Ramsar Information Sheet

Published on 10 January 2024
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United Kingdom of Great Britain and Northern Ireland (Overseas territories)

Hungry Bay Mangrove Swamp

Designation date	11 May 1999
Site number	987
Coordinates	32°17'27"N 64°45'30"W
Area	2,85 ha

https://rsis.ramsar.org/ris/987
Created by RSIS V.1.6 on - 10 January 2024

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

Hungry Bay Mangrove Swamp is located in a shallow tidal bay with a narrow opening to the sea. It represents the largest example of a near-natural, tidal mangrove swamp on Bermuda, growing at the most northerly location for this habitat type in the Atlantic. It also has the longest continuous sequence of mangrove peat layers in the Atlantic and provided the first documented evidence of significant forest retreat caused by contemporary sea-level rise.

The site supports a diverse assemblage of mangrove-associated species. This includes both Red mangrove Rhizophora mangle and Black mangrove Avicennia germinans, and the largest Bermudian populations of the Giant land crab Cardisoma guanhumi and the Land hermit crab Coenobita clypeatus, all of which are listed as vulnerable on the Bermuda Protected Species Order (2012). It is noted as a valuable wintering location for various migrant bird species, as a breeding site for resident herons and the Bermuda white-eyed vireo Vireo griseus bermudianus, and as a spawning ground for several commercially important fish species. Numerous other species inhabit the mangroves and areas of salt marsh and rocky shore habitat are also present.

Erosion is a major threat, exacerbated by climate change affecting both the frequency and intensity of tropical cyclones. In addition, large amounts of floating debris are blown and washed in the site off the ocean.

2 - Data & location

2.1 - Formal data

2.1.1 - Name and address of the compiler of this RIS

Responsible compiler

Institution/agency	Bermuda Government
Postal address	DENR Headquarters, the Botanical Gardens, 169 South Road, Paget, DV04, Bermuda

National Ramsar Administrative Authority

Institution/agency	Department for Environment, Food and Rural Affairs
Postal address	2 Marsham Street, London SW1P 4DF

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

From year	1999
To year	2023

2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	Hungry Bay Mangrove Swamp

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) The boundary has been delineated more accurately	☑
(Update) The boundary has been extended	☐
(Update) The boundary has been restricted	☐
(Update) B. Changes to Site area	the area has increased
(Update) The Site area has been calculated more accurately	☑
(Update) The Site has been delineated more accurately	☐
(Update) The Site area has increased because of a boundary extension	☐
(Update) The Site area has decreased because of a boundary restriction	☐
(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?	Not evaluated

2.2 - Site location

2.2.1 - Defining the Site boundaries

b) Digital map/image
<2 file(s) uploaded>

Former maps	0

Boundaries description

The geographical coordinates for the site are 32°17'28"N, 64°45'30"W. It is located at Hungry Bay, Paget Parish, 2 km east of Hamilton, on the south coast of the Main Island of Bermuda. The landward boundaries of the Ramsar Site follow the boundary of the Bermuda Government nature reserve. The seaward boundary of the site roughly follows where the edge of the mangroves were when the site was designated in 1999.

2.2.2 - General location

a) In which large administrative region does the site lie?	Paget Parish, Bermuda
b) What is the nearest town or population centre?	City of Hamilton

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): 2.85

Area, in hectares (ha) as calculated from GIS boundaries: 2.852

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
WWF Terrestrial Ecoregions	Neotropic
Marine Ecoregions of the World (MEOW)	Tropical Atlantic, Tropical Northwestern Atlantic

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	See section 4.5
Other ecosystem services provided	See section 4.5
Other reasons	Hungry Bay Mangrove Swamp is the largest example of a near-natural, tidal mangrove swamp on Bermuda, growing at the most northerly location for this habitat type in the Atlantic. The site has the longest continuous sequence of mangrove peat layers in the Atlantic and the first documented evidence of significant forest retreat caused by contemporary sea-level rise.

☑ Criterion 2 : Rare species and threatened ecological communities

Optional text box to provide further information	The site supports significant numbers of the two locally occurring mangrove tree species, the Red mangrove Rhizophora mangle and Black mangrove Avicennia germinans, both of which are listed as Vulnerable on the Bermuda Protected Species Order (2012) and are reportedly declining throughout their range. As the largest remaining mangrove swamp on Bermuda, Hungry Bay has the most diverse assemblage of mangrove-associated fauna. This includes the largest Bermudian populations of the Giant land crab Cardisoma guanhumi and the Land hermit crab Coenobita clypeatus, both of which are listed as Vulnerable on the Bermuda Protected Species Order (2012). All of these species are at the northern limit of their range in Bermuda.

☑ Criterion 3 : Biological diversity

Justification	The site is rich in biodiversity. It supports a regionally important area of tidal mangrove swamp and a wide-range of associated plant and animal species. These include several scarce species of crab (see Criterion 2), various wintering bird species, especially herons, egrets, osprey, North American wood warblers, and the endemic subspecies of the White-eyed vireo Vireo griseus bermudianus (see Criterion 4). Numerous other species inhabit the Hungry Bay mangroves, including marine and terrestrial snails, lizards, insects, marine invertebrates like oysters, sponges and algae, and many types of fish. Some species found in the Hungry Bay mangroves, such as the Giant land crab Cardisoma guanhumi, are rarely seen and have been wiped out in other parts of Bermuda. The site also protects areas of salt marsh and rocky shore habitat.

☑ Criterion 4 : Support during critical life cycle stage or in adverse conditions

Optional text box to provide further information	The site is a valuable wintering location for various migrant bird species, especially the Great blue heron Ardea herodias, Snowy egret Egretta thula, Mallard Anas platyrhynchos, Belted kingfisher Ceryle alcyon and Northern waterthrush Parkesia noveboracensis. The Hungry Bay mangroves provide breeding habitat for resident herons, particularly the Yellow-crowned night heron Nyctanassa violacea and Green heron Butorides virescens, and the Bermuda white-eyed vireo Vireo griseus bermudianus.

☑ Criterion 8 : Fish spawning grounds, etc.

Justification: The subtidal prop roots of Red mangroves at Hungry Bay shelter juvenile fish, including several commercially important species such as the Grey snapper Lutjanus griseus and the Schoolmaster snapper Lutjanus apodis.

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

<no data available>

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																	
ARTHROPODA / MALACOSTRACA	*Cardisoma guanhumi*	☑	☐	☐	☐	☑	☐	☐	☐					☐	☐	Vulnerable Status under the Bermuda Protected Species Order (2012)	Listed as a Level 1 protected species with Vulnerable status under the Bermuda Protected Species Order (2012)
ARTHROPODA / MALACOSTRACA	*Coenobita clypeatus*	☑	☐	☐	☐	☑	☐	☐	☐	85	1990-2000			☐	☐	Vulnerable Status under the Bermuda Protected Species Order (2012)	Listed as Level 2 protected species with Vulnerable status under the Bermuda Protected Species Order (2012)
ARTHROPODA / MALACOSTRACA	*Goniopsis cruentata*	☐	☐	☐	☐	☑	☐	☐	☐					☐	☐		Uncommon resident native crab species
CHORDATA / ACTINOPTERYGII	*Lutjanus apodus*	☐	☐	☐	☐	☑	☐	☐	☑				LC	☐	☐		Commercially important spawning fish species
CHORDATA / ACTINOPTERYGII	*Lutjanus griseus*	☐	☐	☐	☐	☑	☐	☐	☑				LC	☐	☐		Commercially important spawning fish species
Birds																	
CHORDATA / AVES	*Anas platyrhynchos*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Notable wintering migrant bird species
CHORDATA / AVES	*Ardea herodias*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Notable wintering migrant bird species
CHORDATA / AVES	*Butorides virescens*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		Notable resident breeding bird species
CHORDATA / AVES	*Egretta thula*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Notable wintering migrant bird species
CHORDATA / AVES	*Megaceryle alcyon*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Notable wintering migrant bird species
CHORDATA / AVES	*Nyctanassa violacea*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Notable resident breeding bird species
CHORDATA / AVES	*Parkesia noveboracensis*	☐	☑	☐	☐	☑	☐	☐	☐				LC	☐	☐		Notable wintering migrant bird species
CHORDATA / AVES	*Vireo griseus bermudianus*	☐	☑	☐	☐	☑	☐	☐	☐					☐	☐		Notable resident breeding bird species

1) Percentage of the total biogeographic population at the site

The population size of Cardisoma guanhumi is uncertain; 240 burrow entrances were counted in 2001, 186 of which were deemed to be active (Coleman, 2001); however, burrows have multiple entrances and are not a reliable indicator of population size. The population count of 85 individuals for Coenobita clypeatus was recorded by Godsall (2000). In September 1990, the Coenobita clypeatus population at Hungry Bay numbered 82 individuals, which accounted for over half of the island-wide population for Bermuda which numbered 150 individuals (see Walker, 1994).

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

<no data available>

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

4.1 - Ecological character

Hungry Bay Mangrove Swamp is located in a shallow (mostly c.1m deep), tidal bay with a relatively narrow opening to the sea. It contains the best example of a large coastal mangrove swamp in Bermuda. Both the Red mangrove Rhizophora mangle and Black mangrove Avicennia germinans are present, whilst the closely related Buttonwood Conocarpus erectus and a range of other trees occur in the surrounding woodland.

The mangrove tree canopy provides important habitat for birds, such as breeding herons and visiting songbirds. Mangrove crabs Goniopsis cruentatus, Coffee bean snails Melampus coffeus, and Golden silk spiders Trichonephila clavipes can all be found climbing in the mangroves. Numerous other species inhabit the subtidal prop roots of the Red mangrove trees including marine invertebrates, like oysters, mangrove periwinkles, hydroids, anemones, soft corals, sponges and algae. The high diversity of food available around these prop roots, and the shade and protection they offer from predators, attracts many types of fish.

The site also protects areas of salt marsh and rocky shore habitat. On the south-east edge, the following marsh plants occur: Sea purslane Sesuvium portulacastrum, Sea ox-eye Borrichia arborescens, Sea lavender Limonium carolinianum, Seashore paspalum Paspalum vaginatum, Sand rush grass Sporobolus virginicus, Woody glasswort Sarcocornia perennis and West Indian grass Eustachys petraea. These areas are not extensive, but are of interest as they illustrate the position of Bermuda on the northern margin of tropical mangrove distribution and on the southern margins of temperate saltmarsh distribution.

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
A: Permanent shallow marine waters		0	0.44	Representative
H: Intertidal marshes		0	0.02	Representative
I: Intertidal forested wetlands		0	2.39	Representative

4.3 - Biological components

4.3.1 - Plant species

Other noteworthy plant species

Phylum	Scientific name	Position in range / endemism / other
TRACHEOPHYTA/MAGNOLIOPSIDA	*Avicennia germinans*	Bermuda is the northern limit of range in the Atlantic for this species
TRACHEOPHYTA/MAGNOLIOPSIDA	*Rhizophora mangle*	Bermuda is the northern limit of range in the Atlantic for this species

Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/MAGNOLIOPSIDA	*Casuarina equisetifolia*	Actual (major impacts)	No change
TRACHEOPHYTA/LILIOPSIDA	*Livistona chinensis*	Actual (minor impacts)	No change
TRACHEOPHYTA/MAGNOLIOPSIDA	*Scaevola sericea*	Actual (major impacts)	increase
TRACHEOPHYTA/MAGNOLIOPSIDA	*Schinus terebinthifolia*	Actual (major impacts)	No change

Optional text box to provide further information

The Australian whistling pine tree Casuarina equisetifolia is invasive along much of Bermuda's coast. At Hungry Bay it has invaded the rocky shoreline and drier ground on the landward edge of the mangrove swamp. The Brazil pepper tree Schinus terebinthifolia has also invaded the landward edge of the mangroves, forming a dense woodland and preventing mangrove migration inland. The invasive Beach naupaka Scaevola sericea began to appear in the saltmarsh portion of the site around 2009, and has since established dense bushes that threaten to crowd out the indigenous flora.

4.3.2 - Animal species

Invasive alien animal species

Phylum	Scientific name	Impacts	Changes at RIS update
CHORDATA/AVES	*Columba livia domestica*	Actual (minor impacts)	No change
ARTHROPODA/INSECTA	*Linepithema humile*	Actual (minor impacts)	No change
CHORDATA/MAMMALIA	*Rattus rattus*	Actual (minor impacts)	No change

Optional text box to provide further information

Cliff-holes and ledges adjacent to the site are used as nest sites by non-native feral pigeons. Black rat and Argentine ant are ubiquitous over all of Bermuda; at Hungry Bay they probably have a minor impact by disturbing nesting birds.

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
C: Moist Mid-Latitude climate with mild winters	Cfa: Humid subtropical (Mild with no dry season, hot summer)

Bermuda has a sub-tropical climate, which is hot and humid in summer and autumn, and mild but frost-free in winter and spring. Gales and strong winds are common during the winter, and tropical cyclones are increasingly frequent in late summer.

4.4.2 - Geomorphic setting

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

a) Maximum elevation above sea level (in metres): 4

- 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.

The site is connected to the open ocean of the Western North Atlantic by a 42 m wide opening at the mouth of the bay

4.4.3 - Soil

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

The soils are composed of clay, mud, peat and sand. The dominant substrate is mangrove-derived peat and calcium carbonate-rich sand derived from erosion of the soft Aeolian limestone. As a result of severe erosion of the nearby shoreline, sand has been deposited over some areas of underlying peat, changing the surface substrate.

4.4.4 - Water regime

Water permanence

Presence?	Changes at RIS update
Usually permanent water present	

Source of water that maintains character of the site

Presence?	Predominant water source	Changes at RIS update
Water inputs from precipitation	☐	No change
Marine water	☑	No change

Water destination

Presence?	Changes at RIS update
Marine	No change

Stability of water regime

Presence?	Changes at RIS update
Water levels fluctuating (including tidal)	No change

4.4.5 - Sediment regime

Significant erosion of sediments occurs on the site ☑

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

Significant accretion or deposition of sediments occurs on the site ☑

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

Sediment regime is highly variable, either seasonally or inter-annually ☑

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

Sediment regime unknown ☐

Please provide further information on sediment (optional):

Sediment tends to accumulate amongst the root systems of mangroves. However, the site has suffered significant degradation in recent decades, culminating in the almost total destruction of the outer (western) third of the swamp during Hurricane Fabian in September 2003. Erosion is partly a natural process, but it is exacerbated by climate change. There is considerable evidence that coastal mangrove swamp in the area has been in retreat for hundreds or possibly thousands of years, largely due to natural causes, particularly continuing sea level rise. There is also evidence of long-term erosion of the organic peat/sediment substrate that underlies the present swamp and that the living mangroves grow in. However, significant quantities of reef sands have been deposited in the outer part of the mangrove by successive hurricane waves since 2003, offsetting some of the erosion losses. These deposits are over 50cm thick in places.

4.4.6 - Water pH

Alkaline (pH>7.4) ☑

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

Unknown ☐

4.4.7 - Water salinity

Mixohaline (brackish)/Mixosaline (0.5-30 g/l) ☑

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

Euhaline/Eusaline (30-40 g/l) ☑

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

Unknown ☐

4.4.8 - Dissolved or suspended nutrients in water

Unknown ☑

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 site is surrounded by a residential neighbourhood of low density housing (low density for Bermuda). The surrounding land contains large expanses of open grass lawns, ornamental gardens, houses and roadways.

4.5 - Ecosystem services

4.5.1 - Ecosystem services/benefits

Provisioning Services

Ecosystem service	Examples	Importance/Extent/Significance
Food for humans	Sustenance for humans (e.g., fish, molluscs, grains)	Low

Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Hazard reduction	Coastal shoreline and river bank stabilization and storm protection	Medium

Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Nature observation and nature-based tourism	Low
Scientific and educational	Educational activities and opportunities	Medium
Scientific and educational	Major scientific study site	High

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	High

Optional text box to provide further information

The site provides benefits through the rich diversity of lifeforms and ecosystems that it supports. The hydrological services provided include dissipating erosive forces, particularly during severe storms, and sediment trapping. The site also acts as an educational resource, having been of significant scientific interest for decades. It is the subject of a long-running mangrove monitoring study, and provides the first documented evidence of significant forest retreat caused by contemporary sea-level rise. Active management of the swamp vegetation will contribute to knowledge of how to assist global mangrove swamps under-going sea-level rise. Public access is limited, with only two access points distant from the mangrove. Direct access is only possible through private lands, and not encouraged. There is a limited amount of recreational use of channels in the mangrove by snorkelers, kayaks and paddleboards.

Outside the site: 100s

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

<no data available>

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):

The site is owned by the Government of Bermuda and is designated a Nature Reserve under the Bermuda National Parks Act (1986).

5.1.2 - Management authority

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

As a Government-owned nature reserve, the site is managed by the Department of Environment and Natural Resources.

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

Senior Terrestrial Conservation Officer, Terrestrial Conservation Section, Department of Environment and Natural Resources

Postal address:

Department of Environment and Natural Resources Headquarters, Botanical Gardens, 169 South Road, Paget, DV04, Bermuda

E-mail address:

environment@gov.bm

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	Low impact		☑	No change	☐	No change

Transportation and service corridors

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Roads and railroads	Low impact		☐	No change	☑	No change
Utility and service lines (e.g., pipelines)	Low 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	Low impact		☑	No change	☑	No change

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	Medium impact		☑	No change	☑	No change

Pollution

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Household sewage, urban waste water	Medium 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
Storms and flooding	High impact		☑	No change	☑	No change

Please describe any other threats (optional):

Erosion is a major threat. Degradation in recent decades culminated in the almost total destruction of the outer (western) third of the swamp (25-30% of the total area of mangroves) during Hurricane Fabian in September 2003. Erosion is partly a natural process, but it is exacerbated by climate change, which is affecting both the frequency and intensity of tropical storms. There is considerable evidence, in the form of layers of mangrove peat and stumps underlying the outer portion of Hungry Bay, that this mangrove swamp has been in retreat for hundreds or possibly thousands, of years. This is largely due to natural causes, in particular continuing sea level rise. Much of the recent damage has been caused by the eroding of the protective peninsula that separates the mangrove swamp from the open ocean, and the formation of a new tidal channel/over wash area which enables huge waves and storm surges during hurricanes to break directly into the outer third of the swamp. In this area, more than 75% of the Red mangroves were washed out by the roots and destroyed. Although most of the large, mature Black mangroves were not uprooted, more than 50% subsequently died after being smothered by sand and rubble swept in during Hurricane Fabian. Dredging may also have occurred in the past, resulting in the loss of seagrasses and potentially promoting the loss of mangroves.

There is also evidence of long-term erosion of the organic peat/sediment substrate that underlies the present swamp. This may be caused in part by sea-level rise, but it appears to have been greatly accelerated by the cutting of a boat channel through the mangroves 60-70 years ago, which concentrated and increased the speed of tidal flow through the mangroves, sweeping away leaf fall, other vegetation, and fine sediment that otherwise would be deposited around the prop root complexes. Peat and substrate build-up has therefore not kept up with sea level rise and continuing erosion, especially along the margins of the boat channels, has undermined and exposed the mangrove root systems, making them vulnerable to catastrophic storm events.

Large amounts of floating debris are blown and washed in off the ocean and become trapped within the mangroves. The majority of this consists of a variety of plastic containers and products, some of which, like fuel containers and ice chests, are quite large. There are also heavier items such as car and motorcycle wheels, refrigerators and heavy lumber, that are also swept in especially during storms and which can cause significant damage to the supporting prop roots of the mangroves. Although some of the heavier debris, such as household appliances, car and motorcycle parts, originate from the solid waste dump at the Bermuda International Airport in Castle Harbour, the majority of the plastic comes in from the open ocean.

5.2.2 - Legal conservation status

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Nature Reserve under Bermuda National Parks Act 1986	Hungry Bay Nature Reserve	https://environment.bm/hungry-ba y	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

Habitat

Measures	Status
Habitat manipulation/enhancement	Partially implemented
Re-vegetation	Partially implemented

Human Activities

Measures	Status
Communication, education, and participation and awareness activities	Implemented
Research	Implemented

Other:

The site has been designated as a National Nature Reserve under the Bermuda National Parks Act (1986). It is also zoned as a Nature Reserve under the Development and Planning Act (1974) and Bermuda Plan (2018). In addition, a Tree Preservation Order (#29/2) protects the mangroves. Both species of mangrove and the Giant land crab and Land hermit crab are afforded specific protection under Protected Species Orders.

The need to stabilise the rocky shore of the peninsula at Hungry Bay, to reduce erosion and storm impacts on the bay and mangroves, has been a recognised management need since the 1990s. In 2022 the Bermuda Zoological Society successfully applied for funding to construct a seawall to close the eroded gap. This work is planned for 2022. Some clean ups of marine plastics and planting of mangrove propagules within the swamp have both been undertaken in recent years by residents from the neighbouring properties. Many of the neighbours are keen conservationists who want to care for the mangrove swamp.

Detailed research into the effects of sea-level change on the mangrove swamp within the site has been conducted by Joanna Ellison (Ellison, 1991, 1993, 1996). Some monitoring of the land hermit crab population has been undertaken by students from Clearwater Middle School, in collaboration with the Department of Environment and Natural Resources, and maps for the Hungry Bay Nature Reserve were updated in December 2017 for the passage of the Bermuda National Parks Amendment Act (2017).

5.2.5 - Management planning

Is there a site-specific management plan for the site? No

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 ◉

Please indicate if a Ramsar centre, other educational or visitor facility, or an educational or visitor programme is associated with the site:

As the land is zoned Nature Reserve under the Bermuda Plan (2018), building any facilities on the site is prohibited.

URL of site-related webpage (if relevant): https://environment.bm/hungry-bay

5.2.6 - Planning for restoration

Is there a site-specific restoration plan? No, but a plan is being prepared

Further information

A significant project was approved in early 2022 for the Bermuda Zoological Society to begin remediation of the eroded shoreline.

5.2.7 - Monitoring implemented or proposed

Monitoring	Status
Animal species (please specify)	Proposed

Proposed research and monitoring for the Giant Land Crab and Land Hermit Crab populations at Hungry Bay are outlined in the Protected Species Recovery Plans for both species (see Copeland 2020a, 2020b).

6 - Additional material

6.1 - Additional reports and documents

6.1.1 - Bibliographical references

Copeland, A.I. (2020a) Management plan for the Giant Land Crab (Cardisoma guanhumi) in Bermuda. Department of Environment and Natural Resources, Government of Bermuda. https://environment.bm/s/Giant-Land-Crab-Plan-200716_signed_redacted.pdf
Copeland, A.I. (2020b) Management plan for the Land Hermit Crab (Coenobita clypeatus) in Bermuda. Department of Environment and Natural Resources, Government of Bermuda. https://environment.bm/s/Land-Hermit-Crab-Plan-200722_redacted.pdf
Ellison, J.C. (1991) Hungry Bay Mangrove Swamp, Bermuda. Present condition and future management. Report of Bermuda Biological Station for Research, St George's.
Ellison, J.C. (1993) Mangrove retreat with rising sea level, Bermuda. Estuarine, coastal and shelf science, 37(1), 75-87.
Ellison, J.C. (1996) Pollen evidence of Late Holocene mangrove development in Bermuda. Global Ecology and Biogeography Letters, 5(6), 315-326.
Godsall, B. (2000) Survey of the population of the land hermit crab, Coenobita clypeatus, in Hungry Bay. Bermuda Biodiversity Project (BBP) student project report. BAMZ#981.
Mitchell, W. (1990) Cardisoma guanhumi: an overview of the population in Hungry Bay, Paget
Thomas, M.L.H. (1993) Mangrove swamps in Bermuda. Atoll Research Bulletin, 386, 1-17.
Walker, S.E. (1994) Biological Remanie: Gastropod fossils used by the living terrestrial hermit crab Coenobita clypeatus, on Bermuda. Palaios Vol. 9, 403-412. BBSR#1347.

Previous versions of RIS
Hungry Bay Mangrove Swamp Ramsar Information Sheet UK41002. Version 3.0, 13/06/2008, produced by JNCC.
Hungry Bay Mangrove Swamp Ramsar Information Sheet GB987RIS. Dated 20 February 1999.

6.1.2 - Additional reports and documents

i. taxonomic lists of plant and animal species occurring in the site (see section 4.3)
<no file available>

ii. a detailed Ecological Character Description (ECD) (in a national format)
<no file available>

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

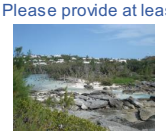
iv. relevant Article 3.2 reports
<no file available>

v. site management plan
<no file available>

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:



Dead mangroves and eroding rocky shore at Hungry Bay (*Alison Copeland, 08-04-2009*)

Red mangrove trees along a tidal channel, Hungry Bay Mangrove Swamp (*Alison Copeland, 08-04-2009*)

6.1.4 - Designation letter and related data

Designation letter
<1 file(s) uploaded>

Date of Designation: 1999-05-11