

THREATENED SPECIES SCIENTIFIC COMMITTEE

Established under the *Environment Protection and Biodiversity Conservation Act 1999*

The Minister approved this conservation advice and included this species in the Endangered category, effective from 5 May 2016

Conservation Advice

Calidris canutus

Red knot

Taxonomy

Conventionally accepted as *Calidris canutus*, Linnaeus 1758.

Other common names: knot, common knot, Iceland sandpiper, East Siberian sandpiper, lesser knot.

The species is polytypic, meaning more than one subspecies exists. Globally, the following six subspecies are recognised:

- *Calidris canutus canutus* (nominate subspecies) breeds in central Siberia;
- *C.c. piersmai* breeds in the New Siberian Islands;
- *C.c. rogersi* breeds on Chukotka Peninsula (north-eastern Siberia);
- *C.c. roselaari* breeds at Wrangel Island, Siberia, and north-west Alaska;
- *C.c. rufa* breeds in the Canadian Arctic, south of 75 °N; and
- *C.c. islandica* breeds on the islands of the Canadian high Arctic and northern Greenland (Bamford et al. 2008; Leyrer et al. 2014; Gill & Donsker 2015).

Two subspecies, *C. c. piersmai* and *C. c. rogersi*, regularly occur in Australia (Garnett et al. 2011). One other subspecies, *C. c. canutus*, is considered a vagrant in Australia (Garnett et al. 2011).

Summary of assessment

Conservation status

Endangered: Criterion 1 A2(a)

The highest category for which *Calidris canutus* is eligible to be listed is Endangered.

Calidris canutus has been found to be eligible for listing under the following listing categories:

Criterion 1: A2 (a): Endangered

Criterion 2: Not eligible

Criterion 3: Not eligible

Criterion 4: Not eligible

Criterion 5: Not eligible

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 new information provided to the Committee to list *Calidris canutus*.

Public Consultation

Notice of the proposed amendment and a consultation document was made available for public comment for 47 business days between 1 October and 4 December 2015. Any comments

received that were relevant to the survival of the species were considered by the Committee as part of the assessment process.

Species/Sub-species Information

Description

The red knot is a small to medium migratory shorebird. It has a length of 23–25 cm, a wingspan of 45–54 cm and a weight of 120 g. The species is robust, short-necked with a short straight bill, long wings extending beyond the tail and short legs (Higgins & Davies 1996). The red knot has a faint pale brow line. The upper body is brownish grey with fine dark streaks on the head and neck and the underbody is white with some light streaking. In breeding plumage, the upper body is boldly marked, contrasting with the mainly chestnut-red body (BirdLife Australia 2012).

Breeding plumage:

- *C. c. piersmai*: Deep brick-red underparts and reddish napes with black mantle and scapulars boldly marked by rufous fringes and panels within each feather. Many scapulars have narrow white tips but these are inconspicuous;
- *C. c. rogersi*: Paler, peachier underparts, and whitish napes with more extensive silvery variegation on the upperparts caused by a combination of broader grey-white tips to individual feathers, the presence of many scapulars with grey-white panels within the feather, and only a pale rufous tinge to other markings within the scapulars (Rogers et al. 2010).

The two subspecies *C. c. piersmai* and *C. c. rogersi* cannot be distinguished from each other in nonbreeding plumage (Rogers et al. 2010). However, the location in which the individual is present can help distinguish the two subspecies, with *C. c. piersmai* tending to overwinter almost exclusively in North-west Australia, and *C. c. rogersi* tending to overwinter in other parts of Australasia (del Hoyo et al. 2014).

Distribution

Global Distribution

The red knot (all six subspecies combined) has a global distribution and an extremely large range. The species breeds at a range of locations around the Arctic and, for the boreal winter, migrates to non-breeding areas that extend to the southernmost parts of the Americas, Africa, Europe and Australasia (del Hoyo et al. 1996). For the species, the global extent of occurrence is estimated to be 1,600,000 km² (BirdLife International 2015).

Australian Distribution

The red knot breeds in the northern hemisphere and undertakes migrations along the East Asian-Australasian Flyway (EAAF) to spend the boreal winter in Australasia. The vast majority of the population is considered to spend the non-breeding period in Australia (Bamford et al. 2008).

The red knot is common in all the main suitable habitats around the coast of Australia (Barrett et al. 2002), is less numerous in south-west Australia and is occasionally recorded inland in all regions (Higgins & Davies 1996). Very large numbers are regularly recorded in north-west Australia. 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, along the coasts of NSW and Victoria, and is a regular visitor, in small numbers, to the coasts of Tasmania. In South Australia, the species is found mostly from The Coorong, north and west to the Yorke Peninsula and Port Pirie. The red knot has also been recorded at Norfolk Island, Lord Howe Island, Macquarie Island, Kermadec Island, Chatham Islands, Auckland Islands and Campbell Islands (Higgins & Davies 1996). Red knots migrating to New Zealand may stage in Australia, particularly in the Gulf of Carpentaria (Bamford et al. 2008; Rogers et al. 2010; Garnett et al. 2011).

Relevant Biology/Ecology

Life History

The generation time of 7.8 years (Garnett et al., 2011) is derived from an age of first breeding of 2.0 years (Cramp et al. 1983), an adult survival of 68% (Boyd 1962) and a maximum longevity of 18.8 years (Garnett et al., 2011).

Breeding

The red knot does not breed in Australia. Red knots breed in north Siberia and Alaska during the austral winter (Department of the Environment 2015a,b). In June, the red knot lays 3-4 eggs and incubation lasts for around 21–22 days. On hatching, females depart the nest leaving the male to tend for young. Fledging occurs after 18–20 days. In one sample of 26 eggs, 54% hatched and 27% fledged (del Hoyo et al. 1996).

General Habitat

The red knot breeds on dry upland tundra in high Arctic areas. During the boreal summer, they nest on open vegetated tundra or stone ridges, often close to a clump of vegetation. Breeding density is normally around one pair per km² (del Hoyo et al. 1996).

During the non-breeding season in Australasia, the red knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms. They are occasionally seen on terrestrial saline wetlands near the coast and on sewage ponds and saltworks (Higgins & Davies 1996).

Feeding Habitat

The red knot usually forages in soft substrate near the water edge 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).

Roosting Habitat

The red knot roosts on sandy beaches, spits and islets, and mudflats (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, shorebirds prefer to roost where a damp substrate lowers the local temperature and different roosts were used at night when birds chose safer, but more distant, roosts from foraging areas (Rogers et al. 2006).

Feeding

The red knot eats worms, bivalves, gastropods, crustaceans and echinoderms (Higgins & Davies 1996). In Australia, they predominantly forage on shellfish by being able to detect pore-water pressure differentials to locate hard, buried prey (Piersma et al. 1998). They have a large muscular gizzard for crushing bivalves which are swallowed whole (Piersma et al. 1993; van Gils et al. 2005; Rogers et al. 2010). In some circumstances they also visually locate prey items and sometimes take prey from the surface (Rogers 2001).

The red knot is diurnal and nocturnal. They forage in large, dense, often mixed-species flocks, with birds rapidly, intensively and methodically probing the wet mud as they walk quickly across the mudflats exposed by the falling tide (BirdLife Australia 2012). In non-breeding areas, feeding activity is regulated by the tide with birds closely following the tide-edge when foraging (Rogers 2001).

Migration Patterns

The red knot is migratory, breeding in the high Arctic and moving south to non-breeding areas to approximately 50 °S. They are capable of flying non-stop between north-eastern China and northern Australia and tend to use only a few staging areas (Bamford et al. 2008).

Departure from breeding grounds

The subspecies *C. c. rogersi* breeds in north-east Siberia, including around the Chukotka 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. The subspecies *C. c. piersmai* breeds in the New Siberian Islands and migrates along the coast of east Asia, with some birds reaching Australia and New Zealand (Higgins & Davies 1996).

Non-breeding season

In Australia, most red knots arrive on the north-west coast and the Gulf of Carpentaria from late August (Higgins & Davies 1996). They move south, mostly along coasts, with some inland records from September–November and arrive in south-west Australia from 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 *C. c. piersmai*, although some may also occur in eastern Australia. The subspecies *C. c. rogersi* mainly occur in eastern Australia and New Zealand although some of these birds pass through north-west Australia on migration (Rogers et al. 2010).

During the non-breeding period, around 93% of the EAAF population of the red knot (subspecies *C.c. piersmai* and *C.c. rogersi*) occurs in Australia and New Zealand, with smaller numbers in China, Indonesia and other countries in southeast Asia (Bamford et al. 2008).

Return to breeding grounds

Red knots leave Tasmania from February–May and leave south-east mainland Australia from late February or late March to early April. Inland records suggest that some birds move overland on northern migration. They leave north-west Australia from late March to late April. Most probably passing through the northern half of the Yellow Sea (Barter 2002) with large numbers seen in the Korean Peninsula in April and May. Some birds overwinter in Australia, mainly northern Australia (Higgins & Davies 1996).

Internationally, the Yellow Sea is extremely important as stopover habitat for red knot, with over 45% of the EAAF population using a single site at Bohai Bay, Yellow Sea during their migration (Rogers et al. 2010; Iwamura et al. 2013).

Threats

Migratory shorebirds, such as the red knot, are sensitive to certain development activities due to their high site fidelity, tendency to aggregate, very high energy demands, and need for habitat networks containing both roosting and foraging sites (Department of the Environment 2015a,b).

Threats to the global population of the red knot across its range include habitat loss and habitat degradation (e.g. through land reclamation, industrial use and urban expansion, changes to the water regime, invasive plants and environmental pollution), over-exploitation of shellfish, pollution/contamination impacts, disturbance, direct mortality (hunting), diseases, extreme weather events, and climate change impacts (BirdLife International 2015; Department of the Environment 2015a,b).

Habitat loss and habitat degradation

The red knot is threatened by wetland degradation in East Asia, where it stages on migration (Bamford et al. 2008). The red knot is specifically threatened at Bohai Bay, Yellow Sea where both subspecies (*C. c. piersmai* and *C. c. rogersi*) stage on the intertidal mudflats. Rogers et al. (2010) estimated that their study site area of 20 km of coastline in Bohai Bay was used by over 45% of the combined global population of adult *C. c. piersmai* and *C. c. rogersi*. Between 1994 and 2010, the reclamation of large areas (including intertidal mudflats) in the bay for two industrial projects caused the northward migrating red knot to become concentrated in an ever smaller remaining area. The northward migration numbers of *C. c. piersmai* and *C. c. rogersi* in this so far little affected area increased from 13% in 2007 to 62% in 2010 of the global populations (Yang et al. 2011). With the proposed continuation of land reclamation in Bohai Bay, it is predicted that shorebird densities in the remaining areas will increase to a point of collapse (Yang et al. 2011). Along with other major areas of tidal flat habitat in East Asia, the Bohai Bay tidal flats currently have no formal protection (Murray & Fuller 2015). Reclamation on intertidal mudflats is also a threat in other areas of the EAAF, for example Malaysia (Wei et al. 2006). 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 2005; Barter et al. 1998).

In Australia, 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 which 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 (Department of the Environment 2015a,b).

As most migratory shorebirds, such as the red knot, have specialized feeding techniques, they are particularly susceptible to slight changes in prey sources and foraging environments. Activities that cause habitat degradation 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 cordgrass; water pollution and changes to the water regime; changes to the hydrological regime; and exposure of acid sulphate soils, hence changing the chemical balance at the site (Department of the Environment 2015a,b).

The non-breeding grounds of the species in south-eastern Australia are threatened by habitat degradation, loss and human disturbance (Garnett et al. 2011), but those in the north are generally free of such disturbances (NTDoLRM 2012).

Climate change

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 shorebirds (Harding et al. 2007). Rises in sea level could have a major impact on the red knot due to loss of intertidal habitat (Iwamura et al. 2013). Taking into account upshore movements of intertidal habitat, modelling indicates that, for both *C.c. piersmai* and *C.c. rogersi*, population flow could reduce by 15% with a 150 cm sea level rise (Iwamura et al. 2013).

Pollution/contamination

Migratory shorebirds may be adversely affected by pollution, both on passage and in non-breeding areas (Harding et al. 2007; Wei et al. 2006).

Disturbance

Human disturbance can cause shorebirds to interrupt their feeding or roosting and may influence the area of otherwise suitable feeding or roosting habitat that is actually used. Disturbance from human activities may force migratory shorebirds to increase the time devoted to vigilance and anti-predator behaviour and/or may compel the birds to move to alternative, less favourable feeding areas (Goss-Custard et al., 2006; Glover et al., 2011; Weston et al., 2012).

Disturbance can result from recreational activities including fishing, boating, four wheel driving, walking dogs, noise and night lighting. While some disturbances may have a low impact, it is important to consider the combined effect of disturbances with other threats (Department of the Environment 2015a,b).

Diseases

The red knot is susceptible to avian influenza and so may be threatened by future outbreaks of the virus (Melville & Shortridge 2006).

Since, 1992, the viral disease testing of Charadriiformes from coastal northwest Australia has not detected any evidence of avian influenza virus excretion in the red knot or any other species tested. However, from serologic testing, there was evidence of past exposure to the virus in the sampled red knots and the exposure risk profile for this species had significantly higher values compared to other species (Curran et al. 2014).

Direct mortality

Direct mortality may result from the construction of wind farms located in migration or movement pathways, bird strike with vehicles and aircraft, hunting, chemical spills and oil spills (Schacher et al., 2013; Department of the Environment 2015a,b).

Hunting is still a very serious problem for shorebirds in China, and the red knot has been identified as one of the species caught (Ming et al. 1998). Records between 1985 and 1998 indicate that at least 709 individuals of this species were hunted in China and Thailand alone. Within this period, taking into account the year with lowest take (lower bound) and the year with highest take (upper bound), the possible range of annual take is at least 39 to 469 individuals (Parish and Melville 1985, Ruttanadakul and Ardseungnarm 1986, Tang and Wang 1995, Ming et al. 1998, Ge et al. 2006).

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	<p>Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>(a) direct observation [except A3]</p>		
A2			
A3			
A4			
		<p>based on any of the following:</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p>	

Evidence:

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

The global population of red knot was previously estimated at 1,090,000 with the population in the EAAF at 220,000 (Bamford et al. 2008). Although numbers at several sites have declined, it is also thought that the previous estimate of red knots at Eighty Mile Beach, WA (80,700), based on extrapolation from aerial surveys, may have been inflated (Rogers et al. 2010). Rogers et al. (2010) presented revised estimates for Australian and New Zealand sites using the most recently available austral summer counts. Assuming around 93% of the EAAF population of the red knot occurs in Australia and New Zealand (Bamford et al. 2008), a revised population estimate for the EAAF, based on a sum of revised estimates for the Australian and New Zealand populations of 104,986 (Rogers et al. 2010), is approximately 112,000 individuals, of which 68,000 occur in Australia (Garnett et al., 2011).

In Australia, direct counts of red knots at key sites (e.g. Rogers et al. 2009) have shown a population decline of more than 30% over the last 20 years. For example, numbers in Victoria showed a decline in count data from 4,474 to 2,419 individuals (Wilson 2001). Numbers at Eighty-mile Beach declined by c.78% between 2000 and 2008 (Rogers et al. 2009), at Moreton Bay by 75% between 1993 and 2008 (Fuller et al. 2009) and by c.27% across 49 Australian sites between c.1983 and c.2007 (Garnett et al. 2011).

Numbers of red knots appear to have had a less severe decline elsewhere in the EAAF e.g. no clear trends in Japan between 1978 and 2008 (Amano et al. 2010).

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), suggests the rate of decline is large enough to pass the threshold for the endangered category (Studds et al., submitted). Time series data from directly observed summer counts at a large number of sites across Australia indicate a severe population decline of 62.0% over 23 years (4.4% per year) which for this species is equal to three generations (Studds et al., submitted).

In large part, the observed decline in red knot 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. In addition, threats are also occurring in Australia including coastal development and recreational activities causing disturbance.

The Committee considers that the species has undergone a severe reduction in numbers over three generation lengths (23 years for this assessment), equivalent to at least 62 percent and the reduction has not ceased, the cause has not ceased and is not understood. Therefore, the species has met the relevant elements of Criterion 1 to make it eligible for listing as Endangered.

Criterion 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
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; (iv) number of mature individuals			

Evidence:

Not eligible

The extent of occurrence in Australia is estimated to be 36 000 km² (stable) and area occupied 2 400 km² (stable; Garnett et al., 2011). Therefore, the species does not meet this required element of this criterion.

Criterion 3. 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
(a) (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 68 000 in 2011 (Garnett et al., 2011), but has declined since. There are no current data available to allow assessment against this criterion. Therefore, the species does not meet this required element of this criterion.

Criterion 4. Number of mature individuals			
	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 is 68 000 which is not considered extremely low, very low or low. Therefore, the species does not meet 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, national, state and local levels.

Conservation and Management Actions

- Work with governments along the East Asian – Australasian Flyway to prevent destruction of key migratory staging sites.
- Protect important habitat in Australia.
- Support initiatives to improve habitat management at key sites.
- Maintain and improve protection of roosting and feeding sites in Australia.
- Advocate for the creation and restoration of foraging and roosting sites in Australia.
- Incorporate requirements for red knot into coastal planning and management.
- Manage important sites to identify, control and reduce the spread of invasive species.

- Manage disturbance at important sites which are subject to anthropogenic disturbance when red knot are present – e.g. discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures.

Survey and monitoring priorities

- Enhance existing migratory shorebird population monitoring programmes, particularly to improve coverage across northern Australia
- Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

Information and research priorities

- Undertake work to more precisely assess red knot life history, population size, distribution and ecological requirements.
- Improve knowledge about dependence of red knot on key migratory staging sites, and non-breeding sites in south-east Asia.
- 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 Endangered category:

Calidris canutus

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

Threatened Species Scientific Committee

01/03/2016

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