Ramsar Information Sheet

Published on 1 July 2022
Update version, previously published on : 1 January 2011

Australia

Hosnie's Spring

Designation date	11 December 1990
Site number	512
Coordinates	10°28'26"S 105°41'34"E
Area	202,00 ha

Color codes

Fields back-shaded in light blue relate to data and information required only for RIS updates.

Note that some fields concerning aspects of Part 3, the Ecological Character Description of the RIS (tinted in purple), are not expected to be completed as part of a standard RIS, but are included for completeness so as to provide the requested consistency between the RIS and the format of a 'full' Ecological Character Description, as adopted in Resolution X.15 (2008). If a Contracting Party does have information available that is relevant to these fields (for example from a national format Ecological Character Description) it may, if it wishes to, include information in these additional fields.

1 - Summary

Summary

Hosnies Spring is located on the eastern side of Christmas Island, in the Indian Ocean, approximately 2,800 km west of Darwin. It is a permanent, shallow freshwater wetland, fed by a natural spring, located approximately 30 m above sea level and 120 m inland from the seaward cliff.

The area surrounding the spring is predominantly rainforest characterised by a 20 to 30 m tall canopy of evergreen and deciduous tree species such as Pisonia grandis and Barringtonia racemosa with a conspicuous lack of herb or 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, and an unvegetated area of limestone pinnacles at the top of the sea cliffs (Woodroffe 1988). The cliff descends 17 m almost vertically to the rocky marine shore below. The site extends 50 m seaward of the low water mark and includes areas of shallow coral reef.

Hosnies Spring meets Ramsar criteria 1, 3 and 4:

1: Christmas Island represents the only landmass within the bioregion, and the spring system and the mangrove stand are unique at the bioregional (and broader) context.

3: The mangrove forest at Hosnies Spring is unique within the bioregion and possibly worldwide. The stand comprises Bruguiera gymnorhiza and B. sexangular, which usually occur in intertidal zones. At Hosnies Spring they are located some 120 m inland, and 37 m above sea level. This mangrove stand is thought to have established over 120,000 years ago, when the site was inundated by the sea.

The site supports an abundance of land crabs. Three species have been observed at high densities within the site: red crabs (Gecarcoidea natalis), robber crabs (Birgus latro) and blue crabs (Tuerkayana celeste, formerly Discoplax hirtipes).

4: The site provides important habitat for the blue crab, which is reliant on the freshwater spring to maintain respiratory function. The spring is one of the few permanent sources of freshwater on Christmas Island and provides a dry season refuge for terrestrial species. The site provides a connection from the plateau to the ocean and is a likely migratory route for red crabs during the breeding season.

The site may also meet criterion 2, as several threatened species have been recorded in or near the site. However, it is unclear whether the site provides core habitat for these species. This criterion will be reassessed when information is available on how threatened species use the site.

2 - Data & location

2.1 - Formal data

2.1.1 - Name and address of the compiler of this RIS

Responsible compiler

Institution/agency	Department of Agriculture, Water and the Environment
Postal address	GPO Box 858 Canberra ACT 2601 Australia

National Ramsar Administrative Authority

Institution/agency	Department of Agriculture, Water and the Environment
Postal address	GPO Box 858 Canberra ACT 2601 Australia

2.1.2 - Period of collection of data and information used to compile the RIS

From year	1983
To year	2021

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	Hosnie's Spring
Unofficial name (optional)	Hosnies Spring

2.1.4 - Changes to the boundaries and area of the Site since its designation or earlier update

(Update) A. Changes to Site boundary	Yes ○ No ◉
(Update) B. Changes to Site area	No change to area
(Update) For secretariat only: This update is an extension	☐

2.1.5 - Changes to the ecological character of the Site

(Update) 6b i. Has the ecological character of the Ramsar Site (including applicable Criteria) changed since the previous RIS?	Uncertain

(Update) Optional text box to provide further information

While there has been no notifiable change in the ecological character, the site is subject to a changing climate. Australia has warmed by an average of 1.4°C (higher than the global average of 1°C) since national records began in 1910, leading to an increased frequency of extreme heat events. Further increases in temperature are projected, with more extremely hot days and fewer extremely cool days under all emissions scenarios (BoM and CSIRO 2020). These conditions will affect the critical components, processes, and services of the Ramsar site and will test the site's resilience.

Climate projections and the information available to guide wetland management under a changing climate is continually evolving. This and other relevant sections of the RIS will be reviewed and updated as significant advances are made.

2.2 - Site location

2.2.1 - Defining the Site boundaries

b) Digital map/image
<1 file(s) uploaded>

Former maps	0

Boundaries description

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.

The approximate centre of the Ramsar site is at Latitude: 10°28'S Longitude: 105°41'E

2.2.2 - General location

a) In which large administrative region does the site lie? Australian Territory of Christmas Island in the Indian Ocean.

b) What is the nearest town or population centre? The Ramsar site is approximately 2,600 kilometres northwest of Perth, Western Australia.

2.2.3 - For wetlands on national boundaries only

a) Does the wetland extend onto the territory of one or more other countries? Yes ○ No ◉

b) Is the site adjacent to another designated Ramsar Site on the territory of another Contracting Party? Yes ○ No ◉

2.2.4 - Area of the Site

Official area, in hectares (ha): 202

Area, in hectares (ha) as calculated from GIS boundaries: 199.738

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Other scheme (provide name below)	Christmas Island Province

Other biogeographic regionalisation scheme

Commonwealth of Australia (2006). Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4 - Christmas Island Province.

3 - Why is the Site important?

3.1 - Ramsar Criteria and their justification

☑ Criterion 1: Representative, rare or unique natural or near-natural wetland types

Hydrological services provided	Hosnies Spring is one of a limited number of permanent springs on Christmas Island. The combination of climate, geomorphology and groundwater hydrology at the site provides a permanent expression of surface water. This is rare on Christmas Island and is essential for maintaining the populations of mangroves and blue crabs at the site. 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 on it would atrophy. Blue crabs rely on the freshwater in the spring to maintain respiratory function. This is particularly important during the dry season when the surrounding landscape is dry.
Other ecosystem services provided	Food webs The Christmas Island red crab is recognised as important in maintaining terrestrial forest structure on the island (Hicks et al. 1984; Green et al. 1997). Elsewhere, crabs are known to be important in mangrove food webs (Smith et al. 1991; Sheaves and Molony 2000) and field observations indicate that this may also be true for the mangrove community at Hosnies Spring (Green et al. 2008). Woodroffe noted that red and blue crabs had burrows in or near the site and that both species were seen “attacking” leaves and propagules. Decomposition (in the absence of detritivores) is slow in permanent aquatic ecosystems. However, by consuming the leaf litter and other biomass of mangroves at or near the site, crabs speed up the process of nutrient cycling, providing important sources of nutrients in a form available for plant uptake and growth. Land crabs are opportunistic feeders that will consume plant material, detritus and other animals. Blue crabs are somewhat more aggressive than red crabs and have been observed predating on both live and dead red crabs (Hicks et al. 1984). Land crabs Hosnies Spring provides significant habitat for blue crabs as a dry season refuge. Blue crabs have both gills and lungs for respiration. Lungs do not require surface water, but gills need to be kept moist to function properly. Urine is passed over the gills to maintain moister levels for respiratory function and for the renal (kidney) function of removing salts (Greenaway 1989). During the dry season blue crabs are restricted to permanent freshwater sources, such as that provided by Hosnies Spring (Hicks et al. 1984). Their burrows intersect the water table, with the bottom part of the burrow underwater (Hicks et al. 1984). Biodiversity Island biodiversity values are quite different to mainland biodiversity values with the biogeography of isolated oceanic islands playing an important role. The biodiversity value of Christmas Island (including Hosnies Spring), does not arise from high species richness, but rather from a unique combination of species and ecosystems, in particular the crab – forest community and the mangrove stand (Expert Working Group 2009). The habitat of the island, and Hosnies Spring is complex, ranging from terrestrial rain forest, to freshwater wetlands and fringing coral reefs. This habitat diversity supports unique associations and biodiversity values.

Other reasons

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 the bioregional (and broader) context (Woodroffe 1988). The mangrove stand is unique:
• it occurs up to 37 m above sea-level and on an inclined surface;
• the mangroves are among the largest of their species (Bruguiera gymnorrhiza and Bruguiera sexangula) ever recorded; and
• conditions favourable for mangrove establishment do not appear to have existed since the last Interglacial period. Therefore, the stand has probably persisted in this location for 120,000 years.

☑ Criterion 3 : Biological diversity

Justification

The Ramsar site supports a relict stand of mangroves, which is unique within the bioregion and possibly worldwide. The stand comprises two species, Bruguiera gymnorrhiza and Bruguiera sexangula, which usually occur in intertidal zones. At Hosnies Spring, the trees are located at the freshwater spring some 120 m inland and 37 m 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 an abundance of land crabs. Large numbers of three species occur at the spring:
• red crabs (Gecarcoidea natalis) which are endemic to Christmas Island
• robber crabs (Bigus latro)
• blue crabs (Tuerkayana celeste) which are endemic to Christmas Island

There are eighteen endemic flora species on Christmas Island which may be present on the Ramsar site. This is a knowledge gap as a floristic survey of the Hosnies Spring Ramsar site has not been undertaken.

The Christmas Island fish community consists of seven endemic species which are likely to occur within the Ramsar site:
• mottled sole (Aseraggodes crypticus)
• Cocos angelfish (Centropyge joculator)
• lemonpeel angelfish (Centropyge flavissima)
• Christmas eviota (Eviota natalis)
• Christmas dottyback (Pseudochromis viridis)
• Christmas blenny (Praealticus natalis)
• island gregory (Stegastes insularis)

The Cocos angelfish is locally abundant and endemic to both Christmas Island and Cocos (Keeling) Islands. The island gregory 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 : Support during critical life cycle stage or in adverse conditions

3.2 - Plant species whose presence relates to the international importance of the site

Phylum	Scientific name	Criterion 2	Criterion 3	Criterion 4	IUCN Red List	CITES Appendix I	Other status	Justification
Plantae								
TRACHEOPHYTA / MAGNOLIOPSIDA	*Bruguiera gymnorhiza*	☐	☑	☐	LC	☐		Part of a relict stand of mangroves that may have persisted for 120,000 years or more.
TRACHEOPHYTA / MAGNOLIOPSIDA	*Bruguiera sexangula*	☐	☑	☐	LC	☐		Part of a relict stand of mangroves that may have persisted for 120,000 years or more.

A floristic survey specific the Hosnies Spring Ramsar site has not been undertaken. However, eighteen endemic vascular plants are present on Christmas Island and may occur within the Ramsar site. A list of these species is attached under Section 6.1.2.

The stand of mangroves found at Hosnies Spring cover almost the entire area of freshwater wetland. There is a range of age classes on the site, indicating active regeneration. Extensive flowering and large numbers of propagules have been recorded within the stand. The stand includes several large specimens, the largest measuring 82 cm (diameter at breast height) and exceeding 40 m in height. This is larger than is typical for the species (Allen and Duke 2006).

3.3 - Animal species whose presence relates to the international importance of the site

Phylum	Scientific name	Species qualifies under criterion				Species contributes under criterion				Pop. Size	Period of pop. Est.	% occurrence 1)	IUCN Red List	CITES Appendix I	CMS Appendix I	Other Status	Justification
		2	4	6	9	3	5	7	8								
Fish, Mollusc and Crustacea																	
CHORDATA / ACTINOPTERYGII	*Aseraggodes crypticus*	☐	☐	☐	☐	☑	☐	☐	☐					☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site.
CHORDATA / ACTINOPTERYGII	*Centropyge flavissima*	☐	☐	☐	☐	☑	☐	☐	☐				LC	☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site.
CHORDATA / ACTINOPTERYGII	*Centropyge joculator*	☐	☐	☐	☐	☑	☐	☐	☐				LC	☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site.
ARTHROPODA / MALACOSTRACA	*Discoplax hirtipes*	☐	☑	☐	☐	☐	☐	☐	☐					☐	☐		Note: this species is now classified as a separate species to Discoplax hirtipes. It is classified as Tuerkayana celeste and is considered endemic to Christmas Island. The site provides a source of freshwater, which is important for maintaining respiratory function.
CHORDATA / ACTINOPTERYGII	*Eviota natalis*	☐	☐	☐	☐	☑	☐	☐	☐					☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site.
ARTHROPODA / MALACOSTRACA	*Gecarcoidea natalis*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site The site forms part of a migratory route, used during annual breeding migrations.
CHORDATA / ACTINOPTERYGII	*Praealticus natalis*	☐	☐	☐	☐	☑	☐	☐	☐				VU	☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site.
CHORDATA / ACTINOPTERYGII	*Pseudochromis viridis*	☐	☐	☐	☐	☑	☐	☐	☐					☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site.
CHORDATA / ELASMOBRANCHII	*Rhincodon typus*	☐	☑	☐	☐	☐	☐	☐	☐				EN	☐	☐		Juvenile whale sharks aggregate in coastal waters in summer to feed on red crab larvae.
CHORDATA / ACTINOPTERYGII	*Stegastes insularis*	☐	☐	☐	☐	☑	☐	☐	☐					☐	☐	Endemic	This species is endemic to Christmas Island and contributes to the biodiversity of the site.

1) Percentage of the total biogeographic population at the site

The following species may occur within the Ramsar site. It is unclear whether the Ramsar site provides important habitat for these species or not.

Birds:
• Abbotts booby (Papasula abbotti) – nationally endangered (EPBC Act)
• Christmas Island frigatebird (Fregata andrewsi) – nationally endangered
• Christmas Island imperial pigeon (Ducula whartoni) – nationally vulnerable
• Christmas Island goshawk (Accipiter fasciatus natalis) – nationally vulnerable
• Christmas Island hawk-owl (Ninox natalis) – nationally endangered
• Christmas Island emerald dove (Chalcophaps indica natalis) – endemic species
• Christmas Island thrush (Turdus poliocephalus erythropleurus) – endemic species
• Christmas Island white-eye (Zosterops natalis) – endemic species
(Hale and Butcher 2011)

Mammals:
• Christmas Island flying fox (Pteropus natalis) – nationally critically endangered

3.4 - Ecological communities whose presence relates to the international importance of the site

<no data available>

Optional text box to provide further information

Whilst not listed nationally as a threatened ecological community, the mangrove stand (Bruguiera gymnorhiza) at Hosnie’s Spring is unique due to its location and nature.

Bruguiera gymnorhiza typically grows on intertidal mud-flats and estuaries, generally on the less exposed parts of the coast. However, at Hosnie’s Springs, the mangroves occur in a freshwater wetland, at an elevation not recorded elsewhere in the world.

In coastal ecosystems, mangroves are important blue carbon ecosystems, for their role in sequestering carbon. As the mangroves at Hosnie’s Spring do not occur within the intertidal zone, it is unclear to what extent they provide this ecosystem service.

4 - What is the Site like? (Ecological character description)

4.1 - Ecological character

The critical components and processes of the Hosnies Spring Ramsar site are:

• Hydrological regime – the hydrology is driven by the underlying geology. The high porosity of the soils and underlying limestone limits the formation of permanent surface water features. Surface water run-off is limited to the wet season. The dominant water source is groundwater. The source of water for Hosnies Spring is a perched, unconfined aquifer that discharges where impermeable volcanic rocks are close to the surface. Although flow rates of the spring are not known, they are expected to be low. The spring is a permanent source of water and remains flowing through the dry season.

• Mangroves – the site contains a unique stand of mangroves from the genus Bruguiera. The site includes Bruguiera gymnorhiza and possibly Bruguiera sexangula. The mangroves cover most of the freshwater wetland. The stand comprises a range of age classes, with evidence of active regeneration. Some of the trees are very large (larger than typical for the species), with the largest tree measuring 82 centimetres diameter at breast height and exceeding 40 metres. There are between 300 and 600 trees in total (more than 2.5 centimetres diameter at breast height) with a density of 10 to 20 trees per 100 m2.

• Land crabs – Hosnies Spring supports a large number of land crabs, of at least three species: endemic red crabs (Gecarcoidea natalis), robber crabs (Birgus latro), and endemic blue crabs (Tuerkayana celeste). There are a number of other land crab species that occur on Christmas Island, but there are currently no records of these from within the Ramsar site.
Hosnies Spring is particularly important as a dry season refuge for blue crabs. During the wet season there is enough surface water in the forests to maintain gill function in blue crabs. However, during the dry season, they are restricted to permanent water sources, such as Hosnies Spring. There is anecdotal evidence that juvenile blue crabs occur within the Ramsar site, but there is insufficient information regarding breeding, juvenile recruitment, and dispersal to determine whether the site is important for breeding and/or recruitment.
Hosnies Spring is likely to form part of the migration pathway for the annual breeding migration of red crabs, which move between the forest and the ocean during their breeding period. The red crab is considered a keystone species on Christmas Island for its role as an ecosystem engineer and consumer (Green et al 1999, Green et al 2008). Red crabs consume and move leaf litter into and around their burrows, resulting in areas with localised higher concentrations of organic matter and nutrients (O'Dowd and Lake 1989).

The critical benefits and services of the Hosnies Spring Ramsar site are:

• Supports near natural wetland types – Hosnies Spring is in near-natural condition and is significant within the bioregion. It is the only area on Christmas Island that supports freshwater mangroves.

• Biodiversity – the site supports a variety of wetland species, communities and habitats including marine, terrestrial, and freshwater dependent species.

• Food webs – the interactions between land crabs and mangroves form an important part of the food web. Crabs speed up the process of nutrient cycling, providing important courses of nutrients in a form readily available for plant uptake and growth.

• Distinct wetland species – blue crabs are reliant on the few permanent freshwater sites on Christmas Island (including Hosnies Spring) for survival in the dry season and possibly for reproduction.

Whilst not critical, the following elements are important in supporting the ecological character of the site:

• climate
• geomorphic setting
• water quality
• marine fish and corals.
(Hale and Butcher 2010).

4.2 - What wetland type(s) are in the site?

Marine or coastal wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
C: Coral reefs		2	4	
D: Rocky marine shores		1	24	

Inland wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type	Justification of Criterion 1
Fresh water > Marshes on inorganic soils >> Xf: Freshwater, tree-dominated wetlands		3	0.33	Unique
Fresh water > Flowing water >> Y: Permanent Freshwater springs; oases		3	0.33	Unique

Human-made wetlands

Wetland types (code and name)	Local name	Ranking of extent (1: greatest - 4: least)	Area (ha) of wetland type
6: Water storage areas/Reservoirs		0	

(ECD) Habitat connectivity: (note that areas included above are rough estimates only).

4.3 - Biological components

4.3.1 - Plant species

Other noteworthy plant species

Phylum	Scientific name	Position in range / endemism / other
TRACHEOPHYTA/POLYPODIOPSIDA	*Asplenium listeri*	Nationally listed (CE), endemic species that may occur at the site.
TRACHEOPHYTA/POLYPODIOPSIDA	*Pneumatopteris truncata*	Nationally listed (CE) species that may occur at the site.

Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/MAGNOLIOPSIDA	*Antigonon leptopus*	Potential	No change
TRACHEOPHYTA/MAGNOLIOPSIDA	*Leucaena leucocephala*	Potential	No change

Optional text box to provide further information

Noteworthy flora
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. The major types of rainforest on the island are dominated by plants which are pan-tropical species most likely from South East Asia. 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) (Hale and Butcher 2011).

Hosnies Spring is remarkable for its almost pure stand of mangroves of the genus Bruguiera, growing 120 m inland and approximately 30 m above sea level. 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.

There are approximately 420 species of vascular plants on Christmas Island. However, a floristic survey of the 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 18 endemic species, 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.

Invasive species
The invasive coral vine (Antigonon leptopus) has been recorded on Christmas Island. This species excludes native understorey and canopy species through competition, affecting the integrity of the forest ecosystem function. Leucaena (Leucaena leucocephala) is also found on Christmas Island and poses a similar threat. It is not known whether these invasive species are present within the Ramsar site.

4.3.2 - Animal species

Other noteworthy animal species

Phylum	Scientific name	Pop. size	Period of pop. est.	%occurrence	Position in range /endemism/other
CHORDATA/AVES	*Accipiter fasciatus natalis*				Nationally listed threatened species (vulnerable) that may occur in the Ramsar site.
ARTHROPODA/MALACOSTRACA	*Birgus latro*				This species contributes to the diversity and abundance of land crabs on Christmas Island and at the site.
CHORDATA/AVES	*Chalcophaps indica natalis*				This species is endemic to Christmas Island and may occur in the Ramsar site.
CHORDATA/AVES	*Ducula whartoni*				Nationally listed threatened species (vulnerable) that may occur in the Ramsar site.
CHORDATA/AVES	*Fregata andrewsi*				Nationally listed threatened species (endangered) that may occur in the Ramsar site.
CHORDATA/AVES	*Ninox natalis*				Nationally listed threatened species (endangered) that may occur in the Ramsar site.
CHORDATA/AVES	*Papasula abbotti*				Nationally listed threatened species (endangered) that may occur in the Ramsar site.
CHORDATA/MAMMALIA	*Pteropus melanotus natalis*				Nationally listed threatened endemic species (critically endangered) that may occur in the Ramsar site.
CHORDATA/AVES	*Turdus poliocephalus erythropleurus*				This species is endemic to Christmas Island and may occur in the Ramsar site.

Invasive alien animal species

Phylum	Scientific name	Impacts	Changes at RIS update
MOLLUSCA/GASTROPODA	*Achatina fulica*	Potential	No change
ARTHROPODA/INSECTA	*Anoplolepis gracilipes*	Actual (minor impacts)	No change
ARTHROPODA/CHILOPODA	*Scolopendra morsitans*	Potential	No change

Optional text box to provide further information

Noteworthy fauna
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. 622 species of fish from 80 families have been recorded in the waters of Christmas Island (Hobbs et al 2010). 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 2010).

Threatened and endemic wetland bird species have been recorded within the Hosnies Spring Ramsar site. However, Hosnies Spring is not thought to provide core habitat in terms of feeding, roosting or nesting for these species (Peter Green, pers. comm.). Further investigation is needed to determine whether the site is important to these and other species.

Invasive species
Yellow crazy ants are thought to have been introduced to Christmas Island between 1915 and 1934. Results of island wide surveys indicate that yellow crazy ant supercolonies are present within the Hosnies Spring Ramsar site and that this has led to a decrease in red crabs. 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. Blue crabs appear to be less affected by the ants, perhaps due to the water within their burros diluting the formic acid.

Red crabs are thought to predate on the giant African land snail and the giant centipede, which may keep populations of these species under control.
(Hale and Butcher 2010).

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
A: Tropical humid climate	Af: Tropical wet (No dry season)

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 mm per year. The site is 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.

According to CSIRO projections for Christmas Island, average temperatures will continue to increase in all seasons. Rainfall is projected to decrease. Mean sea level will continue to rise and height of extreme sea-level events will also increase (CSIRO unpublished data 2021, BoM and CSIRO 2020).

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres): 0

a) Maximum elevation above sea level (in metres): 37

- Entire river basin ☐
- Upper part of river basin ☐
- Middle part of river basin ☐
- Lower part of river basin ☐
- More than one river basin ☐
- Not in river basin ☐
- Coastal ☑

Please name the river basin or basins. If the site lies in a sub-basin, please also name the larger river basin. For a coastal/marine site, please name the sea or ocean.

Hosnies Spring is on the eastern side of Christmas Island, which is within the Indian Ocean.

4.4.3 - Soil

- Mineral ☑
- (Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○
- No available information ☐

Are soil types subject to change as a result of changing hydrological conditions (e.g., increased salinity or acidification)? Yes ○ No ◉

Please provide further information on the soil (optional)

Most of Christmas Island's soils are classified as phosphatic. These were most likely derived from marine sediment (organic and inorganic) before the island rose above the sea surface, and from seabird guano reacting with limestone (Trueman 1965, Gray 1995). Soils are deepest on the central plateau, becoming progressively thinner towards the terraces.
Remaining substrates are mostly derived from weathered parent materials including limestone (terra rossa soils) or volcanic basalt (krasnozem soils). The soils are usually neutral to slightly alkaline (pH 7.0 – 8.0) (Director of National Parks 2014).

4.4.4 - Water regime

Water permanence

Presence?	Changes at RIS update
Usually permanent water present	No change

Source of water that maintains character of the site

Presence?	Predominant water source	Changes at RIS update
Water inputs from groundwater	☑	No change

Water destination

Presence?	Changes at RIS update
Marine	No change

Stability of water regime

Presence?	Changes at RIS update
Unknown	No change

Please add any comments on the water regime and its determinants (if relevant). Use this box to explain sites with complex hydrology:

The hydrology of Christmas Island is groundwater dominant. Surface water run-off is confined to the wet season (December to March) in relatively short, spring fed streams (Grimes 2001). The high porosity of the surface soils and underlying limestone limits the formation of permanent surface water.

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 m inland of the coast on gravel soils, covering 0.33 ha (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 m2 (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.

(ECD) Connectivity of surface waters and of groundwater: Hosnies Spring is groundwater dependent. Groundwater recharge occurs via infiltration of rainfall.

4.4.5 - Sediment regime

Sediment regime unknown ☑

(ECD) Water turbidity and colour: Water clarity is high, with turbidity ranging from 1–13 NTU and suspended solids of 16 mg/L.

4.4.6 - Water pH

Alkaline (pH>7.4) ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

Unknown ☐

Please provide further information on pH (optional):

The water is slightly alkaline (pH 7.4 to 8) and relatively high in calcium (approximately 90 mg/L), which is typical of limestone based karst systems (Ford and Williams 2007).

4.4.7 - Water salinity

Fresh (<0.5 g/l) ☑

(Update) Changes at RIS update: No change ◉ Increase ○ Decrease ○ Unknown ○

Unknown ☐

Please provide further information on salinity (optional):

Water is fresh with an electrical conductivity of 400 to 550 µS/cm.

4.4.8 - Dissolved or suspended nutrients in water

Unknown ☑

Please provide further information on dissolved or suspended nutrients (optional):

Total nitrogen was recorded at 6.4 mg/L in 2003, and over 96% of this was in dissolved form as nitrate (EWL Sciences and Tallegalla Consultants 2005).

(ECD) Water conductivity: 400 to 550 µS/cm

4.4.9 - Features of the surrounding area which may affect the Site

Please describe whether, and if so how, the landscape and ecological characteristics in the area surrounding the Ramsar Site differ from the site itself: i) broadly similar ○ ii) significantly different ◉

Surrounding area has greater urbanisation or development ☐

Surrounding area has higher human population density ☐

Surrounding area has more intensive agricultural use ☐

Surrounding area has significantly different land cover or habitat types ☑

Please describe other ways in which the surrounding area is different:

The spring supports an ancient freshwater mangrove stand, which is quite different from the rest of Christmas Island.

4.5 - Ecosystem services

4.5.1 - Ecosystem services/benefits

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Maintenance of hydrological regimes	Groundwater recharge and discharge	High

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Nature observation and nature-based tourism	Low
Scientific and educational	Important knowledge systems, importance for research (scientific reference area or site)	Medium

Supporting Services

Ecosystem service	Examples	Importance/Extent/Significance
Biodiversity	Supports a variety of all life forms including plants, animals and microorganizms, the genes they contain, and the ecosystems of which they form a part	Medium

Other ecosystem service(s) not included above:

Cultural services:
• Recreation and tourism - While the site is open to the public, tourism is not promoted at the site. Rather, the site is managed to provide a limited number of visitors an opportunity to visit a unique wetland that is largely undisturbed by humans.
• Scientific and educational - The unique nature of the site and the pristine condition, provide excellent opportunities for research.

Supporting services:
• Supports near natural wetland types (critical) - The spring at the Ramsar site is in near-natural condition and significant within the bioregion.
• Food webs (critical) - Interactions between land crabs and mangroves form an important food web at the site.
• Distinct wetland species (critical) - Blue crabs are reliant on the few permanent freshwater sites on Christmas Island (including Hosnies Spring) for reproduction, and for survival in the dry season.
• Biodiversity (critical) - Supports a variety of wetland species, communities and habitats including marine, terrestrial and freshwater dependent species.
• Ecological connectivity - Red crabs migrate from the plateau to the ocean to breed each year.
(Hale and Butcher 2010).

Have studies or assessments been made of the economic valuation of ecosystem services provided by this Ramsar Site? Yes ○ No ○ Unknown ◉

4.5.2 - Social and cultural values

i) the site provides 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) the site has exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland ☐

iii) the ecological character of the wetland depends on its interaction with local communities or indigenous peoples ☐

iv) 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 ☐

<no data available>

4.6 - Ecological processes

(ECD) Nutrient cycling	Land crabs are important in mangrove food webs. Red and blue crabs have burrows in/ near the site and consume plant material, detritus, and animals, speeding up the process of nutrient cycling.
(ECD) Carbon cycling	Mangroves typically sequester carbon. It is unclear to what extent the freshwater population provides this service.
(ECD) Notable aspects concerning animal and plant dispersal	Blue crabs rely on the permanent water source at Hosnies Spring during the dry season.
(ECD) Notable aspects concerning migration	Millions of red crab migrate between the forest and the ocean (and through the Ramsar site) during their annual breeding migration.
(ECD) Pressures and trends concerning any of the above, and/or concerning ecosystem integrity	Increased intensity of tropical storms as a result of climate change could result in damage or destruction of the mangrove community.

5 - How is the Site managed? (Conservation and management)

5.1 - Land tenure and responsibilities (Managers)

5.1.1 - Land tenure/ownership

Public ownership

Category	Within the Ramsar Site	In the surrounding area
National/Federal government	☑	☑

Private ownership

Category	Within the Ramsar Site	In the surrounding area
Other types of private/individual owner(s)	☐	☑

Provide further information on the land tenure / ownership regime (optional):

Hosnies Spring Ramsar site is entirely within a declared Commonwealth Reserve under the control of the Director of National Parks. The site was included in the Park in 1996 and is separated from other parts of the National Park by freehold land.

5.1.2 - Management authority

Please list the local office / offices of any agency or organization responsible for managing the site: Parks Australia

Provide the name and/or title of the person or people with responsibility for the wetland: Director of National Parks

Postal address: GPO Box 858, Canberra, ACT 2601

E-mail address: wetlandsmail@environment.gov.au

5.2 - Ecological character threats and responses (Management)

5.2.1 - Factors (actual or likely) adversely affecting the Site's ecological character

Human settlements (non agricultural)

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Housing and urban areas	Medium impact	Medium impact	☐	No change	☑	No change

Water regulation

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Water abstraction	unknown impact	High impact	☐	No change	☑	No change

Human intrusions and disturbance

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Recreational and tourism activities	unknown impact	unknown impact	☑	unknown	☑	unknown

Invasive and other problematic species and genes

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Invasive non-native/ alien species	unknown impact	High impact	☑	No change	☑	No change

Climate change and severe weather

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Habitat shifting and alteration	unknown impact	unknown impact	☑	unknown	☑	unknown

Please describe any other threats (optional):

Groundwater extraction:
There is little permanent surface water on Christmas Island and water for consumptive uses is extracted from the unconfined aquifers. Although water is not extracted from Hosnies Spring, the groundwater resources of the island are interconnected. This suggests that extraction from sources on the plateau (such as Grants Well or Jane-up) could impact discharge volumes and rates at coastal springs on the shore terrace. A significant reduction in flow, or a loss of permanent water at Hosnies Spring could result in the loss of the mangrove stand and have a severe impacts on blue crabs, which are dependent on permanent water.

Invasive species:
Yellow crazy ants predate on crabs, altering the forest ecosystems and consequently increasing other species such as the giant African land snail and giant centipede. The red crab is considered a keystone species, important in maintaining forest structure through foraging on seedlings and leaf litter, thereby maintaining an open understorey structure. In areas where yellow crazy ants have invaded, red crab numbers are diminishing and the forest structure is changing, with increased seedling cover and a thick layer of leaf litter. This provides habitat for other invasive invertebrates.

Recreation:
Although tourism is not actively promoted, the site is not closed to the public. There is no infrastructure or formed walking track access, which may deter casual visitors, but does not prevent determined visitors. Access of small interest groups, such as bird watchers, or scientific teams, is managed by Parks Australia to conserve the character of the site. Unmanaged site visits by large numbers has the potential to impact the freshwater spring through physical disturbance and trampling of vegetation.

Climate change:
Potential changes in rainfall due to climate change are uncertain. A potential decrease would exacerbate any increase in groundwater extraction for consumptive use. A significant reduction in rainfall would result in reduced groundwater flow and a reduction in the extent and duration of surface water at the site. The mangroves are reliant on the permanent water source for regeneration and survival. A loss of permanent water could result in the loss of the mangrove stand. It would also affect the survival of the blue crab.
It is predicted that the intensity of tropical storms could increase, and sea surface temperatures will continue to rise. Tropical storms with strong winds have the potential to cause direct physical damage to the mangroves at Hosnies Spring. The isolated nature of the mangrove stand makes it vulnerable to storm impacts. There would be little or no chance of recovery if the stand was cleared by an intense storm.
An increase in sea temperature are likely to impact on the marine communities, such as through coral bleaching events and increase in coral diseases (such as white syndrome).
(Hale and Butcher 2010).

5.2.2 - Legal conservation status

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
National Park	Christmas Island National Park	https://parksaustralia.gov.au/ch ristmas/	whole

Non-statutory designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Important Bird Area	Christmas Island	http://datazone.birdlife.org/sit e/factsheet/christmas-island-iba - christmas-island-(to-australia)	whole

5.2.3 - IUCN protected areas categories (2008)

- Ia Strict Nature Reserve ☐
- Ib Wilderness Area: protected area managed mainly for wilderness protection ☐
- II National Park: protected area managed mainly for ecosystem protection and recreation ☑
- III Natural Monument: protected area managed mainly for conservation of specific natural features ☐
- IV Habitat/Species Management Area: protected area managed mainly for conservation through management intervention ☐
- V Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation and recreation ☐
- VI Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems ☐

5.2.4 - Key conservation measures

Legal protection

Measures	Status
Legal protection	Implemented

Other:

In Australia, the ecological character of a designated Ramsar site is protected as a matter of national environmental significance (MNES) under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

5.2.5 - Management planning

Is there a site-specific management plan for the site?	Yes
Has a management effectiveness assessment been undertaken for the site?	Yes ○ No ◉
If the site is a formal transboundary site as indicated in section Data and location > Site location, are there shared management planning processes with another Contracting Party?	Yes ○ No ◉

5.2.6 - Planning for restoration

Is there a site-specific restoration plan?	No need identified

Further information

Whilst a site specific restoration plan has not been developed, Australia has drafted a national Invasive Ant Biosecurity Plan, see: https://www.environment.gov.au/biodiversity/threatened/threat-abatement-plans/draft-national-invasiv e-ant-biosecurity-plan-2018-2028

This plan identifies the yellow crazy ant (Anoplolepis gracilipes) as a high priority invasive species. A threat abatement plan was in place for this species between 2006 and 2016. The Biosecurity plan replaces the Threat Abatement Plan and outlines a means to manage the threat (Commonwealth 2016).

5.2.7 - Monitoring implemented or proposed

Monitoring forms part of the activities identified in Christmas Island National Park Management Plan. Please refer to the management plan for details.

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

This RIS has been prepared using information from the Ecological Character Description for Hosnies Spring; the Christmas Island Management Plan; and past Ramsar Information Sheets. Additional references are included in an attachment under Section 6.1.2 vi.

6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)
<1 file(s) uploaded>

ii. a detailed Ecological Character Description (ECD) (in a national format)
<1 file(s) uploaded>

iii. a description of the site in a national or regional wetland inventory
<no file available>

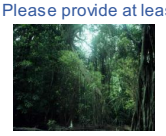
iv. relevant Article 3.2 reports
<no file available>

v. site management plan
<1 file(s) uploaded>

vi. other published literature
<1 file(s) uploaded>

6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:



Stand comprising some of the largest mangrove trees ever recorded (photo credit: Max Orchard) (*Department of Agriculture, water and the Environment, 06-07-2021*)

Blue crab hideout, Christmas Island (photo credit: Isarena Schneider) (*Department of Agriculture, water and the Environment, 06-07-2021*)

Christmas Island blue crab (photo credit: Isarena Schneider) (*Department of Agriculture, water and the Environment, 06-07-2021*)

6.1.4 - Designation letter and related data

Designation letter
<1 file(s) uploaded>

Date of Designation: 1990-12-11