Saba Bank; health status 2010

Cruise report

Erik H.W.G. Meesters
IMARES
December 2010

The author was funded by the Ministry of Economic Affairs, Agriculture and Innovation under project number BO-11-007-000-IMARES-11.

The research is part of the CARIBSAT project (http://www.caribsat.com) part of the European INTERREG IV program, led by the IRD Martinique. Within CARIBSAT this sub-project is the Marin Habitat project led by J.P. Maréchal from the *Observatoire du Milieu Marin de le Martinique* (OMMM).

Introduction

Helpdesk question number HD3284 from the ministry of Economic Affairs, Agriculture and Innovation is intended to provide some perspective on the health status of the coral reefs of the Saba Bank.

The Saba Bank is the largest atoll in the Caribbean Sea located just a few miles west of Saba. It consists of a relatively shallow bank of 40 by 60km that is mostly between 40 and 12m deep and that is fringed by coral reefs along the eastern and southern edges. Recently, a special issue of the journal Plos One (issue 5, 2010) has been devoted to the Saba Bank giving a good overview of the high biodiversity of the Bank.

Director of the Institute (OMMM), Jean-Philippe Maréchal, gave the opportunity to participate in his project which is part of the European CARIBSAT project. This project aims at developing techniques to classify reefs using remote sensing methods to monitor shallow reefs in the Caribbean area. As the Saba Bank is very large, remote sensing is likely to be a good method to gain insight into where what communities are on the Bank. Previous research ((Van der Land, 1977, Meesters et al., 1996), PLOS ONE issue 5, 2010) showed that the Saba Bank has large stretches of reef, algal fields, rubble fields, and big areas that are mainly covered by sand. Good classification maps of the Bank may help to identify important areas with high biodiversity.
From 11 till 22 November 2010 a team of 8 people visited the bank to collect data for the CARIBSAT project. The team consisted of Jean-Philippe Marechal (OMMM), Paul Hoetjes (RCN), Marine Fumaroli (OMMM), manager of the Saba Marine Park (SMP) Kai Wulf (SCF), assistant manager of SMP Gregoor van Laake, manager of Bonaire Marine Park Ramon de Leon (STINAPA Bonaire), and Erik Meesters (IMARES). Data consisted of spectral light data coming from the substrate at many locations together with video footage of the bottom and 2-3 50m transects of coral communities at a number of sites along the edge of the Saba Bank.

Materials and Methods

The Bank covers a very large area and the sea is generally rough. This means that going out and back to the Bank takes much time. Within 11 days we were able to go to the bank 7 times (). Each time we tried to make one or two dives on different places. At each place 2 to 3 belts of 50m length were surveyed. Each belt was high resolution videotaped by one diver, while the others collected data on the species of fish, the number of bleached colonies, the number of corals with diseases, and the number of sea urchins. Additionally, we collected on many places of the Bank video footage with a camera that was lowered from the boat to the bottom of the Bank. In total camera drops were made on 200 spots of the Bank and under water video transects were made at 7 places (). Within a short period a very large amount of data was collected. This data now needs to be analyzed before any definitive conclusions can be made. In this report first impressions are presented regarding the health condition of the reefs at the visited locations.

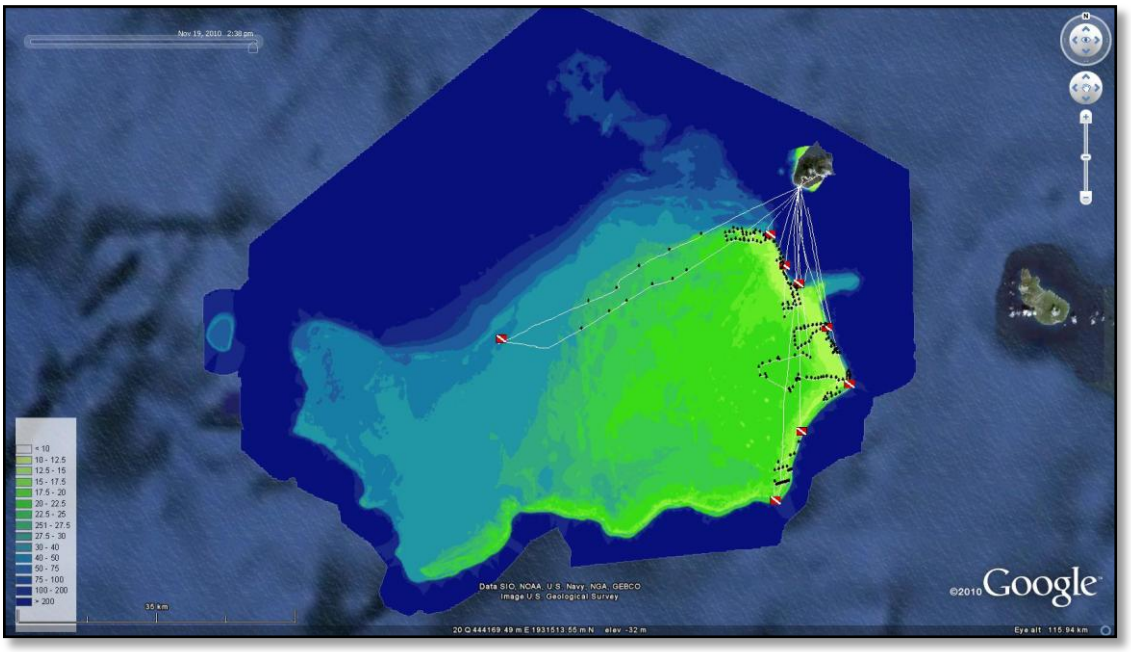

Figure 1. Saba Bank with positions where drops (⬇) and dives (🤿) where made. White lines represent the boat tracks.

Results and conclusions

The main task of EM was to assess the health condition of the coral reefs of the bank. Only a very small part of the bank was visited during 7 dives, but together with the 200 video shots this gives a good impression of the status of the corals of the Saba Bank. Coral reef health is not clearly defined. Coral reefs are built by hermatypic corals which are mainly colonial organisms that live in symbiosis with algae (zooxanthellae). The reef bottom consists out of the skeleton of these animals as well as sediment that originates from the breakdown of coral colonies by other organisms (e.g. grazing fish, sea urchins, boring sponges). The total is cemented into a hard limestone bottom by different taxonomic groups of organisms. A reef is a very complex ecosystem built by coral colonies, that provide food and shelter to an enormous amount of species. The reef can only survive and grow under optimal conditions of low nutrient levels and clear waters. Next to that there are millions of intricate relationships between the organisms that inhabit a reef and that are important for a healthy functioning of the reef. A healthy reef thus is a reef in which all relationships between its inhabitants function properly. Because this is impossible to assess it is generally believed that a good impression of a coral reef's health can be obtained by observing the main components of the reef, i.e. the corals themselves. Further information may be obtained by including important components that fulfill important functions. For example, under the fish there are families such as the parrotfish that graze the algae of the reef. Corals and algae are dependent on light for their survival and algae may overgrow and kill corals. A high cover of algae may also hamper recruitment of corals which is necessary to balance the loss of coral colonies by environmental disturbances such as storms and hurricanes, predation or diseases. Therefore it is important to not have too many algae on a reef. Nutrient enrichment will generally lead to higher growth of algae and thus increase overgrowth of corals by algae. Grazing of algae is also carried out by sea urchins, however, the main urchin species in the Caribbean *(Diadema antillarum*) has been wiped out by a disease in 1983. A healthy coral reef generally has a relatively high cover of corals, much fish and other invertebrates and not too much algae.

Reefs occur mainly along the eastern and southeastern edge of the Bank generally below 15m. In 2005 there was an extreme el ninjo event (Eakin et al., 2010) and corals all over the Caribbean were hit hard. In many places living cover decreased by more than 50 percent. The corals of the Saba Bank were probably no exception. Much of this mortality is still visible today as surface irregularities on coral colonies (e.g. Figure 2).

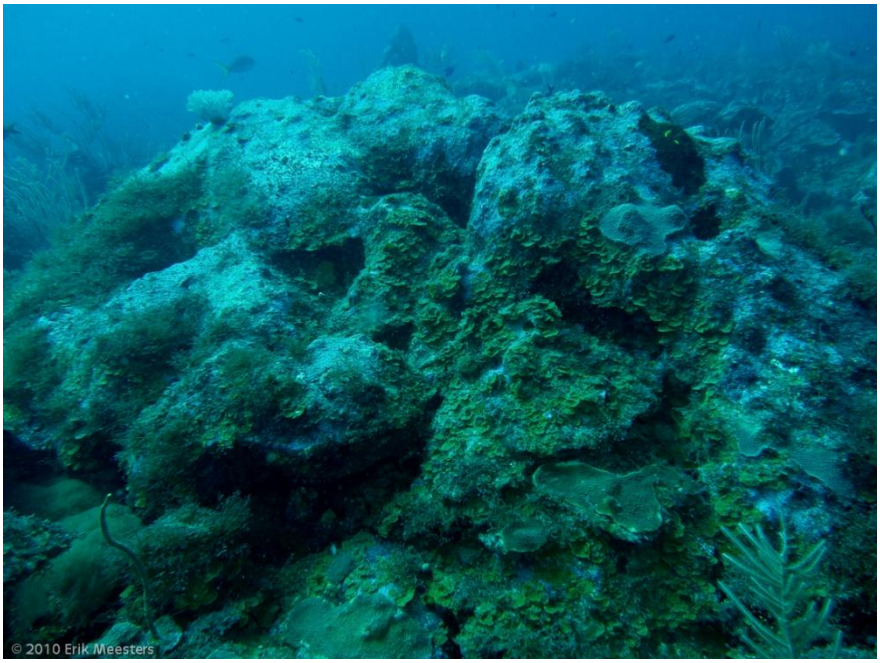

Figure 2. A large *Montastrea faveolata* colony of which most tissue has been killed. Only small pieces with living tissue are visible of this once large colony. The small remnants (also called ramets) may be hundreds of years old. Much of the killed surface is now covered by algae (*Dictyota spp. And Lobophora variegate*).

The general impression is that the Bank is still recovering from the 2005 disaster (Table 1). Furthermore it was observed that there also is a high cover of algae (mainly *Dictyota* spp. and *Lobophora* spp.) on the reefs of the Bank. Coral cover increases through growth of colonies and through the settlement of new colonies on substrate. Substratum that is covered by algae is not available for the settlement of coral larvae. Black sea urchins, which are an important grazer of algae, were not observed, though they are recovering in many reefs around the Caribbean(e.g. Vermeij et al., 2010). Fish numbers appeared to be lower than previously observed, though we observed sharks almost on every dive, indicating that there still is an intact food chain. The low numbers of fish may be a seasonal effect, a result of the presence of predators, or a result of changes that followed from the 2005 bleaching event. Hardly any coral colonies with diseases were observed and although some colonies were bleached as result of the seasonal high water temperatures, there appeared to be almost no mortality among these bleached colonies.

Table 1. Overview of positive and negative observations.

Optimistic
-no diseases
-no recent bleaching mortality on coral colonies
-large predators present
Concern
-no black sea urchins
-high cover of algae
-low numbers of fish and lobster

In summary, the reefs of the Saba Bank have deteriorated since the first observations in 1972, 1996, and 2002. Meesters et al. (1996) describe percentage coral cover at 7 locations to lie between 60-90%. These percentages were nowhere observed this time (the best site visited had an estimated coral cover of around 50%, however the videotapes still need to be analyzed).

Possibly this is caused by just one event, i.e. the 2005 bleaching, but there just aren't any data that exclude other reasons (for example overfishing, damaged reefs by anchors, or hurricanes). The absence of important grazers such as the black sea urchin is likely to slow down recovery, but still corals appear healthy and the reefs of the Saba Bank are probably slowly recovering to their previous grandeur. Meesters et al. (1996) also describe the virtual absence of diseases which appears still to be the case.
It is important that monitoring of the coral reefs of the Bank and human impacts (e.g. fishery) is installed as soon as possible. Permanent video transects are planned to be installed in 2011 at a number of sites on the Bank.

Acknowledgements

I like to thank Jean Philippe Maréchal for inviting me on this research cruise, Paul Hoetjes for setting up the contacts in the first place, and the Bonaire and Saba Marine Park managers Ramon Deleon and Kai Wulf, as well as park ranger Gregoor vander Lake for their good company. I thank Michel and Wes for their assistance during the field trip, taking us to the Bank, and their hospitality.

Abbreviations

IMARES	Institute for MArine Resources and Ecosystem Studies
OMMM	Observatoire du Milieu Marin de le Martinique
RCN	Rijksdienst Caribisch Nederland
SCF	Saba Conservation Foundation

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