

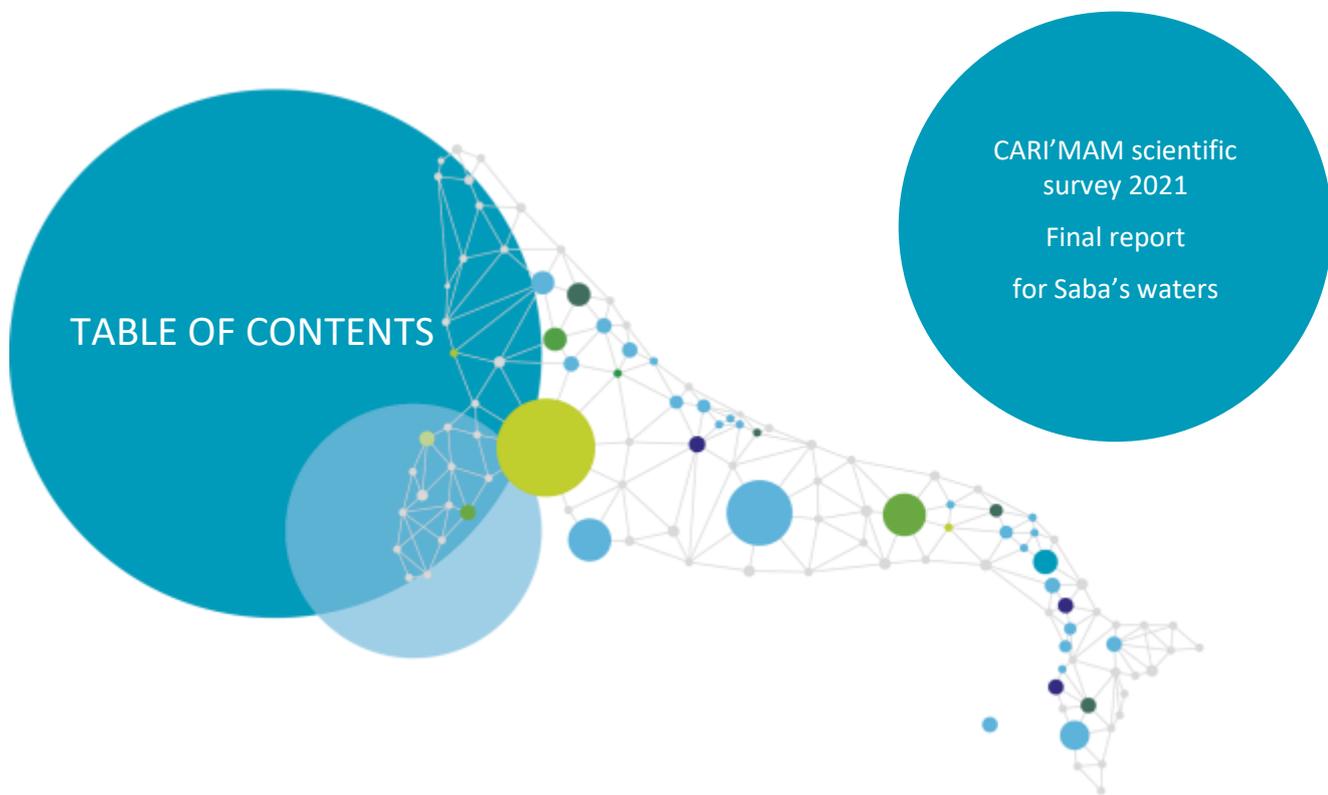
CARI'MAM scientific survey
2021

Final report
for Saba's waters

Agoa Sanctuary
December 2021

Authors: Etienne Jeannesson, Jérôme Couvat

The CARI'MAM project is co-funded by
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I. Introduction

I.1 The CARI'MAM project

More than 30 species of marine mammals inhabit the waters of the Caribbean, which makes it a world hotspot. These highly mobile species are known to move between different Caribbean territories and beyond. Between 2018 and 2021, the CARI'MAM (Caribbean Marine Mammal Preservation Network) project was carried out to develop a network and foster collaboration between Caribbean actors involved in the conservation of marine mammals in the region. Co-funded by the INTERREG Caribbean Program from the European Union, it aimed at providing territories with various socio-economic, legislative and regulatory situations the opportunity to join forces to:

- Improve knowledge on the presence and movements of cetaceans in the Wider Caribbean Region (WCR);
- Develop MPAs' efficiency in managing marine mammals and their habitats within their borders.

This project was coordinated by four organizations:

- SPAW-RAC, the Regional Activity Center for the Specially Protected Areas and Wildlife from the Cartagena Convention;
- The St Martin Natural Reserve;
- The Grand Connetable Island Natural Reserve in French Guyana;
- The Agoa Sanctuary, which is the CARI'MAM project leader.

The CARI'MAM network grew all along the project, gathering more than 50 organizations from about 30 territories from Bermuda to French Guyana, Barbados to Jamaica and Central America.

The main objectives of the CARI'MAM project were to:

- Create a network of MPAs dedicated to marine mammals in the WCR and beyond;
- Building capacities and knowledge among MPA managers;
- Develop common management and evaluation tools;
- Supporting the development of a sustainable whale watching industry in the WCR and beyond.

Specifically, nine Work Packages were identified to reach those objectives. Work Package 2 (WP2), entitled "Data acquisition" aimed at acquiring knowledge on marine mammals and testing field methodology through several scientific campaigns at sea.

Therefore, two scientific campaigns were organized in 2021, covering the waters of Anguilla, St Martin, Sint Maarten, St Barthelemy, Saba, Statia, Guadeloupe and Martinique. The objective of this survey was to evaluate cetacean abundance and distribution during the dry season and the wet season respectively. This report presents the methodology and results of this survey for Saba's waters.

II. Material and Methods

II.1 Study area

The study was divided in two blocks: the Northern Islands, encompassing waters around Anguilla, St Martin, Sint Maarten, St Barthelemy, Saba and Statia and the Southern Islands covering Martinique and Guadeloupe (see Figure 2 and Figure 3).

II.2 Period

Two campaigns took place to collect data in 2021 during the dry season and the wet season, as shown in Table 1 below. The dry season campaign lasted for 21 days, whilst the wet season campaign lasted for 48 days.

Table 1. CARI'MAM campaigns survey periods.

Campaign	Dates	Periods in Saba's waters
Dry season	9 - 29 April	19 – 20 April 25 - 27 April
Wet season	22 Sept. - 9 Nov.	3 November 6 – 7 November

II.3 Platform



Figure 1. The crew on-board the catamaran in April.

During the dry season, the observation platform used for the campaign was a Lagoon 39 catamaran. This boat was chosen because it is suited for navigation in the Caribbean as well as for boarding a crew of eight people. The roof is 3m high above sea surface which allows an observation distance of 4 to 5 NM on the horizon. It also offers a 180° observation platform at the front, suitable for the implementation of the protocol (Figure 1).

During the wet season, an 18m single hull sailing boat was preferred. It offered the same observation possibilities with better navigation properties, which made it more suitable for offshore waters.

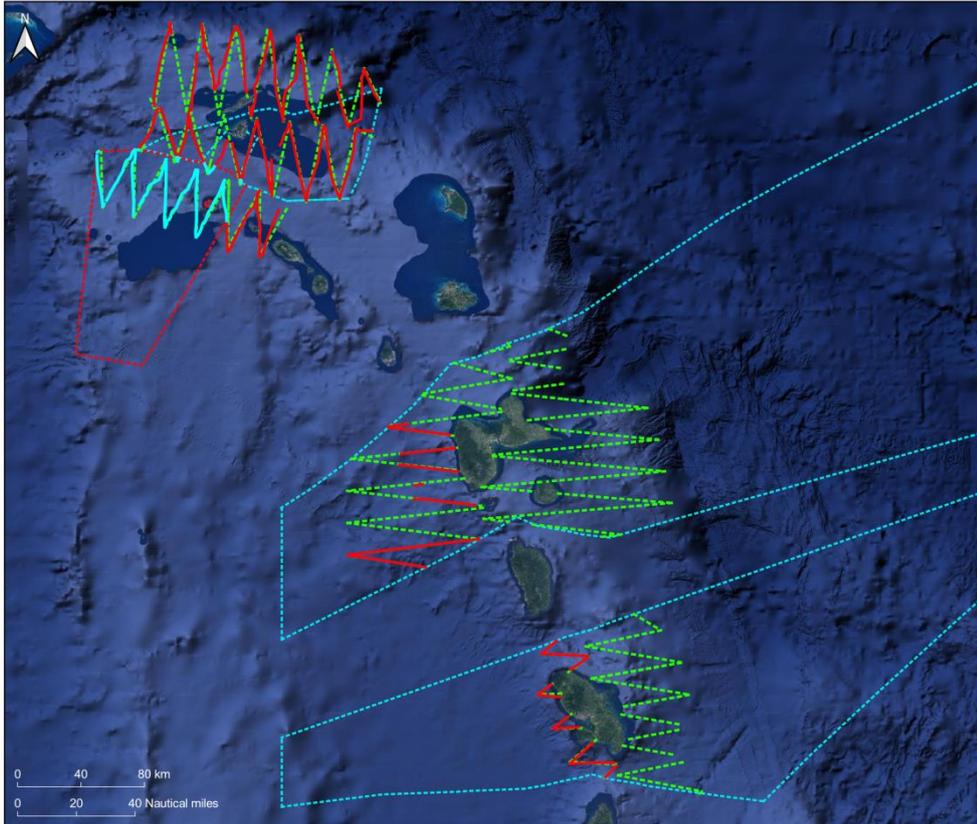
II.4 Protocol

Survey Design

Survey design was carried out following the Distance Sampling methodology. Distance Sampling allows for the robust estimates of abundance and distribution in a defined area, provided that several assumptions are respected, especially at the design stage. A good survey design ensures equal coverage probability in the whole survey area, among others. Thus, transects have to be defined carefully and sometimes need to be adjusted so that theoretical requirements match field reality.

A first survey design was produced for the dry season campaign, and was adjusted for the wet season campaign following feedbacks from April (Figure 2 and Figure 3). These were calculated from the total estimated budget for this study, considering EEZ (exclusive economic zone) limits and bathymetry gradients. The total amount of theoretical effort is presented in Table 2.

CARI'MAM campaign of April 2021
Theoretical transects and transects in effort

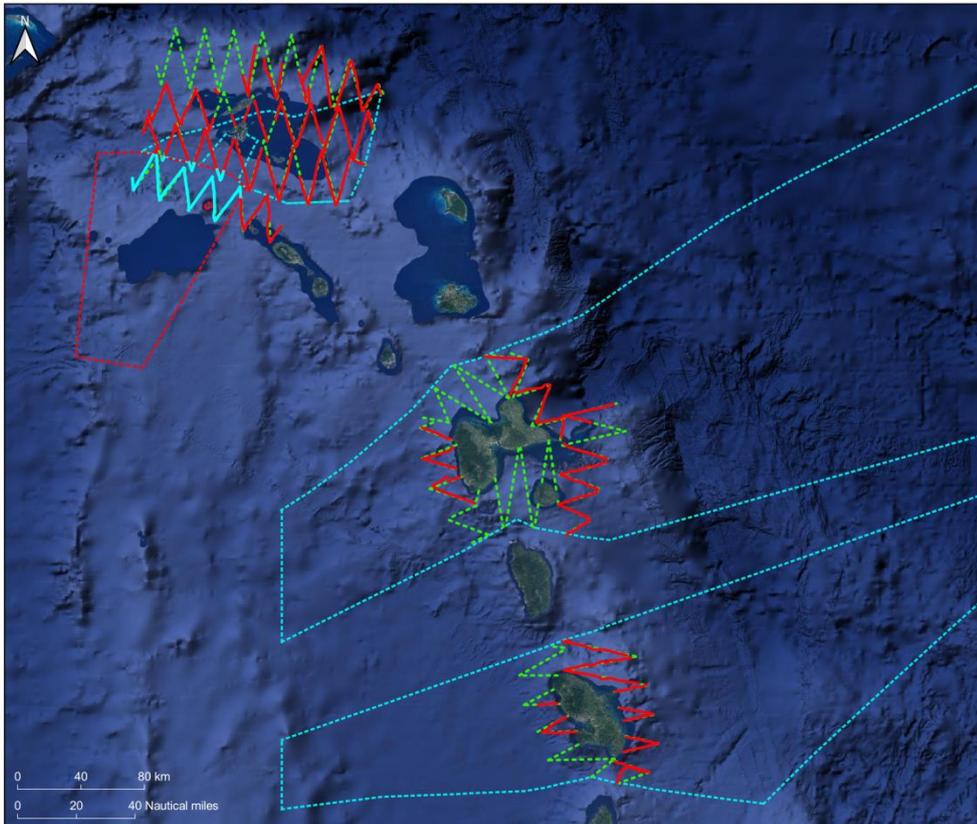


- Legend**
- ⋯ Saba's EEZ
 - ⋯ Agoa Sanctuary
 - ⋯ Theoretical transects
 - Transects in effort
 - Transects in effort in Saba's EEZ

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 Sources des données : CARIMAM, SHOM, Flanders Marine Institute
 Fonds cartographiques : Google satellite
 Système de coordonnées : EPSG:4326

Figure 2. Study area, theoretical transects and covered effort for the dry season campaign.

CARI'MAM campaign of september-november 2021
Theoretical transects and transects in effort



- Legend**
- ⋯ Saba's EEZ
 - ⋯ Theoretical transects
 - ⋯ Agoa Sanctuary
 - Transects in effort
 - Transects in effort in Saba's EEZ

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Figure 3. Study area, theoretical transects and covered effort for the wet season campaign.

Table 2. Theoretical Transect length in Saba's waters and in total.

Campaign	Total transect length in km (Saba's waters)	Total transect length in km (whole survey area)
Dry season	388	4,343
Wet season	226	3,331

Visual observations

Along these transects, visual observations were recorded. The observation team consisted of four persons: a port side observer, a starboard observer, a person responsible for inputting the data and a person on a break. Rotations took place every hour so that each continuous observation time is a maximum of 2 hours per person.

Observers surveyed between 0° and 90°, and focus their efforts on the front of the boat as far as was reasonable to detect animals. The observation effort was constant from sunrise to sunset.

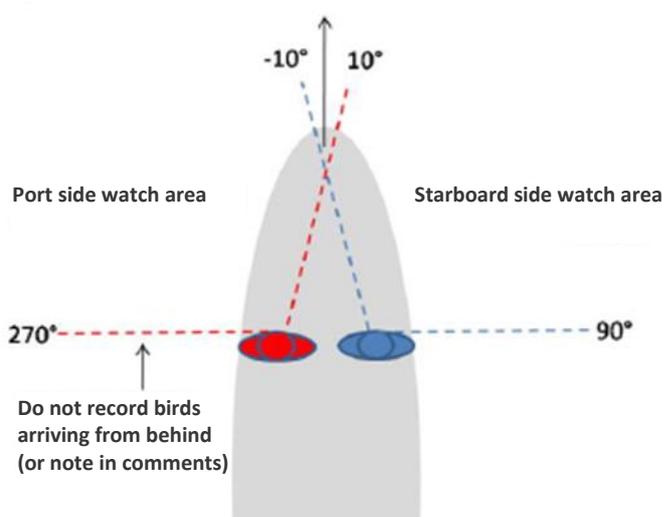


Figure 1: Schematic proposal of the sea observation protocol from the report "MEGASCOPE Programme – Pelagis"

The skipper therefore had to follow the predefined transects, maintaining an average speed of 6-7 knots. The vessel only went out at sea on a Beaufort wind force scale <4. However, if the weather deteriorated along the way, it was recommended to continue observing beyond Beaufort 4, as long as this remained acceptable to observers.

Since photo-identification was not a major objective for this mission, observation of a marine mammal did not justify leaving the transect line. The transect was monitored and held in order not to bias data collection.

In addition to marine mammals, all other bird and marine megafauna observations were collected, as well as sargassum, human activities, fishing gear and marine debris.

Acoustic observation

Listening points were carried out at least twice a day, in the morning before the start of the first transect and in the evening at the end of the last transect. Listening lasted for 10 minutes and were recorded for later analysis. During the wet season, an acoustic point was made after each transect, when possible. The start and end times as well as the recording conditions were accurately recorded in the environmental parameters.

III. Results

III.1 Effort

Details about effort carried out in Saba's waters during the CARI'MAM campaigns are presented in Table 3 below. During the dry season, the research vessel spent 5 partial or full days in Saba's waters (Figure 4). During the wet season, it spent 3 partial or full days in Saba's waters (Figure 5). Effort coverage was good during the both seasons.

Table 3. Theoretical versus covered effort for both campaigns in Saba's waters.

Campaign	Theoretical effort in km	Covered effort in km	Proportion
Dry season	388	369	95 %
Wet season	226	225	99,5 %

III.2 Cetaceans

Visual observations

In total, 2 observations of cetaceans were made during the whole surveys, representing 2 different genus or species identified for at least 2 individuals (in brackets, Table 4). The observations are shown with the hydroacoustic points (Figure 6 and Figure 7). The number of individuals from the dolphin sighting could not be taken with confidence.

Table 4. Cetacean observations made during both campaigns. Numbers in brackets indicate the number of individuals.

Species	Dry season	Wet season
Common bottlenose dolphin (<i>Tursiops truncatus</i>)	-	1 (1)
Dolphin sp.	1 (1)	-

Acoustic observations

Five hydroacoustic points were realized in Saba's waters, 3 during the dry season and 2 during the wet season (Figure 6 and Figure 7). The three points of the dry season lasted 15 min each. No cetacean or other species was detected.

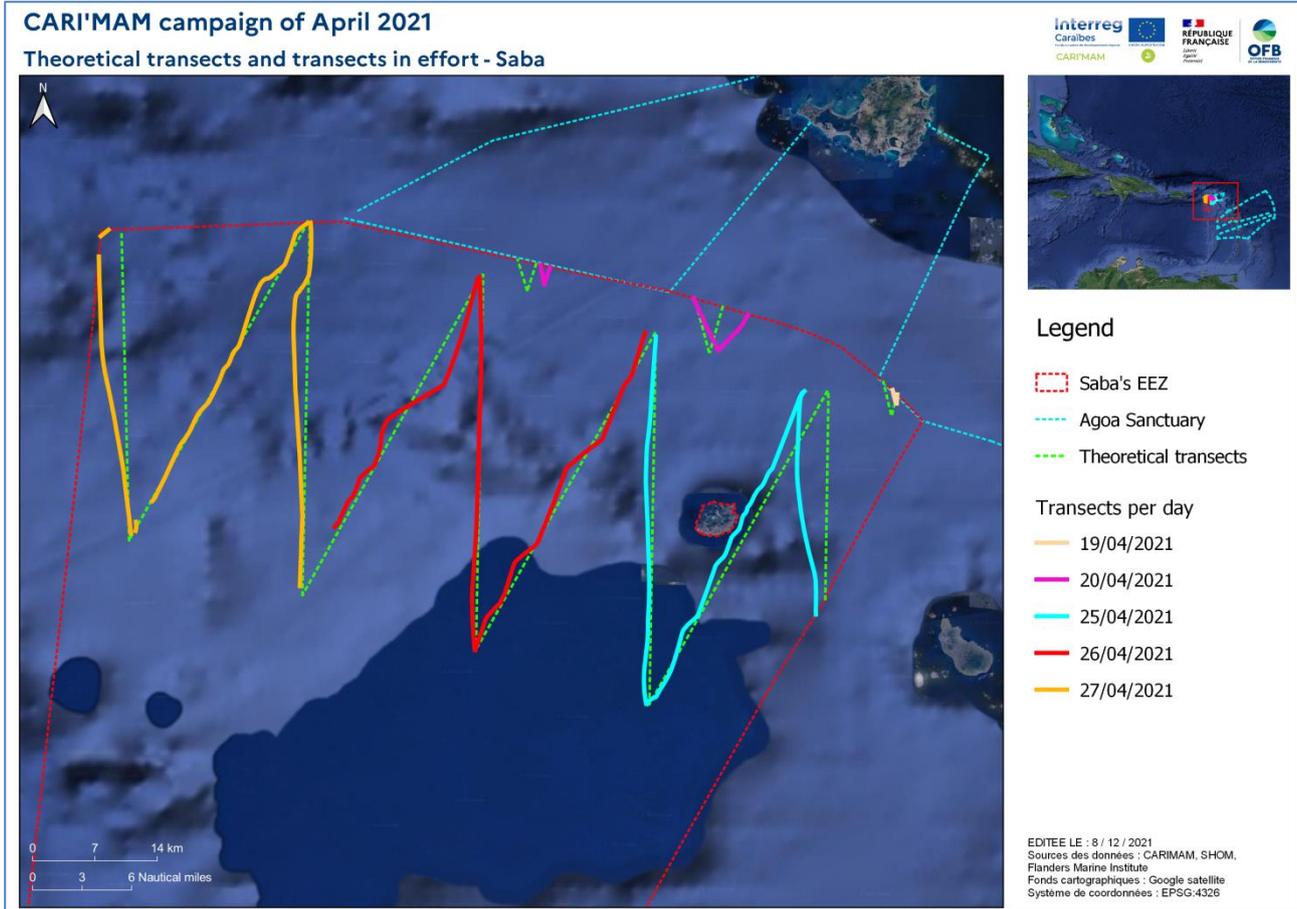


Figure 4. Map of transects covered per day in Saba's waters during the dry season campaign.

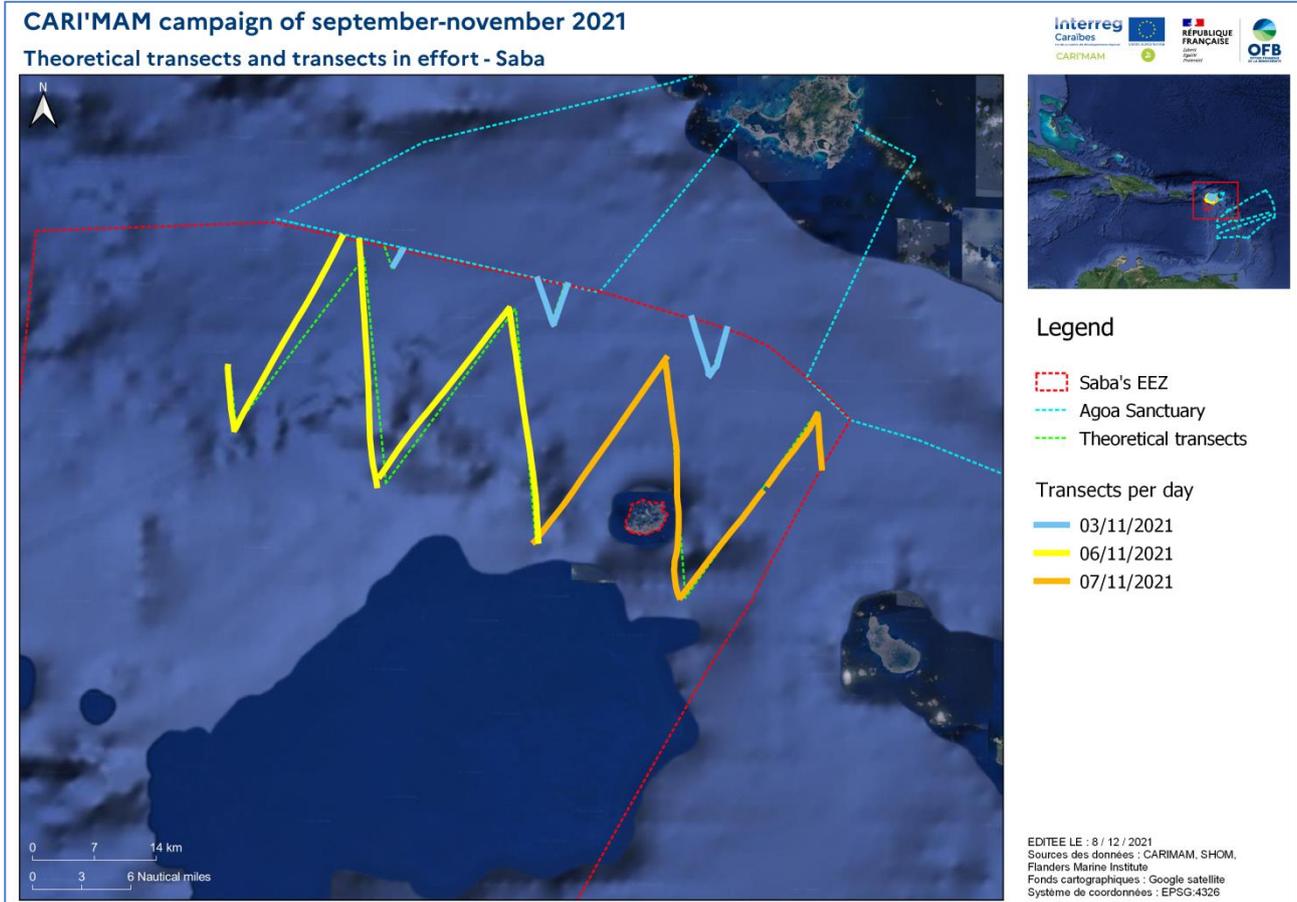


Figure 5. Map of transects covered per day in Saba's waters during the wet season campaign.

CARI'MAM campaign of April 2021

Hydroacoustic points and observations of cetaceans - Saba



Legend

- Saba's EEZ
- Agoa Sanctuary
- Hydroacoustic Point

Cetaceans species

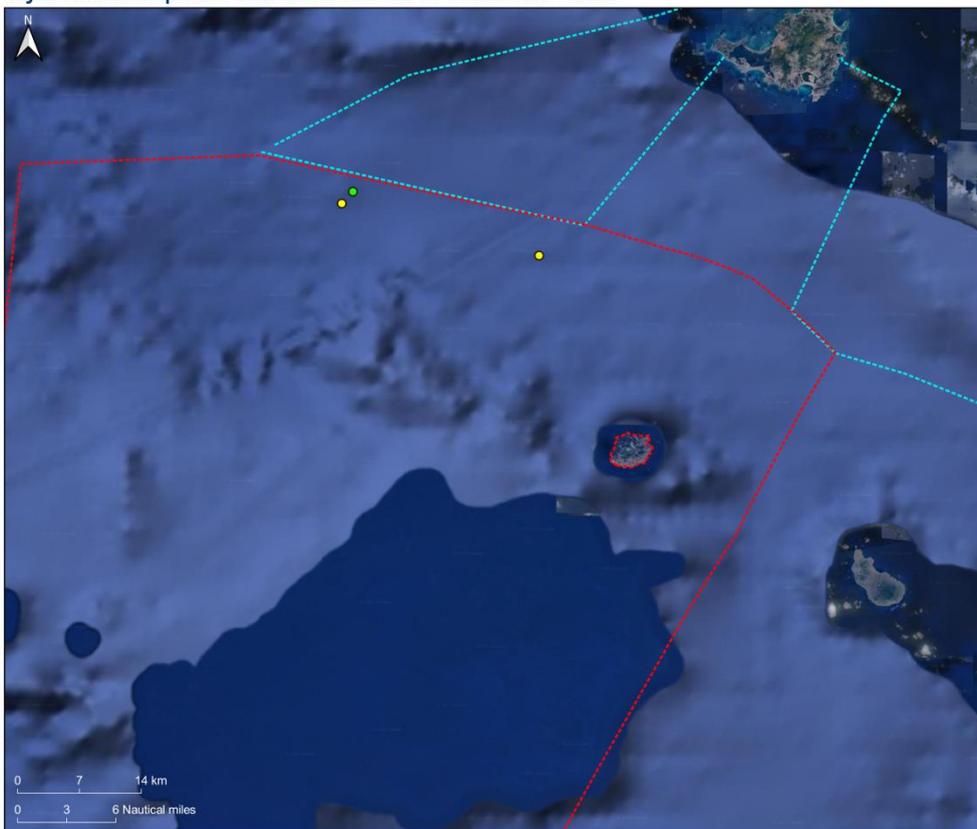
- Dolphin sp.

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Figure 6. Hydroacoustic points and cetacean sightings made in Saba's waters during the dry season campaign.

CARI'MAM campaign of september-november 2021

Hydroacoustic points and observations of cetaceans - Saba



Legend

- Saba's EEZ
- Agoa Sanctuary
- Hydroacoustic point

Cetaceans species

- Common bottlenose dolphin

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Figure 7. Hydroacoustic points and cetacean sightings made in Saba's waters during the wet season campaign.

III.3 Birds

In total, 10 bird species or genera were observed in Saba’s waters, accounting for 146 observations and 382 individuals (Table 5 and Figure 8). Birds were the most observed taxon during both campaigns and were observed nearly all along the transects in Saba’s waters (Figure 9 and Figure 10).

Table 5. Number of bird observations and total number of individuals per species for both campaigns.

Bird species	Dry season		Wet season	
	Observations	Individuals	Observations	Individuals
Sooty tern	64	164	-	-
Red-billed tropicbird	18	135	7	10
Brown booby	12	14	22	32
Shearwater sp.	6	8	3	3
Wilson's storm petrel	5	6	-	-
Royal tern	2	3	-	-
Magnificent frigatebird	2	2	2	2
Masked booby	1	1	-	-
Booby sp.	-	-	1	1
Red-footed booby	-	-	1	1
Total	110	333	36	49

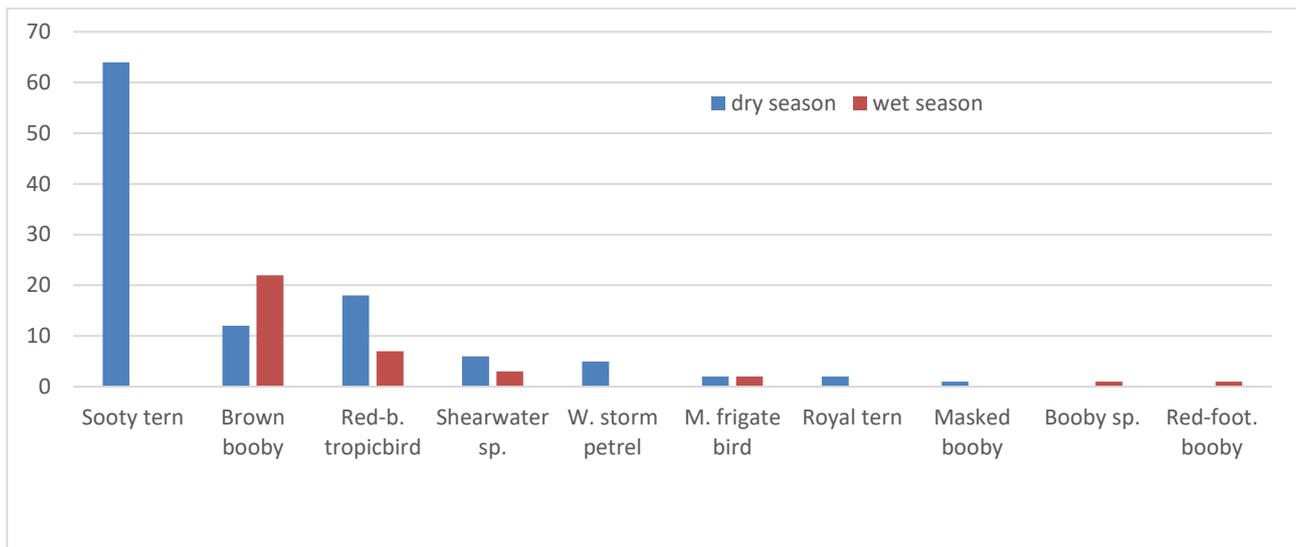
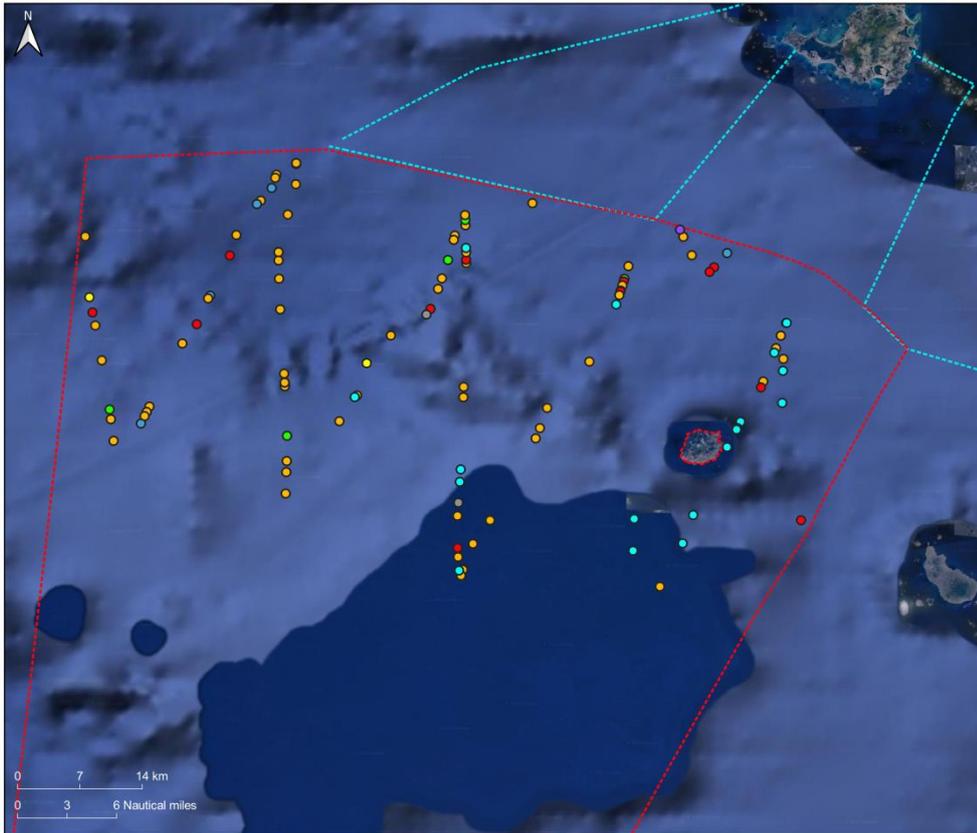


Figure 8. Graph of the number of observations of bird species per season campaign.

The number of observations in the dry season is three times higher than in the wet season, because of the occurrence of the Sooty tern (*Onychoprion fuscatus*), which was not recorded at all in the wet season. Four species or genus were seen on the two campaigns: Brown booby (*Sula leucogaster*), Magnificent frigate bird (*Fregata magnificens*), Red-billed tropicbird (*Phaethon aethereus*) and Shearwater sp. (*Puffinus sp.*).

CARI'MAM campaign of April 2021

Observations of birds - Saba



Legend

- Saba's EEZ
- Agoa Sanctuary

Bird species

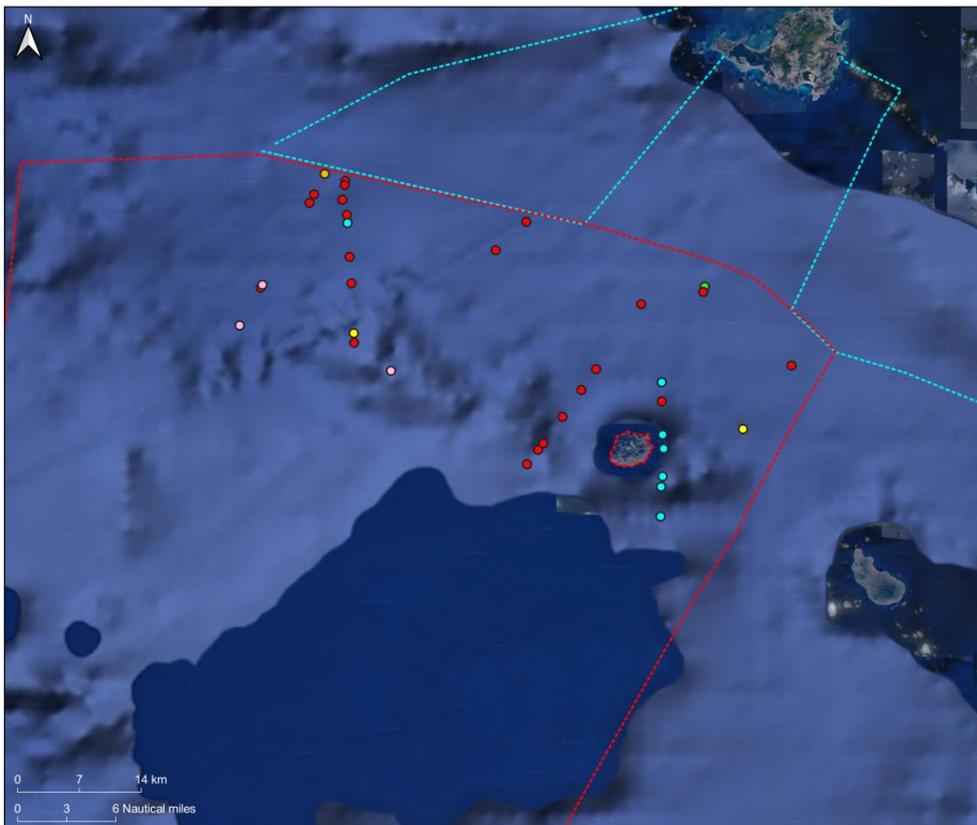
- Brown booby
- Magnificent frigatebird
- Masked booby
- Red-billed tropicbird
- Royal tern
- Shearwater sp.
- Sooty tern
- Wilson's storm petrel

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Figure 9. Observations of birds in Saba's waters during the dry season campaign.

CARI'MAM campaign of september-november 2021

Observations of birds - Saba



Legend

- Saba's EEZ
- Agoa Sanctuary

Birds species

- Booby sp.
- Brown booby
- Magnificent frigatebird
- Red-billed tropicbird
- Red-footed booby
- Shearwater sp.

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Figure 10. Observations of birds in Saba's waters during the wet season campaign.

III.4 Algae and fish

All observations of algae were identified as Sargassum, representing 10 observations (Table 6, Figure 11). The size of the plate was noted as “Scattered” when the plate was less than 1m diameter and as “Patch” when it was between 1 and 10m diameter. During the wet season, “Cord” was added to record when sargassum formed a cord extending over tens or even hundreds of meters.

Table 6. Number of sargassum formations observed in Saba’s waters during both campaigns.

Sargassum formation	Dry season	Wet season
Scattered	7	-
Patch	2	-
Cord	-	1
Total	9	1

Only one observation of other marine megafauna, Common dolphinfish (*Coryphaena hippurus*), was made during the wet season and is shown on the map with the algae.

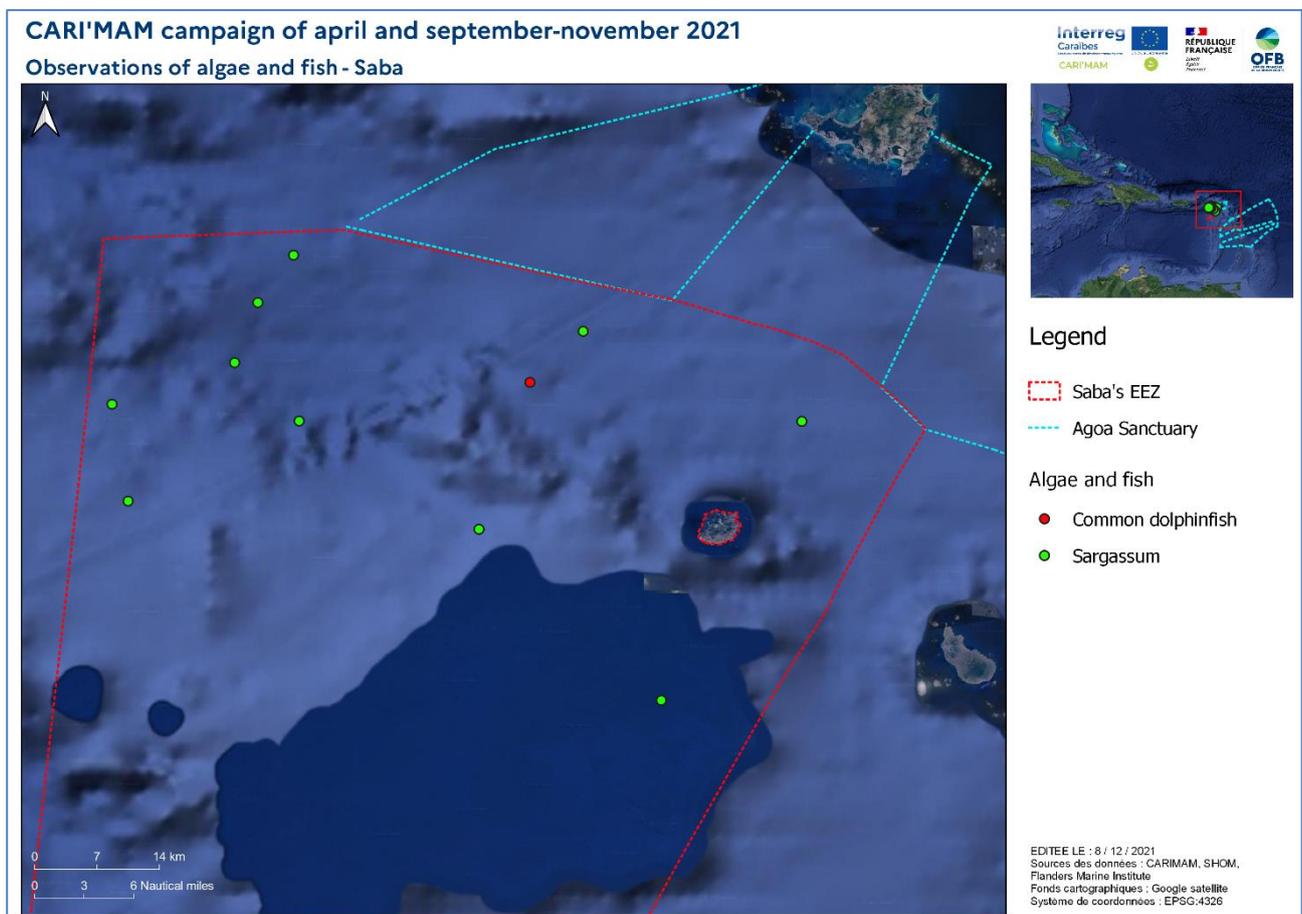


Figure 11. Algae and fish sightings map in Saba’s waters during the dry and the wet season campaign.

III.5 Macrowaste

Seven observations of macrowaste were made in Saba’s waters during the surveys (Table 7, Figure 12).

Table 7. Macrowaste recorded in Saba’s waters for both campaigns.

Macrowaste type	Dry season	Wet season
Plastic container	2	-
Plastic bottle	1	1
Object derived from fishing	1	-
Other polystyrene plastics	1	-
Polystyrene box	1	-
Total	6	1

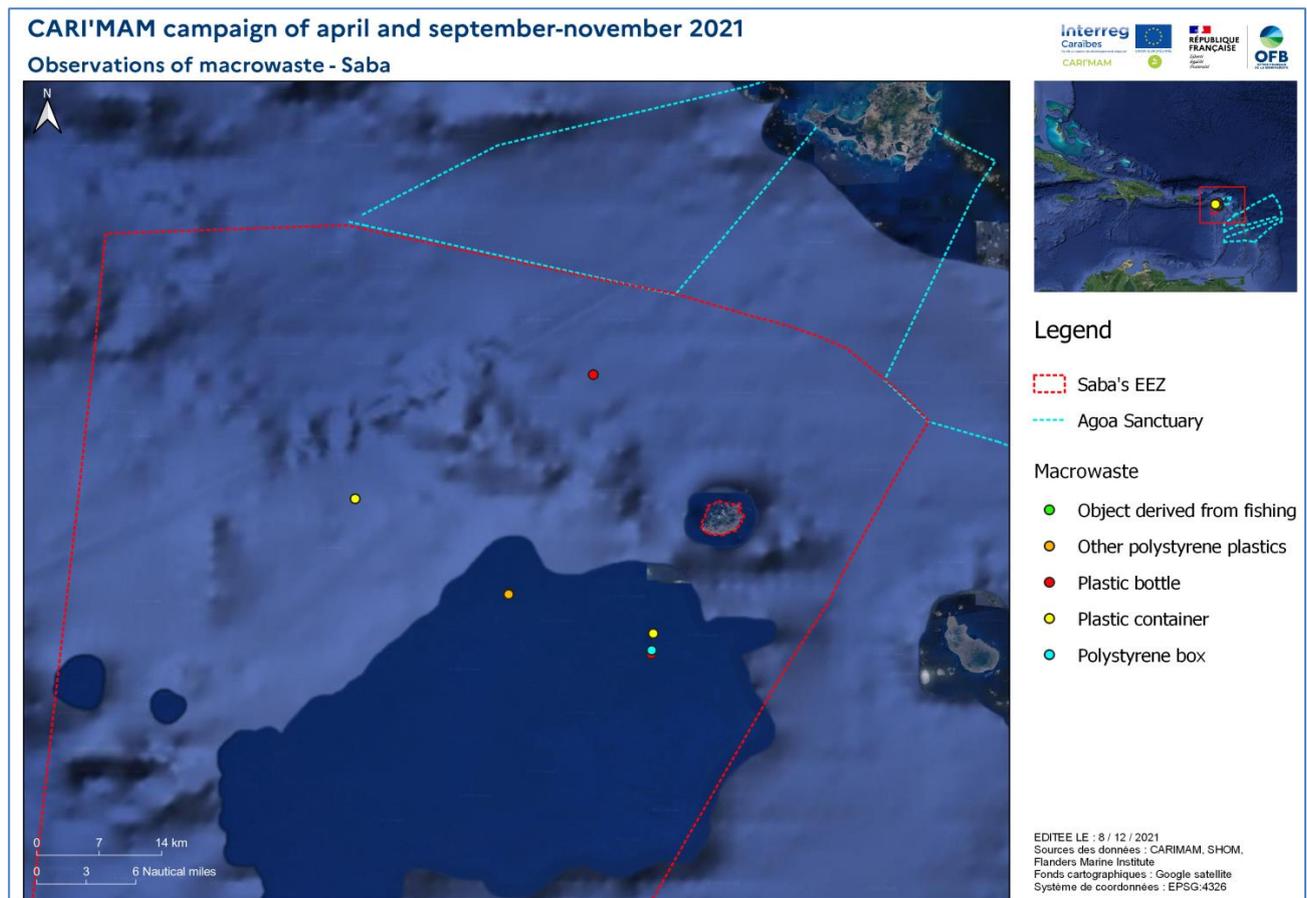


Figure 12. Observations of macrowaste in Saba’s waters during the dry and the wet season campaign. “Object derived from fishing” overlaps with “Other polystyrene plastics” on the map.

III.6 Human activities

The crew recorded 5 observations of human activities in Saba’s waters during the wet season (Table 8, Figure 13), corresponding to one boat for each observation. No observation of human activities was made in the dry season.

Table 8. Human activities recorded in Saba’s waters during the wet season campaign.

Human activities	Number of observations
Merchant ship	1
Motorboat	1
Oil tanker	1
Sailboat to the engine	1
Small fishing boat	1
Total	5

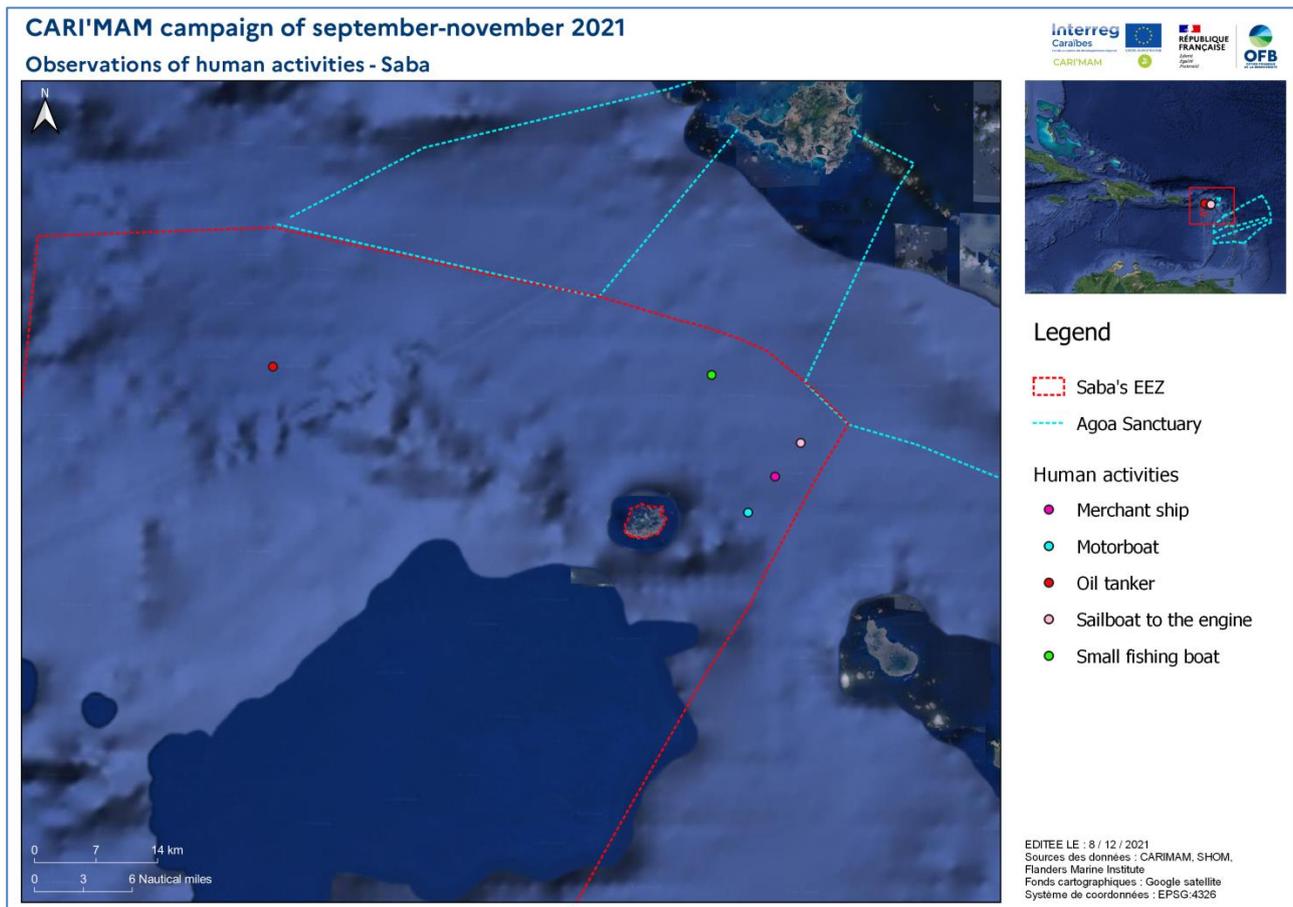


Figure 13. Observations of human activities in Saba’s waters for the wet season campaign.

III.7 Fishing gear

12 observations of fishing gear were recorded, corresponding in total to 86 Fishing aggregating device (FAD), fishing traps and fishing trap buoys (Table 9, Figure 14). The number of gear is indicated in brackets.

Table 9. Table of observations of fishing gear for both season campaigns.

Fishing gear\Number of observations	Dry season	Wet season
Fishing trap	4 (21)	1 (3)
Fishing aggregating device FAD	4 (4)	-
Fishing trap buoys	3 (58)	-
Total	11 (83)	1 (3)

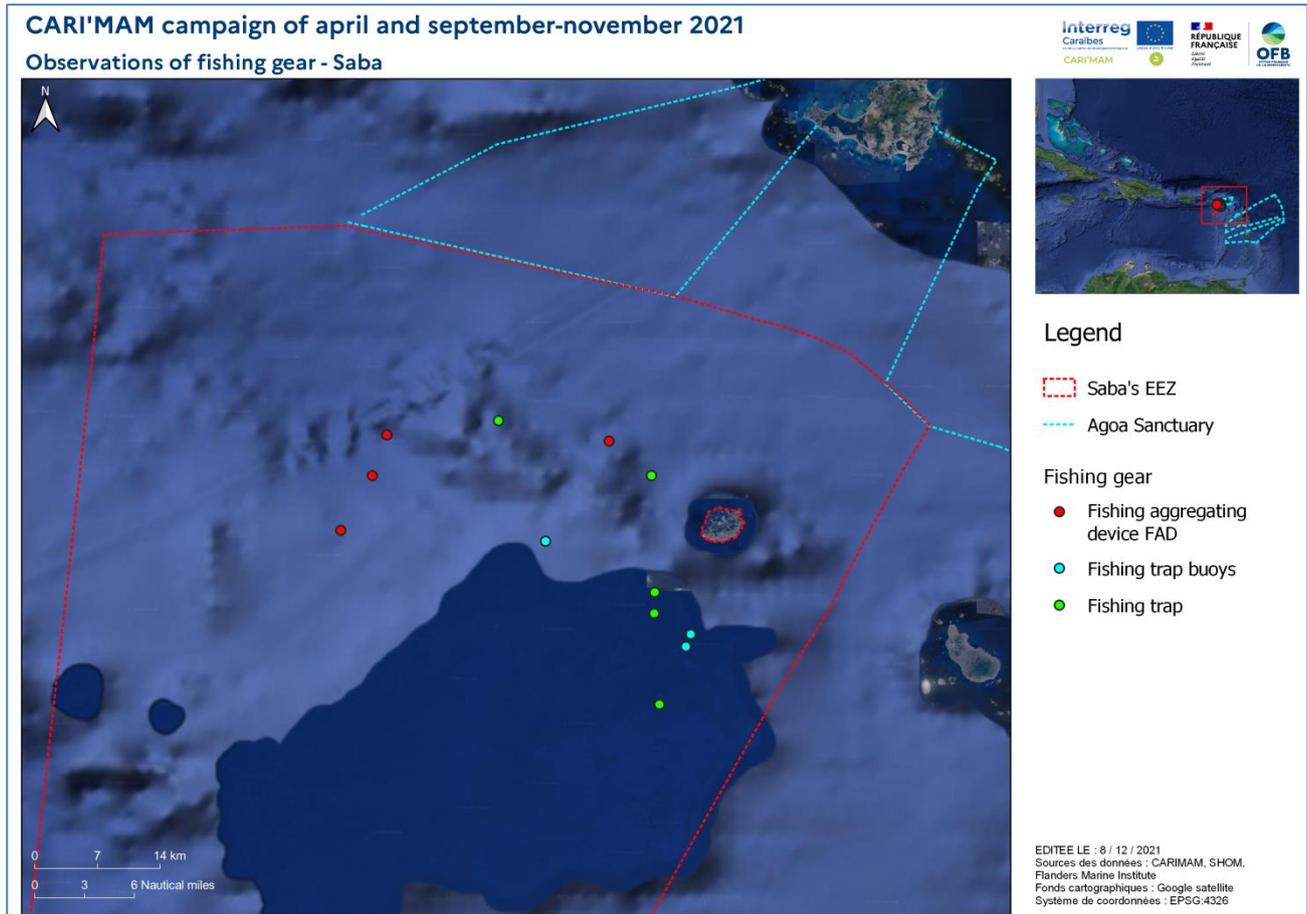


Figure 14. Observations of fishing gear in Saba's waters for both dry and wet season campaigns.

Acknowledgments

The Agoa Sanctuary would like to thank all the people and organisations that made these campaigns possible. Among others, the Agoa Sanctuary would like to thank Aquasearch for organising and carrying out the survey as well as Rijkswaterstaat, Ministry of Infrastructure and Water Management of the Netherlands and the Saba Bank Management Unit for providing the research permits in Dutch waters and in the Saba Bank National Park.



CONTACT

Jérôme Couvat
Project Officer
CARI'MAM Project
Agoa Sanctuary

Tel. : +596 (0) 696 33 19 15

Email : jerome.couvat@ofb.gouv.fr
sanctuaire.agoa@ofb.gouv.fr



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