

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:

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DD MM YY

Designation date

Site Reference Number

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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.

Hosnies Spring

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 2010 the area of Hosnies Spring was expanded from 0.33 hectares to 202 hectares. This extension increased the boundary of the Ramsar site to match that of the national park boundary on the eastern side of Christmas Island. This additional area around the original 0.33 hectares gives greater protection to the unique and ancient freshwater mangrove stand. The expansion means the site now includes two additional Ramsar wetland types including C) coral reefs and D) rocky marine shores.

Previous versions of the Ramsar Information Sheet stated that the site met criterion 2. Re-examination of the evidence to support this criterion has revealed that the site does not (and never did) support threatened species. There are two threatened wetland bird species that have been recorded within the Hosnies Spring Ramsar Site: Abbott's booby (*Papasula abbotti*) and Christmas Island frigatebird (*Fregata andrewsi*). However, the Ramsar Site is not considered to provide core habitat in terms of feeding, roosting or nesting for these species (Peter Green, pers. comm.). There are few records for these wetland birds from within the Ramsar Site and they are numerous in other areas of Christmas Island (Hennicke 2007). Therefore, although threatened species have been recorded within the site, the wetlands within the site are not considered to play a significant role in supporting them.

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.

Hosnies Spring Ramsar site is on the eastern side of Christmas Island.

The boundary of the Ramsar site is identical to that of the Hosnies Spring section of Christmas Island National Park as established by Proclamation made on 14 December 1989 and published in the *Commonwealth of Australia Gazette* No. GN 49 of 20 December 1989. 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: 10°28'S Longitude: 105°41'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.

Hosnies Spring is located in the Australian Territory of Christmas Island in the Indian Ocean. The site is 2,800 kilometres west of Darwin (Northern Territory) and 2600 kilometres northwest of Perth (Western Australia); within the Christmas Island National Park.

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

Maximum – 37 metres AHD (Australian Height Datum) Minimum – sea level

11. Area: (in hectares)

202 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.

Hosnies Spring is an area of permanent, shallow freshwater wetland, fed by a natural spring system located approximately 30 metres above sea level and 120 metres inland of the seaward cliff. The wetland is covered by a stand of mangroves (*Bruguiera gymnorhiza*) estimated to be 120 000 years old (Woodroffe 1988). The Ramsar Site includes surrounding terrestrial areas with rainforest grading to coastal scrub, and includes an area of shoreline and coral reef. The site is significant for the age, location and size of the mangroves as well as for supporting large numbers of crabs including: red crabs (*Gecarcoidea natalis*), robber crabs (*Birgus latro*) and blue crabs (*Discoplax hirtipes*).

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
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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.*

Christmas Island represents the only land mass within the Christmas Island Province bioregion and the wetlands associated with Hosnies Spring, particularly the spring system and mangrove stand are unique in a bioregional (and in fact broader) context (Woodroffe 1988). The mangrove stand is remarkable for three reasons: first it occurs up to 37 metres above sea-level and on an inclined surface; second, the mangroves are among the largest of their species (*Bruguiera gymnorhiza* and *Bruguiera sexangula*) ever recorded; and, third, conditions favourable for mangrove establishment do not appear to have existed since the last Interglacial period and, therefore, the stand has probably persisted in this location for up to 120 000 years.

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.*

This wetland is important for supporting a relict mangrove species which is unique within the bioregion and possibly worldwide. The stand comprises two species, *Bruguiera gymnorhiza* and *Bruguiera sexangula*, both of which usually occur in intertidal zones. However, at Hosnies Spring the trees are located at the spring some 120 metres inland and 37 metres above sea level. It is thought that the stand is a relic of times when the site was inundated by the sea more than 120 000 years ago (Woodroffe 1988).

This site supports the red crab (*Gecarcoidea natalis*) which is endemic to Christmas Island. There is also a total of eighteen endemic species (see Appendix A) of vascular plants on Christmas Island which may be present on the Ramsar site, however a floristic survey specific to the Hosnies Spring Ramsar site has not been undertaken.

The Christmas Island fish community also consists of seven endemic species which are likely to occur within the site:

- mottled sole (*Aseraggodes crypticus*)
- Cocos angelfish (*Centropyge jocularis*)
- lemonpeel angelfish (*Centropyge flavissima*)
- Christmas eviota (*Eviota natalis*)
- Christmas dottyback (*Pseudochromis viridis*)
- Christmas blenny (*Præalticus natalis*)
- island Gregory (*Stegastes insularis*)

The Cocos angelfish (*Centropyge jocularis*) is locally abundant and endemic to both Christmas Island and Cocos (Keeling) Islands. The Island Gregory (*Stegastes insularis*) is also locally abundant in shallow waters (Gilligan et al. 2008) and can only be found at Christmas Island and in small pockets of the north east Pacific.

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 site is important for the blue crab (*Discoplax hirtipes*), which is reliant on the freshwater provided by the spring to maintain respiratory function (Hicks et al. 1984). During the wet season there is sufficient surface water in forests to maintain gill functioning and they can range over large areas of Christmas Island. However, during the dry season they are restricted to permanent freshwater sources, such as that provided by Hosnies Spring (Hicks et al. 1984). Their burrows at Hosnies spring intersect the water table, with the bottom part of the burrow underwater (Hicks et al. 1984).

The spring is one of the few permanent sources of freshwater on Christmas Island and acts as a dry season refuge for a number of terrestrial species. In addition, the site provides a connection from the plateau to the ocean and as such is a likely migratory route for the endemic red crab (*Gecarcoidea natalis*) during breeding migrations.

Christmas Island is also a globally significant area for the vulnerable whale sharks (*Rhincodon typus*) because their juveniles aggregate by the Island in summer to feed on the larvae of red crabs (Hobbs et al, 2009). They have been observed along the east coast of the island within 50 metres of the shoreline (Jean-Paul Hobbs, pers. Comm.) and so potentially could occur at times within the Ramsar site.

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:

Christmas 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.

Christmas Island 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. Annual average rainfall at Christmas Island is in the order of 2,000 millimetres per year. The site is located in an area subject to tropical cyclones. Thirteen tropical cyclones were recorded in the vicinity of Christmas Island between 1972 and 2005, on average this equates to a tropical cyclone every two and a half years.

The hydrology of Christmas Island is driven strongly by the underlying geology. The high porosity of the surface soils and underlying limestone limits the formation of permanent surface water. Surface water run-off is confined to the wet season (December to March) in relatively short, spring fed streams (Grimes 2001). The dominant water resource on the island, and the source of water for the Hosnies Spring Ramsar site, is groundwater.

Hosnies Spring is located at the inland extent of the shore terrace where freshwater trickles over a calcareous flowstone at the base of a limestone cliff. The wetland stretches from approximately 120 metres inland of the coast on gravel soils, which cover 0.33 of a hectare (Woodroffe 1988). Hosnies Spring is an example of a land based spring discharge of a perched aquifer. Water discharges from a number of discrete locations and saturates the soil for an area of approximately 3,300 square metres (Director of National Parks 2002). Although flow rates are not known, the spring is a permanent water source and remains flowing through the dry season.

The area within the Ramsar site that surrounds the spring, is predominantly rainforest characterised by a 20 to 30 metre tall canopy of evergreen and deciduous tree species such as *Pisonia grandis* and *Barringtonia racemosa* and a conspicuous lack of a herb and shrub layer. There is a narrow band of coastal scrub with hardy species such as *Scaevola taccada* at the seaward margin of the shore terrace, with an unvegetated area of limestone pinnacles at the top of the sea cliffs (Woodroffe 1988). The cliff descends some 17 metres almost vertically to the rocky marine shore below. The site extends 50 metres seaward of the low water mark and includes areas of shallow coral reef.

17. Physical features of the catchment area:

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

Christmas Island is a seamount island, which rises above the 5,500 metre deep abyssal area of the Western Australian Basin (SKM 2000). The island has a basaltic volcanic core overlain with limestone of predominantly Tertiary origin (Woodroffe 1988). The island is characterised by a series of stepped terraces, which developed during uplift events. The most prominent of the limestone terraces, is the lowest one, called the “shore terrace”. This feature surrounds the entire island, with the exception of a short break in the northeast at Flying Fish Cove. The freshwater spring lies wholly within the shore terrace, however the Ramsar site spans the plateau, shore terrace and rocky shores.

Although Christmas Island is completely surrounded by coral reef, the extent of this habitat is limited (Gray and Clarke 1995). At the seaward edge, the reef is limited by a steep drop off some 20 to 100 metres from the shore, where the underwater terraces descend steeply. At the landward edge, the reef is limited by the exposed coastline and high impact of waves and consequently only extends to the intertidal zone in sheltered locations (Gray and Clarke 1995).

The soils of Christmas Island are derived from two sources; limestone (terra rossa soils) or basaltic extrusive rocks (krasnozem soils). Terra rossa soils occur mainly on exposed terraces, and are predominantly thin, red-grey soils that dry out rapidly. They may have high phosphate content and be over 30 metres deep. Krasnozem soils are red brown in colour and occur in areas of volcanic activity or in fault or fissure zones. There has been no systematic evaluation of the non mined/non phosphate reserve regions of the island, so other soil types may exist.

Climate in the catchment is as described above in section 16.

18. Hydrological values:

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

Christmas Island has a karst drainage system with surface water restricted to a few springs, and intermittent systems which flow after significant rainfall events in the wet season, but last only for short periods of time (Grimes 2001). Springs are fed from recharge areas on the plateau (Puhlovich et al. 2003) with approximately half of incident rainfall passing through the soil zone to recharge the aquifers, with recharge occurring rapidly once soils are saturated. Recharge also occurs through dissolution features including dolines and sinkholes (Puhlovich et al. 2003).

Rain infiltrates the land surface and contributes to soil water storage, being taken up by plants or moving to recharge the groundwater. Water either flows along the interface or down fractures in the volcanic rock and contributes to basal and perched aquifers (SKM 2000). Higher permeability of the limestone on the margin of the island results in the water table being just above sea level (SKM 2000; Grimes 2001).

Hosnies Spring is one of a limited number of permanent springs on Christmas Island. Flow rates of the spring have not been measured but are very low. Without the spring, it could be expected that the mangrove stand situated upon it would atrophy.

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.

The spring itself is wetland types Y (freshwater springs) and Xf (freshwater tree dominated wetlands) and comprises 0.33 hectares.

The extent of coral reefs (type C) and rocky shores (type D) is not known at this stage.

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.

The terrestrial vegetation, and other biota, of Christmas Island are derived from species colonisation and show little affinity with the Australian mainland. The isolation of the island and the randomness of the colonisation process have resulted in a unique flora and fauna (Expert Working Group 2010). The major types of rainforest on the island are dominated by plants which are pan-tropical species most likely from South East Asia (Expert Working Group 2010). The dominant vegetation types present on Christmas Island include plateau/primary rainforest, marginal rainforest, and scrub forest (also referred to as open forest and vine forest).

Hosnies Spring Ramsar site contains a unique inland stand of mangroves from the genus *Bruguiera*. Investigations in the 1970s and 1980s identified two species of mangrove at the site *Bruguiera gymnorhiza* and *Bruguiera sexangula* (van Steenis 1984 in Woodroffe 1988). However, the two species are morphologically very similar and very difficult to distinguish. The mangroves cover almost the entire area of freshwater wetland and there is a range of age classes present on the site, indicating active regeneration.

The Hosnies Spring Ramsar site supports a large number of land crabs. In particular large numbers of three species occur at the spring site:

- red crabs (*Gecarcoidea natalis*) – which are the most abundant at the site;
- robber crabs (*Birgus latro*) – which are considered common; and
- blue crabs (*Discoplax hirtipes*) – which are described as restricted to the freshwater wetland (and other freshwater areas on the Island). Although widespread, this species occurs in its blue form only on Christmas Island.

The site includes a rocky marine shore and coral reef. Although there is little direct information on these environments, observations and anecdotal evidence suggests that the marine environment and biota of the east coast of Christmas Island is similar to other marine areas that have been surveyed (Jean-Paul Hobbs, pers. Comm.). The reef at Christmas Island is dominated by hard corals, with low cover of soft corals, encrusting algae and other biota. Six hundred and twenty-two species of fish from 80 families have been recorded in the waters of Christmas Island (Hobbs et al, in press). The list includes species of Indo-Pacific, Pacific Ocean and Indian Ocean origins and Christmas Island is considered as an important “stepping-stone” in the dispersal of species between the Indian and Pacific Oceans (Hobbs et al, in press).

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.*

Hosnies Spring is remarkable for its almost pure stand of mangroves *Bruguiera gymnorhiza* and *B. sexangula* growing 120 metres inland and approximately 30 metres above sea level.

There are approximately 420 species of vascular plants on Christmas Island, however a floristic survey specific to Hosnies Spring Ramsar site has not been undertaken. Of the 420 species found on Christmas Island, 242 are indigenous and 177 are naturalised since human occupation (Claussen 2005). The island has eighteen endemic species (see Appendix A), including the lithophytic fern, *Asplenium listeri*, which is listed under the EPBC Act. Two ground ferns *Pneumatopteris truncate* and *Tectaria devexa* var *minor* are also EPBC Act listed.

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.*

In addition to the crabs, listed in section 20 above, there are two threatened wetland bird species that have been recorded within the Hosnies Spring Ramsar: Abbott’s booby (*Papasula abbotti*) and Christmas Island frigatebird (*Fregata andrewsi*). However, the Ramsar site is not considered to provide core habitat in terms of feeding, roosting or nesting for these species (Peter Green, pers. Comm.). A number of other endemic and threatened bird species are also present within the site boundary (Director of National Parks 2002).

Threatened and Endemic Bird Species Present at Hosnies Spring Ramsar Site

Common name	Scientific name	IUCN	CITES	CMS	National Status EPBC Act
Abbott's booby	<i>Papasula abbotti</i>	Endangered	Appendix I	-	Endangered, Marine, Migratory
Christmas Island frigatebird	<i>Fregata andrewsi</i>	Critically Endangered	Appendix I	-	Vulnerable, Marine, Migratory
Christmas Island imperial pigeon	<i>Ducula whartoni</i> (endemic)	Vulnerable			Vulnerable
Christmas Island emerald dove	<i>Chalcophaps indica natalis</i> (endemic)	-	-	-	Endangered
Christmas Island goshawk	<i>Accipiter fasciatus natalis</i> (endemic)	Endangered	-	-	Vulnerable
Christmas Island hawk-owl	<i>Ninox natalis</i> (endemic)	Vulnerable	Appendix I	-	Endangered
Christmas Island thrush	<i>Turdus poliocephalus erythropleurus</i> (endemic)	-	-	-	Endangered
Christmas Island white-eye	<i>Zosterops natalis</i> (endemic)	Vulnerable	-	-	-

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:

Although there is some opportunity for recreation and tourism within the site, because the site is a sensitive site, Hosnies Spring is not actively promoted for tourism and visitor access is limited. Visitor access of small, interest groups such as bird watchers, or scientific teams is managed by Parks Australia to conserve the ecological character of the site.

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:

Hosnies Spring Ramsar site is entirely within a declared Commonwealth reserve under the control of the Director of National Parks.

b) in the surrounding area:

Over 70 percent of Christmas Island is declared National Park, immediately surrounding the site are freehold areas used for mining, transport (roads and airport) and domestic residences.

25. Current land (including water) use:

a) within the Ramsar site:

Land use within the site is conservation and research, within a National Park.

b) in the surroundings/catchment:

The surrounding areas are used for mining, transport (roads and airport) and domestic residences.

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:

The greatest threat to the ecological character from within the Ramsar site comes from the invasive yellow crazy ant (*Anoplolepis gracilipes*). Yellow crazy ants are thought to have been introduced accidentally to Christmas Island between 1915 and 1934 (O'Dowd et al. 1999). Listed as one of the top 100 worst invasive alien species in the world by the Global Invasive Species Database (2009), they have caused wide scale impacts to tropical ecosystems on Christmas Island. Yellow crazy ants forage over a large range of habitats, including forest floor and canopy and are scavengers feeding on a range of invertebrates, but may also be reliant on carbohydrates, which they obtain from plant nectar or honeydew-producing scale insects (particularly of the Homoptera genus). On Christmas Island the relationship between this species and scale insects has resulted in the formation of multi-queen "super colonies" which result in high population densities (Abbott 2005). Results of island wide surveys (Parks Australia unpublished) indicate that yellow crazy ant super colonies are present within the Hosnies Spring Ramsar site and that this has resulted in decreases in red crabs. Yellow crazy ants were observed within the mangrove stand in the 1990s. However, the mangrove may not be a good host for the scale insect and the ants have not significantly impacted on the mangrove stand at the site (Peter Green, pers. comm.). In addition, blue crabs appear to be less affected by the ants, perhaps due to the water within their burrows diluting the formic acid.

b) in the surrounding area:

There is little permanent surface water on Christmas Island, and water for consumptive uses is extracted from the unconfined aquifers. While, there is no information on the quantity of water extracted for consumptive purposes, recent increases in the population at Christmas Island (including the large influx of people associated with the immigration detention facility) may pose a serious threat to freshwater ecosystems. Although water is not extracted from Hosnies Spring directly, Grimes (2001) described the groundwater resources of the island as interconnected. This suggests that extraction from water on the plateau at Grants Well or Jane-up, could impact on the discharge volumes and rates at coastal springs on the shore terrace. A significant reduction in flow, or a loss of permanent water at the Hosnies Spring Ramsar site has the potential to result in dramatic effects to the ecological character of the site, with the potential loss of the mangrove stand and severe impacts to blue crabs, both of which are reliant on permanent water. This situation could be exacerbated by climate change if rainfall were to decrease.

There are a variety of climate change predictions for Christmas Island (McInnes et al. 2008), those of direct relevance to the Hosnies Spring Ramsar site are related to rainfall, tropical storms and sea temperature. In general it is thought that the intensity (if not the frequency) of tropical storms could increase and sea surface temperatures will rise by up to 2.5 degrees Celsius by 2070 (McInnes et al. 2008). The predicted increases in sea temperature are likely to impact on the marine communities of Christmas Island (including those in the Ramsar site) through increasing diseases such as White Syndrome and coral bleaching.

The increase in population due to the Christmas Island Immigration Detention Centre (IDC) may also be a direct or indirect threat regarding increased groundwater use; increased mortality of land crabs due to increased traffic and increases in invasive species like cats, even though the site is some distance from the IDC. However, these threats have not been fully assessed or quantified.

The South-East Asian wolf snake (*Lycodon aulicus capucinus*) was accidentally introduced to the island around 1987, and densities in the residential areas of the Island were relatively high until about 1993. Since then, anecdotal evidence suggests that their densities have declined but they now occur in primary rainforest and in the Central Plateau area. This increase in range may have contributed to the decline in numbers of some of the native reptiles and the pipistrelle bat in the national park. Further research is required to understand the potential impact of this species and possible control options.

The giant African snail (*Achatina fulica*) was probably introduced to Christmas Island during the Second World War (Sproul 1983). It feeds on a wide variety of plants and there is concern about the potential environmental damage it could cause. The presence of land crabs appears to restrict its distribution and abundance. The impact of yellow crazy ants on crab populations may provide potential for the snail to expand its range.

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.

The site is within a National Park, managed for conservation and visitor access to the site is controlled by Parks Australia.

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?:

Christmas Island National Park Management Plan, Director of National Parks, 2002.

d) Describe any other current management practices:

Current management activities include:

- Research and control programs to better understand the ecology of the Yellow Crazy Ant
- Island Wide Survey of yellow crazy ant and red crab distribution and abundance is ongoing.
- Continuation of the Christmas Island Biodiversity Monitoring Program.
- Visitor management activities include maintaining interpretative signage, board walks and walking tracks to minimise recreational impacts.

28. Conservation measures proposed but not yet implemented:

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

The management plan is currently being updated and due for release in 2011.

29. Current scientific research and facilities:

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

Scientific research is periodically carried out within the Ramsar site boundaries, although no specific recent studies have occurred within the site boundary.

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 Christmas Island National Park contains a number of key communication messages and a program for implementing community education.

31. Current recreation and tourism:

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

Visitor access of small, interest groups such as bird watchers, or scientific teams is managed by Parks Australia to conserve the ecological character of the site.

32. Jurisdiction:

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

Commonwealth of Australia

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.

Abbott, K.L., and Green, P.T., 2007, Collapse of an ant-scale mutualism in a rainforest on Christmas Island. *Oikos*. 116: 1238-1246.

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, 2002, Third Christmas Island National Park Management Plan.

Gilligan, J., Hender, J., Hobbs, J-P., Neilson, J. and McDonald, C., 2008, Coral Reef Surveys and Stock Size Estimates of Shallow Water (0-20m) Marine Resources at Christmas Island, Indian Ocean. Report to Parks Australia North.

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

Green, P.T., 1997, Red crabs in rain forest on Christmas Island, Indian Ocean: Activity patterns, density and biomass. *Journal of Tropical Ecology*, 13:17-38.

Grimes, K., 2001, Karst features of Christmas Island (Indian Ocean). *Helictite* 37(2): 41-58

Hennicke, J., 2007, Investigation of the Foraging Ecology of the Endangered Abbott's Booby, Parks Australia North, Christmas Island.

Hicks, J., Rumpff, H. and Yorkston, H., 1984, Christmas Crabs. Christmas Island, Indian Ocean: Christmas Island Natural History Society.

Hobbs, J-P.A., Ayling, A.M., Choat, J.H., Gilligan, J.J, McDonald, C.A., Neilson, J., and Newman S.J. (in press). New records of marine fishes illustrate the biogeographic importance of Christmas Island, Indian Ocean. *Zootaxa*

Hobbs, J-P.A., Jones, G.P. and Munday P.L., 2010, Rarity and extinction risk in coral reef angelfishes on isolated islands: interrelationships among abundance, geographic range size and specialization. *Coral Reefs* 29:1-11

Hobbs, J-P.A., Frisch A.J., Allen, G.R., and van Herwerden, L., 2009, Marine hybrid hotspot at Indo-Pacific biogeographic border. *Biology Letters* 5: 258–261.

McInnes, KL., Macadam, I., Hemer, M., Abbs, D., White, N., Church, J. and Bathols, J. 2008, Recent and future climate conditions for Cocos and Christmas Islands. A project undertaken for Maunsell Pty Ltd, CSIRO Marine and Atmospheric Research

O'Dowd, D.J., Green, P.T. and Lake, P.S. 1999, Status, impact, and recommendations for research and management of exotic invasive ants in Christmas Island National Park. Unpublished report to Environment Australia.

Sproul, A.N., 1983, Report on visit to Christmas Island, Indian Ocean to investigate the giant African snail, 12-26th January, 1983

SKM 2000, Christmas Island satellite launch facility: final environmental impact statement. Report prepared for APSC Asia Pacific Space Centre.

Van Steenis, C.G.G.J., 1984, Three More Mangrove Trees Growing Locally in Nature in Freshwater, *Blumea* 29: 395–397

Woodroffe, C.D., 1988, Relic Mangrove Stand on the Last Interglacial Terrace, Christmas Island, Indian Ocean, *Journal of Tropical Ecology* 4: 1–17

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Appendix A: Endemic Flora (vascular)

Species names from EWL Sciences and Tallegalla (2005), common names from Director of National Parks (2002).

Family	Species	Lifeform	Habitat	Common name
Malvaceae	<i>Abuliton listeri</i>	shrub	coast and shore terrace	lantern flower
Arecaceae	<i>Arenga listeri</i>	palm	closed forests	arenga palm, Christmas Island palm
Aspleniaceae	<i>Asplenium listeri</i>	fern	exposed limestone outcrops	spleenwort
Acanthaceae	<i>Asystasia alba</i>	herb	terrace forest	
Orchidaceae	<i>Brachypeza archytas</i>	epiphytic orchid	terrace and plateau forests	
Rhamnaceae	<i>Colubrina pendunculata</i>	shrub/ small tree	terrace shrubland	
Urticaceae	<i>Dendrocnide peltata</i> var. <i>murrayana</i>	small tree	inland cliffs	stinging tree
	<i>Dicliptera maclearii</i>	herb	terrace vegetation	
	<i>Flickingeria nativitatis</i>	epiphytic orchid	plateau forests	
Tiliaceae	<i>Grewia insularis</i>	small tree	terrace forest	
Asclepidaceae	<i>Hoya aldrichii</i>	vine	closed forests	hoya vine
Poaceae	<i>Ischaemum nativitatis</i>	grass	seacliffs	Christmas Island duck beak
Pandanaceae	<i>Pandanus christmatensis</i>	shrub	shore and inland cliffs	pandanus, screw pine
	<i>Pandanus elatus</i>	shrub/small tree	forest understorey	pandanus, screw pine
Piperaceae	<i>Perperomia rossii</i>	epiphytic herb	plateau (?)	
	<i>Phreatia listeri</i>	epiphytic orchid	plateau forests	
Cucurbitaceae	<i>Zehneria alba</i>	vine	forest margins	
	<i>Zeuxine exilis</i>	epiphytic orchid	plateau forests	

Figure 1

