

Information Sheet on Ramsar Wetlands (RIS) – 2009-2012 version

Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX.22 of the 9th Conference of the Contracting Parties (2005).

1. Name and address of the compiler of this form:

Jennifer Hale and the Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)
John Gorton Building
King Edward Terrace
Parkes ACT 2600
Australia
Phone: +61 2 6274 1111
Email: wetlandsmail@environment.gov.au

FOR OFFICE USE ONLY.

DD MM YY

--	--	--

Designation date

--	--	--	--	--	--

Site Reference Number

2. Date this sheet was completed/updated:

June 2011

3. Country:

Australia

4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Pulu Keeling National Park

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only):

- a) Designation of a new Ramsar site ; or
b) Updated information on an existing Ramsar site

6. For RIS updates only, changes to the site since its designation or earlier update:

a) Site boundary and area

The Ramsar site boundary and site area are unchanged:

or

If the site boundary has changed:

- i) the boundary has been delineated more accurately ; or
ii) the boundary has been extended ; or
iii) the boundary has been restricted**

and/or

If the site area has changed:

- i) the area has been measured more accurately ; or
ii) the area has been extended ; or
iii) the area has been reduced**

**** Important note:** If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

In 2005, the lagoon entrance within the PKNP Ramsar site closed (as a result of natural forces of deposition) which has led to significant changes within this habitat (Hobbs in prep.). Seagrass is no longer present in the lagoon area, but has been replaced by a cyanobacterial mat one to 50 centimetres thick across the entire lagoon surface. As a consequence the lagoon no longer supports large numbers of fish and invertebrates and it is considered that the mud crab (*Scylla* sp) and bonefish (*Albula glossodontā*) have become locally extinct (Hobbs in prep.). The impact of the lagoon closure on the Cocos buff-banded rail (*Gallirallus philippensis andrewsi*) remains unknown. However, as this species was often observed feeding on invertebrates along the lagoon shore, the impact on food resources may be significant.

The criteria have been re-assessed and it is considered that the site also meets criteria 5 and 6 on the basis of the large numbers of seabirds supported by the site. This does not represent a change in ecological character, rather a more thorough assessment of the ecology of the site.

7. Map of site:

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

- i) a **hard copy** (required for inclusion of site in the Ramsar List): ;
- ii) an **electronic format** (e.g. a JPEG or ArcView image) ;
- iii) a **GIS file providing geo-referenced site boundary vectors and attribute tables** .

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The boundary of the Ramsar site is identical to that of Pulu Keeling National Park as established by Proclamation made on 12 December 1995 and published in the *Commonwealth of Australia Gazette* Number GN 50 of 20 December 1995. See Figure 1 for map.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):

Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Latitude: 11°49' S Longitude: 96° 49' E

9. General location:

Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

The Pulu Keeling National Park (PKNP) Ramsar site comprises North Keeling Island in the Australian territory of the Cocos (Keeling) Islands, approximately 2800 kilometres northwest of Perth in the Indian Ocean. It includes 2.1 square kilometre land area of the island, including the enclosed central lagoon, and the waters around the island extending out to 1.5 kilometres from the high water mark.

10. Elevation: (in metres: average and/or maximum & minimum)

Sea level

11. Area: (in hectares)

2603.46 hectares

12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The PKNP Ramsar site is a coral atoll comprising of approximately 213.22 hectares of land, including the enclosed central lagoon, and 2390.24 hectares of surrounding coral reef and sea. At the time of listing, the centre of the atoll contained a single, tidal lagoon with a narrow connection to the Indian Ocean on the eastern side. Natural processes have since closed this connection. The site is significant for the number of seabirds it supports including large breeding colonies of red-footed booby (*Sula sula*) and lesser frigatebirds (*Fregata ariel*). An endemic species of buff-banded rail (*Gallirallus philippensis andrewsi*) is a resident within the Ramsar site. Fish and marine invertebrate fauna are abundant and while there are few endemic species present, the fish fauna is considered unique due to the mixing of Indian and Pacific Ocean species which are at the edge of their distributions (Hobbs and Salmond 2008).

13. Ramsar Criteria:

Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9

14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criterion 1: *A wetland should be considered internationally important if it contains a representative, rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.*

The 27 islands that comprise the Cocos (Keeling) Islands represent the only land within the Cocos (Keeling) Island Province bioregion. Although all of the wetland types within the PKNP Ramsar site are represented in the islands of the southern atoll, there is a strong argument for those at the Ramsar site representing the best examples. The southern atolls are inhabited and have been impacted by various human activities (Woodroffe and Berry 1994). The northern Pulu Keeling Island has never been permanently inhabited and this, coupled with the remote location of this site has resulted in wetlands in near-natural condition. Four Ramsar wetland types have been identified within the site including: B) marine sub-tidal aquatic beds, C) coral reefs, D) rocky shores and E) Sand shores.

Criterion 2: *A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.*

There are three threatened species supported by the wetlands within the PKNP Ramsar site that contribute to the site meeting this criterion.

Common name	Scientific name	IUCN	CITES	CMS	National Status	Notes
Birds						
Cocos buff-banded rail	<i>Gallirallus philippensis andrewsi</i>	-	-	-	Endangered	This species is restricted to the Ramsar Site (Director of National Parks 2004).
Reptiles						
Green turtle	<i>Chelonia mydas</i>	Endangered	Appendix I	Appendix I	Vulnerable	Regularly breeds in the sand beaches of the Ramsar Site (Whiting 2006).
Hawksbill turtle	<i>Eretmochelys imbricata</i>	Critically Endangered	Appendix I	Appendix I	Vulnerable	Waters within the Ramsar Site are considered critical feeding habitat for this species (Environment Australia 2003).

Criterion 3: *A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.*

The PKNP Ramsar site supports three endemic species: the Cocos buff-banded rail (*Gallirallus philippensis andrewsi*); the Cocos sub-species of pandanus (*Pandanus tectorius cocosensis*); and the angelfish (*Centropyge jocularis*), which is only recorded from Christmas and the Cocos (Keeling) Islands (Woodroffe and Berry 1994). In addition, the PKNP Ramsar site supports a number of species of plant and animal that are not found in the southern atoll islands such as the robber crab (*Birgus latro*). It has been suggested that this is due to the lack of human activity in the Ramsar site (Williams 1994; Stokes 1994). Stokes et al. 1984 described the main atoll as “virtually barren of birds” and considered the North Keeling Island (synonymous with the Ramsar site) as one of the few remaining pristine tropical islands in the Indian Ocean. As such the site, which supports flora and fauna that no longer occurs on the southern atoll islands, is important in maintaining biodiversity within the bioregion.

A total of eight species of fish recorded at Pulu Keeling have not been observed in the southern atoll (Hobbs in prep.). They are:

- *Caracanthus maculatus* (spotted coral croucher)
- *Cephalopholis urodeta* (black-finange rock cod)
- *Lutjanus kasmira* (bluestripe seaperch)
- *Forcipiger longirostris* (longnose butterflyfish)
- *Stegastes insularis* (Acapulco damselfish)
- *Cirripectes stigmaticus* (red-streaked blenny/ember blenny)
- *Ptereleotris zebra* (zebra goby)
- *Acanthurus mata* (elongate surgeonfish)

In addition, Hobbs and Salmond (2008) indicated that the coral reef communities of the Cocos (Keeling) and Christmas Islands were globally unique. This was based on a high proportion of species occurring at the edge of their geographical range and the co-habitation of Indian and Pacific Oceans' regional biota. The unique fish communities at these islands have produced the most recorded marine fish hybrids of any location in the world (Hobbs et al. 2009). Therefore, the islands are of global importance to the evolution of reef fishes, and possibly other coral reef taxa (Hobbs et al. 2009).

Criterion 4: *A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.*

The PKNP Ramsar site supports 13 species of waterbird listed as migratory under international treaties (Appendix 1) and two species of migratory turtles, the green turtle (*Chelonia mydas*) and the hawksbill turtle (*Eretmochelys imbricate*). The site, also, supports breeding of green turtles (Whiting 2006) and 15 species of waterbird (Appendix 1); including the following species that breed in significant numbers within the Ramsar site (Director of National Parks 2004):

- Red-footed booby (*Sula sula*) – over 30 000 pairs observed in 1982 (Stokes et al. 1984) and similar numbers remain (Director of National Parks 2004);
- Lesser frigatebirds (*Fregata ariel*) – estimated that approximately 3 000 breeding pairs regularly use the Ramsar site (Director of National Parks 2004);
- Greater frigatebirds (*Fregata minor*) – estimated that up to 3 000 regularly use the island and many of these for breeding (Stokes 1982); and
- Common noddy (*Anous stolidus*) – 500 to 750 breeding pairs recorded (Stokes 1982).

Criteria 5: *A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.*

The PKNP Ramsar site regularly supports more than 30 000 pairs of red-footed booby (*Sula sula*); up to 15 000 common noddy (*Anous stolidus*) and 3 000 greater (*Fregata minor*) and lesser (*Fregata ariel*) frigatebirds (Stokes et al. 1984).

Criterion 6: *A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.*

The PKNP Ramsar site regularly supports 30 000 breeding pairs of red-footed booby (*Sula sula*) (six per cent of the global population); and 3 000 breeding pairs of lesser frigatebirds (*Fregata ariel*) (three per cent of the global population).

15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation):

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:

Cocos (Keeling) Island Province

b) biogeographic regionalisation scheme (include reference citation):

IMCRA v4 (Commonwealth of Australia 2006)

16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

The PKNP Ramsar site lies within the moist tropical climatic zone of the Indian Ocean. The general climatic pattern is warm to hot temperatures and high rainfall occurring year round. Rainfall, on average, occurs year round with highest monthly average rainfall in April (256 mm) and lowest in October (82 millimetres). Annual average rainfall at the Cocos (Keeling) Islands is in the order of 2 000 millimetres per

year. Temperatures are warm to hot year round, with little seasonal variation. Maximum monthly temperatures are between 28 and 30 degrees Celsius and average minimum temperatures between 24 and 25 degrees Celsius.

The Cocos (Keeling) Islands are located in an area subject to tropical cyclones. Twenty-seven tropical cyclones were recorded in the vicinity of the Cocos (Keeling) Islands between 1955 and 2005; four of which caused destructive winds gusts of at least of 125 kilometres per hour (Doreen January 1968, Annie November 1973, Pedro November 1989 and Harriet February 1992). On average this equates to a tropical cyclone every two years and one causing destructive winds every 12.5 years.

The Island within the PKNP Ramsar site is approximately two kilometres long and 1.3 kilometres wide, and at the time of listing had a shallow (less than 2 metre deep) lagoon occupying the centre. The lagoon was connected to the Indian Ocean by a single channel on the south eastern shore (Woodroffe and McLean 1994). In 2005, the lagoon entrance within the Ramsar site closed (as a result of natural forces of deposition) which has lead to significant changes within this habitat (Hobbs in prep.). The Island is young in geological terms, with coral conglomerate from the surrounding reef radiocarbon dated at approximately 3 000 to 4 000 years before present (Woodroffe and McLean 1994).

The island is comprised mostly of calcareous sand and rubble of coral origin, with a broad sandy beach along the north shore. The lagoon sediments are predominantly composed of sands and sandy mud, with a broad intertidal sand area near the connection to the Indian Ocean. There are areas of beach rock and shingle along the eastern and southern shore and areas of coral conglomerate platform. A reef crest surrounds the island on all but the north-western shore (Woodroffe and McLean 1994).

17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

The Cocos (Keeling) Islands are an Australian territory comprising twenty-seven coral islands with a total land area of approximately 14 square kilometres. There are 26 islands in the southern atoll of which two, Home Island and West Island, are inhabited. North Keeling Island (the PKNP Ramsar site) is located 24 kilometres to the north. The atolls have developed on top of old volcanic seamounts, rising from a depth of 5 000 metres in the north-eastern Indian Ocean (Bunce, 1988).

As a coral atoll, the site does not have a “catchment” per se. Climate of the region is described in Section 16 above.

18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

No freshwater exists on the island.

19. Wetland Types

a) presence:

Circle or underline the applicable codes for the wetland types of the Ramsar “Classification System for Wetland Type” present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U • Va •
Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:

List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

C, D, E, B, J

20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

At the time of listing there were three main marine habitat types at the site, although the closure of the lagoon has limited this to the following two:

- Coral reefs - conglomerate reef platforms within the PKNP Ramsar site are composed of cemented coral shingle and rubble accumulated over the past 3 000 – 4 000 years (Woodroffe et al. 1994). Fossilised Porite (Boulder Coral) and Acropora (Staghorn corals) have been found within the reef flats and crests indicating the roles of these species in the construction of the coral atoll (Woodroffe et al. 1994). Corals on the reef flat are within shallow water and may be exposed at low tide, providing a high light and temperature environment. Conversely the corals on the crest and the seaward side are exposed to greater wave action, but lower temperature and light environments. The coral reef surrounding the site supports an abundance of fish and invertebrates including corals, molluscs and decapod crustaceans. Over 193 species of fish have been recorded from within the site, most of which are either cosmopolitan or common in the Indo-Pacific region.
- Rocky and sandy shores - Much of the shore of the PKNP Ramsar site (outside the lagoon) is comprised of shingle, rubble and beach rock (Woodroffe and McLean 1994). The sand beaches, which are important habitat for nesting turtles, are mostly confined to the northern area of the atoll, where the reef crest is absent.

Aquatic vascular vegetation was limited to a single species of seagrass (*Thalassia hemprichii*), which occurred within the lagoon area. This no longer occurs at the site, following the closure of the lagoon.

Terrestrial vegetation provides nesting and roosting habitat for waterbirds using the Ramsar site, which supports breeding of 15 species of seabird. Terrestrial vegetation is dominated by coconut (*Cocos nucifera*) and pisonia (*Pisonia grandis*) forest, which tower 30 metres above the ground. Octopus bush shrubland lines the eastern shore with a more diverse community of shrubs and saltmarsh herblands along the shore of the lagoon. The most diverse communities are located on the sandy spits adjacent to the lagoon entrance (Williams 1994). Thirty-three species of native vascular plant have been recorded within the Ramsar site (Director of National Parks 2004).

21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

The forests of PKNP Ramsar site provide an example of the original vegetation for the region with many of the plant species no longer found on the other 26 islands in the Cocos group (Woodroffe 1994). The island still has extensive stands of ironwood (*Cordia subcordata*), which apparently once formed extensive stands of forest on the southern atoll but has now been reduced to a few small clumps because its wood was sought after for building (Bunce, 1988). The Cocos sub-species of pandanus (*Pandanus tectorius cocosensis*), which is only localised in occurrence, is considered endemic to the Cocos (Keeling) Islands (Williams, 1990).

22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14. Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

The PKNP Ramsar site supports a number of species that are no longer found within the southern atoll. This includes a number of waterbirds as well as fish and invertebrate species. This is mostly due to the isolation of the Ramsar site compared to the southern atoll and the protection of biota from harvest and use by the National Park status (Stokes 1994).

A total of 24 species of waterbird have been recorded within the PKNP Ramsar site (Appendix 1). This includes 15 species that are listed under international migratory agreements CAMBA (13), JAMBA (13) and ROKAMBA (7) and all species recorded are listed under the EPBC Act. There are two species that are considered threatened at the national and international levels:

- the Cocos buff-banded rail (*Gallirallus philippensis andrewsi*) listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is restricted to the PKNP Ramsar Site (Director of National Parks 2004); and
- the Round Island petrel (*Pterodroma arminjoniana s. str.*) (Critically endangered); although there is only a single record of the Round Island Petrel from the site.

The site is a significant seabird rookery with, significant breeding of red-footed booby (*Sula sula*), greater frigatebirds (*Fregata minor*), lesser frigatebirds (*Fregata ariel*) and the common noddy (*Anous stolidus*). An additional 12 species of waterbird have been observed breeding on the island in lesser numbers including brown booby (*Sula leucogaster*), masked booby (*Sula dactylatra*), terns and tropicbirds.

The site supports at least 26 species of crabs, including several species of hermit crabs (terrestrial and aquatic), the red spider crab (*Schizophris aspera*) and swimmer crabs (*Thalamitoides quadridens*). Of note is the presence of the coconut or robber crab (*Birgus latro*) which was formerly abundant on the southern atoll, but now rare or absent (Bunce 1988) and a small number of red crabs (*Gecarcoidea natalis*) the only known population outside Christmas Island (Director of National Parks 2004).

The site supports a single endemic angelfish (*Centropyge jocularis*), which is known only from Christmas Island and the Cocos (Keeling) Islands (Director of National Parks 2004). Although endemism is low, there is evidence of hybridisation of a number of species within the bioregion, which contributes to the uniqueness of the community (Hobbs and Salmond 2008).

The site provides foraging habitat for the hawksbill turtle and breeding habitat for the green turtle, both of which are listed as vulnerable under national threatened species legislation.

23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

The site has remained largely uninhabited, with the exception of visits for short periods from the southern atoll residents for timber and nut collecting as well as bird hunting (Bunce 1988). In 1914 the German warship the SMS Emden ran aground at Pulu Keeling following an encounter with the HMS Sydney. The salvage of the vessel from October 1915 to January 1916 by islanders probably represents the longest period of settlement within the Ramsar Site (Woodroffe and McLean 1994). Despite further salvage of the vessel by a professional Japanese salvage company in the 1950s, parts of the wreck remain on the reef of the southern shore and are protected by Australia's *Historic Shipwrecks Act 1976*.

The PKNP site is important to the local Cocos Malay community both economically and spiritually. The pristine nature of the site attracts tourists and special interest groups that must be transported to and from the island and accommodated on the southern atoll (camping is forbidden in the Ramsar site). This provides a valuable source of income for local residents of the southern atoll (Director of National Parks 2004). In addition, the site features in traditional stories, including that of the penunggu, the female guardian of the island, who lives in an area surrounding the landing place on Pulu Keeling and protects the atoll (Bunce 1988).

Cocos residents are allowed to fish recreationally within the site by trolling, with a valid permit.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box and describe this importance under one or more of the following categories:

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

24. Land tenure/ownership:

a) within the Ramsar site:

The entire PKNP Ramsar site is a declared Commonwealth National Park on lease from the Cocos (Keeling) Shire Council to the Director of National Parks.

b) in the surrounding area:

Territorial waters belong to the Commonwealth of Australia.

25. Current land (including water) use:

a) within the Ramsar site:

Conservation of wildlife (National Park) and research.

b) in the surroundings/catchment:

Only two of the southern atoll islands are permanently inhabited. The primary land use on these islands used to be (until 1987) the production of copra through the cultivation of Cocos palms.

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site:

There are a number of activities that may cause potential threats to the ecological character of the site. However, the most significant of these are:

1. Hunting of seabirds - once a common practice in the Cocos (Keeling) Islands (Bunce 1988). Although hunting within the PKNP Ramsar site is now prohibited, poaching may continue to pose a threat to seabird populations (Director of National Parks 2004). It is estimated that between 2 000 and 3 000 birds are illegally taken from the Ramsar site each year and in some years this may be as much as 10 000 (Baker et al. 2004).

2. Yellow crazy ants (*Anoplolepis gracilipes*) - occur within the Ramsar site in areas of *pisonia* forest (Neville et al. 2008). Listed as one of the top 100 worst invasive alien species in the world by the Global Invasive Species Database (2009). No super colonies have been recorded on the site and it is possible that growth and population expansion may be limited in the absence of Homoptera insect populations (Global Invasive Species Database 2009). Impacts from yellow crazy ants include both mortality of prey items (such as the red crab on Christmas Island), as well as defoliation of the forest, through the combined action of ants and scale insects (Hill et al. 2003). Within the Ramsar site this would have flow on ecological effects on nesting bird species such as the Red-footed booby, which rely on the forest habitat for breeding.

b) in the surrounding area:

Climate change predictions for the Cocos (Keeling) Islands indicate an increase in sea level, sea surface temperature and intensity of tropical storms. An increase in sea level could result in an increase in submerged areas and intertidal sands at the expense of terrestrial vegetation. Tropical cyclones, with strong winds also have the potential to cause direct physical damage to the vegetation at the site. There are examples in the recent past of tropical cyclones causing extensive damage to the *pisonia* trees, which in turn resulted in declines in Red-footed booby (Baker et al. 2004). To date, vegetation and seabirds have recovered from the effects of tropical cyclones in the intervals between intense storms (Baker and Cunningham 2007). However, an increase in the frequency of category 4 and 5 tropical cyclones may reduce the potential for recovery and lead to sustained changes in vegetation and the seabirds that rely on the vegetation for nesting and roosting.

An increase in sea surface temperature could have significant impacts to the reef and coral communities within the Ramsar site. Although no coral bleaching or disease has been recorded in the Ramsar site to date (Commonwealth of Australia 2005a); white syndrome, or coral bleaching, has been linked to increased water temperature in other parts of the world (Hobbs and Frisch in prep).

27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site:

In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

Pulu Keeling National Park is leased to the Director of National Parks by the Cocos (Keeling) Islands Shire Council. The island is leased for the purposes of administration, management and control of the Park in accordance with the EPBC Act. Under the Lease agreement the Director has covenanted:

- that the flora, fauna and natural environment of the Park will be preserved, managed and maintained according to the best comparable management practices established for national parks anywhere in the world (or if no comparable management practices exist, to the highest standards practicable); and
- to take all practicable steps to ensure compliance with the Lease, the EPBC Act, the EPBC Regulations and the management plans for the Park.

The lease provides for the establishment and continuation of the Pulu Keeling National Park Community Management Committee to advise on matters relating to the management of the site.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ; Ib ; II ; III ; IV ; V ; VI

c) Does an officially approved management plan exist; and is it being implemented?:

An official management plan exists (Pulu Keeling National Park Management Plan; Director of National Parks, 2004) and is being implemented by Parks Australia. A revised management plan for the national park, which includes the whole Ramsar site, is currently under preparation, and is expected to be completed in 2012.

d) Describe any other current management practices:

There are a number of on-ground activities that have been implemented within the Ramsar site, including monitoring of important species and communities such as Red-footed booby, Cocos buff-banded rail and green turtles, as well as monitoring of significant threats such as yellow crazy ants and weed species. In addition, some weed control has been implemented.

28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

Update of the management plan is scheduled for 2012.

Further research and adaptive management for weed control and crazy ant management are proposed for the near future (Parks Australia pers. comm.).

29. Current scientific research and facilities:

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

The remote nature of the PKNP Ramsar site and its near pristine nature provide a rare opportunity in the Indian Ocean to collect baseline information on coral reef and atoll ecology. The Ramsar site was surveyed by the Western Australian Museum in the late 1980s including fish, birds, vegetation, and marine invertebrates (Woodroffe and Berry 1994). However, difficulty of access meant that not all studies conducted on the southern atoll were undertaken in the Ramsar site (e.g. marine habitat surveys). Access remains a barrier to extensive research today, with landings requiring a swim of 100 m across the reef with equipment (Director of National Parks 2004). Despite this, annual surveys of Red-footed booby have been conducted since 1986; turtle monitoring has been conducted on green and hawksbill turtles (Whiting 2006; Whiting et al. 2008) and a reef condition monitoring site has been established (Commonwealth of Australia 2005a).

30. Current communications, education, participation and awareness (CEPA) activities related to or benefiting the site:

e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

The management plan for the PKNP Ramsar site contains a number of key communication messages and a program for implementing community education. Key CEPA messages include:

- The Ramsar values of the site and the importance of the Ramsar site as a habitat for breeding seabirds.
 - The significance of the site in maintaining biodiversity in the region, particularly in light of the reduced biodiversity in the Southern Atoll.
 - The threats that hunting, fishing and inappropriate recreational activities pose to the ecological character of the site.
 - The threat of yellow crazy ants and the impact they could have on the sites values.
 - Climate change, the potential impacts on the benefits and services of the Ramsar site and the ways in which additional pressures from activities such as boating, fishing and hunting can exacerbate the effects of climate change on marine and tropical environments.
 - The importance of cooperative management of site involving the local community on maintaining the ecological character of the PKNP Ramsar site.
-

31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Despite the difficulty of access, the PKNP Ramsar site is valued for recreation and tourism. Licensed tour operators conduct occasional day trips to the site for bird watching, diving, snorkelling and sight seeing. As visitors are not permitted to stay within the Ramsar site overnight, these activities provide a valuable source of income for the residents of the southern atoll in terms of boat operators and accommodation providers (Director of National Parks 2004).

Cocos residents are allowed to fish recreationally within the site by trolling, with a valid permit.

32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

Director of National Parks, Australia under lease from the Cocos (Keeling) Islands Shire Council.

33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Director of National Parks
GPO Box 787
Canberra, ACT 2601

34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

Allen, G.R. and Smith-Vanz, 1994, Fishes of the Cocos (Keeling) Islands), Atoll Research Bulletin 412, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Baker, G.B. and Cunningham, R.B., 2007, Data Analysis System for Red-footed Booby Program at Cocos (Keeling) Islands 2007, Report prepared for the Department of Environment and Water Resources, Canberra.

Baker, G.B., Cunningham, R.B. and Murray, W., 2004, Are red-footed boobies *Sula sula* at risk from harvesting by humans on Cocos (Keeling) Islands, Indian Ocean? Biological Conservation 119: 271–278

Bureau of Meteorology, 2009a, Climate data online, downloaded from <http://www.bom.gov.au/climate/averages/> on 15/9/2009.

Bureau of Meteorology, 2009b, Australian tide predictions, downloaded from http://www.bom.gov.au/cgi-bin/oceanography/tides/tide_predictions.cgi on 22/9/2009.

Bunce, P., 1988, The Cocos (Keeling) Islands: Australian Atolls in the Indian Ocean, Jacaranda Press: Milton, Queensland

Commonwealth of Australia, 2005a, Status of the Coral Reefs at the Cocos (Keeling) Islands
A report on the status of the marine community at Cocos (Keeling) Islands, East Indian Ocean, 1997–2005

Commonwealth of Australia, 2005b, National Recovery Plan for the Buff-banded Rail (Cocos (Keeling) Islands) *Gallirallus philippensis andrewsi*. Department of the Environment and Heritage, Canberra.

Commonwealth of Australia, 2006, A guide to The Integrated Marine and Coastal Regionalisation of Australia - version 4.0 June 2006 (IMCRA v4.0)

Director of National Parks, 2004, Second Pulu Keeling National Park Management Plan, Commonwealth of Australia, Canberra.

Global Invasive Species Database, 2009, (<http://www.issg.org/database>) accessed October 4, 2009.

Hobbs, J-P, in prep., Fishes of North Keeling Island (Pulu Keeling National Park) and the impact of the lagoon closure, report to Parks Australia.

Hobbs, J-P., Frisch, A.J., Allen, G.R., Herwerden, L.V., 2009, Marine hybrid hotspot at Indo-Pacific biogeographic border, *Biol. Lett.* 5: 258-261

Hobbs, J-P. and Salmond, J.K., 2008, Cohabitation of Indian and Pacific Ocean species at Christmas and Cocos (Keeling) Islands, *Coral Reefs*, 27:933

Lincoln Smith, M.P., Skilleter, G.A., Underwood, A.J., Stark, J., Smith, A.K., Hawes, P.M.H., Howitt, L., White, G.A. and Chapman, M.G., 1995, Cocos (Keeling) Islands: Quantitative baseline surveys for core marine reserves and biosphere reserve in the South Keeling Lagoon. Report to the Australian Nature Conservation Agency by the Institute of Marine Ecology, University of Sydney and The Ecology Lab Pty. Limited.

Jones, D.S., 1994, Barnacles (Cirripedia, Thoracica) of the Cocos (Keeling) Islands, *Atoll Research Bulletin* 413, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Marsh, L.M., 1994, Echinoderms of the Cocos (Keeling) Islands, *Atoll Research Bulletin* 411, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA

Morgan, G.J., 1994, Decapod Crustaceans of the Cocos (Keeling) Islands, *Atoll Research Bulletin* 414, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Neville, P.J., O'Dowd, D.J., and Yen. A.L., 2008, Issues and implications for research on disturbed oceanic islands illustrated through an ant survey of the Cocos (Keeling) Islands, *Journal of Insect Conservation* 12: 313–323

Reid, J.R.W., 2000, Survey of the Buff-banded Rail (*Gallirallus philippensis andrewsi*) in Pulu Keeling National Park, Cocos Islands, Indian Ocean

Reid J.R.W. and Hill B.M., 2005, Recent Surveys of the Cocos Buff-banded Rail *Gallirallus philippensis andrewsi*. Report to the Australian Government Department of the Environment and Heritage. Centre for Resource and Environmental Studies, Australian National University, Canberra

Stokes, T., 1982, Birds of the Cocos (Keeling) Islands, Indian Ocean. Australian National Parks and Wildlife Service Internal Report.

Stokes, T., 1994, An update on birds of the Cocos (Keeling) Islands, *Atoll Research Bulletin* 405, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Stokes, T., Shiels, W., and Dunn, K., 1984, Birds of the Cocos (Keeling) Islands, *The Emu*, 84: 23–28.

Veron, J.E., 1994, Hermatypic Corals of Cocos (Keeling) Islands: a Summary, *Atoll Research Bulletin* 409, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Wells, F.E., 1994, Marine Molluscs of the Cocos (Keeling) Islands, Atoll Research Bulletin 410, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Whiting, S., 2006, Sea Turtle Study Cocos (Keeling) Islands, Indian Ocean, Year 7, Parks Australia, Canberra

Williams, D.G., 1994, Vegetation and Flora of the Cocos (Keeling) Islands, Atoll Research Bulletin 404, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Woodroffe, C.D., and Berry, P.F., 1994, Scientific Studies In the Cocos (Keeling) Islands, Atoll Research Bulletin 399, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Woodroffe, C.D., and McLean, R.F., 1994, Reef Islands of the Cocos (Keeling) Islands, Atoll Research Bulletin 403, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA.

Woodroffe, C.D., McLean, R.F., and Wallensky, E., 1994, Geomorphology of the Cocos (Keeling) Islands, Atoll Research Bulletin 402, Natural Museum of Natural History, Smithsonian Institute, Washington DC, USA

Please return to: **Ramsar Convention Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
Telephone: +41 22 999 0170 • Fax: +41 22 999 0169 • e-mail: ramsar@ramsar.org

Appendix 1: Wetland birds recorded in the PKNP Ramsar Site

Order	Scientific Name	Common name	EPBC Listing	Comments
Ardeiformes	<i>Ardea ibis</i>	Cattle egret	Marine; Migratory (CAMBA, JAMBA)	Vagrant
	<i>Egretta sacra</i>	Eastern reef egret	Marine; Migratory (CAMBA)	Resident Breeding
	<i>Nycticorax caledonicus</i>	Nankeen night heron	Marine	Resident Breeding
Charadriiformes	<i>Chlidonias leucopterus</i>	White-winged tern	Marine; Migratory (CAMBA, JAMBA, ROKAMBA)	Migratory Single sighting
	<i>Gygis alba</i>	White tern	Marine	Resident Breeding
	<i>Onychoprion anaethetus</i>	Bridled tern	Marine; Migratory (CAMBA, JAMBA)	Vagrant Breeding
	<i>Onychoprion fuscata</i>	Sooty tern	Marine	Resident Breeding
	<i>Arenaria interpres</i>	Ruddy turnstone	Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	Migratory
	<i>Anous stolidus</i>	Common noddy	Marine; Migratory (CAMBA, JAMBA)	Resident Breeding
	<i>Calidris alba</i>	Sanderling	Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	Migratory
	<i>Gallinago stenura</i>	Pin-tailed snipe	Marine; Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	Migratory
Ciconiiformes	<i>Phoenicopterus ruber</i>	Greater flamingo	Marine	Vagrant
Gruiformes	<i>Gallirallus philippensis andrewsi</i>	Cocos buff-banded rail	Endangered	Resident Breeding
Pelecaniformes	<i>Sula dactylatra</i>	Masked booby	Marine; Migratory (JAMBA, ROKAMBA)	Resident Breeding
	<i>Sula leucogaster</i>	Brown booby	Marine; Migratory (CAMBA, JAMBA, ROKAMBA)	Resident Breeding
	<i>Sula sula</i>	Red-footed Booby	Marine; Migratory (CAMBA, JAMBA)	Resident Breeding
	<i>Fregata andrewsi</i>	Christmas Island frigatebird,	Vulnerable; Marine; Migratory (CAMBA)	Vagrant
	<i>Fregata ariel</i>	Lesser frigatebird	Marine; Migratory (CAMBA, JAMBA, ROKAMBA)	Resident Breeding
	<i>Fregata minor</i>	Greater frigatebird	Marine; Migratory (CAMBA, JAMBA)	Resident Breeding
	<i>Phaethon lepturus fulvus</i>	White-tailed tropicbird	Marine	Resident Breeding
	<i>Phaethon rubricauda</i>	Red-tailed tropicbird	Marine	Resident Breeding
Procellariiformes	<i>Puffinus pacificus</i>	Wedge-tailed shearwater	Marine; Migratory (JAMBA)	Migratory Breeding
	<i>Pterodroma arminjoniana s. str.</i>	Round Island petrel	Critically Endangered	Single record
	<i>Puffinus lherminieri</i>	Tropical shearwater	Marine	Single record; Breeding?

Figure 1.

