



## 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

Ramsar Site Lac Baai (1550 ha) includes a sheltered 824 hectares shallow inland bay and a 500 m bufferzone (726 ha) around it. This bufferzone includes some 183 ha of Caribbean sea (of which 19 ha between 0-6 m deep) with fringing coral reefs, which slopes down to some 80 m deep. The site is located on the south-eastern shore of Bonaire, about 7 kilometers southeast of Kralendijk. Lac Baai is the largest inland bay in the Dutch Caribbean and Bonaire's most significant lagoon. It contains thriving seagrass beds and actively growing mangroves and it is an important nursery for conch and many species of reef fish as well as being a critical foraging ground for globally endangered juvenile Green Turtles. Some 790 hectares of the bay are shallow marine waters, partly covered with seagrasses and 365 ha of mangrove forests. The maximum water depth within the bay is as shallow as 4.5 metres (15 feet). Lac Baai is separated from the ocean by a submerged barrier of coral rubble. Behind this barrier, few patch reefs have formed in the shallow area of the site. Lac Baai has two peninsulas that border the connection to the sea on both sides. North of Lac Baai are large expanses of salt flats and small salina's. Lac Baai is included within the Bonaire National Marine Park.

The site supports significant numbers of breeding and wintering shorebirds and seabirds. It is an important feeding area for these birds, including the Magnificent Frigatebird (*Fregata magnificens*), Osprey (*Pandion haliaetus*), Brown Pelican (*Pelecanus occidentalis*) and several gull and tern species (*Laridae* sp.), as well as waders among which eight heron species. The site is an important tourism and recreation destination, which implicates such threats as wildlife disturbance and pollution.

The largest and single-most important threat to the ecological functioning of the bay however is that in the last decades it has been rapidly filling in with sediment. This is not only due to infilling from erosion on land, but also due to the biological productivity in the bay itself. As a consequence, on average the bay has been losing 2.34 hectares of productive waters each year. In shallow, hot and saline backwaters mangroves and important nursery fish species simply do not survive. To re-establish water depth, removal of built-up sediments and re-establishing open water connections by clearing mangrove creeks are the only real solution. Restoration actions are carried out.

## 2 - Data & location

### 2.1 - Formal data

#### 2.1.1 - Name and address of the compiler of this RIS

##### Responsible compiler

Institution/agency	Wageningen Environmental Research
Postal address	PO Box 47 6700 AA Wageningen The Netherlands

##### National Ramsar Administrative Authority

Institution/agency	Ministry of Agriculture Nature and Food Quality
Postal address	Bezuidenhoutseweg 73 P.O. Box 20401 2500 EK The Hague The Netherlands

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

From year	1993
To year	2017

#### 2.1.3 - Name of the Ramsar Site

Official name (in English, French or Spanish)	Lac Baai
Unofficial name (optional)	Lac Bay of Lac Bonaire, originally designated as: Het Lac

#### 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 <input checked="" type="radio"/> No <input type="radio"/>
(Update) The boundary has been delineated more accurately	<input type="checkbox"/>
(Update) The boundary has been extended	<input checked="" type="checkbox"/>
(Update) The boundary has been restricted	<input type="checkbox"/>
(Update) B. Changes to Site area	the area has increased
(Update) The Site area has been calculated more accurately	<input type="checkbox"/>
(Update) The Site has been delineated more accurately	<input type="checkbox"/>
(Update) The Site area has increased because of a boundary extension	<input checked="" type="checkbox"/>
(Update) The Site area has decreased because of a boundary restriction	<input type="checkbox"/>
(Update) For secretariat only: This update is an extension	<input type="checkbox"/>

#### 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
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## 2.2 - Site location

### 2.2.1 - Defining the Site boundaries

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

Former maps	0
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##### Boundaries description

The boundary has a.o. been determined by a 500 m line which extends from the high water mark and mudflats
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2.2.2 - General location

- a) In which large administrative region does the site lie?
- b) What is the nearest town or population centre?

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

2.2.5 - Biogeography

Biogeographic regions

Regionalisation scheme(s)	Biogeographic region
Marine Ecoregions of the World (MEOW)	Realm: Tropical Atlantic, Province: Tropical North-western Atlantic, Ecoregion: Southern Caribbean.

### 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	<p>Brauman et al. 2007 recognise five hydrological services, only three of which apply to the Lac Baai Ramsar Site:</p> <p>1. Water damage mitigation: this hydrological service concerns reduction of flood damage, dryland salinization, saltwater intrusion and sedimentation (Brauman et al. 2007). This service does apply to Lac Baai in the sense that the reefs and mangroves serve as coastal protection. The annual coastal protection values of the nearshore reef-associated habitats of Bonaire (including Lac) as a whole for short-term (i.e. within 10 years) and long-term processes (i.e. beyond 10 years) are estimated at \$33,000 and \$70,000, respectively. (Min. EZ, 2013). Siltation of eroded sediment takes place in the mangroves and prevents siltation of the coral reefs, which in return safeguards the reefs' coastal protection function.</p>
Other ecosystem services provided	<p>2. Spiritual and aesthetic: this service concerns provision of religious, educational and tourism values (Brauman et al. 2007). Bonairean ecosystems, among which The Lac, support touristic activities that depend on the quality of the natural environment. These include diving, snorkelling, kayaking, boating, enjoying beaches, surfing and participating in land-based sightseeing activities. The tourism sector is an industry with substantial size and financial contribution to the economy of Bonaire. The expenditure by tourists on Bonaire is found to be around \$125 million annually. An estimated welfare of around \$50 million is contributed by Bonaire's nature to tourism. Marine ecosystems are found to be more economically significant than terrestrial ecosystems on the island. Lac Baai is an important part of these figures (Min EZ, 2013) as it is an important ecotourism destination.</p> <p>3. Supporting: this service concerns water and nutrients to support vital estuaries and other habitats, preservation of options (Brauman et al. 2007). This hydrological service also applies to Het Lac. The lagoon supports a variety of wildlife and landscapes which can be enjoyed by a variety of tourists, while its fish nursery function supports fisheries and the values for snorkeling and scuba diving.</p> <p>Marine fishing provides an important source of income and livelihood on Bonaire, also many people fish for recreational purposes. A large part of the catch is composed of reef-dependent species. The reef-related total commercial fisheries for Bonaire as a whole are valued at almost \$400,000 annually, while the recreational fishery value is estimated at an economic value of almost \$700,000 per annum. As Lac accounts for more than 95% of the seagrass and mangrove nursery habitat of the island it contributes critically to these figures (Min EZ, 2013).</p>
Other reasons	<p>Lac Baai represents one of the largest natural inland bays in the Caribbean. It contains thriving seagrass beds and actively growing mangroves and is an important nursery site for conch and many species of reef fish as well as being a critical foraging habitat for the globally endangered juvenile Green Turtles and rainbow parrotfish, <i>Scarus guacamaia</i>). Patches of reefs form behind a barrier of coral rubble that separates the lagoon from the sea. These reefs are an important sleeping area for sea turtles.</p> <p>The fringing reefs are part of the Bonaire National Marine Park which is home to virtually every species of hard and soft coral found in the Caribbean (IUCN, 2011; Perry et al., 2013). More than 340 fish species live here, making it one of the healthiest, most resilient and most bio-diverse reefs in the region. Conservation International considers the waters around Bonaire (including Klein Bonaire) to be a hotspot of Caribbean biodiversity.</p> <p>The Ramsar Site supports significant numbers of breeding (Wells and Wells 2006), wintering and foraging wetland birds (Prins et al. 2009; Debrot et al 2014).</p>

Criterion 2 : Rare species and threatened ecological communities

Criterion 3 : Biological diversity

Justification

Lac Baai is among the largest inland bays in the Caribbean with a mosaic of habitats ranging from mangrove forests and sea grass beds to shallow marine waters and coral reefs. The site supports a great variety of ecological communities and wetlands species including birds, sea turtles, fish and corals. Especially valuable for maintaining the biological diversity in the biogeographic region is it's nursery function for reef fishes and Green turtles as well as its function for migratory and wintering birds (Debrot et al. 2012a, 2012b, 2012c, Debrot 2014; Stapleton et al. 2014; Wells and Wells 2006).

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

Criterion 8 : Fish spawning grounds, etc.

Justification

The large areas of mangrove forests and associated seagrass beds of Lac Baai are of great value as nursery habitat for queen conch (*Strombus gigas*) and many important reef fish species including snappers, grunts and groupers. It's the most important fish nursery habitat of Bonaire. Particularly important is the role of mangrove creek habitat as habitat for the globally threatened Rainbow parrotfish (*Scarus guacamaia*). (Debrot et al. 2012a).  
The fringing reefs around Lac Baai as well have an important nursery function for fish species.

### 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
<b>Plantae</b>								
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Avicennia germinans</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	LC	<input type="checkbox"/>	SPAW Annex 3	Debrot et al. 2013. This site supports the only mangrove forest of Bonaire.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Conocarpus erectus</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	LC	<input type="checkbox"/>	SPAW Annex 3	Debrot et al. 2013. This site supports the only mangrove forest of Bonaire.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Laguncularia racemosa</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	LC	<input type="checkbox"/>	SPAW Annex 3	Debrot et al. 2013. This site supports the only mangrove forest of Bonaire.
TRACHEOPHYTA/ MAGNOLIOPSIDA	<i>Rhizophora mangle</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	LC	<input type="checkbox"/>	SPAW Annex 3	Debrot et al. 2013. This site supports the only mangrove forest of Bonaire.
TRACHEOPHYTA/ LILIOPSIDA	<i>Ruppia maritima</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	LC	<input type="checkbox"/>	SPAW Annex 3	Debrot et al. 2013. The site supports the largest sea grass area on Bonaire.
TRACHEOPHYTA/ LILIOPSIDA	<i>Syringodium filiforme</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	LC	<input type="checkbox"/>	SPAW Annex 3	Debrot et al. 2013. The site supports the largest sea grass area on Bonaire.
TRACHEOPHYTA/ LILIOPSIDA	<i>Thalassia testudinum</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	LC	<input type="checkbox"/>	SPAW Annex 3	Debrot et al. 2013. The site supports the largest sea grass area on Bonaire.

On Bonaire, the mangrove forests and sea grasses of Lac Baai on the east coast of the island are of essential and great value as a breeding and foraging habitat for resident and migratory birds and as a nursery area for important coral reef fish such as various sea bass. Especially important is the role of the mangrove creeks as a habitat for the near threatened Rainbow parrotfish, *Scarus guacamaia*. Section 3.3 lists (a selection of) species that use the area for breeding, feeding and/or resting.

### 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								
<b>Others</b>																	
CNIDARIA/ ANTHOZOA	<i>Acropora cervicornis</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>				CR	<input type="checkbox"/>	<input type="checkbox"/>	SPAW Annex 3	Debrot et al., 2012a
CNIDARIA/ ANTHOZOA	<i>Acropora palmata</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				CR	<input type="checkbox"/>	<input type="checkbox"/>	SPAW	Debrot et al., 2012a
CHORDATA/ REPTILIA	<i>Chelonia mydas</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	165	2014		EN	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	SPAW Annex 2	Stapleton et al. 2014
<b>Fish, Mollusc and Crustacea</b>																	
CHORDATA/ ACTINOPTERYGII	<i>Epinephelus itajara</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>				VU	<input type="checkbox"/>	<input type="checkbox"/>		Van Moorsel and Meijer, 1993
CHORDATA/ ACTINOPTERYGII	<i>Epinephelus striatus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>				CR	<input type="checkbox"/>	<input type="checkbox"/>		Van Moorsel and Meijer, 1993
MOLLUSCA/ GASTROPODA	<i>Lobatus gigas</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>	SPAW Annex 3	Debrot et al., 2012a
CHORDATA/ ACTINOPTERYGII	<i>Lutjanus cyanopterus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>				VU	<input type="checkbox"/>	<input type="checkbox"/>		Debrot et al., 2012a
CHORDATA/ ACTINOPTERYGII	<i>Scarus guacamaia</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>				NT	<input type="checkbox"/>	<input type="checkbox"/>		Debrot et al., 2012a
<b>Birds</b>																	
CHORDATA/ AVES	<i>Amazona barbadensis</i>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	100			VU	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SPAW Annex 2. IBA criteria: A1, A2, A3	formerly an important refuge and roosting area for the species (Voous 1983)
CHORDATA/ AVES	<i>Aratinga pertinax</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>		resident species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Ardea alba</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		migratory species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Ardea herodias occidentalis</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>		migratory species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Butorides virescens</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>	<input type="checkbox"/>		resident and migratory species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Charadrius wilsonia</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		migratory species (Debrot et al. 2013)
CHORDATA/ AVES	<i>Egretta rufescens</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				NT	<input type="checkbox"/>	<input type="checkbox"/>	SPAW Annex 2	resident species (Debrot et al. 2013)
CHORDATA/ AVES	<i>Egretta thula</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		resident species (Debrot et al. 2013)
CHORDATA/ AVES	<i>Egretta tricolor</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		resident species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Elaenia martinica</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>	IBA-criteria: A2	resident species (Debrot et al. 2013)
CHORDATA/ AVES	<i>Falco peregrinus</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Spaw annex II	migratory species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Fregata magnificens</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		resident species, sleeping and foraging at the site (Debrot et al., 2013)
CHORDATA/ AVES	<i>Hirundo rustica</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		numerous migratory species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Nyctanassa violacea</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		resident and migratory species (Debrot et al., 2013)
CHORDATA/ AVES	<i>Nycticorax nycticorax</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		migratory species; Debrot et al., 2013
CHORDATA/ AVES	<i>Pandion haliaetus</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		migratory species; Debrot et al., 2013

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								
CHORDATA/AVES	<i>Parkesia noveboracensis</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		numerous migratory species (Debrot et al., 2013)
CHORDATA/AVES	<i>Patagioenas corensis</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>	IBA-criteria: A3	resident species (Debrot et al. 2013)
CHORDATA/AVES	<i>Patagioenas squamosa</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>		resident species (Debrot et al, 2013)
CHORDATA/AVES	<i>Pelecanus occidentalis</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>	SPAW Annex 2	resident species, foraging at the site (Debrot et al. 2013)
CHORDATA/AVES	<i>Phoenicopterus ruber</i>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				LC	<input type="checkbox"/>	<input type="checkbox"/>	Spaw annex III	resident species, foraging (Debrot et al., 2013)

1) Percentage of the total biogeographic population at the site

#### Green Turtle

The aggregation of green turtles near Lac Baai is much larger than elsewhere along the coast of Bonaire. Green turtles captured there are bigger than conspecifics elsewhere, perhaps as a result of the composition and high densities of sea grasses in Lac Baai (Stapleton et al. 2014).

#### Yellow-shouldered amazon

While the Lac mangrove thickets were formerly used by the Yellow-shouldered Amazon (Voous 1983), this no longer appears to be the case (Smith et al. 2012, Debrot et al. 2013). In former times, the species was actively persecuted by man and the surrounding woodlands suffered more extensive disturbance by agricultural activity and charcoal burning (Freitas et al. 2005). Under such circumstances, the mangroves of Lac Baai apparently served as a roosting area for this bird. However, as awareness about the value of this bird has increased, and its persecution decreased, the species apparently no longer needs the shelter in isolation provided by the mangroves of Het Lac, and is no longer using this area. Also, the quality of the woodlands in many areas of Bonaire has improved in recent decades, which also probably offer the Yellow-shouldered Amazon a wider range of habitat options (Debrot et al. 2013).

#### Reddish egret

The Reddish egret ranked among the top 10 most abundant species of the salt flat habitat in Het Lac. Lac Baai may be of local significance as a breeding and foraging site to this species (Debrot et al. 2013).

#### Goliath and Nassau Groupers and other fish and coral species

In the past up until the early 1990s various grouper species had been documented for Het Lac, among which the threatened Goliath and Nassau Grouper. Most of these species have largely disappeared from the waters of Bonaire however due to overfishing in the past and have not since recovered (Debrot and Criens 2005). No groupers were recorded in Lac Baai during 2012 surveys (Debrot et al. 2012a). Threatened grouper species and other species have been recorded like: Mutton snapper (VU); Yellowmouth grouper (VU); Snowy grouper (VU); Queen triggerfish (VU) and Hogfish (VU); and coral species like: Boulder star coral (both *M. annularis* (EN) and *M. franksi* (VU); Mountainus star coral (EN); Pillar coral (VU); Lamarck's sheet coral (VU) and Elliptical star coral (VU).

#### Queen Conch

Conch fishing in Lac Baai is forbidden by Marine Ordinance of 1991. This moratorium seems to be effective as the conch population has increased (Engel, 2008).

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

Name of ecological community	Community qualifies under Criterion 2?	Description	Justification
Mangrove forests	<input checked="" type="checkbox"/>	The area includes 365 hectares of mangrove forests	Caribbean mangrove forests are threatened (Polodoro 2010). See further information below.

[Optional text box to provide further information](#)

Lac Baai covers 365 ha of mangrove forests which provides a habitat for numerous birds, fish, crustaceans and other species groups. The international importance lies in the threatened status of mangrove forests as the Caribbean region lost 24% of its mangrove area in approximately 25 years (in: Polodoro BA, Carpenter KE, Collins L, Duke NC, Ellison AM, et al. (2010) The Loss of Species: Mangrove Extinction Risk and Geographic Areas of Global Concern. PLoS ONE 5(4): e10095. doi:10.1371/journal.pone.0010095).

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

### 4.1 - Ecological character

Lac Baai is a clear-water, shallow (max. depth some 4.5 m) tropical lagoon of approx. 7 km<sup>2</sup> opening onto the wave- and wind-exposed east coast of the island of Bonaire. The site is separated from the ocean by a submerged barrier of coral rubble. Behind this barrier, few patch reefs have formed in the shallow area of the bay, though the (buffer)zone (being part of the Ramsar Site) surrounding Lac Baai has a larger area of fringing reefs. Lac Baai has two peninsulas that border the connection to the sea on both sides. North of Lac Baai are large expanses of salt flats and small salinías where Wilson’s Plover, Snowy Plover and Least tern breed (Wells and Wells 2006. Based on these and other characteristics, Wells and Debrot (2008) nominated Lac Baai as an IBA.

Lac Baai contains actively growing mangroves (some 100 ha) and thriving seagrass and algal beds which provide critical foraging ground for globally endangered juvenile Green Turtles. The site forms an important nursery habitat for conch and reef fish species. Recent surveys resulted in 45 fish species (Debrot et al. 2012a; Hylkema et al. 2014). Mangroves fringing open waters had highest overall fish densities and species diversity likely due to edge effects and complex shaded structures. The various vegetated sub-habitats all played a unique role for different size-classes of different fish species.

The central bay and blue pool habitats were hardly used as a juvenile habitat by reef fish, while in the more isolated dark pools and backwaters, nursery species were almost absent. In the case of the central bay habitat, the limiting factor likely was the low degree of three-dimensional shelter offered by an invasive seagrass species, while in the isolated, dark pools and warm hypersaline backwaters, physiological tolerance limits were likely the most important factors (Hylkema et al. 2014).

Long-term changes driven by mangrove expansion into this non-estuarine lagoon have been steadily reducing the net coverage of clear, well circulated open bay waters by an average of more than 2 hectares per year, while the surface of shallow, muddy, stagnant, hypersaline backwaters has been increasing by an almost equal amount. These backwaters are unable to support either meaningful mangroves, seagrass or algal meadows. Consequently the long-term biodiversity and ecosystem function of the bay could be at stake and management action is needed to stem further erosion of nursery habitat quality.

The valuable sea grass and mangrove habitats of Lac are essentially trapped in an enclosed bay. As shallow, warm and saline back-water habitat continues to increase in importance in the bay due to the process of land reclamation by mangroves, these current nursery habitats will come under additional salinity stress and likely continue to decrease in coverage and quality at an accelerated rate (Debrot et al. 2012a).

Lac Baai also supports large numbers of breeding and wintering shorebirds and seabirds. Some 63 species have recently been recorded (Debrot et al. 2012c; 2013). Of these, 31 (49%) were migrant, 24 (38%) were resident, 6 (10%) occurred both as resident and migrant and 2 (3%) were migrant species that possibly or irregularly breed. The majority of the migratory species were shore birds and waders (76%). Among the species recorded were the Magnificent Frigatebird, Osprey, Brown Pelican and several gull and wader species, among which seven species of heron (Debrot et al. 2012c; 2013).

Breeding birds of particular interest are the Reddish egret (*E. rufescens*) (Debrot et al. 2014), Snowy Plover (*Charadrius alexandrina*), Wilson’s Plover (*C. wilsonia*)

### 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		1	440	Representative
B: Marine subtidal aquatic beds (Underwater vegetation)		3		Representative
C: Coral reefs		4		Representative
D: Rocky marine shores		0		Representative
E: Sand, shingle or pebble shores		0		Representative
G: Intertidal mud, sand or salt flats		0		Representative
H: Intertidal marshes		0		Representative
I: Intertidal forested wetlands		2	365	Representative
J: Coastal brackish / saline lagoons		0		Representative
Zk(a): Karst and other subterranean hydrological systems		0		Representative

#### Other non-wetland habitat

Other non-wetland habitats within the site	Area (ha) if known
Recreational development area/settlements/beach	21
Dryland (lowe and middel terrace)	17

(ECD) Habitat connectivity The Ramsar Site is (largely) unfragmented.

### 4.3 - Biological components

#### 4.3.1 - Plant species

##### Other noteworthy plant species

Phylum	Scientific name	Position in range / endemism / other
TRACHEOPHYTALILIOPSIDA	<i>Halodule wrightii</i>	

Invasive alien plant species

Phylum	Scientific name	Impacts	Changes at RIS update
TRACHEOPHYTA/LILIOPSIDA	<i>Halophila stipulacea</i>	Actual (minor impacts)	increase

Optional text box to provide further information

Halimeda Opunta was also listed under other noteworthy plants, but does not appear in the species list nor their synonyms  
 Avrainvillea nigricans ""  
 Acetabularia crenulata ""  
 Batophora oerstedii ""  
 All above are macro-algae

4.3.2 - Animal species

Invasive alien animal species

Phylum	Scientific name	Impacts	Changes at RIS update
CHORDATA/ACTINOPTERYGII	<i>Pterois miles</i>	Actual (minor impacts)	No change

4.4 - Physical components

4.4.1 - Climate

Climatic region	Subregion
B: Dry climate	BWh: Subtropical desert (Low-latitude desert)

The mangroves are likewise vulnerable to climate change induced sea level rise and can be expected to die back with rising water levels. The mangrove forests are currently severely threatened by increased sedimentation due to agricultural practices mainly (Debrot et al. 2010a). Basically, an increased sedimentation can help mangroves to adapt to a sea level rise, but the current sedimentation rate is much too large. The fringing reefs are zoned benthic communities and form an important coastal defence against waves. They are already quite vulnerable to extreme weather (Meyer et al., 2003; Bries et al., 2004) and will only become more so with greater water depth in shallow areas (Debrot and Bugter 2010).

4.4.2 - Geomorphic setting

a) Minimum elevation above sea level (in metres)

a) Maximum elevation above sea level (in metres)

- 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.

Southern Caribbean Sea

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)

Sediment in generally stagnant pools in the mangrove forests contain a mean of 94% organic matter. The organic matter will also be high in the backwaters, though data are lacking. The sediment in the other habitats predominantly consists of silt and sand (Debrot et al. 2012a).

#### 4.4.4 - Water regime

##### Water permanence

Presence?	Changes at RIS update
Usually permanent water present	decrease

##### Source of water that maintains character of the site

Presence?	Predominant water source	Changes at RIS update
Marine water	<input checked="" type="checkbox"/>	No change
Water inputs from precipitation	<input type="checkbox"/>	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

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

Agricultural practices from the historical past and current feral livestock cause erosion of soil and sedimentation of waters in the back of Het Lac. These back-water habitats become shallower, warmer and more saline. The area of this habitat increases further due to the land reclamation process by the mangroves

(ECD) Stratification and mixing regime Lac Baai is a shallow intertidal bay. Stratification is not applicable.

#### 4.4.5 - Sediment regime

Significant accretion or deposition of sediments occurs on the site

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

Sediment regime unknown

Please provide further information on sediment (optional):

Agricultural practices cause erosion of soil and sedimentation of waters in the back of Het Lac. These back-water habitats become shallower, warmer and more saline. The area of this habitat increases due to the land reclamation process by the mangroves.

(ECD) Water turbidity and colour

The mean Secchi disk depth in the back-waters is less than 0.4 m, while it is generally between 4.3±1.5 and 9.2±2.3 m in

(ECD) Light - reaching wetland

The bottom irradiance (% of surface irradiance) is with 12.2±4.8% lowest in the shallow back-water habitats. Next are th

(ECD) Water temperature

The mean temperature in the back-waters has been recorded 32.3±1.1 °C, while the mean water temperatures in the other ha

#### 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):

(Source: De Freitas et al. 2005).

#### 4.4.7 - Water salinity

Euhaline/Eusaline (30-40 g/l)

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

Hyperhaline/Hypersaline (>40 g/l)

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

Unknown

Please provide further information on salinity (optional):

The back-waters and brown mangrove pools are generally hypersaline with mean salinities of 52.1±1.7 g/l and 40.6±4.7 g/l respectively. The other habitats are generally eusaline (Debrot et al. 2012a).

#### 4.4.8 - Dissolved or suspended nutrients in water

Oligotrophic

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

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 immediate surrounding area mainly consists of terrestrial habitat mainly used for livestock grazing. The site borders the Caribbean sea in the south east and to a lesser extent a series of condenser lagoons for maximum salt production through evapotranspiration.

### 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)	Medium

##### Regulating Services

Ecosystem service	Examples	Importance/Extent/Significance
Erosion protection	Soil, sediment and nutrient retention	Medium

##### Cultural Services

Ecosystem service	Examples	Importance/Extent/Significance
Recreation and tourism	Water sports and activities	High
Recreation and tourism	Nature observation and nature-based tourism	Medium
Scientific and educational	Long-term monitoring site	High
Scientific and educational	Major scientific study site	Medium

##### Supporting Services

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

Within the site:

Outside the site:

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

Where economic studies or assessments of economic valuation have been undertaken at the site, it would be helpful to provide information on where the results of such studies may be located (e.g. website links, citation of published literature):

See reference Min. EZ (2013) or:  
<https://www.dcbd.nl/document/whats-bonaire-nature-worth-2011-2012>  
<http://www.wolfscompany.com/sem-porta-mollis-parturient/>  
<http://www.ivm.vu.nl/en/projects/projects/economics/bonaire/ind ex.aspx>

#### 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

##### Description if applicable

Since 2010, the Dutch Ministry of Economic Affairs has supported a series of projects towards the sustainable management and restoration of Lac Baai, the Netherlands' most important mangrove wetland. Projects that have been carried out in close cooperation between scientists and local stakeholders like the management organisation STINAPA. Lac Baai is part of the Bonaire National Marine Park which is in the nomination process to become a Unesco World Heritage site for its outstanding natural values among others. Reports can be downloaded from <https://www.wur.nl/en/Research-Results/Research-Institutes/marine-research/show-marine/Bonaire-St-Eustatius-and-Saba.htm>

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

#### 4.6 - Ecological processes

(ECD) Notable species interactions, including grazing, predation, competition, diseases and pathogens	The seagrass beds serve as a foraging habitat for juvenile Green turtles.
(ECD) Notable aspects concerning migration	Lac Baai is an important site for migratory birds.
(ECD) Pressures and trends concerning any of the above, and/or concerning ecosystem integrity	The Green turtles do feed on the invasive seagrass species <i>Halophila stipulacea</i> . However, as the invertebrates community associated with <i>H. stipulacea</i> is different compared to native seagrass species, this may implicate a change in diet. The long-term imp

## 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
Local authority, municipality, (sub)district, etc.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Private ownership

Category	Within the Ramsar Site	In the surrounding area
Commercial (company)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

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

Public Entity of Bonaire

#### 5.1.2 - Management authority

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

STINAPA Bonaire  
P.O. BOX 368, Bonaire, Dutch Caribbean  
Headquarter visitor's address:  
Barcadera 10, Bonaire, Dutch Caribbean

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

Director STINAPA: Herman Sieben Manager Bonaire National Marine Park: Sabine Engel

Postal address:

STINAPA Bonaire  
P.O. BOX 368, Bonaire, Dutch Caribbean  
E-mail address: (The online RIS only accepts valid e-mail addresses, e.g. example@mail.com )  
E-mail Herman Sieben: director@stinapa.org  
E-mail Sabine Engel: marinepark@stinapa.org

E-mail address:

director@stinapa.org

## 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
Tourism and recreation areas	Medium impact	High impact	<input checked="" type="checkbox"/>	increase	<input checked="" type="checkbox"/>	No change

Water regulation

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Salinisation	Medium impact	High impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	No change

Agriculture and aquaculture

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Livestock farming and ranching	High impact	High impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change

Biological resource use

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Fishing and harvesting aquatic resources	Low impact	Low impact	<input checked="" type="checkbox"/>	decrease	<input checked="" type="checkbox"/>	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	Medium impact	High impact	<input checked="" type="checkbox"/>	increase	<input checked="" type="checkbox"/>	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	High impact	<input checked="" type="checkbox"/>	increase	<input checked="" type="checkbox"/>	increase

Pollution

Factors adversely affecting site	Actual threat	Potential threat	Within the site	Changes	In the surrounding area	Changes
Agricultural and forestry effluents	Medium impact	High impact	<input type="checkbox"/>	No change	<input checked="" type="checkbox"/>	No change
Garbage and solid waste	Medium impact	Medium impact	<input checked="" type="checkbox"/>	No change	<input type="checkbox"/>	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	Low impact	High impact	<input checked="" type="checkbox"/>	increase	<input checked="" type="checkbox"/>	increase

Please describe any other threats (optional):

Apart from the substantial impacts and threats from recreational activities the one and foremost important aspect that is causing the degradation of Lac Baai (and its surrounding area) is the overgrazing by extensive livestock husbandry resulting in an accelerated infilling of the bay with nutrients and sediment. This causes algae blooms, hampers water circulation and causes mangrove die-off (Debrot et al. 2010b, 2012b).

5.2.2 - Legal conservation status

Global legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
World Heritage site	Bonaire National Marine Park	<a href="http://whc.unesco.org/en/tentativelists/5627/">http://whc.unesco.org/en/tentativelists/5627/</a>	whole

National legal designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
National Park	Bonaire National Marine Park	<a href="http://www.bmp.org/">http://www.bmp.org/</a>	partly

Non-statutory designations

Designation type	Name of area	Online information url	Overlap with Ramsar Site
Important Bird Area	Lac Bay	<a href="http://www.birdlife.org/datazone/userfiles/file/IBAs/CaribSitePDFs/AN013.pdf">http://www.birdlife.org/datazone/userfiles/file/IBAs/CaribSitePDFs/AN013.pdf</a>	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
Soil management	Partially implemented

Human Activities

Measures	Status
Regulation/management of recreational activities	Implemented
Research	Implemented

Other:

- A zone of 500 meters from the high water mark around Lac Baai is incorporated in the Structure Plan of Bonaire. It is needed to control developments, which can have a negative impact on the Ramsar Site. The zone is divided in two areas namely: a 0–100 m designated setback zone; and a 100 – 500 m zone allowing for controlled use. This zone is now an official part of the Ramsar Site designation.
- Lac Baai is state owned. The marine environment is protected (activities in the area, and use of natural resources are regulated) within the Bonaire National Marine Park. A multi-year management and education program for Lac Bay was undertaken by STINAPA and the Marine Park.

### 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

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

The Mangrove Information Center (<https://www.mangrovecenter.com/>) is an excursion center. Visitors to the center learn about the mangroves. The Mangrove Information Center offers guided kayak and solar boat tours through the mangrove forest of Lac Bay.

URL of site-related webpage (if relevant):

### 5.2.6 - Planning for restoration

Is there a site-specific restoration plan? Yes, there is a plan

Further information

Follow-up: Therefore, to ensure broader acceptance of such an approach it was deemed critical to first demonstrate it through small pilot studies that could provide tangible “proof of concept” (Debrot et al. 2010c). As critical follow-up, in 2013, IMARES Wageningen UR led the drafting of a new project to implement several physical management interventions. Mid-2015 the project was approved by the Dutch government which means that in 2016 several interventions will take place to enhance and restore the ecological functioning of Het Lac. In this IMARES, and her sister-organizations Alterra and Wageningen University will help ensure scientific standards for these projects while execution will be the responsibility of STINAPA Bonaire and the Bonaire Office of Spatial Planning and Policy. (Source: <https://www.wageningenur.nl/en/project/Ecological-rehabilitation-Lac-Bay-Mangroves-Bonaire-from-know-ledge-to-proactive-intervention-.htm>).

### 5.2.7 - Monitoring implemented or proposed

Monitoring	Status
Water quality	Implemented
Plant community	Implemented
Animal community	Implemented
Animal species (please specify)	Implemented
Birds	Implemented

Animal species: benthic and fish, birds

## 6 - Additional material

### 6.1 - Additional reports and documents

#### 6.1.1 - Bibliographical references

The Dutch Caribbean Biodiversity Database ([www.dcbd.nl](http://www.dcbd.nl)) provides the most complete overview of data, maps and documents on the Dutch Caribbean Islands, among which Het Lac. Many documents can also be found and downloaded from the website of the project: Ecological rehabilitation Lac Bay Mangroves, Bonaire: from knowledge to proactive intervention (<https://www.wageningenur.nl/en/project/Ecological-rehabilitation-Lac-Bay-Mangroves-Bonaire-from-knowledge-to-proactive-intervention-.htm>).

References used to compile this RIS are:

Becking, Leontine E., Tineke van Bussel, M. Sabine Engel, Marjolijn J.A. Christianen and Adolphe O. Debrot, 2014. Proximate response of fish, conch, and sea turtles to the presence of the invasive seagrass *Halophila stipulacea* in Bonaire. Imares report number C118/14. 35p.

Brauman, Kate A, Gretchen C. Daily, T. Ka'eo Duarte and Harold A. Mooney, 2007. The Nature and Value of Ecosystem Services: An Overview Highlighting Hydrologic Services. Annual Review of Environment and Resources.32:6.1–6.32.

Bries et al., 2004. Damage to the leeward reefs of Curaçao and Bonaire, Netherlands Antilles from a rare storm event: Hurricane Lenny, November, 1999. Coral Reefs 23: 297-307.

Debrot, A.O., R. van Bemmelen and J. Ligon. 2014. Bird communities of contrasting semi-natural habitats of Bonaire, in the arid South-eastern Caribbean. Caribbean Journal of Science 48 (2-3): 138-150.

Debrot, A.O., Henkens, R.J.H.G., Verweij, P.J.F.M. (reds.), 2018. Staat van de natuur van Caribisch Nederland 2017: Een eerste beoordeling van de staat (van instandhouding), bedreigingen en managementimplicaties van habitats en soorten in Caribisch Nederland. Wageningen Marine Research Wageningen UR (University & Research centre), Wageningen Marine Research rapport C086/17. 214 blz.

Debrot, A.O. and S.R. Criens, 2005. Reef fish stock collapse documented in Curaçao, Netherlands Antilles, based on a preliminary comparison of recreational spear fishing catches half a century apart. 32nd AMLC (Abstract).

Debrot et al., A.O., A. Hylkema, W. Vogelaar, H.W.G. Meesters, M.S. Engel, R. de León, W.F. Prud'homme van Reine and I. Nagelkerken, 2012a. Baseline surveys of Lac Bay benthic and fish communities, Bonaire. Imares, Wageningen UR. Report number C129/12. 52p.

Debrot, Adolphe O., Carsten Wentink and Astrid Wulfsen, 2012b. Baseline survey of anthropogenic pressures for the Lac Bay ecosystem, Bonaire. Imares Wageningen UR. Report number C092/12. 71p.

Debrot, Adolphe O., Rob van Bemmelen and Jerry Ligon, 2013. Bird communities of contrasting semi-natural habitats of Lac Bay, Bonaire, during the fall migration season, 2011. Report number C165/12. 25p.

Debrot, A.O. and R. Bugter, 2010a. Climate change effects on the biodiversity of the BES islands; Assessment of the possible consequences for the marine and terrestrial ecosystems of the Dutch Antilles and the options for adaptation measures. Wageningen, Alterra, Alterra-report 2081; IMARES-report C118/10. 36 p.

#### 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

<1 file(s) uploaded>

vi. other published literature

<no file available>

#### 6.1.3 - Photograph(s) of the Site

Please provide at least one photograph of the site:



Mangrove creek Lac Baai ( Dolfi Debrot, 11-05-2016 )



Canoeing at Lac Baai ( Dolfi Debrot, 11-05-2016 )



Fence at Lac Baai to prevent grazing livestock entering the mangroves. ( Dolfi Debrot, 25-06-2013 )



Salt pan Cai at Lac Baai ( John Meulermans, 25-03-2013 )

#### 6.1.4 - Designation letter and related data

Designation letter

<1 file(s) uploaded>

Date of Designation 1980-05-23