., Ki, J.-Y., Lewis, J., & Piersma, T. (2010). Invisible Connections: Why Migrating Shorebirds Need the Yellow Sea. CSIRO Publishing, Melbourne.

Wilson, J.R. (2000). The northward movement of immature Eastern Curlews in the austral winter as demonstrated by the population monitoring project. *Stilt* 36, 16-19.

Woehler, E. (2014). Personal communication by email, 5 November 2014. Birds Tasmania.