

[1] "*Calidris canutus* — Red Knot, Knot — Glossary SPRAT Profile For information to assist regulatory considerations, refer to Policy Statements and Guidelines, the Conservation Advice, the Listing Advice and/or the Recovery Plan. EPBC Legal Status and Documents Top EPBC Act Listing Status Listed as Endangered (Date effective 05-May-2016) Listed marine Listed migratory - EPBC Act, Bonn, CAMBA, JAMBA, ROKAMBA Under threatened listing assessment, due 30-Oct-2022. Approved Conservation Advice Threatened Species Scientific Committee (2016). Conservation Advice *Calidris canutus* Red knot. Canberra: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/855-conservation-advice-05052016.pdf>. In effect under the EPBC Act from 05-May-2016. Listing Advice Listing assessment information may be available in the approved Conservation Advice Recovery Plan Decision Recovery Plan not required, approved conservation advice provides sufficient direction to implement priority actions and mitigate against key threats. Significant management and research is being undertaken at international, national, state and local levels (2/05/2016). Adopted/Made Recovery Plans There is no adopted or made Recovery Plan for this species Adopted/Made Threat Abatement Plans No Threat Abatement Plan has been identified as being relevant for this species Wildlife Conservation Plans Commonwealth of Australia (2015). Wildlife Conservation Plan for Migratory Shorebirds. Canberra, ACT: Department of the Environment. Available from: <http://www.environment.gov.au/biodiversity/publications/wildlife-conservation-plan-migratory-shorebirds-2016>. In effect under the EPBC Act from 15-Jan-2016. Other Commonwealth Documents Top Other EPBC Act Plans EPBC Act Policy Statement 3.21 - Industry Guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment, 2015) [Admin Guideline]. Policy Statements and Guidelines National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Department of the Environment and Energy, 2020) [Admin Guideline]. Shorebirds - A Vulnerability Assessment for the Great Barrier Reef (Great Barrier Reef Marine Park Authority (GBRMPA), 2011) [Admin Guideline]. Information Sheets Migratory Shorebirds of the East Asian - Australasian Flyway: Population estimates and internationally important sites (Bamford M., D. Watkins, W. Bancroft, G. Tischler & J. Wahl, 2008) [Information Sheet]. Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species (Hansen, B.D., R.A. Fuller, D. Watkins, D.I. Rogers, R.S. Clemens, M. Newman, E.J. Woehler & D.R. Weller, 2016) In effect under the EPBC Act from 29-May-2017. [Information Sheet]. Federal Register of Legislative Instruments Marine: Declaration under section 248 of the Environment Protection and Biodiversity Conservation Act 1999 - List of Marine Species (Commonwealth of Australia, 2000c) [Legislative Instrument] Migratory: List of Migratory Species (13/07/2000) (Commonwealth of Australia, 2000b) [Legislative Instrument] Threatened: Amendment to the lists of threatened species, threatened ecological communities and key threatening processes under sections 178, 181 and 183 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (188) (02/05/2016) (Commonwealth of Australia, 2016g) [Legislative Instrument] Wildlife Conservation Plan: Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2006r) [Legislative Instrument] Wildlife Conservation Plan: Environment Protection and Biodiversity Conservation Act 1999 - Section 285 - Instrument revoking and making a wildlife conservation plan (Commonwealth of Australia, 2016) [Legislative Instrument] State Government Documents and Websites NT: Threatened Species of the Northern Territory - Red Knot, *Calidris canutus* (Ward, S., 2012a) [Information Sheet]. State Listing Status NT: Listed as Vulnerable (Territory Parks and Wildlife Conservation Act 2000 (Northern Territory): 2012 list) QLD: Listed as Endangered (Nature Conservation (Animals) Regulation 2020



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Where available the sections below provide a biological profile for the species. Biological profiles vary in age and content across species, some are no longer being updated and are retained as archival content. These profiles are still displayed as they contain valuable information for many species. The Profile Update section below indicates when the biological profile was last updated for some species. For information to assist regulatory considerations, please refer to Conservation Advice, the Recovery Plan, Policy Statements and Guidelines.

**Australian and State/Territory Government Legal Status**

Western Australia: The two subspecies, *Calidris canutus rogersi* and *C. c. piersmai* are listed as Vulnerable under the Wildlife Conservation Act 1950.

**Taxonomy**

**Top**

**Scientific name:** *Calidris canutus*  
**Common name:** Red Knot  
**Other common names:** Knot, Common Knot, Iceland Sandpiper, East Siberian Sandpiper.

The species is polytypic, meaning more than one subspecies exists. The nominate subspecies *C. c. canutus* breeds on the Taymyr Peninsula and in central-north Siberia. The subspecies *C. c. rogersi* breeds in north-east Siberia, including the Chukotskiy Peninsula, and possibly areas farther west. The subspecies *C. c. roselaari* breeds at Wrangel Island, Siberia, and north-west Alaska. The subspecies *rufa* breeds in the Canadian Arctic, south of 75 °N. The subspecies *C. c. islandica* breeds on the islands of the Canadian high Arctic and northern Greenland. The subspecies *C. c. rogersi* and, probably, *canutus* occur in the Australian region (Higgins & Davies 1996). Another subspecies, *C. c. piersmai*, has been described (Tomkovich 2001) breeding in the New Siberian Islands and spending the non-breeding season in Australasia. However, the respective geographical distributions of this new subspecies and subspecies *C. c. rogersii* in this region have yet to be determined (Barter 2002).

**Description**

**Top**

The Red Knot is a small to medium member of the Calidridinae family. It has a length of 23\009625 cm, a wingspan of 45\009654 cm and a weight of 120 g. The species is robust, short-necked, rather dumpy but long bodied wader with a short straight bill, long wings extending beyond the tail and short legs. The Red Knot is similar in shape and proportions to Great Knot, *Calidris tenuirostris*, but smaller and less bulky, with shorter bill, and the breeding plumage differs markedly. In all plumages the species has a clear narrow white wing bar and off-white patch on the rump and uppertail-coverts. It is obscured by narrow dark barring and appears pale grey at a distance (Higgins & Davies 1996).

**Australian Distribution**

**Top**

The Red Knot is common in all the main suitable habitats around the coast of Australia (Barrett et al. 2002b; Minton, C.D.T. 2002, pers. comm.; Watkins 1993), but is less numerous in south-west Australia than elsewhere (Lane 1987). Very large numbers are regularly recorded in north-west Australia, with 80 Mile Beach and Roebuck Bay being particular strongholds. The only places it is not found in significant numbers are the northern part of the Great Australian Bight in South Australia and Western Australia, and along much of the NSW coast, where wader habitat is rather scarce (excluding the Hunter Estuary). It is also relatively absent west of Warranbool, Victoria through to the Coorong, South Australia. A flock, sometimes in the hundreds, is regularly recorded at Albany, south-west Western Australia (Minton, C.D.T. 2002, pers. comm.). It is occasionally recorded inland in all regions. In Queensland, the Red Knot migrates along the coast north of 19 °S, sometimes in large numbers; it is widespread along the coast south of Townsville and along the coasts of NSW and Victoria. There are few records between Bermagui and Lakes Entrance, and from west Bellarine Peninsula to Warrnambool. It is a regular visitor to the coasts of Tasmania, and King and Flinders Islands, in small numbers. In South Australia, the species is found mostly from The Coorong, north and west to the Yorke Peninsula and Port Pirie. In Western Australia there are scattered records in the south, and it is occasionally seen around Peron Peninsula and Carnarvon. It is widespread on the coast from Ningaloo and Barrow Island to the south-west Kimberley Division. In the Northern Territory it is mainly recorded from Darwin, but also seen at various other sites. It is also recorded at Norfolk Island, Lord Howe Island, Macquarie Island, Kermadec Island, Chatham Island, Auckland Island and Campbell Island (Higgins & Davies 1996).

Australian sites of international importance, and there populations are listed below Bamford et al. 2008):

| Site                               | State              | Max Count |
|------------------------------------|--------------------|-----------|
| Eighty Mile Beach                  | Western Australia  | 80        |
| 700 South east Gulf of Carpentaria | Queensland         | 23        |
| 657 Roebuck Bay                    | Western Australia  | 11        |
| 200 Corner Inlet                   | Victoria           | 71        |
| 10 Port Pirie coast                | South Australia    | 48        |
| 00 Roper River area                | Northern Territory | 31        |
| 00 Ceduna Bays                     | South Australia    | 27        |
| 88 Lake MacLeod                    | Western Australia  | 25        |

**Global Distribution**

**Top**

The Red Knot has a worldwide distribution, breeding at a range of locations right around the Arctic. The species then migrates to non-breeding areas that extend to the southernmost parts of the Americas, Africa, Europe and Australasia (del Hoyo et al. 1996). Non-breeding distribution (excluding Australia)

Internationally the Red Knot is a non-breeding visitor to most continents. Some occur in North America, in west Florida, the Gulf of Mexico and the

Caribbean. In Central America the species is found around Costa Rica and Panama, while in South America it is mostly found in Argentina and southern Chile, from Valdes Peninsula to Tierra del Fuego and occasionally Lake Maracaibo in north-west Venezuela. It is also found in French Guyana, and in the north-central region of Brazil and on the Pacific coast of Peru and Chile. In western Europe it is mostly found in the British Isles, France and the Netherlands, with a few on the Iberian Peninsula (Higgins & Davies 1996); some occur in Germany and Denmark (Minton, C.D.T. 2002, pers. comm.). In Africa the Red Knot is mostly found in southern Morocco and Mauritania and in the south between north-west Namibia and Natal. It is also seen in east and south-east Asia, from eastern China, through the Philippines, south to Indonesia, and west to Malaysia and Australasia. It is a vagrant to India, Thailand, Mongolia, Hawaii, Palau, Fiji, east Africa, east South Africa, south Mozambique and Botswana (Higgins & Davies 1996).

**Breeding distribution**  
The Red Knot breeds in North America, Russia, north-west and east Greenland, north Alaska round the Seward Peninsula, the De Long Mountains and, rarely, at Point Barrow and Cooper Island. It also breeds in the north Canadian Arctic Archipelago, including Queen Elizabeth Island, from Prince Patrick and Melville Island, south to Prince of Wales and Somerset Island, and west to Devon and Ellesmere Island; also south Victoria Island (possibly also on Adelaide Pen.), east Melville Peninsula and the islands in north Hudson Bay. It occasionally breeds in north-west Spitsbergen at the Taymyr Peninsula, New Siberian Island, Wrangel Island and the mountainous regions of the Chukotskiy Peninsula, from Yuzhnyy Anyuyskiy and Vernyy Anyuyskiy Ravine, east through Chukotskiy (Anadyrskiy) and the Ekiatapskiy Mountains, east to Tenkanyy Ravine, and south to just south of Arctic Circle (Higgins & Davies 1996).

**Distribution during migration**  
On passage the species occurs in Canada, the United States, north South America, Iceland, Scandinavia, Baltic countries, Iberian Peninsula, north, north-west and west Africa; east Asia, from the Kamchatka Peninsula through east Siberia, the Korean Peninsula, Japan, eastern China, the Philippines, Malaysia, Indonesia and Irian Jaya (Higgins & Davies 1996).

**Population Information**

**Population**  
The global population of Red Knot is estimated at 1 090 000. The population in the East Asian Australasian Flyway is estimated at 110 000 (Hansen et al. 2016). Populations by country (in the non-breeding period) are:

| Country         | Population |
|-----------------|------------|
| Australia       | 135 000    |
| New Zealand     | 68 000     |
| China           | 10 000     |
| Indonesia       | 5000       |
| Other countries | 960        |

**Sites of international importance (excluding Australian sites) are listed below. These are calculated using the 1% criterion (i.e. a site is considered important if it is occupied by more than 1% of the bird's total population) (Bamford et al. 2008):**

| Site                               | Country     | Max Count |
|------------------------------------|-------------|-----------|
| Farewell Spit                      | New Zealand | 24 227    |
| Manukau Harbour                    | New Zealand | 22 433    |
| Kaipara Harbour                    | New Zealand | 16 910    |
| North-west Bo Hai Wan              | China       | 14 277    |
| Parengarenga Harbour               | New Zealand | 13 500    |
| North Bo Hai Wan                   | China       | 9358      |
| Dongsha Islands                    | China       | 8140      |
| Firth of Thames                    | New Zealand | 7819      |
| Shi Jiu Tuo/Daqing He              | China       | 5000      |
| Shuangtaizihekou N. N. Reserve     | China       | 4200      |
| Whangarei Harbour                  | New Zealand | 4198      |
| Yancheng National Nature Reserve   | China       | 3169      |
| Moroshechnaya River Estuary        | Russia      | 3000      |
| Houhora Harbour                    | New Zealand | 2855      |
| Rangaunu Harbour                   | New Zealand | 2500      |
| Dongjin Estuary                    | South Korea | 1500      |
| Yalu Jiang National Nature Reserve | China       | 1499      |
| Baikal Bay                         | Russia      | 1000      |
| Asan Bay                           | South Korea | 1000      |
| Linghekou                          | China       | 969       |
| Huang He National Nature Reserve   | China       | 756       |
| Namyang Bay                        | South Korea | 580       |

**Trends**  
The Red Knot is not listed as globally threatened (del Hoyo et al. 1996), but some populations (e.g. those in North America and Australia) are probably in serious decline (Minton, C.D.T. 2002, pers. comm.). Numbers in Victoria have shown a marked decline, possibly reflecting changes in the larger population. The current estimate of 2419 birds is a decrease on the previous estimate of 4474 birds (Wilson 2001a). A dramatic decline in numbers (from around 140 000 to under 50 000) was noted at Delaware Bay in North America (Minton, C.D.T. 2002, pers. comm.).

**Habitat**  
**Typical habitat**  
In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (Higgins & Davies 1996).

**Habitat for refuge**  
About a day after a cyclone had passed through Broome, lower than expected numbers (no birds) were seen in Roebuck Bay. Birds presumably moved to sheltered areas to avoid the high winds and heavy rain (Jessop & Collins 2000).

**Habitat for feeding**  
The Red Knot usually forage in soft substrate near the edge of water on intertidal mudflats or sandflats exposed by low tide. At high tide they may feed at nearby lakes, sewage ponds and floodwaters (Higgins & Davies 1996). They have also been recorded foraging on beds of eelgrass on tidal sandflats (Battley, P. in

Higgins & Davies 1996), on a thick algal mat in shallow water (Dann 1983), and in shallow pools on crest of coral reef (Domm & Recher 1973). Habitat for roosting  
The Red Knot roosts on sandy beaches, spits and islets, and mudflats; also in shallow saline ponds of saltworks. In New Zealand they are known to roost on short wet pastures near the coast (Higgins & Davies 1996). They have been seen roosting on an inland claypan near Roebuck Bay, north-west Western Australia (Collins et al. 2001). They like to roost in open areas far away from potential cover for predators, but close to feeding grounds (Rogers 2001). In hot conditions, waders prefer to roost where a damp substrate lowers the local temperature (Rogers 1999b).

**Life Cycle**  
**Top**

The species does not breed in Australia. Micro-habitat needed for breeding  
The Red Knot nests on open vegetated tundra or stone ridge, often close to a clump of vegetation. Breeding density is normally around one pair per km<sup>2</sup> (del Hoyo et al. 1996). Breeding season  
The Red Knot lays eggs in June (del Hoyo et al. 1996). Fecundity, lifespan, generation interval  
The Red Knot lays three to four eggs and incubates for around 21 009622 days; females depart on hatching leaving the male to tend for young. Fledging occurs after 18 009620 days. In one sample of 26 eggs, 54% hatched, 27% fledged. The annual adult mortality is 32% (del Hoyo et al. 1996). The age of first breeding is probably 3 00964 years (Minton, C.D.T. 2002, pers. comm.). Individuals can live for over 18 years (Minton, C.D.T. 2002, pers. comm.; see also Anon. 1998d).

**Feeding**  
**Top**

**Summary of food items**  
The Red Knot is omnivorous. In Australia the species eats mostly worms, bivalves, gastropods, crustaceans and echinoderms (Higgins & Davies 1996). In Roebuck Bay, Western Australia, they feed predominantly on buried bivalves which are located by touch, as they do internationally. However, in some circumstances they also visually located and took prey from the surface. Unusual food records included insects, seeds and mudskippers Periophthalmidae (Rogers 2001). Internationally they also take shoots, bulbs and roots, especially early in the breeding season, as well as hydrozoans, arachnids, insects, fish and kitchen scraps (Higgins & Davies 1996). Feeding behaviours  
The Red Knot is diurnal and nocturnal. In non-breeding areas, feeding activity is regulated by the tide, they feed less just before and after high tide, but timing of cessation of feeding and roosting depends on the time of year and height of tides. They sometimes follow the receding edge of the tide. They are known to feed in large mixed flocks with Great Knots, *Calidris tenuirostris*, Bar-tailed Godwits, *Limosa lapponica*, and Grey-tailed Tattlers, *Heteroscelus brevipes* (Higgins & Davies 1996), as well as Curlew Sandpipers, *Calidris ferruginea*, and Red-necked Stints *Calidris ruficollis* (Minton, C.D.T. 2002, pers. comm.). In Roebuck Bay, Western Australia, Red Knots followed the tide-edge closely when foraging, which resulted in them leaving areas of high prey abundance to feed in less rich areas as the tide receded (Rogers 2001). In one survey, juveniles foraged in different areas from adults, and were only found feeding far from the sea-edge, on soft mud near the mangroves (Rogers 1999a); adults spent more time, and were more successful, than young birds in tactile foraging as compared to visual foraging (Rogers 2001).

**Movement Patterns**  
**Top**

**Migration patterns**  
The Red Knot is migratory, breeding in the high Arctic and moving south to non-breeding areas between 58 °N and 50 °S. The subspecies *rogersi* breeds in north-east Siberia, including around the Chukotskiy Peninsula and possibly farther west, and migrates mainly to Australia and New Zealand. Although the route of migration to Australia is not known it may move in a loop, migrating south across the west Pacific Ocean and north along the east Asian coast. They tend to make long non-stop flights between only a few staging areas and are known to migrate overland and visit inland wetlands while migrating. The newly described subspecies *piersmai* that breeds in the New Siberian Islands and migrates along the coast of east Asia, and some birds reach Australia and New Zealand. Only these populations are discussed below (Higgins & Davies 1996). Departure from breeding grounds  
The subspecies *piersmai* probably move across inland eastern Siberia to the coast of east Asia while the subspecies *rogersi* move to Sea of Okhotsk (Tomkovich 1992). Juveniles move through Ussuriland from late August (Dement'ev & Gladkov 1951). They are recorded in Korea from August 0096September. They are uncommon or seen in small numbers in Japan, China, Hong Kong, south-east Asia and the south Pacific during southern migration. Banding suggests birds do not move along the coast of eastern China, although in 1991 small numbers moved through the Jiangsu Province during August, and others were recorded in Shanghai during mid-September (Higgins & Davies 1996). Juveniles arrive in Hong Kong from September 0096November may be able to fly non-stop to northern Australia, probably flying non-stop across the west Pacific Ocean from north-east Asia (Barter 1992). They are rare on Pacific islands, but have been recorded from Fiji, Tonga, Samoa, from between Fiji and New Zealand, and from the Kermadec Islands. Many regularly pass through parts of New Guinea, and the species is an irregular passage migrant in south-west Torres Strait (Higgins & Davies 1996). Arrival in Australia  
Most Red Knots arrive on the north-west coast and the Gulf of Carpentaria, however, birds in south-east Australia and New Zealand do not move through north-west Australia on either

migration. Some birds may move from west Australia to New Zealand between non-breeding seasons (Barter 1992; Higgins & Davies 1996). They arrive in north-west Australia from late August with rapid increases in weight before migrating further; numbers there decline by 50% in November (Watkins 1993). In Darwin, Northern Territory, numbers peak in September and October (Lane 1987). In the Gulf of Carpentaria, tens of thousands probably pass through in September and October before numbers drop by December (Garnett 1986; Lane 1987); the Gulf is probably the main staging area for birds moving to New Zealand, although some move to south-east Australia, arriving there from late September; some also move from south-east Australia to New Zealand (Barter 1992). In the non-breeding season, the subspecies *rogersi* are found predominately in large numbers in Australia and New Zealand (de Schauensee 1984; Barter 1992). In Australia, most remain in north with less than 10 000 in southern Australia (Lane 1987). They move south, mostly along coasts, with some inland records from September–November and arrive in south-west Australia from September, Gulf St Vincent, South-Australia, from September–November and Tasmania from August–September (Higgins & Davies 1996). Information derived from banding and flagging programs suggests that the population that remains in north-west Australia is mostly the subspecies *Calidris piersmai*, but that some *C. piersmai* may winter in eastern Australia. The subspecies *rogersii* mainly winter in eastern Australia and New Zealand, but that some of these birds pass through north-west Australia on migration. A genetic study is under way (Minton, C.D.T. 2002, pers. comm.).

**Return to breeding grounds**

The Red Knots leave New Zealand from late March to early April (Barter 1992), although may sometimes leave earlier (Higgins & Davies 1996). They leave Tasmania from February–May and leave south-east mainland Australia from late February or late March to early April. Both New Zealand and south-east Australian birds might move through the Gulf of Carpentaria, and inland records suggest that some birds move overland on northern migration. Small flocks move along the coast of eastern Queensland from mid-March and pass through the Gulf of Carpentaria in March and April. They regularly stop in large numbers in south-east Irian Jaya, from April to early May. They leave north-west Australia from late March to late April and may fly directly to China. Only small numbers pass through south-east Asia. Biometrics indicate that birds migrate along the east Asian coastline (Higgins & Davies 1996), with most probably passing through the northern half of the Yellow Sea (Barter 2002); large numbers have been seen in Korea in April and May. Some they overwinter in Australia, mainly northern Australia (Higgins & Davies 1996).

**Reasons for migration**

Apparently, southward migration is to escape severe winter conditions and consequent high energy demand and low prey availability; northward migration is to breeding grounds where food is temporarily superabundant during the Northern Hemisphere summer. The evolution of these migrations is poorly understood.

**Threats**

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**Global threats**

There are a number of threats that affect migratory shorebirds in the East Asian-Australasian Flyway. The greatest threat is indirect and direct habitat loss (Melville 1997). Staging areas used during migration through eastern Asia are being lost and degraded by activities which are reclaiming the mudflats for development or developing them for aquaculture (Barter 2002, 2005c; Ge et al. 2007; Round 2006). This is especially evident in the Yellow Sea, where at least 40% of intertidal areas have been reclaimed. This process is continuing at a rapid rate and may accelerate in the near future (Barter 2002, 2005c). For example, in South Korea, the Mangyeong and Dongjin River estuaries each supported 5% of the combined estimated Flyway populations (and are the most important sites for this species on both northern and southern migration) but they are currently being reclaimed as part of the Saemangeum Reclamation Project (Barter 2002, 2005c). The 33 km sea-wall across these two estuaries was completed in April 2006, resulting in significant change in the 40 100 ha area.

Reclamation is also a threat in other areas of the Flyway, such as in Malaysia (Wei et al. 2006). In addition, water regulation and diversion infrastructure in the major tributaries have resulted in the reduction of water and sediment flows (Barter 2002; Barter et al. 1998).

Migratory shorebirds are also adversely affected by pollution, both on passage and in non-breeding areas (Harding et al. 2007; Melville 1997; Round 2006; Wei et al. 2006).

Disturbance from human activities, including recreation, shellfish harvesting, fishing and aquaculture is likely to increase significantly in the future (Barter et al. 2005c; Davidson & Rothwell 1993).

It is predicted that the rate of decrease in the intertidal area in the Yellow Sea will accelerate (Barter 2002). In addition, intensive oil exploration and extraction, and reduction in river flows due to upstream water diversion, are other potentially significant threats in parts of China where this species is present in internationally significant numbers (Barter 2005c; Barter et al. 1998).

Global warming and associated changes in sea level are likely to have a long-term impact on the breeding, staging and non-breeding grounds of migratory waders (Harding et al. 2007). Iwamura and colleagues (2013) found that rises in sea level could cause a dramatic collapse of population flow of this species caused by intertidal habitat loss. Taking into account upshore movements of intertidal habitat, their modelling indicates that this species population flow could reduce by 15% with a 150 cm sea

level rise (Iwamura et al. 2013). Hunting is still a very serious problem for waders in China, and this species is sometimes caught (Ming et al. 1998). Threats within Australia Within Australia, there are a number of threats common to most migratory shorebirds, including the Red Knot. Habitat loss The loss of important habitat reduces the availability of foraging and roosting sites. This affects the ability of the birds to build up the energy stores required for successful migration and breeding. Some sites are important all year round for juveniles who may stay in Australia throughout the breeding season until they reach maturity. A variety of activities may cause habitat loss. These include direct losses through land clearing, inundation, infilling or draining. Indirect loss may occur due to changes in water quality, hydrology or structural changes near roosting sites (DEWHA 2009aj). Habitat degradation As most migratory shorebirds have specialized feeding techniques, they are particularly susceptible to slight changes in prey sources and foraging environments. Activities that cause habitat degradation (DEWHA 2009aj) include, but are not restricted to: loss of marine or estuarine vegetation, which is likely to alter the dynamic equilibrium of sediment banks and mudflats; invasion of intertidal mudflats by weeds such as cord grass; water pollution and changes to the water regime; changes to the hydrological regime; exposure of acid sulphate soils, hence changing the chemical balance at the site. Disturbance Disturbance can result from residential and recreational activities including; fishing, power boating, four wheel driving, walking dogs, noise and night lighting. While some disturbances may have only a low impact it is important to consider the combined effect of disturbances with other threats. Roosting and foraging birds are sensitive to discrete, unpredictable disturbances such as loud noises (i.e. construction sites) and approaching objects (i.e. boats). Sustained disturbances can prevent shorebirds from using parts of the habitat (DEWHA 2009aj). Direct mortality Direct mortality is a result of human activities around the migration pathways of shorebirds and at roosting and foraging sites. Examples include the construction of wind farms in migration or movement pathways, bird strike due to aircraft, hunting, chemical and oil spills (DEWHA 2009aj).

Threat Abatement and Recovery

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Governments and conservation groups have undertaken a wide range of activities relating to migratory shorebird conservation (AGDEH 2005c) both in Australia and in cooperation with other countries associated with the East Asian-Australasian Flyway. Australia The Wildlife Conservation Plan for Migratory Shorebirds (AGDEH 2006f) outlines national activities to support flyway shorebird conservation initiatives and provides a strategic framework to ensure these activities and future research and management actions are integrated and remain focused on the long-term survival of migratory shorebird populations and their habitats. Since 1996, the Australian Government has invested approximately \$5 000 000 of Natural Heritage Trust (NHT) funding in projects contributing to migratory shorebird conservation (DEWHA 2007e). This funding has been distributed across a range of important projects, including the implementation of a nationally coordinated monitoring programme that will produce robust, long-term population data able to support the conservation and effective management of shorebirds and their habitat; migration studies using colour bands and leg flags; and development of a shorebird conservation toolkit to assist users to develop and implement shorebird conservation projects. Birds Australia is currently co-ordinating the Shorebirds 2020 project, which aims to monitor shorebird populations at important sites throughout Australia; and Birdlife International is identifying sites and regions which are important to various species of birds, including shorebirds, and the processes that are affecting them. The aim is to inform decisions on the management of shorebird habitat. It may be possible to rehabilitate some degraded wetlands or to create artificial wader feeding or roosting sites to replace those destroyed by development, such as by creating artificial sandflats and sand islands from dredge spoil and by building breakwaters (Dening 2005; Straw 1992a, 1999). The Significant impact guidelines for 36 migratory shorebirds Draft EPBC Act Policy Statement 3.21 (DEWHA 2009aj) provides guidelines for determining the impacts of proposed actions on migratory shorebirds. The policy statement also provides mitigation strategies to reduce the level and extent of those impacts.

International

Australia has played an important role in building international cooperation to conserve migratory birds. In addition to being party to international agreements on migratory species, Australia is also a member of the Partnership for the Conservation of Migratory Waterbirds and the Sustainable Use of their Habitats in the East Asian-Australasian Flyway (Flyway Partnership), which was launched in Bogor, Indonesia on 6 November 2006. Prior to this agreement, Australia was party to the Asia-Pacific Migratory Waterbird Conservation Strategy and the Action Plan for the Conservation of Migratory Shorebirds in the East Asian-Australasian Flyway and the East Asian-Australasian Shorebird Site Network. The East Asian-Australasian Flyway Site Network, which is part of the broader Flyway Partnership, promotes the identification and protection of key sites for migratory shorebirds. Australia has 17 sites in the network (Partnership EAAF 2008): Kakadu National Park, Northern Territory (1 375 940 ha) Parry Lagoons, Western Australia (36 111 ha) Thomsons Lake, Western Australia (213 ha) Moreton Bay, Queensland (113



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