

Preliminary evaluation of potential sites for the installation of manatee soft release enclosures in the Grand Cul de Sac Marin bay

Report
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Summary

Methodology	8
Prior identification of sites to explore.....	8
Prospecting of the sites	8
Assessment of the sites	9
Alternative assessment, based on biological criteria.....	9
Results	10
Criteria for evaluating the potential sites	11
Evaluation grid of the potential sites	12
Classification of the evaluated sites	13
Classification of the evaluated sites based on “biological” criteria	14
Potential sites prospected.....	15
Sites assessed by the evaluation methodology.....	16
Preselected sites.....	17
Sheets of preselected sites.....	18
Anse Bésia #27.....	19
Pointe Saint-Vast #24	20

Anse Christophe #23	21
Macou #6.....	22
Pointe Grande Rivière à Goyave #26.....	23
Belle Plaine #19	24
Anse Lambis #17.....	25
L'épine Est #29	26
L'épine Ouest #30.....	27
Moustique #31	28
Baie à Chat 2 #22.....	29
Anse du figuier #7.....	30
Appendices	31
Appendice 1: Map of the uses and touristic flows in the Grand Cul-de-Sac marin bay.....	31
Appendice 2: Map of the fishing activities in the Grand Cul-de-Sac marin bay.....	32
Appendice 3: Map of the potential manatee occupation of the Grand Cul-de-Sac marin bay	33
Appendice 4: Map of the historical hunting areas of the manatee	34

Abstract

This report is the result of a field work of prospection and evaluation of potential sites for the installation of soft-release enclosure as part of the proposed reintroduction of the manatee in the Grand Cul de Sac Marin bay in Guadeloupe. This work was carried out by the team of the National Park during the year 2012.

In total, 31 sites were surveyed throughout the bay; 15 sites have been assessed according to a multi-criteria assessment grid in which each criterion was weighted according to their relative importance; 12 sites were pre-selected and considered *a priori* as most relevant to the installation of soft release enclosures.

This technical report aims to serve as a working basis and inform a group of manatee rehabilitation, who will participate in an assessment mission of the potential sites from 27th to 29th of August 2012. This mission should help to refine this preliminary work and to advise the National Park in selecting and developing soft release enclosures and protocols. The experts will be conducted during two days to the 12 preselected sites.

Reminder: the manatee reintroduction project

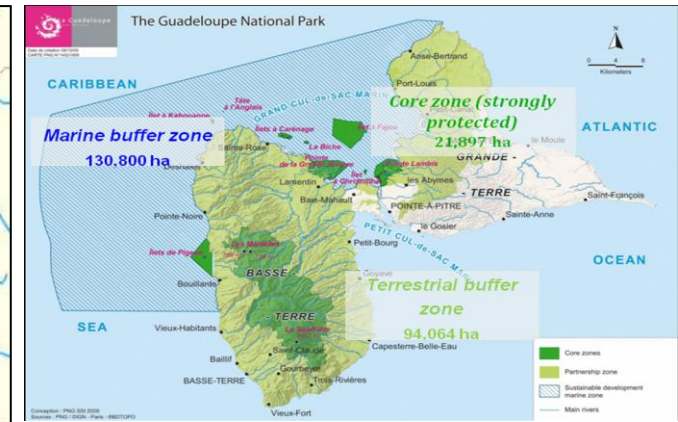
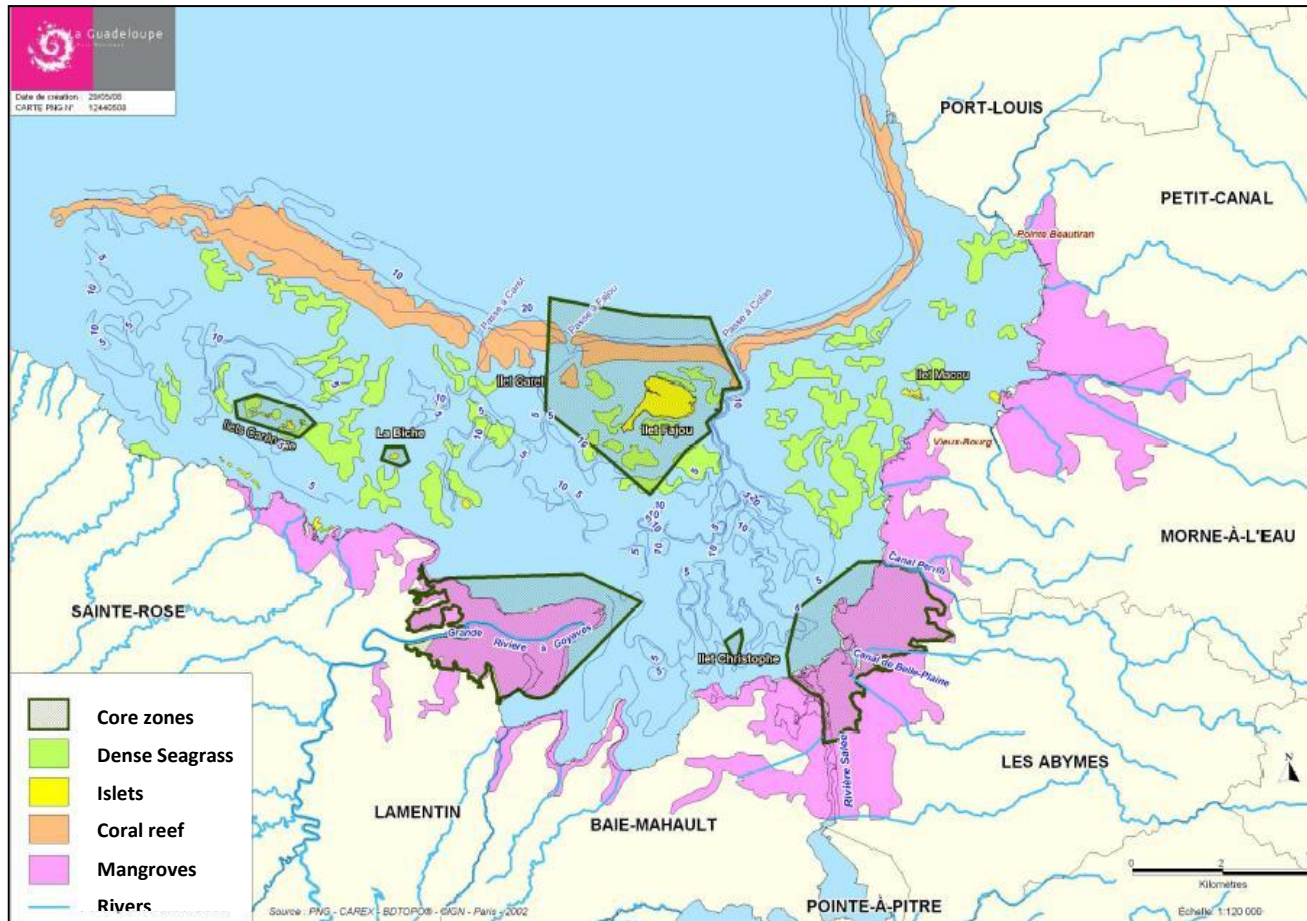
West Indian manatees are present in 20 range states in the wider Caribbean, but numbers are reported to be small (fewer than 100 individuals) and in decline in 14 of those 20. In addition, in many range states, persistence of manatees is threatened by incidental takes in fishing gear, poaching, contaminants, and habitat destruction. Furthermore, although protective legislation exists and Marine Protected Areas have been created, economic constraints prevent both enforcement of laws and effective infrastructures for conservation to function. Thus, manatees could easily disappear within the foreseeable future from most Caribbean countries and territories they inhabit today. In such a grim situation, creative and collaborative approaches and actions should be considered to conserve remaining manatees and, as possible, facilitate the establishment and growth of new populations. With support from the French Ministry of Ecology, the National Park of Guadeloupe has taken careful steps to assess the feasibility of re-introducing manatees to the waters of the Grand Cul-de-Sac-Marin (GCSM). Although manatees were extirpated from Guadeloupe several decades ago, the waters of the GCSM are well protected, including enforced no-entry zones, and have relatively little boat traffic or other threats to manatees. Formal agreements with local fishing organizations and excellent relationships with communities (including “Lamentin” - French for manatee) are attempting to secure local support of a re-introduction effort. A committee of expert scientists and fisheries managers is carefully guiding the process. Altogether, the quality of the habitat, emergence of community buy-in, careful and measured guidance by experts, and presence of well-funded enforcement of protected areas mean that if manatees are successfully re-introduced to the GCSM, this population could become one of the Caribbean’s most secure. In light of the extreme rarity of marine mammal re-introductions globally, this program may provide an extremely useful model and good lessons to enhance species conservation.

Study site: The Grand Cul-de-Sac marin bay

The GCSM bay includes 15,000 hectares of lagoon delimited in its marine part by a barrier of coral reef 25 km long, and its land by a mangrove belt of 6,000 ha. The bay has 8220 hectares of seagrass with 4879 ha of dense seagrasses and 3341 ha of sparse seagrasses (Bouchon et al. 2002). The main species are *Thalassia testudinum* and *Syringodium filiforme*. Bathymetry varies between outcrops and channels up to 35 meters deep. Many shallow waters are present and consist of either seagrass meadows or small reef formations.

Several streams, rivers, canals open into the lagoon. The dry season from December to May, is characterized by rainfall rarely exceeding 120 mm per month. It is especially marked during Lent (February-March) where many ravines are then dried. The rainy season, June to November, is characterized by high rainfall (monthly values greater than 120mm) and cyclonic periods. The waters are generally turbid along the mangrove and clearest near the reef. The average temperature of the water in the lagoon is 29 ° C. The barrier of coral reef is cut by passes that allow a continuous exchange between the sea and the lagoon.

Different economic activities, tourism or fisheries, depend directly on the GCSM bay. Seven ports are located on the shores of the lagoon: Sainte Rose, Morne Rouge, Lamentin (Manatee in french), Bay Mahault, Vieux-Bourg, Petit Canal and Port Louis. It should be added that boats from the port of Laurisque, the Marina of Pointe a Pitre and those moored in the canals are also likely to use the GCSM.



- Six core zones of the National Park surrounded by marine and terrestrial buffer zones / RAMSAR and MAB site
 - 3 types of habitats: mangroves (6000ha), sea grass meadows (5500 ha) and a coral reef of 25 km long
 - Several rivers flow in the bay
 - About 15 000 ha
 - 120 000 inhabitants living around
- Human activities:
- Tourism activities (with trips on boat, yachting, diving activities, kayaks...)
 - Fishing activities (using small boats with gillnets and traps)
 - 120,000 inhabitants living around

Methodology

Prior identification of sites to explore

A preliminary identification of potential sites for installation of soft release enclosures was conducted between January to April 2010 by a student of Master 2 of the UAG¹ (Hebert 2010). This study has identified a shortlist of seven potential sites. This site has been reassessed as part of this work in completing the list of criteria to be considered while specifying the technical constraints (site accessibility, maneuverability, handling and capture of animals, etc..) and human constraints (attendance, uses, potential threats, etc..). The preliminary selection of 31 sites to be surveyed was made on the basis of an analysis of ortho-aerial photographs, supplemented by knowledge of field rangers of the National Park.

Prospecting of the sites

Prospecting sites was conducted by boat (sometimes by a terrestrial survey when access was possible), supplemented by an approach in canoeing in areas less accessible (shallow waters, mangrove channels, rivers...).

Areas of seagrass and the nature of the substrate have been studied previously based on the work of Chauvaud et al. 2005 "Cartographies of coastal marine habitats communities of the lagoon of the Grand Cul de Sac Marin." The study of the bathymetry of the sites was conducted using marine maps. Assessing the quality and size of the seagrass areas, depth and substrate nature of the sites was supplemented by snorkeling transects.

Salinity readings were made occasionally, mainly to search for points of access to fresh water (Salinity \leq 8mg / L) in or around the sites (eg. river mouths).

In most cases the team consisted of three people: a pilot boat, a person moving by canoe and another for the exploration of seagrass beds. This work represents ten days of field survey, representing about 80 hours.

¹ Antilles and Guyana University

Assessment of the sites

A multi-criteria assessment grid was developed with 12 criteria to rate the various sites. Each criteria was described as a value ranging from 0 to 2 ("2" being the maximum) and weighted according to its supposed importance for site selection. Three criteria were weighted by a multiplier coefficient of "4" (presence of natural fresh water near the site; possibility of input of an artificial freshwater source inside the park; presence of seagrass in the site), four criteria by a factor of "2" (time-to-site; presence of a land access; threats / attendance; depth of the site) and 5 criteria for a coefficient of "1".

Potential sites have been evaluated following the assessment grid and scored from 0 to 2 for each criterion based on their respective potential. The weighting of the criteria completes the evaluation of the final grade of each site.

On 31 sites surveyed, 15 sites were evaluated using the methodology described above. 16 sites have not been evaluated because of "disqualifying" constraints such as the lack of seagrass, too shallow waters, the unavailability of fresh water, too complex access, etc.

Alternative assessment, based on biological criteria

This method assesses the parks on the basis of four criteria considered fundamental to the well-being of manatees in the pre-release: (i) the presence of seagrass in or around the site, (ii) possibility of an artificial freshwater input, (iii) presence of natural fresh water nearby, (iv) sufficient depth. This evaluation method suggests that the selection of sites should be done in a first time on the basis of biological criteria and then be refined according to other criteria, technical and human.

Results

The sites ranking according to the 12 criteria evaluation grid allowed to pre-select 12 potential sites including 9 sites particularly interesting.

The results obtained using the method of calculation based on biological criteria confirmed the previous selection.

The exclusion of 3 sites with a low value on one of the criteria 'seagrass meadows' or 'depth' provides a ranking close in the two methods of calculation.

It should be noted that this selection using multicriteria evaluation grid has only reinforce the field expertise of team of the National Park.

The evaluation of 12 potential sites by the expert mission should help refine the choice of soft-release sites.

Criteria for evaluating the potential sites

weighting coefficient	Criteria	0	1	2
4	Natural fresh water source ²	Absent or distant	Moderately distant / close but <u>temporary</u>	Presence near or not distant <u>permanent</u>
4	Artificial freshwater input ³	Absence and / or very difficult to provide	Moderate difficulty of providing	Nearby presence or easy to provide
4	Seagrass	No inside / low peripheral presence	Small size inside / good presence outside the site	Good presence inside and outside
2	Time-to-site (from the port of Baie Mahault)	Long (+ 30 min)	Medium (15 to 30 min)	Short (-15 min)
2	Terrestrial access	Absence	Difficulty to develop	Presence or easy to develop
2	Threats, attendance, disturbance ⁴	High	Medium	Low
2	Depth	< 1 m on the majority of the site	>1m on the majority of the site	>1m on the entire site
1	Storm shelters	Site exposed to the swell	Moderately exposed site	Good shelter
1	Maneuverability on site	Poor (presence of numerous obstacles)	Medium	Easy to work
1	Site Status	Municipality possibly ⊗ National Park	Municipality assumed ⊙ National Park	Core Zone of the park
1	Drooping branches of mangrove trees (secondary food source)	Absence	Medium	Numerous
1	Closure of the soft-release park	Difficult	Medium (great length)	Easy

² The close presence of a natural source of freshwater could help facilitate the settlement of manatees near the release area.

³ The possibility of an artificial freshwater source may be a criterion for the welfare of the animals for the period of their presence in semi-captive conditions.

⁴ Close threats (boating, fishing); attendance (use of the site and surrounding area), potential for disturbance to animals during their presence in soft release area.

Evaluation grid of the potential sites

Criteria Site names	N° Coef.	4	4	4	2	2	2	2	1	1	1	1	1	Final note	Notes
		fresh water	Artificial water	Seagrass	Time-to-Site	Terrestrial access	Threats	Depth	Storm shelters	Status zone	Maneuverability	mangrove	Closure of Park		
Pointe à Retz nord	1	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
Pointe à Retz sud	2	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
Anse de la voute	3	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
Canal renard	4	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
Anse vieux bourg Macou	5	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
Macou	6	2	1	2	1	0	0	1	0	1	2	1	1	29	Not sheltered area / freshwater / seagrass
Anse du figuier	7	0	1	1	1	1	1	0	1	1	2	1	1	20	-
Coin à nous 1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
Coin à nous 2	9	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
Coin à nous 3	10	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / muddy bottom / no seagrass
J'ai fouillé 1	11	0	0	2	1	0	2	1	2	1	2	1	1	23	-
Anse Pierrefite 1	12	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / seagrass external
Anse Pierrefite 2	13	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / seagrass external
Anse Pierrefite 3	14	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / seagrass external
Perrin nord	15	0	0	2	0	0	1	1	1	2	2	2	2	21	-
Perrin sud	16	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / seagrass external
Anse Lambis	17	0	0	2	1	0	1	2	2	2	2	2	2	26	seagrass ext/low depth entry
Pointe Lambis	18	0	0	2	1	0	1	1	2	2	1	2	1	22	low depth entry /seagrass ext.
Belle Plaine	19	2	0	1	1	0	1	1	2	2	2	2	0	26	Taonaba project
Choisy	20	-	-	-	-	-	-	-	-	-	-	-	-	-	Unable to locate / closed area
Baie à chat	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Baie à chat 2	22	1	2	0	2	2	1	1	2	1	1	2	2	32	Small seagrass / near Christophe
Anse Christophe	23	1	2	1	2	2	1	2	2	1	2	2	1	38	-
Pointe St-Vast	24	2	2	2	2	2	2	1	0	1	2	2	1	44	-
Cosselette	25	-	-	-	-	-	-	-	-	-	-	-	-	-	Turbid / no grass
Pointe Grande Rivière	26	2	0	1	2	0	1	1	2	2	2	0	0	26	60-70 cm de profondeur max à l'entrée
Anse Bézia	27	0	2	2	1	2	1	1	0	1	2	1	1	31	-
Welch	28	-	-	-	-	-	-	-	-	-	-	-	-	-	Beaux herbiers/pas de fond/pas d'abris
L'épine est	29	1	1	1	1	0	2	1	2	1	1	1	2	27	-
L'épine ouest	30	1	2	1	1	1	2	1	2	1	0	2	2	29	No seagrass
Moustique	31	2	1	1	0	0	2	0	0	1	0	1	2	24	Low depth

Classification of the evaluated sites

Site names	Coef.	4	4	4	2	2	2	2	1	1	1	1	1	Final note	Remarques
	N°	fresh water	Artificial water art.	Seagrass	Time-to-Site	Terrestrial access	Threats	Depth	Storm shelters e	Status zone	Maneuvera bility mangrove	Closureof Park			
Pointe St-Vast	24	2	2	2	2	2	2	1	0	1	2	2	1	44	
Anse Christophe	23	1	2	1	2	2	1	2	2	1	2	2	1	38	
Baie à chat 2	22	1	2	0	2	2	1	1	2	1	1	2	2	32	This site presents only a very small area of seagrass
L'épine ouest	30	1	2	1	1	1	2	1	2	1	0	2	2	33	
Anse Bésia	27	0	2	2	1	2	1	1	0	1	2	1	1	31	
Macou	6	2	1	2	1	0	0	1	0	1	2	1	1	29	
L'épine est	29	1	1	1	1	0	2	1	2	1	1	1	2	27	
Anse Lambis	17	0	0	2	1	0	1	2	2	2	2	2	2	26	
Belle Plaine	19	2	0	1	1	0	1	1	2	2	2	2	0	26	
Pointe Grande Rivière	26	2	0	1	2	0	1	1	2	2	2	0	0	26	
Moustique	31	2	1	1	0	0	2	0	0	1	0	1	2	24	This site has a very low depth
Anse du figuier	7	1	1	1	1	1	1	0	1	1	2	1	1	24	This site has a very low depth
J'ai fouillé 1	11	0	0	2	1	0	2	1	2	1	2	1	1	23	
Pointe Lambis	18	0	0	2	1	0	1	1	2	2	1	2	1	22	
Perrin nord	15	0	0	2	0	0	1	1	1	2	2	2	2	21	

Preselected sites

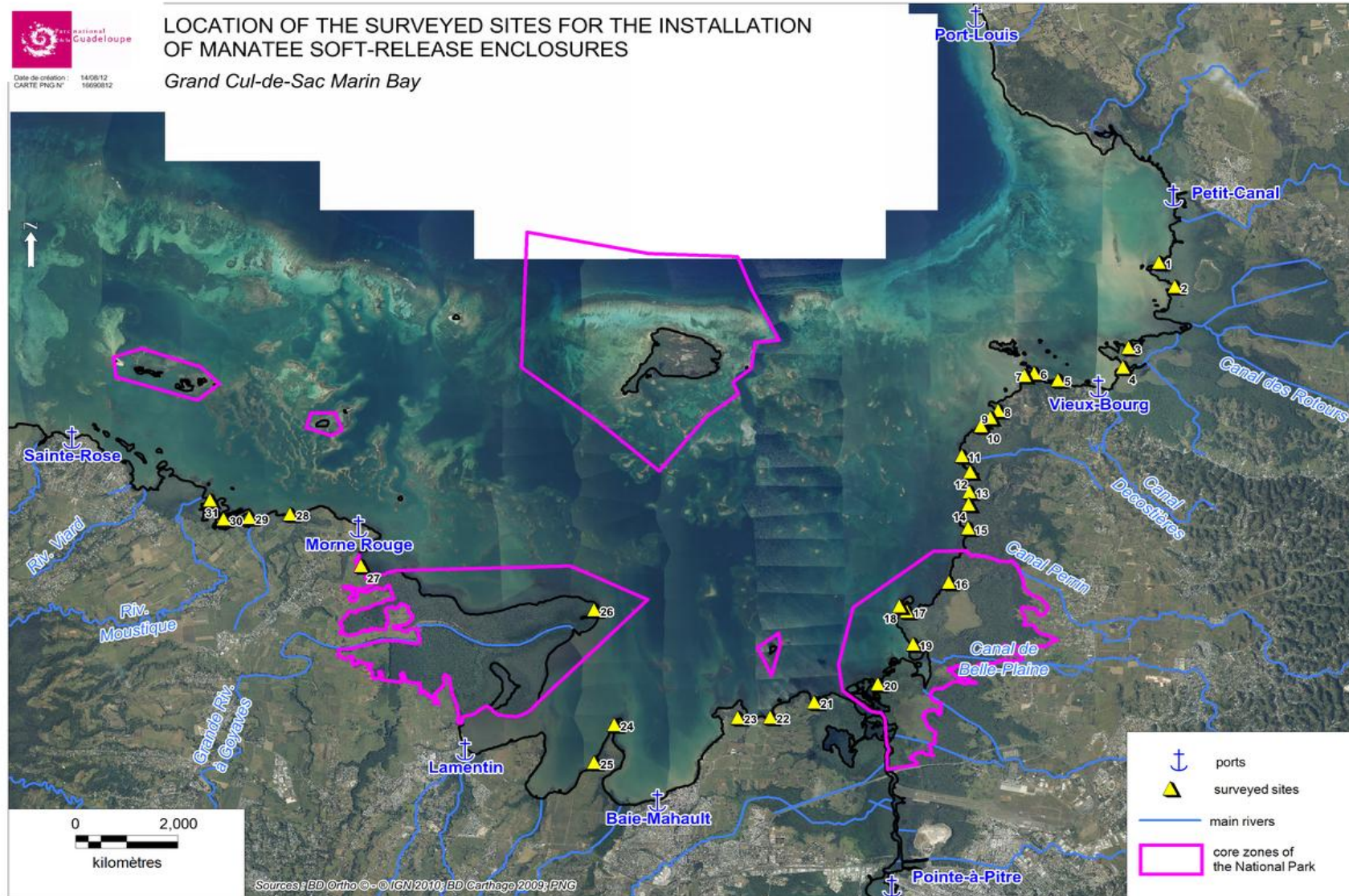
Site : Sites with a criterion "seagrass" or "depth" has a very low value.

Classification of the evaluated sites based on “biological” criteria

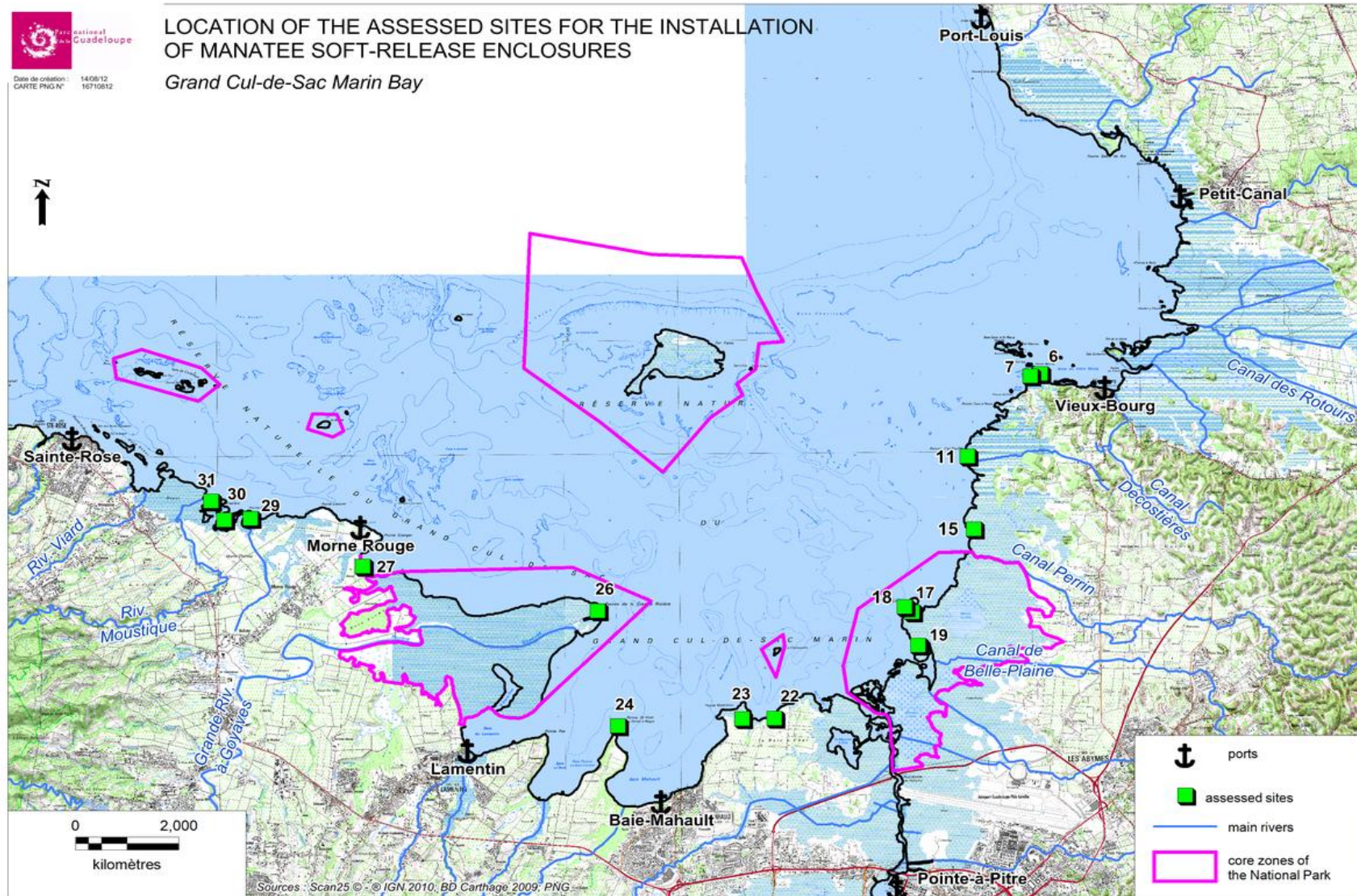
Criteria	N°	4	4	4	2	Final score	Note
Site names							
Pointe St-Vast	24	2	2	2	1	26	
Anse Christophe	23	1	2	1	2	20	
Macou	6	2	1	2	1	22	
Anse Bésia	27	0	2	2	1	18	
L'épine ouest	30	1	2	1	1	18	
Moustique	31	2	1	1	0	16	This site has a very low depth
Baie à chat 2	22	1	2	0	1	14	This site presents only a very small area of seagrass
Pointe Grande Rivière	26	2	0	1	2	14	
L'épine est	29	1	1	1	1	14	
Belle plaine	19	2	0	1	1	14	
Anse du figuier	7	1	1	1	0	12	This site has a very low depth
Anse Lambis	17	0	0	2	2	10	
Pointe Lambis	18	0	0	2	1	10	
Perrin nord	15	0	0	2	1	10	
J'ai fouillé 1	11	0	0	2	1	9	

Preselected sites

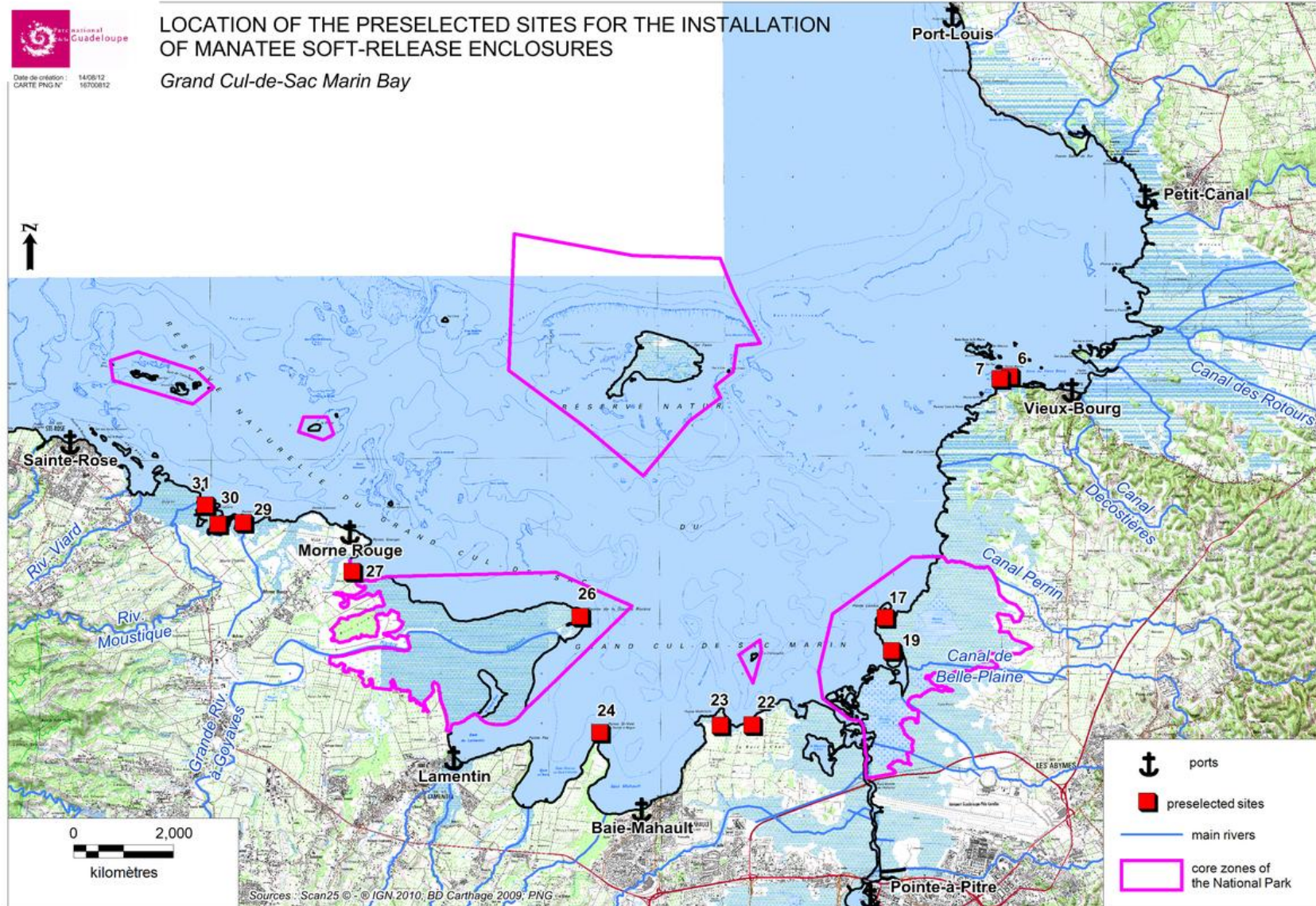
Potential sites prospected



Sites assessed by the evaluation methodology



Preselected sites



Sheets of preselected sites



Anse Bésia #27



Pointe St Vst #24



Macou #6



Anse Christophe #23



Anse Lambis #17

Aerial photographs of some sites © Hébert 2010

Anse Bésia #27



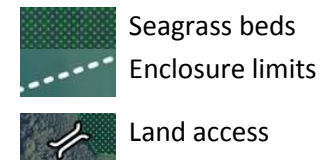
Location of the site



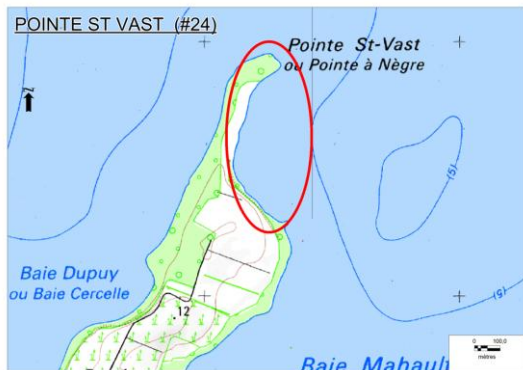
Seagrass beds by teledetection (Chauvaud 2005)



- Total area of the enclosure: 13 ha
- Surface of seagrass in the enclosure : 10,5 ha
- Net length : 840 m
- Presence of seagrass around the site
- Artificial freshwater input : easy
- Land accessibility: easy
- Potential threats / attendance: medium to low
- Storm shelters: bad / northeast oriented
- Features / notes: site with one of the most beautiful area of seagrass, with easy land access and an artificial supply of fresh water. One of the sites a priori the most interesting



Pointe Saint-Vast #24



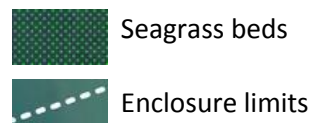
Location of the site



Seagrass beds by teledetection (Chauvaud 2005)



- Total area of the enclosure: 5,35 ha
- Surface of seagrass in the enclosure : 5,26 ha
- Net length : 762 m
- Presence of seagrass around the site
- Artificial freshwater input : easy
- Land accessibility: easy
- Potential threats / attendance: medium to low
- Storm shelters: bad / east oriented
- Features / notes: site with one of the most beautiful area of seagrass, with easy land access and an artificial supply of fresh water. The nearby presence of the mouth of the “Grande Rivière à Goyave” (historical presence of the manatees) may be of interest to facilitate the settlement of the animals. One of the sites a priori the most interesting.



Anse Christophe #23



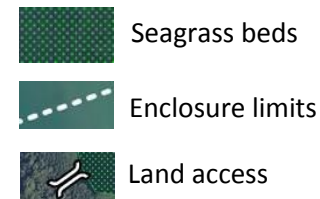
Location of the site



Seagrass beds by teledetection (Chauvaud 2005)



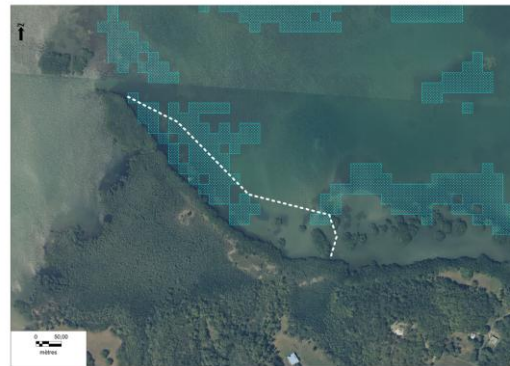
- Total area of the enclosure: 5,24 ha
- Surface of seagrass in the enclosure : 2, 31 ha
- Net length : 459 m
- Presence of seagrass around the site
- Artificial freshwater input : easy
- Land accessibility: easy
- Potential threats / attendance: medium to low
- Storm shelters: good / well protected
- Features / notes: site with easy land access and an artificial supply of fresh water. Well protected inside, the park is on the outside to include a seagrass meadow area. Not so far of the “Grande Rivière à Goyave”, is one of the sites a priori the most interesting.



Macou #6



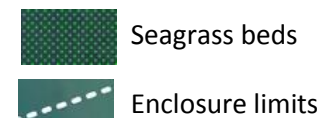
Location of the site



Seagrass beds by teledetection (Chauvaud 2005)



- Total area of the enclosure: 3,45 ha
- Surface of seagrass in the enclosure : 1, 99 ha
- Net length : 567 m
- Presence of seagrass around the site
- Artificial freshwater input : medium
- Land accessibility: medium
- Potential threats / attendance: high (many activities from the port of Vieux Bourg)
- Storm shelters: bad / northeast oriented
- Features / notes: site with a good area of seagrass, with possibility of land access and an artificial supply of fresh water. Near the freshwater source of Vx Bourg (historical presence of manatees). One of the sites a priori the most interesting



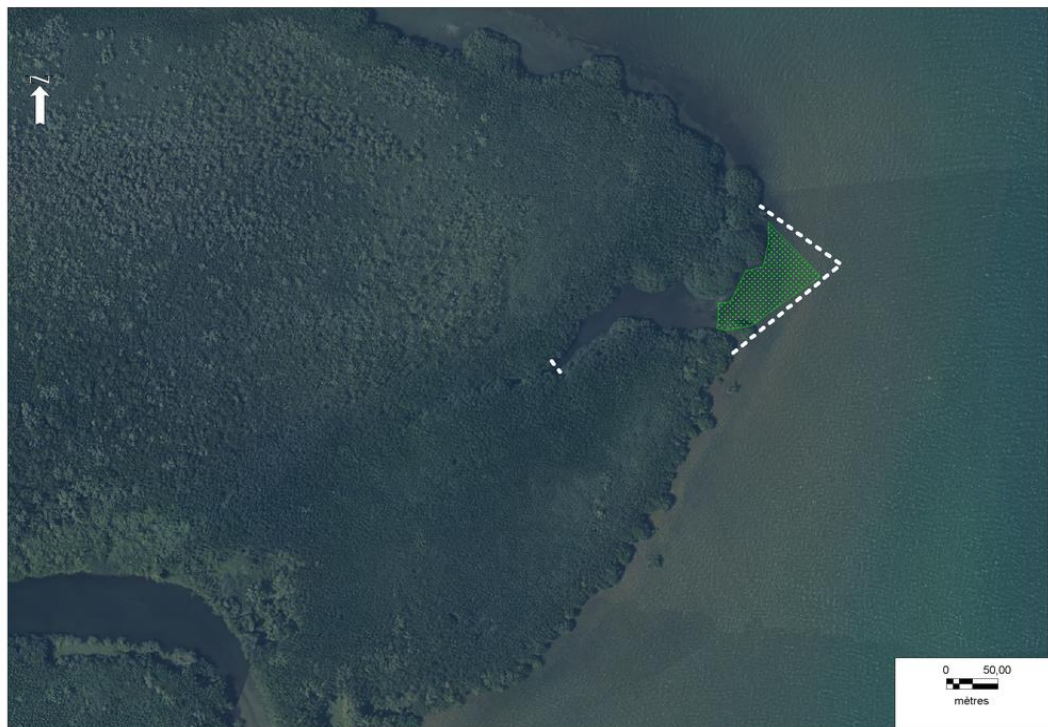
Pointe Grande Rivière à Goyave #26



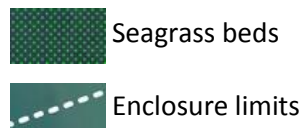
Location of the site



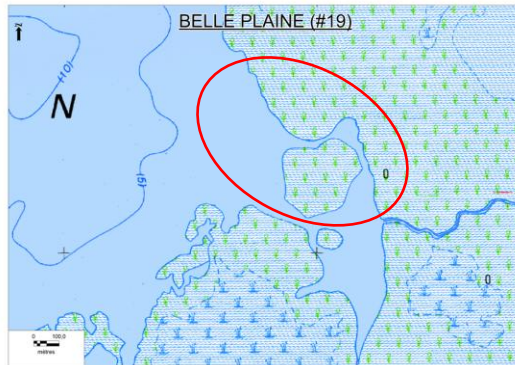
Seagrass beds by teledetection (Chauvaud 2005)



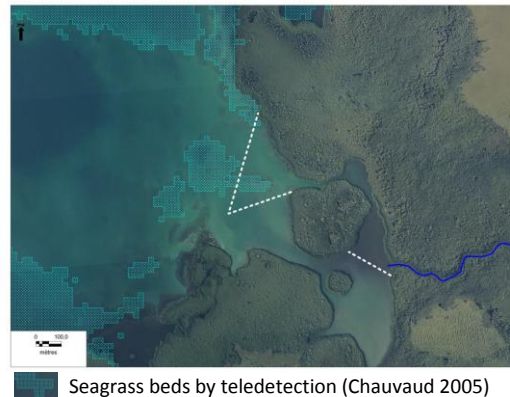
- Total area of the enclosure: 1,21 ha
- Surface of seagrass in the enclosure : 0,44 ha
- Net length : 247 m
- Presence of seagrass around the site
- Artificial freshwater input : easy (if from the “Grande Rivière à Goyave”)
- Land accessibility: impossible
- Potential threats / attendance: medium to low
- Storm shelters: bad / east oriented
- Features / notes: 60 to 70 cm deep at the entrance. This is the old mouth of “Grande Rivière à Goyave”, an historical site for manatees, the new mouth being very close. This area is core zone of the national park.



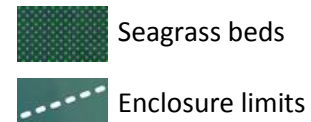
Belle Plaine #19



Location of the site

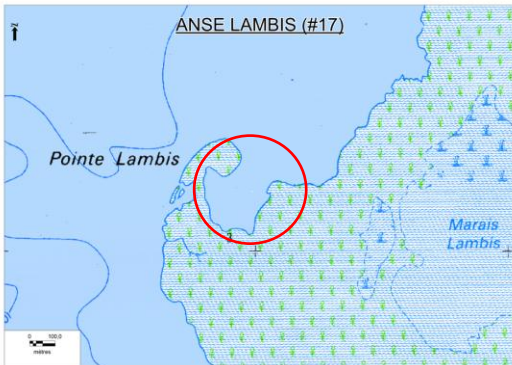


Seagrass beds by teledetection (Chauvaud 2005)

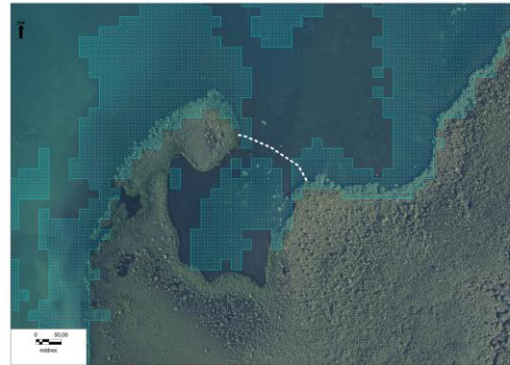


- Total area of the enclosure: 8,82 ha
- Surface of seagrass in the enclosure : 1,81 ha
- Net length : 864 m
- Presence of seagrass around the site
- Artificial freshwater input : very difficult but natural fresh water source with the Belle Plaine river
- Land accessibility: difficult
- Potential threats / attendance: medium to low (but an ecotouristic project "Taonaba")
- Storm shelters: good/ well protected
- Features / notes: the only site with a fresh water source inside. Beautiful mangrove areas. Taking into account an area of seagrass, the site is very large. Interesting site.

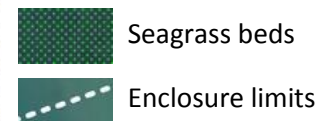
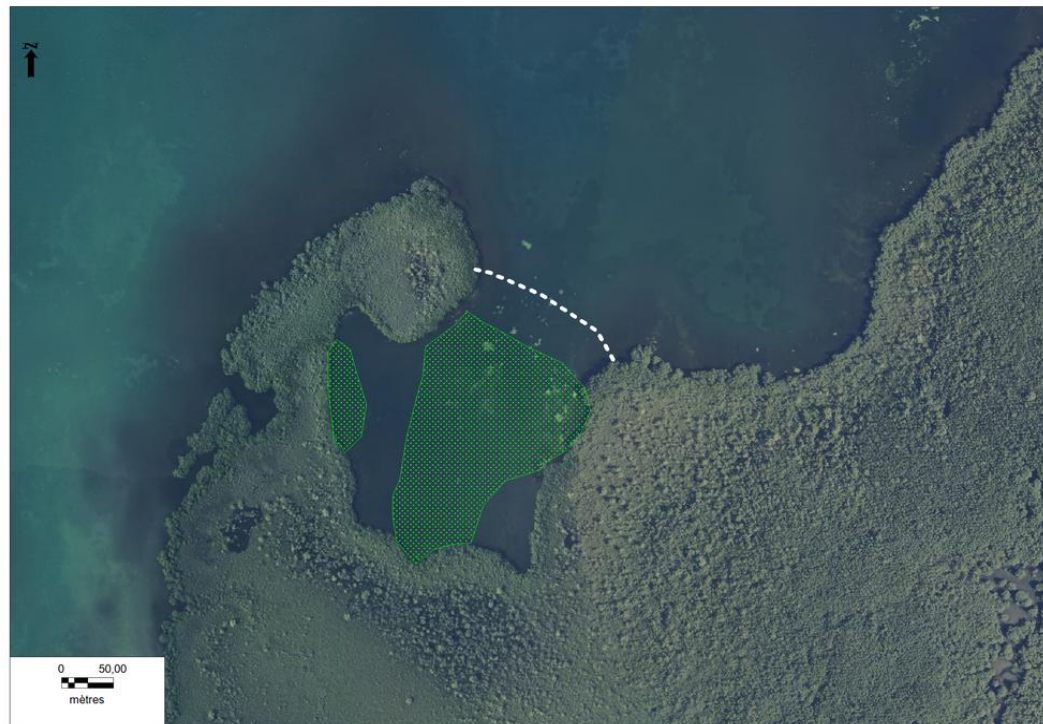
Anse Lambis #17



Location of the site

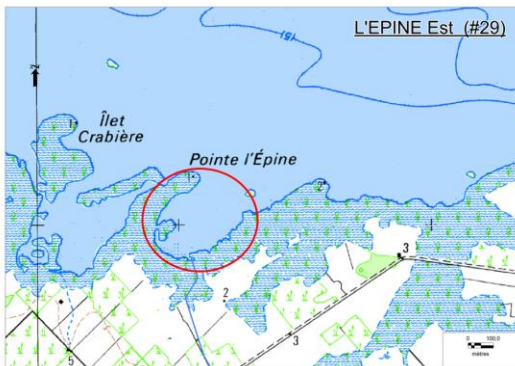


Seagrass beds by teledetection (Chauvaud 2005)

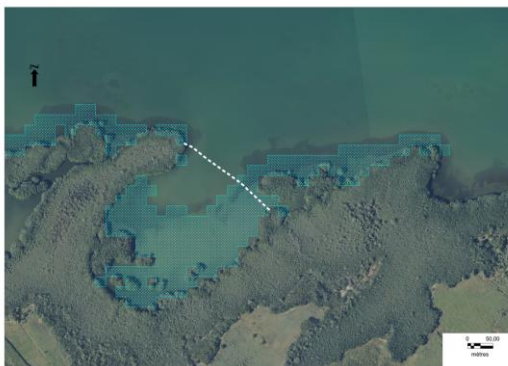


- Total area of the enclosure: 5,19 ha
- Surface of seagrass in the enclosure : 3 ha
- Net length : 170 m
- Presence of seagrass around the site
- Artificial freshwater input : very difficult
- Land accessibility: very difficult
- Potential threats / attendance: medium to low
- Storm shelters: medium / northeast oriented
- Features / notes: site with one of the most beautiful area of seagrass. Core zone of the national park. Lack of land access and fresh water could be problematic.

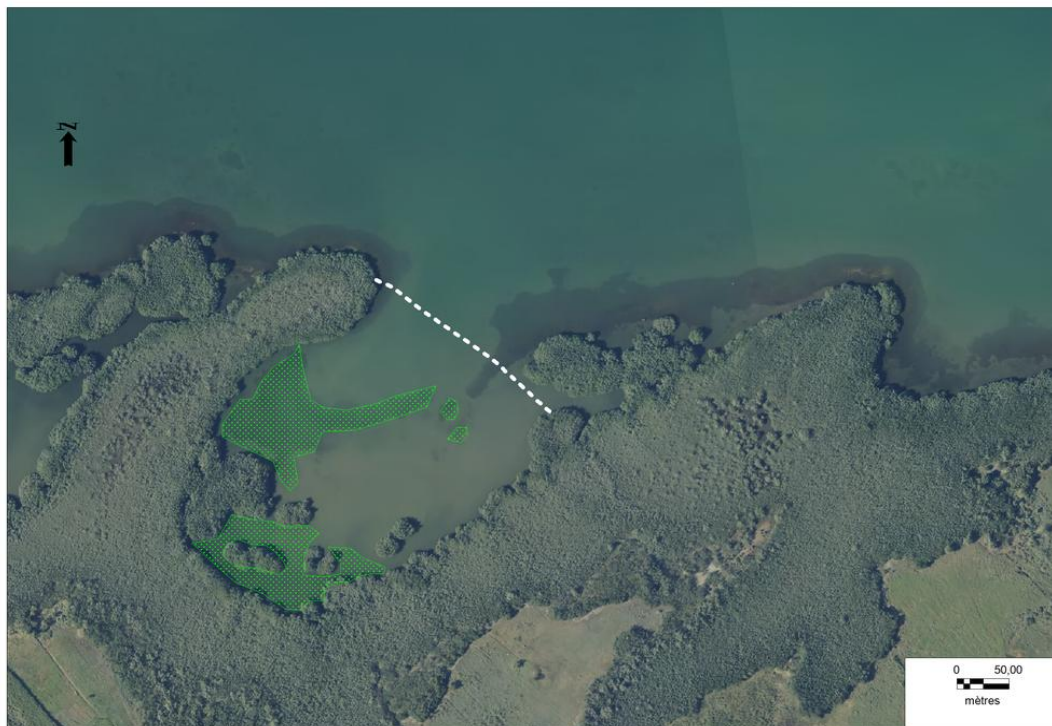
L'épine Est #29



Location of the site



Seagrass beds by teledetection (Chauvaud 2005)

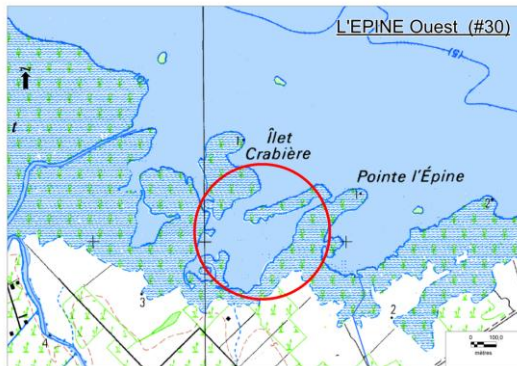


Seagrass beds

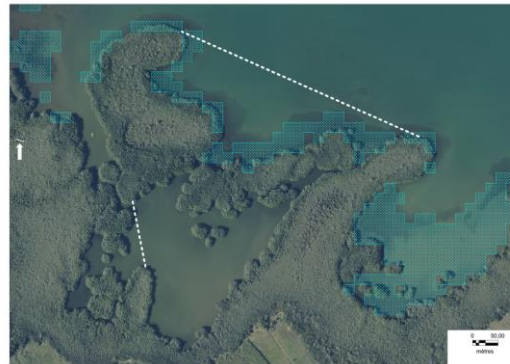
Enclosure limits

- Total area of the enclosure: 6,84 ha
- Surface of seagrass in the enclosure : 1, 62 ha
- Net length : 218 m
- Presence of seagrass around the site
- Artificial freshwater input : medium to easy
- Land accessibility: medium to easy
- Potential threats / attendance: relatively high
- Storm shelters: good / well protected
- Features / notes: site with mangrove islets, with a possibility of land access and an artificial supply of fresh water.

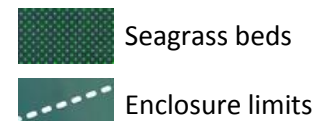
L'épine Ouest #30



Location of the site

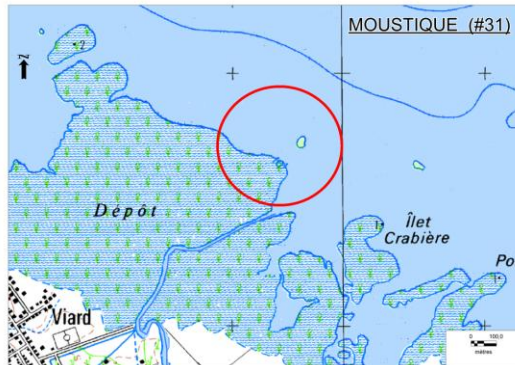


Seagrass beds by teledetection (Chauvaud 2005)



- Total area of the enclosure: 14,16 ha
- Surface of seagrass in the enclosure : 2,69 ha
- Net length : 641 m
- Presence of seagrass around the site
- Artificial freshwater input : easy to medium
- Land accessibility: easy to medium
- Potential threats / attendance: relatively high
- Storm shelters: good
- Features / notes: site with the most beautiful area of seagrass, with easy land access and an artificial supply of fresh water. One of the sites a priori the most interesting

Moustique #31



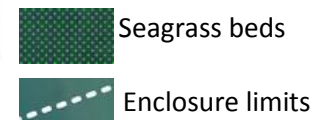
Location of the site



Seagrass beds by teledetection (Chauvaud 2005)



- Total area of the enclosure: 9,31 ha
- Surface of seagrass in the enclosure : 3,63 ha
- Net length : 970 m
- Presence of seagrass around the site
- Artificial freshwater input : difficult
- Land accessibility: difficult
- Potential threats / attendance: relatively high
- Storm shelters: bad / northeast oriented
- Features / notes: site with the nearby presence of the “Moustique” river (possibly permanent).



Baie à Chat 2 #22



Location of the site



Seagrass beds by teledetection (Chauvaud 2005)



Seagrass beds

Enclosure limits

- Total area of the enclosure: 2,79 ha
- Surface of seagrass in the enclosure : 0,85 ha
- Net length : 323 m
- Presence of seagrass around the site
- Artificial freshwater input : easy
- Land accessibility: easy
- Potential threats / attendance: medium to low
- Storm shelters: good / well protected
- Features / notes: site very near of Anse Christophe (#23) but less interesting due to few seagrass meadows and turbid water.

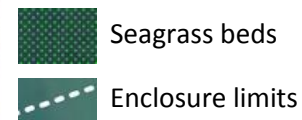
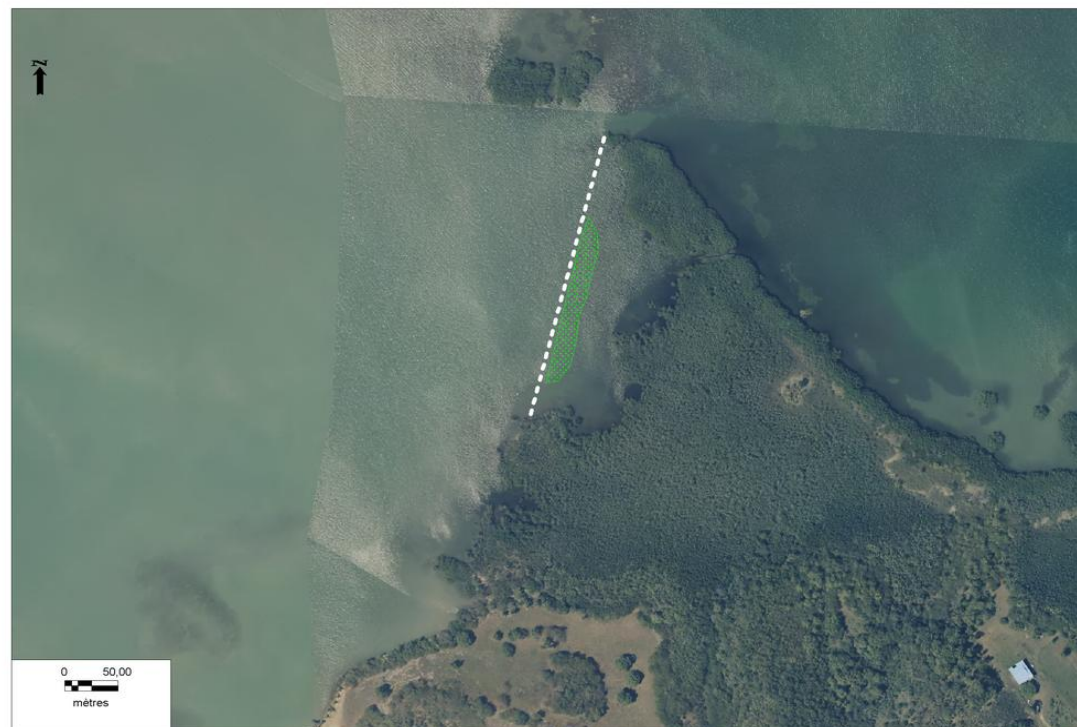
Anse du figuier #7



Location of the site



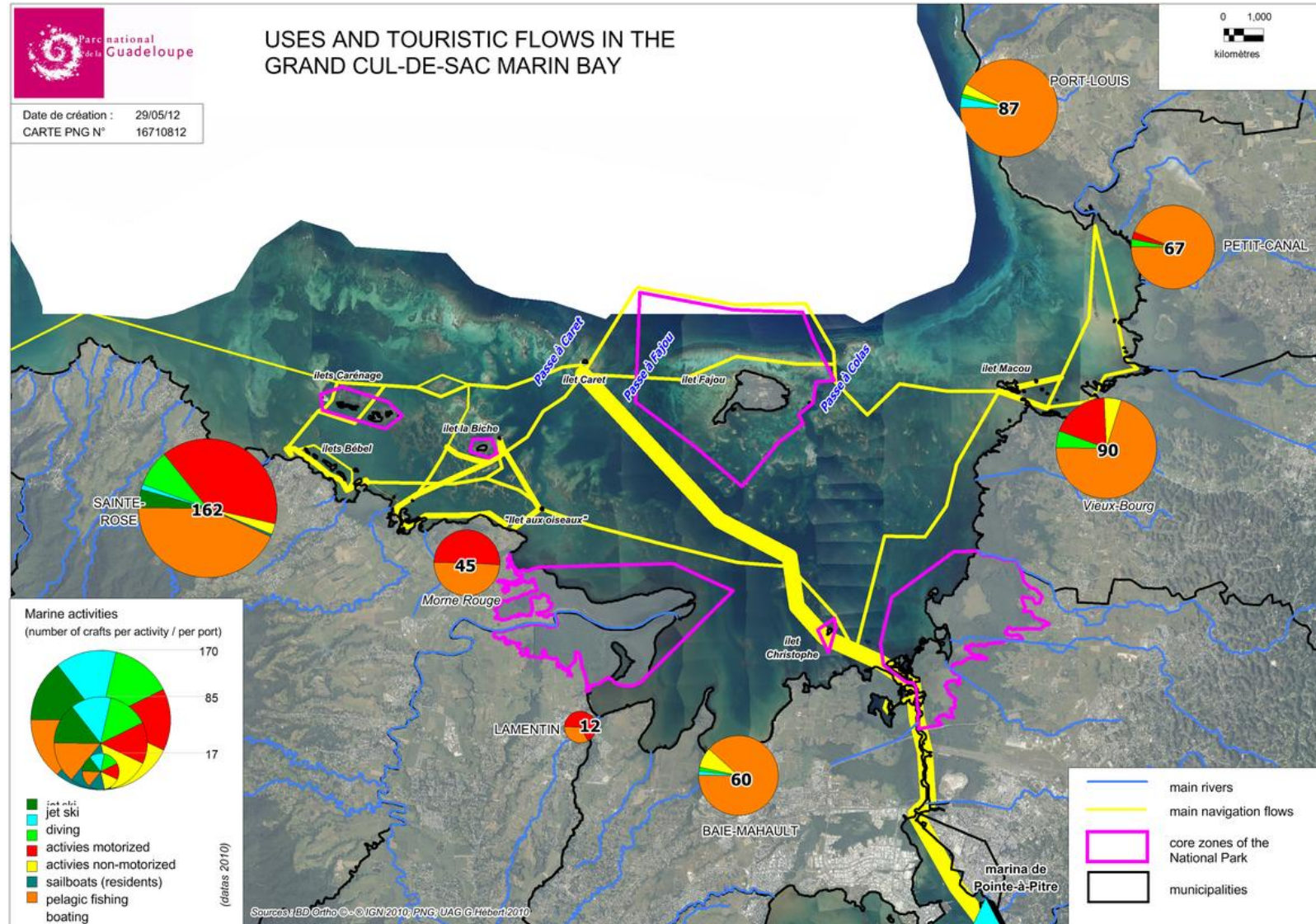
Seagrass beds by teledetection (Chauvaud 2005)



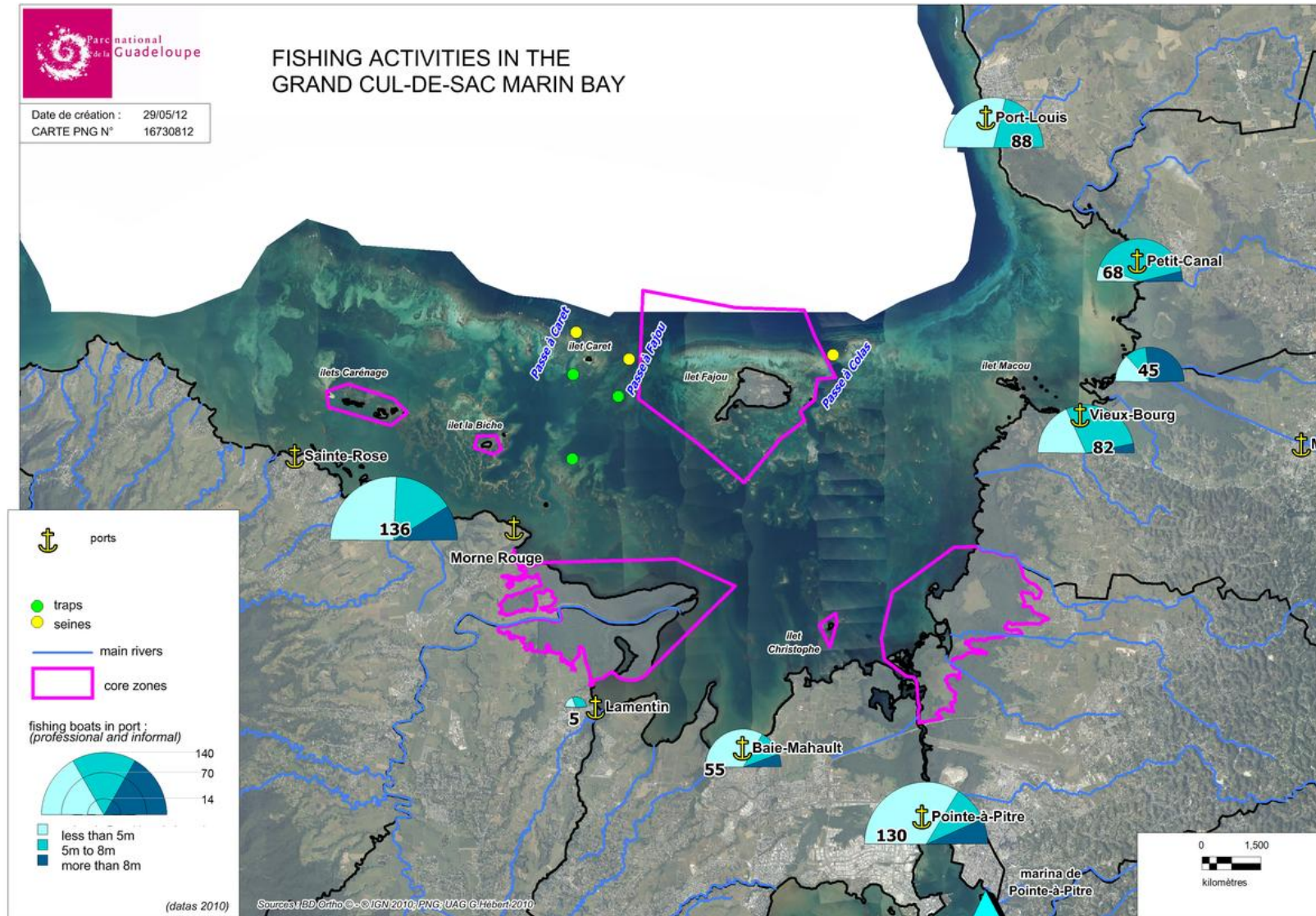
- Total area of the enclosure: 1,95 ha
- Surface of seagrass in the enclosure : 0,27 ha
- Net length : 288 m
- Artificial freshwater input : medium
- Land accessibility: medium
- Potential threats / attendance: high (many activities from the port of Vieux Bourg)
- Storm shelters: bad / northeast oriented
- Features / notes: site near Macou site #6. Not so far from the freshwater source of Vx Bourg (historical presence of manatees).

Appendices

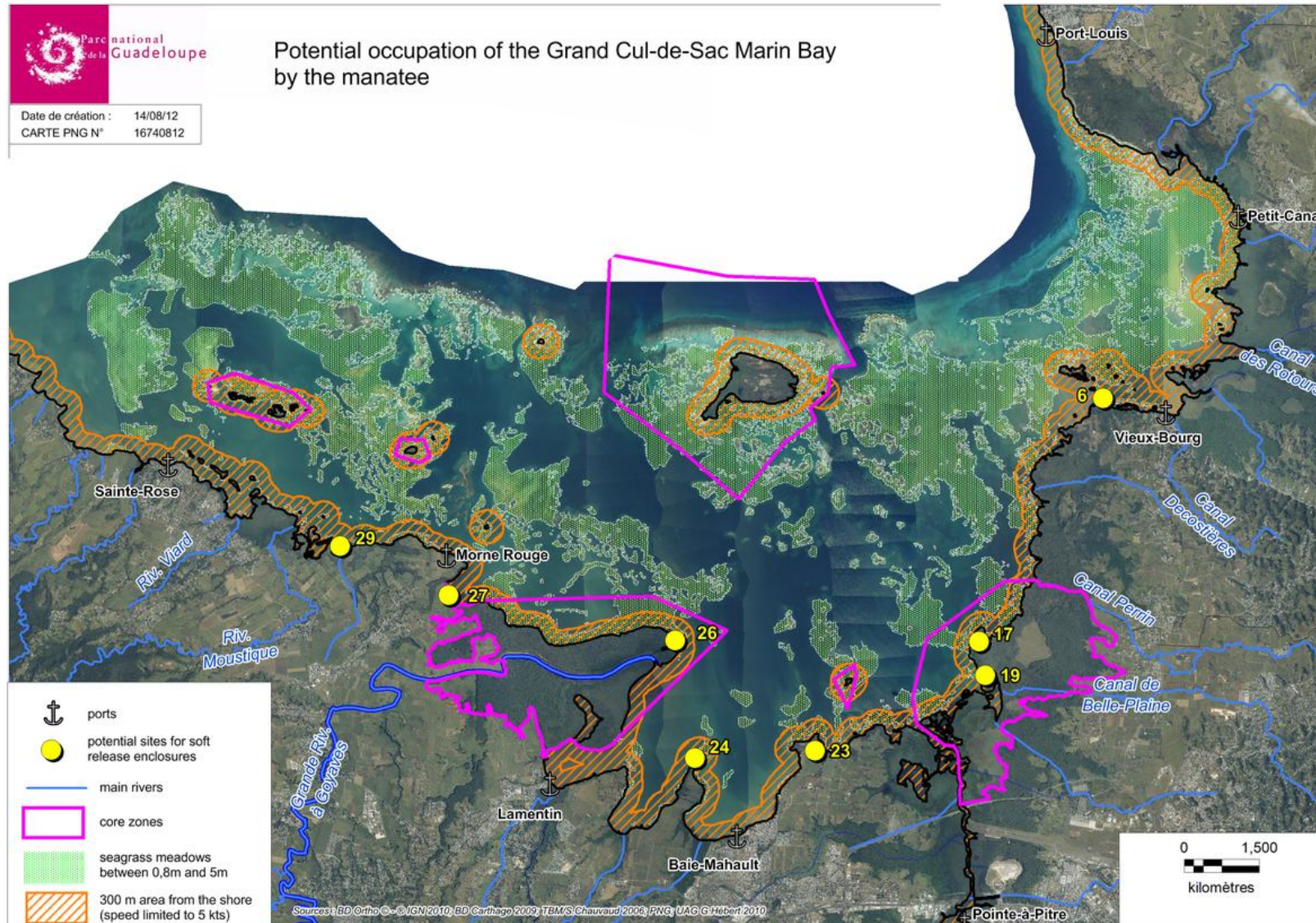
Appendice 1: Map of the uses and touristic flows in the Grand Cul-de-Sac marin bay



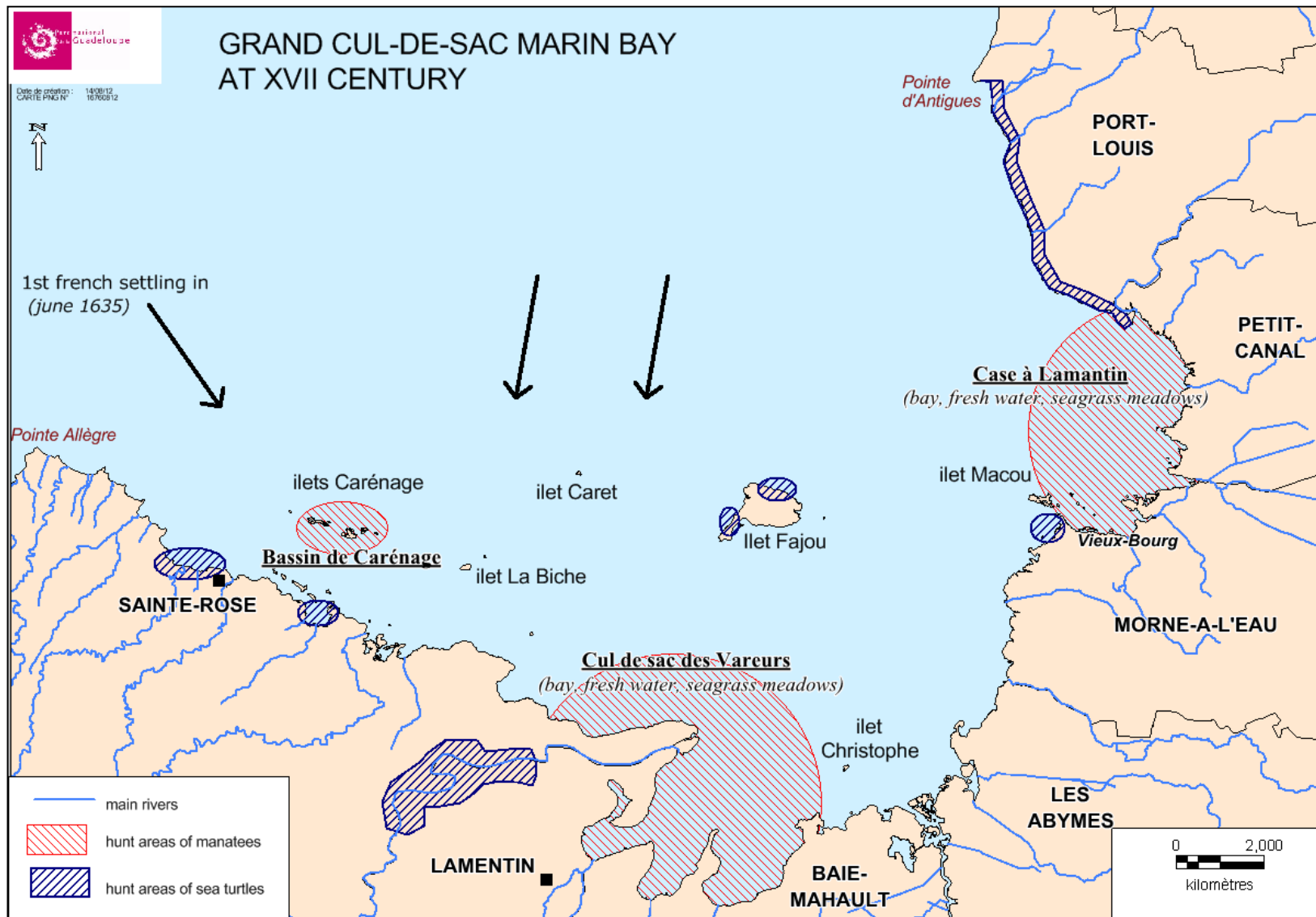
Appendice 2: Map of the fishing activities in the Grand Cul-de-Sac marin bay



Appendice 3: Map of the potential manatee occupation of the Grand Cul-de-Sac marin bay



Appendice 4: Map of the historical hunting areas of the manatee



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