

BIONEWS

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Editor's Letter

Dutch Carribean, December 2016

A dedicated Saba Bank Symposium was organised by the University of Wageningen in December 2016. The Symposium was held in Den Helder and brought together researchers and conservationists from throughout the Kingdom to share their knowledge and to provide an overview of the current state of scientific knowledge about the Netherlands's largest and most remote National Park.

Among others, presentations were given on the following topics:

- *Expeditions to the Saba Bank*
- *Coral diversity and historical collections*
- *Fish and fisheries*
- *Sharks*
- *Marine mammals*
- *State of the Saba Bank*

The Symposium ended with a panel discussion on the sustainable use of the Saba Bank and what is needed to protect the Saba Bank for the future.

We have done our best to capture the wealth of information presented at the symposium for you here and hope, that like us, you are impressed by the depth and diversity of the work that has been done to explore and document our largest National Park: The Saba Bank.

"We need to improve the resilience of the Saba Bank to cope with the effects of

Wageningen University & Research
(Becking & Meesters, 2017)

The Netherland's largest national park

For the longest time, the Saba Bank has been the largest and richest forgotten treasure within the Kingdom of the Netherlands. It lies just 5 kilometers (3 miles) south west of the island of Saba but extends almost 70km from the Saba coastline covering an area roughly the size of the Dutch part of the Waddenzee or, more evocatively, about the same size as Luxembourg (2,679 km² / 850 mi²). The Saba Bank was set up as a nature park as recently as 2010, and was recognized as a protected area of regional importance under the SPAW-protocol (Protocol Concerning Specially Protected Areas and Wildlife of the Wider Caribbean) in 2012. In the same year it was declared a National Park, making it the largest National Park in the Netherlands (DCNA, n.d.).

The fishery on the Saba Bank was first documented in 1907 by Boeke who also mentioned the existence of extensive coral reefs. In 1972 an expedition to the Saba Bank was organised and van der Land started mapping the coral reefs (Land, 1977). In 2006 the Dutch Hydrographic Service collected high-resolution bathymetric data, from which the first detailed maps of the Saba Bank were made.

We now know that the Saba Bank is a flat-topped carbonate seamount rising 1,800 metres (5,905 feet) above the sea floor, crowned by a ring of growing coral reef on its fringes. It is the second largest submerged carbonate platform of its kind in the world (Church et al. 2004), and its rich biodiversity includes coral reefs, patch reefs, sand flats, as well as limestone pavements overgrown with uniquely diverse algal assemblages. It is entirely submerged and most of it lies at water depths of 20 to 50 meters (66 to 164 feet). It is thought that the southwestern part of the Bank contains the healthiest reefs.

From the bathymetric data the Bank can be seen in fascinating detail showing the presence of distinctive beach, reef crests and lagoon

formations, which must have formed during previous glaciations when parts of the Bank were above sea level. Old spur and groove structures and former barrier reefs can be identified as well as a cluster of unidentified pinnacle like structures, which dot the northeastern part of the Bank rising 10m above the bottom. The bathymetric data can be used to distinguish bottom types but these still need to be translated into habitat maps, so for the most part we still do not know what lives or grows there.

The race to discover more about this unique area only began in earnest in the mid-nineties, once it became clear that significant quantities of Queen Conch, lobster and grouper were being systematically harvested by foreign vessels.

About one-quarter of the Saba Bank lies within Saban territorial waters and 1.3% within the territorial waters of St. Eustatius, the rest falls within the Exclusive Economic Zone. After a brief exploratory expedition in 1996, and a first inventory of the fisheries in 1999, the former Netherlands Antilles organized two further expeditions to inventory the biodiversity of the Saba Bank with support from Conservation International and the Dutch government. After the constitutional changes in 2010, the Saba Bank became the direct responsibility of the Netherlands and since then six expeditions to the Saba Bank have explored various aspects of the biology and 'health' of the area.

The Saba Bank is exceptionally biodiverse and in addition to extensive coral reefs it is particularly rich in gorgonians and macro-algae, including algal assemblages never described before (Littler et al. 2010). The abundance of shallow water gorgonians is high (43 recorded species) which is 10-30% higher than at other sites in the Caribbean with the discovery of a new species of Pterogorgia being confirmed (Etnoyer et al. 2010). In terms of fish diversity, despite the absence of shallow

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water habitats, the Saba Bank ranks eighth in the Caribbean in terms of fish species richness. A total of 270 fish species were recorded during a nine-day expedition to the Saba Bank, raising expectations that the final count may exceed 400 species (Williams et al. 2010).

There have been 4 species of sharks recorded on the Saba Bank as well as 6 species of marine mammals (Stoffers 2012, Debrot et al. 2013). Humpback whales are regularly spotted in the channel between Saba and the Saba Bank and there have been various sightings of humpback whales with calves, leading to speculation about the role of the Saba Bank as a calving and/or nursery area for humpbacks.

The Saba Bank is also an important foraging ground for many seabirds and conservative estimates indicate that ¼ million sea birds are dependent on the Saba Bank. This includes birds from Saba, St Eustatius and Dog Island, which alone supports 100,000 pairs of nesting seabirds including Magnificent Frigatebirds, Tropicbirds, Sooty terns and Masked boobies, all of which are species whose global populations are in decline. An estimated 18% of the world population, the equivalent of 70% of the Caribbean population of Red-billed Tropicbirds, forage on the Saba Bank (Adrian Delnevo, personal communication, 23 February 2017).

The high species abundance on the Saba Bank prompted Conservation International to designate it an important “biodiversity hotspot” within the Caribbean (Hoetjes, 2010). In addition, the Parties to the Convention on Biological Diversity (CBD) identified the Saba Bank as an Ecologically or Biologically Significant Marine Area (EBSA).

“

An estimated 18% of the world population, the equivalent of 70% of the Caribbean population of Red-billed Tropicbirds, forage on the Saba Bank

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Whilst the Saba Bank is not immune to the effects of global climate change, sea level rise, ocean acidification etc., and has a history of fisheries exploitation, its remoteness means that it has been spared many of the insidious anthropogenic effects such as eutrophication and increased sedimentation. Recent studies indicate that good genetic connectivity as well as genetic diversity comparable to other sites in the Caribbean mean that the Saba Bank is a likely source of fish and coral larvae and may serve an important ecological role, bolstering the resilience of reefs downstream (Bakker et al 2016)

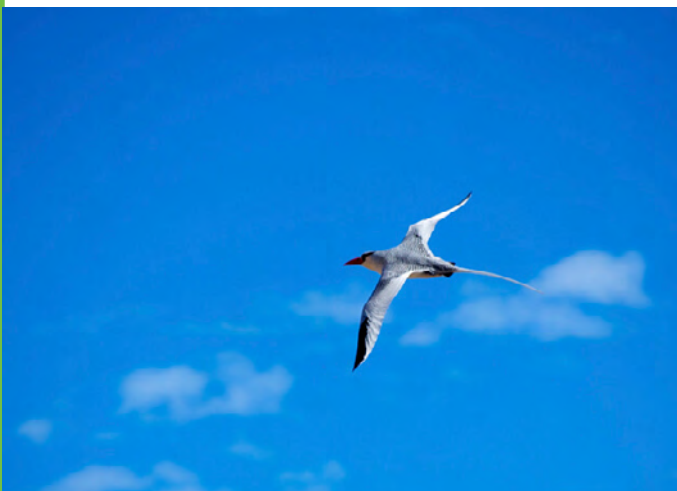


Photo by: © Kai Wulf

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Exploring the Saba bank

1968-1969

R/V Oregon, R/V Pillsbury, R/V eastward Caribbean Cruise E- 33D-70/71

Small samples of fish and possibly other organism have been collected by passing research vessels.

1972

CICAR Expedition

The first recorded expedition to the Saba Bank was in May and June of 1972 aboard the Dutch Royal Navy vessel, HMS Luymes. Collections of the benthos were made by hand using Dutch Naval divers. Twenty-five sites were sampled spanning the length and breadth of the Saba Bank. Collections included 37 species of stony corals.

1989

Corwith Cramer Cruise C-103

During this expedition a depth Recorder profile and sediment sample transect lines were completed.

1996

Netherlands Antilles Department of Environment (MINA) survey

A first quick field survey of the Saba Bank was commissioned by the Netherlands Antilles Department of Nature and Environment in 1996. The expedition focused on the central and eastern part of the Saba Bank and surveyed approximately 1.8% of the total area. Researchers concluded that the Saba Bank is a regionally unique and relatively pristine ecosystem with high biodiversity and productivity. The survey noted a high abundance of apex predators, which are generally considered good indicators of a healthy ecosystem.

1999

AGRRA expedition

Less than two weeks after hurricane Lenny, the reefs of the Windward islands were surveyed using the Atlantic And Gulf Rapid Reef Assessment (AGRRA) with modifications to detect impacts by hurricane Lenny. Three sites on the Saba Bank were examined and stony coral cover of 11, 26 and 41% was reported, mainly *Montastraea annularis faveolata* (23%). Windward islands were largely influenced by hurricanes; around 1% of all the individually surveyed colonies were physically damaged and >23% was bleached with lowest percentage occurring on the Saba Bank (9%).

2006

Conservation International expedition In

January 2006, Conservation International financed a Rapid Assessment of the Saba Bank. Surveying 17 sites the expedition confirmed the high species richness on the bank and identified many species of fish, coral, sponges and macro-algae. On average researchers found one new species a day including two new species of goby, one new to science, and more than a dozen new species of macro algae as well as previously undocumented macro algal assemblages. As a result of this work Conservation International declared the Saba Bank a Biodiversity Hot Spot.

Please check the References and Publications on page 37 to find an overview of the publications which are the result of these expeditions.

2007

Royal Dutch Navy, MINA, Harte Research Institute, Conservation International (CI), and Saba Conservation Foundation

An expedition in October 2007 focused on octocorals as well as surveys of fish and conch. Two new species of gorgonian were discovered and for the first time monitoring included surveys for crustacean as well as some ROV deep water exploration. The expedition was used to ground truth a high-resolution bathymetric map based on 2006 survey data from the Dutch Hydrographic Service. Results from all expeditions so far plus a six month survey of fisheries, ship traffic and biodiversity out of Saba, formed the basis for the Saba Bank Special Marine Area Management Plan 2008 (Lundvall, 2008).

2010

CARIBSAT expedition, M.V. Caribbean Explorer

In November 2010, a team of eight scientists and conservation practitioners came together for a mapping expedition to the Saba Bank with the M.V. Caribbean Explorer. This was part of a joint project called CARIBSAT, between Martinique, Saba and Bonaire, to find ways to use satellite images to map the benthic communities and included data collected from 200 video camera drops. The expedition found that the health of the reefs of the Saba Bank had deteriorated since the first observations in 1972, 1996, and 2002. The general impression was that the Bank is still recovering from the 2005 bleaching disaster, but there is not enough data to exclude other reasons (e.g. overfishing, anchor damage, hurricanes).

2011

IMARES expedition aboard Caribbean Explorer

The October 2011 research expedition aimed to collect data on benthic and reef fish communities; sponges and nutritional sources of the sponge community; seabirds and marine mammals; water quality, water velocity and other physical parameters. A multidisciplinary team conducted video and visual surveys of the benthos, fish and sponges at ten sites, while sea birds and marine mammals were surveyed by means of on-board visual surveys and acoustic data loggers. The first passive acoustic monitoring sensor (noise logger) for marine mammals was placed on the Saba Bank. Water velocity and water quality were also measured on-board. During the expedition 8 sponge species were collected and 37 scleractinian coral species and 85 fish species were identified. Most frequently sighted seabirds were the Brown Booby and Magnificent Frigatebird.

2013

IMARES expedition

An international team of marine biologists collected data on benthic communities at 11 study sites, recording fish abundance and size, reef structural complexity, coral-algal interactions, water quality and connectivity. A preliminary comparison with data from 2011 showed a reduction in snappers, groupers, and grunts, whilst there were noticeably more sharks. Fewer algae were recorded on the bank, possibly indicating a healthier reef, though there appeared to be a gradient with algal cover increasing towards the island of Saba. The expedition was filmed by Mouissie Corporation and broadcast as part of a series on marine life for National Geographic.

2015

IMARES / NIOZ joint expedition aboard Caribbean Explorer

In October 2015 fourteen researchers visited 11 sites on the Saba Bank to continue benthic and fish monitoring as well as to look at productivity. Particular attention was paid to sponge communities. Other areas of the bank were also monitored using camera drops. Research teams diving at sites with a flat bottom, small low growing reefs and a substrate that was partly unconsolidated recorded 18 coral species one of which was new to science (*Meandrina danae*). Together with earlier expeditions this brings the total confirmed number of stony corals on the Saba Bank to around 40 species which includes four unattached, free living varieties of coral (coralliths). These were found by roving divers at a depth of 15-20 meters. One of the conclusions of this expedition was that the Saba Bank includes unique wave-swept habitats, which support free-living corals so far not reported from any other sites.

2016

NIOZ expedition aboard R.V. Pelagia

In August and September, a group of scientists from NIOZ, University of Wageningen and others surveyed 30 sites on the Saba Bank to investigate how environmental conditions are impacting coral reef ecosystem function on the Saba Bank. This work is part of an NWO funded project entitled "Caribbean Coral Reef Ecosystems - interactions of anthropogenic ocean acidification and eutrophication with bio-erosion by coral excavating sponges". Researchers want to gain a better understanding of the hydrography of the Saba Bank and to determine if net ecosystem calcification is occurring. In other words is the Saba Bank growing or eroding and which factors can explain these processes.

2016

DCNA Shark Tagging expedition aboard the Caribbean Explorer

In October 2016 as part of a three year long "Save our Sharks" project the Dutch Caribbean Nature Alliance ran a shark tagging expedition to the Saba Bank. Drum lines were used to catch a total of 22 sharks: sixteen Caribbean reefs sharks and six adult Tiger sharks (*Galeocerdo cuvier*). All were fitted with Passive Integrated Transponder (PIT) tags. Four of the tiger sharks were additionally fitted with SPOT satellite transmitting devices, which will be used to track the sharks movements for up to four years via the ARGOS satellite tracking system.

2016

Waite Institute expedition aboard M.V Plan B

The Saba Bank was included in a Waite Institute's research voyage to the Dutch Caribbean Windward Islands to collect standardized information on the status of the reefs. The surveys were conducted using GCRMN monitoring protocols in addition to new efforts in large-area reef imaging using photography and advanced image post-processing to create photomosaic images of the reefs.

Managing the Saba Bank

Fisheries

Management of the Saba Bank dates back to 1994 and the declaration of the Exclusive Fishery Zone in the Dutch Caribbean and the passing of a national fishery ordinance made it illegal for foreign vessels to fish on the Bank without a license. In 1996, despite international protests, the Coastguard started to enforce the new fisheries regulations and removed all unlicensed fishing vessels. Licenses were issued preferentially to Saba and Statian fishing boats. This effectively ended all illegal, unreported and unregulated (IUU) fishing on the Saba Bank. In particular conch fishing was effectively stopped altogether, lobster and finfish fisheries continued but only by local, licensed fishermen. To justify continued exclusion of foreign fishing vessels, monitoring of the fisheries then became a necessity.

Shipping and Marine Protected Area designations

In the past, substantial damage was caused to the Saba Bank by shipping traffic, particularly tankers bound for the St. Eustatius Oil Terminal (established in 1982), routinely anchoring on the Bank. Monitoring of Automatic Identification System (AIS) transponders legally required on any large ship over a five-year period starting in 2007, found that until the prohibition on anchoring in 2010, an average of 21 vessels with an average length of 210 m anchored on the Saba Bank every year, for an average of 3.5 days. The ship's anchor coupled with hundreds of meters of anchor chain is estimated to destroy an area of approximately $\frac{3}{4}$ hectare of bottom per incident as the vessel swings on its anchor. Using conservative estimates this indicates that since establishment of the Statia oil terminal over 200 hectares of the Saba Bank have been completely destroyed by anchoring, much of the damage being concentrated on small areas of the Bank.

This threat to the Saba Bank was finally ended when it was declared a Nature Park in December

2010 and in 2012 it became the world's 13th Particularly Sensitive Sea Area (PSSA), giving it an International Maritime Organisation (IMO) designation as a no-anchoring area as well as an Area To Be Avoided (ATBA) by shipping. That same year it was designated as a National Park and recognized as an area of regional importance by the Specially Protected Areas and Wildlife (SPAW) Protocol and in 2013 it was recognised as an Ecologically/Biologically Significant Marine Area (EBSA) by the Convention on Biological Diversity. In September 2015, thanks in major part to the efforts of Saba's Commissioner Chris Johnson, the Saba Bank became part of the Yarari Marine Mammal and Shark Sanctuary covering all waters of Saba and Bonaire.

In 2007 a Saba Bank Management Plan was developed, but it took until 2012 before the Saba Bank Management Unit (SBMU) was established by the Dutch Ministry of Economic Affairs, in close cooperation with the Saba Conservation Foundation and the Saba Island Government. The SBMU is responsible for day-to-day management of the Saba Bank. It is staffed by two fulltime staff and its tasks consist of just surveillance and reporting shipping or fishing violations, facilitating and conducting scientific research, monitoring of fish landings and liaising with local resource users.

Climate change effects

The impacts of global climate change are undeniably taking their toll on the biodiversity of the Saba Bank. In 2005 for example an estimated 70% coral cover on the Bank was lost during an intensive bleaching event. Accurate data are not available but similar loss of coral cover was recorded on neighboring islands of Saba and St. Eustatius and many other islands in the northeastern Caribbean. Anecdotal data such as comparison of before and after photographs of an identical spot on the Saba Bank from 2003 and 2007 show an almost complete loss of coral cover.

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What will it take to manage the Saba Bank?

The Saba Bank is a very important biological resource for Saba as well as for the surrounding islands and it supports a valuable and sustainable local fishing industry. Threats will continue to exist and law enforcement remains difficult, especially in a remote and large area like the Saba Bank.

There is also much left to explore and discover of the Saba Bank but capacities within the SBMU are limited. Support from research institutes and universities is essential to many of the scientific

research projects on the Saba Bank. To ensure a sustainable future for the Saba Bank it is important the SBMU continues its activities and its capacities are strengthened. Some wish list items for research include:

- Identification, description and a mapping of main ecological habitats
- Continued monitoring of reefs, fisheries, marine mammals and sharks
- Habitat restoration experiments (anchor damaged areas)
- Methods to reduce shark bycatch, and parrotfish bycatch in fisheries
- Development of methods for a targeted lionfish fishery
- Identify and protect other spawning aggregation area

“The Saba Bank, the most pristine and largest coral reef area of the Dutch Caribbean.”

Erik Meesters (Wageningen Marine Research)

What have we learned from the past 5 years:

Conservation activities:

The Saba Bank Management Unit or SBMU was established by the Ministry of Economic Affairs in close cooperation with the Saba Conservation Foundation and the island government. From 2012-2014 a Shark Protection Plan was drafted for the Ministry of Economic Affairs. In 2015 the Yarari Marine Mammal and Shark Sanctuary was established. The “Save our Sharks” DCNA awareness project is being implemented from 2015-2017 (grant from National Postcode Lottery). As part of a multi-year program funded by EZ, the collaborating parties are working out the steps needed towards implementing marine mammal management and policy measures for the Yarari Sanctuary.

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Saba Bank: coral status and trends

The University of Wageningen (IMARES) has participated in research voyages to the Saba Bank in 2011, 2013 and 2015. Monitoring of coral reefs has mostly been done by surveying video transects and looking at coral recruitment.

Coral cover on the Saba Bank varies significantly from area to areas with the lowest recorded stoney coral cover at "Tertre de Fleur" (2.6%) and the highest recorded stoney coral cover on the southern edge of the Saba Bank at "Gorgonian Delight" (15.5%)

The Saba Bank is comprised of many different benthic ecosystems all of which are likely to be functionally linked and important to the health of the area as a whole. The benthic communities include coral dominated reefs, fields of calcareous algae, sargassum beds, algal beds and sand plains.

A number of events over the past twenty years have combined to dramatically reduce coral cover on the Saba Bank. These include Hurricane Lenny in 1999 and the bleaching events in 1998 and 2005.

Due to its remote location the Saba Bank experiences high rates of water exchange and is not directly impacted by land based pollution or terrestrial run off. The reefs have consistently shown few signs of disease and whilst fish population numbers are highly variable, the number of apex predators on the Saba Bank seems to be consistently high.

But, the Saba Bank is by no means immune to the impacts of global climate change. Bleaching events are believed to have already taken their toll on coral reef communities. Of concern too is the very real possibility of more, and more intense, weather events such as bleachings and hurricanes as well as the impacts of ocean acidification.

Successive expeditions have noted the virtual absence of grazing urchins on the Saba Bank. Invasive lionfish are now present and evidence from other parts of the Caribbean indicates that lionfish are capable of decimating reef fish populations, and have caused a 78% decrease in juvenile fish. The Saba Bank is an important fisheries resource for the island of Saba and there is a thriving fishery for lobster and red fish as well as red hind.

At this time it is unclear how the reef communities on the Saba Bank will fare and what impact, if any, fishing activity is having on the reefs. It is therefore essential that actions are taken to raise the resilience of the Saba Bank as much as possible to cope with the effects of climate change.

Sampling sites included
(from south to east to north)

- *Dutch Plains*
- *Scottish Hills*
- *Gorgonian Delight*
- *Coral Gardens*
- *Pauls Cathedral*
- *Tertre de Fleur*
- *Erik's Point*
- *Twelve Monkeys*
- *La colline aux gorgones*
- *Devils Corner*
- *Rebecca's Garden*

This news item is based on a presentation given by Erik Meesters (WUR)

<https://www.wur.nl/en/download/Erik-Meesters-State-of-the-reefs-3-expeditions-to-Saba-Bank.htm>

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What have we learned from the past 5

Reef status:

Compared to the 1990s, coral cover on Saba Bank is currently much lower. In 2011, 2013 and 2015 quantitative surveys were carried out on the Saba Bank on 10 locations. At each site 3 transects of 50 m were photographed (150m²). In 2011, living coral cover was only 8%, which is much lower than the coverages of 40-60% reported in 1996. The proximate causes for this dramatic decline remain uncertain but we suggest that bleaching and climate change are largely responsible for the lower cover of living corals on the bank. Climate change leads to warmer sea water and this causes periods when the sea water temperature is too high for corals leading to so called bleaching events, which often cause high coral mortality. In particular, the 2005 Caribbean bleaching event which decimated coral cover all over the north eastern Caribbean is important in this respect. On a positive note, between 2011 and 2015, there is no indication that coral cover has further declined. Encouraging indications for reef resilience were that there are many small young coral colonies and there are very little signs of coral disease. Furthermore, Saba Bank is not a 'sponge reef' and sponges are not becoming dominant over corals, as is the case in several disturbed eutrophic reefs in the Caribbean. These findings seem to indicate that the Bank is relatively less disturbed. Even under the best circumstances, we have to add that restoration of coral reefs is a very slow process and might take several decades. Saba Bank will, however, not stay the same in the coming years, as it will continue to change due to climate change and this change must be considered in management plans.

During the 2016 research expedition of NIOZ many new coral areas were discovered, as well as other habitats. At this moment knowledge is insufficient to set up a biologically sound benthic monitoring plan or management plan for the whole Bank – more basic knowledge of the bank is required.

Due to its high species and unique genetic diversity, the upstream position with respect to the wider western Atlantic, its large area of deeper reef, and relatively limited anthropogenic disturbance, Saba Bank serves as an important source population to the wider Caribbean. However, further research is necessary to establish to what extent and how it serves as a source and or sink for key species groups.

Fish communities:

From surveys between 2011-2013 a reduction in snappers, groupers, and grunts has been observed, while there were noticeably more sharks. The visual surveys (UVC) in 2011, 2013 and 2015 demonstrated repeatedly that the biomass of key herbivorous fish families and key commercial fish families was low, indicating possibly a poor status of these fish families. Lionfish are present on the Bank, but their densities are lower compared to the neighbouring islands and no significant increase was seen between years 2011-2015 at 20-30m depth.

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(Becking & Meesters, 2017)

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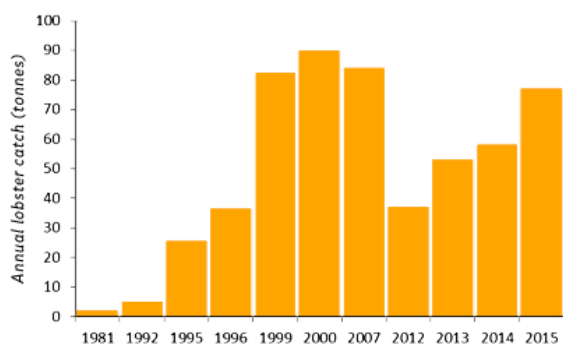
Saba Bank: Fisheries

The Saba Bank supports a vibrant local fishing industry. Fishing effort focuses mainly on a trap fishery, targeting lobster and deep water red fish (snapper) (Dilrosun 2000, Toller 2008, van Gerwen 2013, Boonstra 2014), as well as bottom drop lining for red fish (snapper). Other common fishing activities include hand lining and trap fishing for red hind (grouper) as well as trolling for pelagic species.

Studies of fishing effort from 2000 – 2007 indicate that the fishery on the Saba Bank was relatively stable at that time, supporting 50 active fishermen from Saba and generating around Euro 1 million annually, or 8% of the total economic activity on the island of Saba (Dilrosun 2000, Toller and Lundvall 2008). Fishing currently accounts for an estimated US\$ 1.38 million income annually (Lely, 2014).

Fishing activities on the Saba Bank have been regulated since 1996 but it is only since 2012 that researchers from the Wageningen Marine Research institute have been involved with fishermen and Saba Bank Management Unit staff in the structural monitoring of fishing activities.

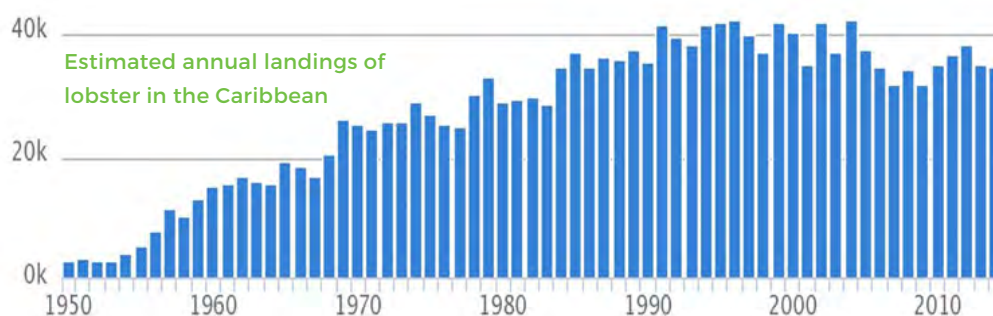
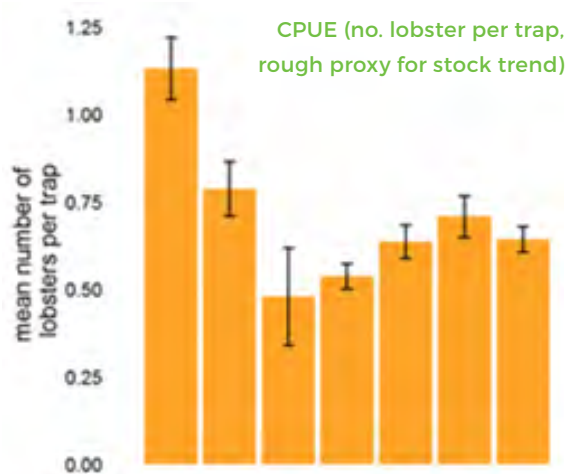
Estimated annual landings of lobster on the Saba Bank



Lobster

Caribbean spiny lobsters (*Panulirus argus*) are caught on the Saba Bank using traps. Only ten Saban fishermen currently have licenses to fish for lobster on the Saba Bank and their annual catch (Fig. 1) is believed to account for approximately 0.1% of the total lobster landed in the Caribbean annually. In common with other places in the Caribbean, lobster catches from the Saba Bank declined after 2000. Despite the lower lobster stock abundance (expressed as CPUE), recent annual landings are comparable to the annual landing in 2000 due to an increase in the number of fishing trips.

Lobster throughout the Caribbean, are currently thought to be part of one metapopulation and the management of lobster stocks therefore requires international collaboration and co-ordination. The current recommended is to follow management proposals of Caribbean Regional Fisheries Mechanism (CRFM) (Headley, 2014).



Mixed reef fish

Whilst fishermen do not actively target reef fish, they are caught in lobster traps. Since 2000 the landings of mixed reef fish caught in lobster traps has remained rather stable. Assuming that the mixed fish are harvested from 100-400 km² of coral reef on the Saba Bank, only 0.12-0.3 tonnes of reef fish are harvested per km² of coral reef. This is significantly lower than the 2 tonnes per km² of mixed reef fish harvested on Bonaire's reefs (de Graaf et al, 2016).

In addition to reef fish, which are landed, a similar amount of mixed reef fish are discarded annually by fishermen (see Table 1 and 2).

Bycatch is a potentially important issue for the lobster fishery with an estimated 500-950 nurse sharks caught in lobster traps annually (de Graaf, personal communication). Under a recent agreement, signed in 2016, Saba fishermen have pledged to return trap caught sharks to the reef alive.

Ghost traps

On average 0.6 traps are lost per fishing trip. This amounts to between 400-600 lobster traps lost annually, which can trap sea life as 'ghost traps'. Work is underway to refine the trap design to make them more sustainable. Current recommendations include increasing the mesh size to over 38mm and making sure traps are made with biodegradable material and include a biodegradable panel to prevent ghost fishing.

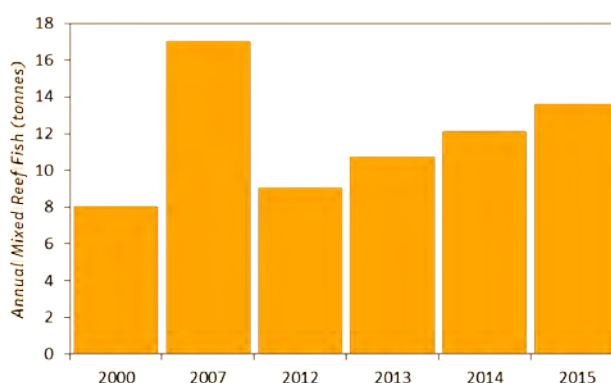


Figure 1: Estimated annual catch of mixed reef fish on the Saba Bank (de Graaf et al., in prep).

Common name	Latin name	% Catch
White grunt	<i>Haemulon plumierii</i>	27
Red hind	<i>Epinephelus guttatus</i>	11
Cottonwick grunt	<i>Haemulon melaanurum</i>	8
Queen trigger fish	<i>Balistes vetula</i>	6
Doctorfish	<i>Acanthurus chirurgus</i>	6
Honeycomb cowfish	<i>Acanthostracion polygonia</i>	6
Spotted goatfish	<i>Pseudopeneus maculatus</i>	3
Coney	<i>Cephalopholis fulva</i>	3
Blue tang	<i>Acanthurus coeruleus</i>	3
	<i>Other</i>	24

Table 1: Species composition of the landed mixed reef fish from lobster traps on the Saba Bank (van Gerwen 2013)

Common name	Latin name	% Catch
White grunt	<i>Haemulon melanurum</i>	27
Red hind	<i>Haemulon plumierii</i>	11
Cottonwick grunt	<i>Acanthostracion polygonia</i>	8
Queen trigger fish	<i>Acanthostracion quadricornis</i>	6
Doctorfish	<i>Acanthurus bahianus</i>	6
Honeycomb cowfish	<i>Cheatomodon striatus</i>	6
Spotted goatfish	<i>Chilomycterus antillarum</i>	3
Coney	<i>Acanthurus chirurgus</i>	3
Blue tang	<i>Acanthurus coeruleus</i>	3
	<i>Other</i>	24

Table 2: Species composition of the discarded mixed reef fish from the lobster traps on the Saba Bank (van Gerwen 2013).

Red fish

The red fish fishery targets mostly silk snapper (*Lutjanus vivanus*), blackfin snapper (*Lutjanus buccanella*) and vermilion snapper (*Rhomboplites aurorubens*), with silk snapper accounting for approximately ¾ of the total landings.

Since 2007, annual landings of red fish have remained relatively stable. The CPUE (kg per trap which is a proxy for the stock) has even showed a modest increase since 2011. A drop in red fish landings recorded in 2015 is the result of a decline in redfish fishing trips.

Despite evidence from landings that fish populations are stable, there is concern amongst local fishermen about the status of red fish populations. This has resulted in a local fishermen agreement, brokered by Saban fishermen themselves in 2016, which introduces a number of self-imposed restrictions aimed at protecting red fish populations from over-exploitation. These measures include a 6 month closure for red fish beginning in April 2017. Once the site closure ends licensed fishermen have agreed to deploy only 25 traps and to use large mesh sizes. These restrictions are being regulated through the existing fishing license system, which does not extend to the EEZ (Exclusive Economic Zone). Fishermen also expressed the intention to set up a fishermen's organisation.

Red hind

There is an emerging fishery on the Saba Bank for red hind (*Epinephelus guttatus*), which has developed over the past five years. Fishing activity focuses on red hind spawning aggregation sites. These fish group together at spawning aggregation sites annually to breed. Targeting spawning aggregation sites makes the red hind extremely vulnerable to overfishing and population collapse.

The danger of targeting spawning aggregations has been highlighted by work on Nassau groupers (*Epinephelus striatus*) for which more than 60% of spawning aggregation sites have been overfished to the point of collapse. Most of the remaining Nassau grouper aggregations are severely depleted (Whaylen 2007, Sadovy de Mitcheson 2008).

As a response to this, the first fisheries related closure of a fishing ground was introduced in December 2013 to protect known red hind spawning aggregations. Annually from December to February all fishing for red hind, whether by traps or lines, is now prohibited on the Moonfish Bank.

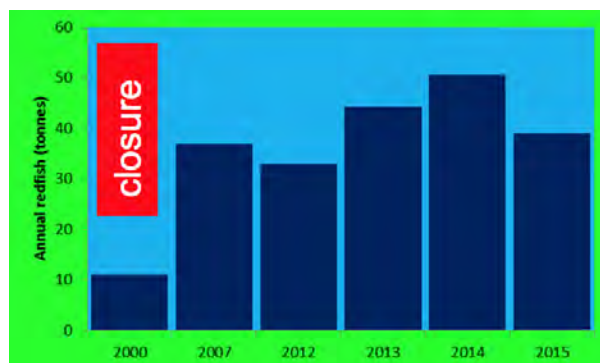


Figure 1: Estimated annual landings of the red fish trap fishery on the Saba Bank

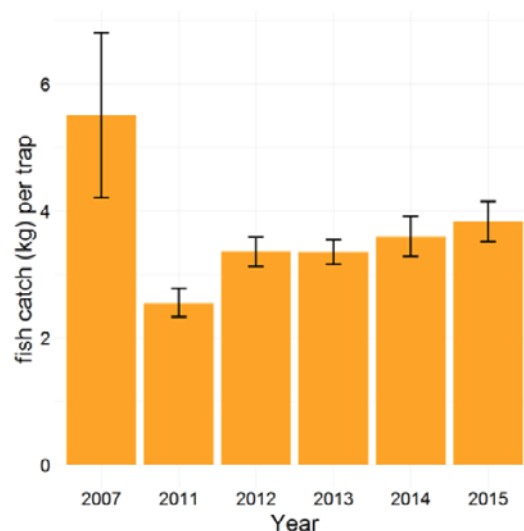


Figure 2: CPUE (kg of red fish per trap, rough proxy for stock trend) (de Graaf et al., in prep).

Conch

Whilst no local conch fishery exists, until 1996 Queen conch (*Strombus gigas*) were the target of intensive and unsustainable fishing activities by foreign vessels on the Saba Bank.

Recent monitoring indicates that Queen conch populations appear to be recovering (Boman, unpublished results). Their size at maturity is around 10mm lip thickness and their spawning season lasts from

June to September (Boman et al, in preparation). This makes the Saba Bank not only an important potential source of larval recruitment for large areas downstream, but also, with good management, the Saba Bank could potentially support a sustainable local conch fishery.

This news item is based on a presentation given by Martin de Graaf (WUR) at the Saba Bank Symposium.

<https://www.wur.nl/en/download/Martin-de-Graaf-Fish-and-fisheries-at-Saba-Bank.htm>

Saba Bank 2016/ Chizzilala

Short documentary produced for broadcast on Saba local TV about the Saba Bank. Commissioned by the Ministry of Economic Affairs (EZ) of The Netherlands can be watched here: <https://vimeo.com/195774102>

What have we learned from the past 5 years:

Fisheries

Most fishermen are positive towards working on regulations and working together with management. During 2012-2015 the West-Indian spiny lobster stock remained stable and total annual landings increased yearly due to increasing effort (number of fishing trips). The peak and subsequent gradual decline in annual in lobster landings as witnessed in recent years, mirror catch trends for the wider Caribbean region.

A potentially healthy sign is the consistently large size of harvested lobsters between 2000 and 2015. The rules and regulations of both the lobster and deep-water snapper trap fisheries will need to be updated in the near future to provide the responsible management authorities with the appropriate tools to ensure a sustainable fisheries.

Wageningen University & Research

(Becking & Meesters, 2017)

"The Saba bank is a unique area, invaluable for neighboring Saba, but also for the region as a whole as a source of coral, fish, lobster, and queen conch larvae. I'd say it is the richest biodiversity area of the entire Kingdom"

Paul Hoetjes (RCN)

Saba Bank: Sharks

Want to know the best place to see sharks in the Netherlands? Recent studies would seem to indicate that it's the Saba Bank!

Researchers on early expeditions to the Saba Bank recorded seeing sharks on every dive and even cases of researchers being chased out of the water by sharks. In today's world, where about a quarter of sharks and rays are considered globally endangered ⁽¹⁾, this is very good news and has prompted the Netherlands to declare the Yarari Marine Mammal and Shark Sanctuary in Dutch Caribbean waters as well as developing a policy document protecting sharks ("Shark Protection Plan").

Monitoring sharks

To find out more about sharks, a technique involving the use of simple, non-invasive, Baited Remote Underwater Videos (**BRUVs**), has been used to gather information on species composition and length frequency distribution. BRUVs have been deployed on Saba since 2013 and on the Saba Bank since 2014 across a variety of habitats in depths of 15 – 100m water for between 50min and 70 minutes per drop. This work has shown that sharks are most common along the shallow eastern and southern edge of the Saba Bank and that the most common species are Caribbean reef sharks (*Carcharhinus perezii*) and nurse sharks (*Ginglymostoma cirratum*). On average BRUV studies record 0.23 reef shark sightings per hour, which is higher than sightings at study sites on Belize and the Bahamas and 50% higher than around the adjacent island of Saba. (See BioNews 30 for an in depth article on the

BRUV work in the Dutch Caribbean) Fishing effort on the Saba Bank does not target sharks, but there is an unwanted by-catch of nurse sharks estimated at up to 900 sharks annually. These are caught in lobster traps and are not landed but discarded.

Without historical information on the Saba Bank or reference points from other locations in the Caribbean it is difficult to assess whether or not shark densities on the Saba Bank are "reasonable". GlobalFinprint is a worldwide initiative, which aims to create reference points by using available BRUV data to assess reef shark abundance around the world. Researchers from the Wageningen Marine Research are also participating in this initiative.

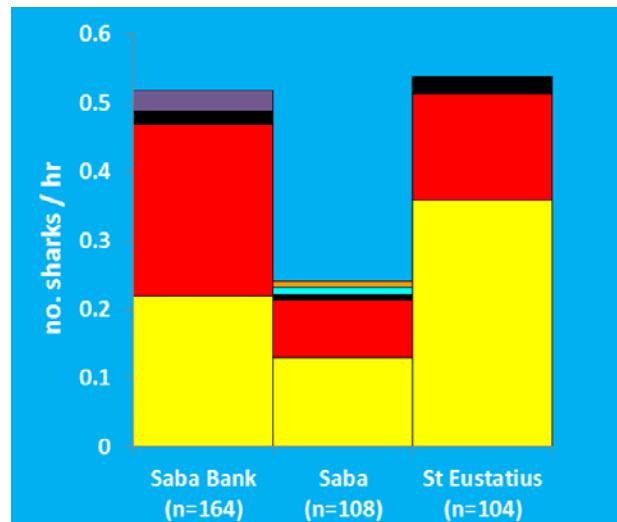


Figure 1: Species composition of sharks on the Saba Bank, Saba and St. Eustatius (BRUV results). Mainly Caribbean Reef sharks (*C. perezii*) and Nurse sharks (*G. cirratum*) were recorded. n= no. sharks

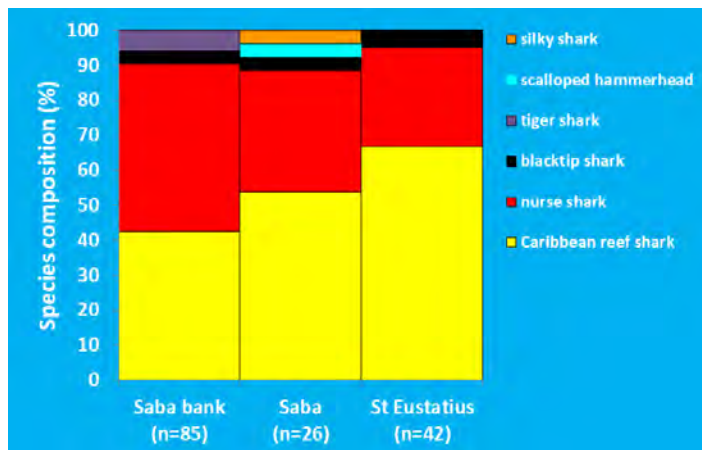


Figure 2: Number of sharks observed per hour on the Saba Bank, Saba and St. Eustatius (BRUV results). This number was about 50% higher on the Saba Bank and St. Eustatius than on Saba. (n=no. drops)

Tracking shark movements

VEMCO acoustic telemetry equipment has been deployed to track shark movements. In total a network of 32 acoustic receivers has been set up, eight of them on the Saba Bank and the remainder on Saba, St. Eustatius and St. Maarten. Receivers have a detection range of 450-850m and a battery life of up to 4.5 years. Pilot studies on Saba started in 2014 and expanded to the Saba Bank in 2015.

(See BioNews 30 for an in depth article on the acoustic telemetry work on Saba)

So far 11 sharks caught on the Saba Bank have been fitted with acoustic transmitters and data collected so far from the individual movement patterns of two Caribbean reef sharks (*C. perezi*) seems to indicate that they may have a relatively small home range. One 1.63m long male

Caribbean reef shark (*C. perezi*) has been detected by acoustic receivers on the north, south and east of the Saba Bank.

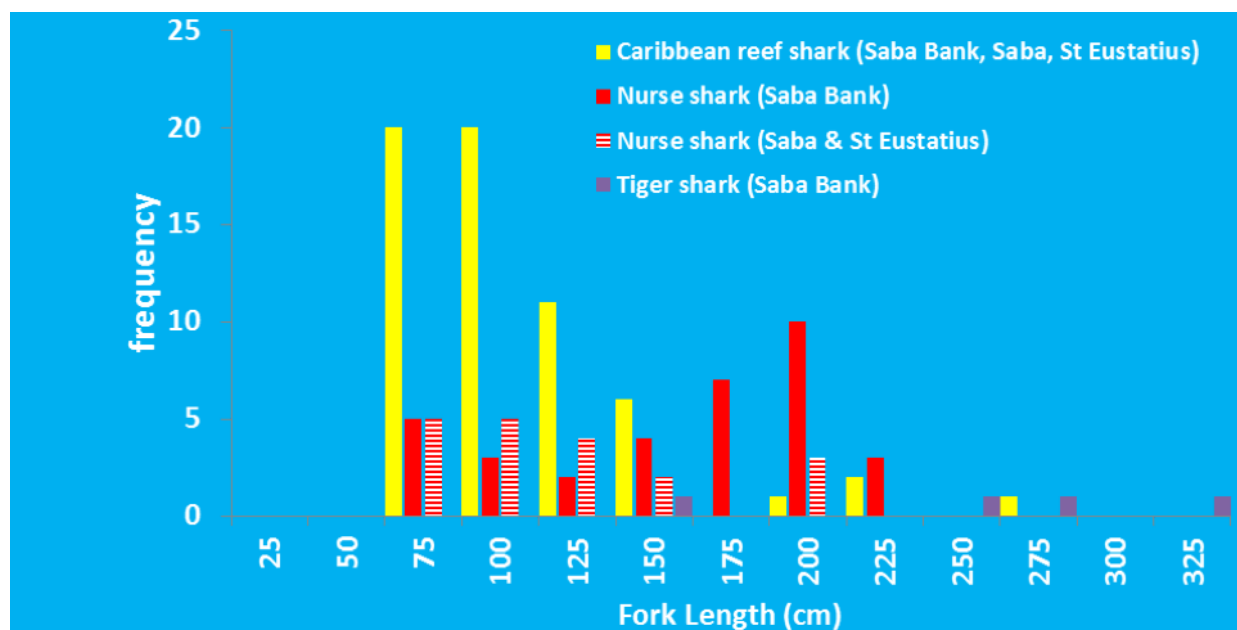
The scientific data collected so far, does not show whether or not the Saba Bank is important for particular life stages of sharks, such as a mating ground or as a nursery area, but it does indicate that the Saba Bank supports healthy populations of Caribbean reef and nurse sharks. Local conservation efforts and the establishment of shark-protected areas may be a very good management option for this species.

This article is based on the presentation by Erwin Winter's (**WUR**) given at the Saba Bank Symposium: www.wur.nl/en/download/Erwin-Winter-Shark-Habitat-Use.htm

Area	Species	Latin name	Shark hr ⁻¹
Saba Bank	Reef shark	<i>C. perezi</i>	0.23 (0.13 - 0.36)
Saba Bank	Nurse shark	<i>G. cirratum</i>	0.18 (0.08 - 0.25)
Bahamas (Brooks et al 2011)	Reef shark	<i>C. perezi</i>	0.08 (0 - 0.23)
Bahamas (Brooks et al 2011)	Nurse shark	<i>G. cirratum</i>	0.21 (0.12 - 0.35)
Belize (Bond et al. 2012)	Reef shark	<i>C. perezi</i>	0.16 (0.03 - 0.29)

Table 1: BRUV data from the Saba Bank compared to other areas.

Figure 3: Length of sharks recorded around Saba, St. Eustatius and the Saba Bank (BRUV results). Mainly neonates (<0.8m), y-o-y (<1m) and juveniles (<1.5-2m) of Caribbean reef shark (*C. perezi*) were recorded. Mostly juveniles (<2m) of nurse shark (*G. cirratum*) on St Eustatius and Saba were filmed.



What have we learned from the past 5 years:

Sharks

Caribbean reef sharks, nurse sharks and tiger sharks were observed during the 155 baited video (**BRUV**) deployments across the Saba Bank. The relative abundance of reef sharks on the Saba Bank appeared to be higher compared to similar standardised BRUV surveys in the wider Caribbean region. Saba Bank appears to have relatively healthy reef shark populations. Results further suggest that the Saba Bank is an important nursery and adult habitat for Caribbean Reef and Nurse Sharks (possibly also for the Tiger Shark). Individual movement patterns based on tracking data point to small home ranges of the Reef and Nurse sharks which show that reserves and marine parks offer good opportunities to protect these shark species.

Wageningen University & Research
(Becking & Meesters, 2017)



Would you like to learn more about the sharks in the Dutch Caribbean?

Follow the 'Save Our Sharks' online or on facebook (<http://saveoursharks.nl/en/home-page/>) + (<https://www.facebook.com/SaveOurSharksNL/?fref=ts>)

You can help save our sharks by signing the petition!

<http://saveoursharks.nl/en/events/petition/>

Saba Bank: marina mammals

The Northern Caribbean is a well-known breeding and calving ground for North Atlantic humpback whales (*Megaptera novaeangliae*) and considerable research effort has focused on the largest aggregations of whales, off the Silver Bank, north of the Dominican Republic during their winter breeding and calving season.

Resident marine mammals in the Caribbean include bottlenose dolphin (*Tursiops*), spinner dolphin (*Stenella longirostris*), Atlantic spotted dolphin (*Stenella frontalis*), short-finned pilot whales (*Globicephala macrorhynchus*) and Cuvier's beaked whales (*Ziphius cavirostris*). Seasonal visitors include humpback whales

(*Megaptera novaeangliae*), common minke whales (*Balaenoptera acutorostrata*) and sperm whales (*Physeter macrocephalus*). Little is known about the seasonal migration and distribution of whales and dolphins in the Caribbean as a whole.

Ecotourism activities in the windward islands in the form of whale watching tours has encouraged many Caribbean islands that whales are more economically valuable to them alive than dead. And whilst humpback whale populations worldwide have shown some signs of recovery in recent years, concern remains about the status of marine mammal populations in the Caribbean.

The Dominican Republic and France were the first to establish marine mammal protected areas and in September 2015 the Dutch Caribbean Yarari Marine Mammal and Shark Sanctuary was declared by ministerial decree and which includes the territorial waters of Saba and the Saba Bank.

Marine mammal monitoring is generally conducted by aerial surveys and through sighting networks. More recently Passive Acoustic Monitoring (**PAM**) noise recorders have been deployed to detect whale soundings. The first MARU noise logger was placed in 2011 and from 2015 onwards more AMAR noise loggers have been deployed including loggers deployed by NOAA in Guadeloupe, St Martin and Aruba. Two PAM noise loggers were placed on the Saba Bank, one on the north eastern tip and the other on the south eastern part of the bank.

Noise loggers detect all ambient noise including noise of natural background, produced by tidal current and waves, anthropogenic noise from shipping, seismic operations and naval sonar. Shipping intensity is high in some parts of the Caribbean and this could interfere sound produced by marine mammals and fish. Humpback whales and Minke whales, in particular, have distinctive vocalizations. Male humpback whales "sing" and Minke whales produce calls or pulse trains.

From December 2011 to April 2012 the distinct continuous acoustic presence of Humpback whales was detected around the Saba Bank demonstrating consistent use of the Saba Bank during their winter breeding season. There was a general increase in song positive hours at the end of December, which peaked in February and tailed off towards the end of April. From February to April whale song was recorded 89% of the time.

The occasional presence of minke whales was also detected with most pulse trains were recorded from February through to April 2012. Acoustic loggers also picked up distinctive vocalizations by grouper, squirrelfish and damselfish.

This work not only highlights the feasibility of using passive acoustic monitoring to record the presence of marine mammals in otherwise remote and understudied areas but also opens the door to the tracking of migration routes and first estimates of marine mammal densities in the region.

This news item is based on a presentation given by Dick de Haan (WUR) at the Saba bank symposium. https://www.wur.nl/upload_mm/3/b/1/943f3a6e-8doa-45db-acfb-c632deae6do_9.de_Haan_SabaBankSymposium2016.

What have we learned from the past 5 years:

Marine mammals

There are at least 9 species that are regularly observed over the Saba Bank. Presence and temporal aspects of whale migration are being studied using passive acoustic monitoring as part of regional acoustic monitoring network together with the USA and France. Our results indicate intensive use by Humpback whales during the winter calving season as well as regular winter presence of the Minke whale.

Wageningen University & Research
(Becking & Meesters, 2017)

Saba Bank: recommendations

Wageningen University & Research (Becking & Meesters, 2017)

- *Institutional responsibilities for policy and management activities need to be clearly defined: who needs to take leadership in what activity? What is the ultimate goal of the Dutch cabinet for the Saba Bank?*
 - *Saba Bank Management Unit needs more capacity; currently only 2 people are employed in the unit; The current vessel is too small for unencumbered operations on the bank.*
 - *Studies are needed to explore the impacts of climate change on the bank and what mitigation measures might be possible.*
 - *A habitat map of Saba Bank is required that includes habitat identification, descriptions, and location, as well as the ecological significance for fisheries and/or coral reef resources. This baseline information is crucial to support management and monitoring.*
 - *Ecosystem functioning and connectivity on the bank needs to be identified and assessed: how are coral reef areas, marine calcareous algal fields, marine algal fields, and other areas ecologically connected?*
 - *Monitoring program (WOT). Continued monitoring of reefs, fisheries, marine mammals and sharks is necessary for sustainable use of the Bank's resources.*
 - *The feasibility of zonation (of fisheries) needs to be determined including possibilities of closing a large portion of the bank (e.g. the part furthest away from Saba).*
 - *Fisheries regulations need to be reviewed and amended.*
 - *Quantitative fisheries management goals and objectives need to be formulated.*
 - *Gear type and allowed quantity, needs to be linked to the fishing licenses.*
 - *Research on methods to reduce shark bycatch is needed.*
 - *Spawning aggregation areas for target species need to be identified for protection by seasonal closure.*
 - *Escape hatches for undersized and by-catch species should become obligatory.*
 - *The role of the Saba Bank for specific life stages of marine mammals, mating and calving and connectivity to adjacent reef systems still remains to be unravelled.*
 - *Ship disturbance of whales needs to be studied by comparing noise logger data with vessel movements.*
 - *Better data management is needed: data is getting lost (e.g. from navy) or not well preserved. Data coordination and sharing arrangements are needed to prevent further loss.*
- The Saba Bank photo collection is available through the Image Collections of Wageningen University & Research:** <http://images.wur.nl/cdm/search/collection/coll18/searchterm/saba%20bank/order/nosort> We would like to thank all researchers for sharing their pictures!

Would you like to share a news item?

Please e-mail us: research@DCNAnature.org

Research overview

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Algae	Population genetics and dynamics of <i>Lobophora</i>	CUR	University of the Algarve: Aschwin Engelen; CARMABI
Algae	Impact of red filamentous algae on Caribbean corals	CUR	CARMABI: Mark Vermeij
Birds	Suitability study and reforestation of exclosures facilitating the Yellow-shouldered Amazon Parrots (<i>Amazona barbadensis</i>) on Bonaire	BON	Echo: Lauren Schmaltz
Cnidaria	Spawning Aggregations of the box jellyfish, <i>Alatina alata</i>	BON	CIEE: Rita Peachey, Austin Lin
Coral Reef ecosystems	Status of <i>Diaderma antillarum</i> on Caribbean Reefs	All	Scripps institution of oceanography: Stuart Sandin CARMABI: Kelly Latijnhouwers
Coral Reef ecosystems	Screening of UV filter presence in Lac Bay and ecological risk assessment	BON	WUR: Diana Slijkerman, Iris Schaap (student) STINAPA: Sabine Engel
Coral Reef ecosystems	Cyanobacteria on reefs	CUR	UvA: Petra Visser CARMABI
Coral Reef ecosystems	Course: coral reef ecology	CUR	UvA: Petra Visser CARMABI
Economics of ecosystems	The Economics of Ecosystems and Biodiversity (TEEB) on Aruba	AUA	Wolfs Company: Esther Wolfs, Boris van Zanten VU: Pieter van Beukering YABI consultancy: Francielle Laclé
Fish	Baited Remote Underwater Video (stereo BRUV) to study sharks	BON, CUR	WUR: Martin de Graaf Nijs Ruijs, Adrian Reid Novarro, Tom van Ee (students) STINAPA, CARMABI
Human impacts	Impact of off-road vehicular activity on wind and soil erosion	AUA	WUR: Klaas Metselaar, Teun Vogel (student) Sustain-by-Nature: Tatiana Becker, Emil ter Horst
Invasive species	Research into mitigation measures for Sargassum Seaweed	SXM	NFSXM: Tadzio Bervoets Government of St. Maarten

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Invasive species	Invasive seagrass-sea turtle interactions (*Part of NWO project: Ecology and conservation of green and hawksbill turtles in the Dutch Caribbean)	BON	STCB: Mabel Nava RuG: Marjolijn Christianen WUR: Lisa Becking, Miriam Loth (student), Thijs Wijckhuijsen (student)
Invasive species	Environmental DNA (eDNA) of lionfish in Lac Bay: A tool for detecting the invasive species in complex habitats (mangroves)	BON	CIEE: Rita Peachey Indiana University: Stephen Glaholt
Management	Assessment of Klein Bonaire	BON	WUR: Eva van Voskuijlen (Msc. student), Judith van Leeuwen STINAPA: Wijnand de Wolf
Mangrove ecosystems	Pilot-scale testing and evaluation of mangrove ecosystem intervention options (fish fauna, epibionts on mangrove prop roots) *Part of Natuurgelden Project: Ecological restoration Lac Bay and South coast, Bonaire	BON	WUR: Dolfi Debrot, Lisa Becking, Franka de Raad (student), Yorick de Beer (student) and Renate Reitsma (student) STINAPA: Sabine Engel DRO
Mangrove ecosystems	Hydrology of the mangroves	AUA	WUR: Klaas Metselaar, Siebe Houtsma (student) Tatiana Becker, Emil ter Horst
Molluscs	Conch ecology	CUR	NIOZ: Fleur van Duyl
Nature Policy Planning	Developing a nature policy plan for Bonaire	BON	Wolfs Company: Boris van Zanten, Esther Wolfs DRO
Plants	Germination of seeds of indigenous trees of Curacao	CUR	CARMABI: John de Freitas
Plants	Testing effective ways to grow native plants	BON	Echo: Quirijn Coolen, Johan van Blerk
Reptiles	Red bellied Racer snake dispersal and habitat requirements	EUX	EcoPro: Hannah Madden RAVON: Tim van Wagenveld, Marieke Zobel (student)

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Reptiles	Effect of invasive boas on the Aruban ecosystem (including the endemic Aruban whiptail lizard)	AUA	<p>Auburn University: Jeff Goessling, Matt Kearly (volunteer)</p> <p>Sam Houston State University: William Lutterschmidt</p> <p>Toledo Zoological Society: Andrew Odum</p> <p>The College of New Jersey</p> <p>Arcadia University</p>
Zooplankton	UV light effects on zooplankton diversity and density in Lac Bay	BON	<p>CIEE: Rita Peachey, Sara Buckley, James Emm</p>

Long term projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Coral Reef Ecosystems	Deep Reef Observation Project (DROP) (ARMS: Autonomous Reef Monitoring Structures)	CUR	Smithsonian: Carole Baldwin
Coral Reef Ecosystems	Postsettlement dynamics of Caribbean corals & Reef restoration	CUR	UvA: Valerie Chamberland (PhD candidate) CARMABI SECORE Foundation
Coral Reef Ecosystems	Bioersion of reefs by coral-excavating sponges	BON,CUR, SAB, EUX	NIOZ: Fleur van Duyl WUR: Erik Meesters, Didier de Bakker (PhD student)
Coral Reef Ecosystems	Development of restoration methods for threatened Caribbean coral species	BON, CUR, SAB	CRF Bonaire: Augusto Montbrun, Francesca Viridis SECORE Project CARMABI: Mark Vermeij UvA: Valerie Chamberland (PhD candidate) SCF, Sea Saba, Samford University: Jennifer Rahn
Coral Reef Ecosystems	Developing a plan to manage the waters around Curaçao sustainably, profitably, and enjoyably for this and future generations - including mesophotic reef dropcam project	CUR	Waitt Institute (Blue Halo Curaçao): Kathryn Mengerink
Database	Dutch Caribbean Species Catalog: Taxonomic knowledge system Dutch Caribbean (http://www.dutchcaribbeanpecies.org/)	All	Naturalis: Sander Pieterse & Berry van der Hoorn
Environmental	Zero nutrient discharge of domestic waste (water) nutrients and total reuse of nutrients in agriculture and aquaculture in Caribbean Islands (TripleP@Sea Program)	EUX	WUR: Grietje Zeeman, Marc Spiller, Indra Firmansyah (PhD student) CNSI
Environmental	Sustainable ecosystem management and use by marine communities in two exemplary regions (TripleP@Sea Program)	BON, EUX	WUR: Linde van Bets (PhD student); Arthur Mol, Jan van Tatenhove; Machiel Lamers WUR: Han Lindeboom CNSI
Environmental	Effects of dispersants on the fate of oil in realistic conditions (C-IMAGE consortium, TripleP@Sea Program)	EUX	WUR: Tinka Murk, Marieke Zeinstra-Helfrich (PhD student) CNSI

Long term projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Environmental	Ecotoxicological aspects of rational application of chemicals in response to oil spills to reduce environmental damage (C-IMAGE consortium, TripleP@Sea Program)	EUX	WUR: Tinka Murk, Justine van Eenennaam (PhD student) CNSI
Environmental	Ecotoxicological aspects of rational application of chemicals in response to oil spills to reduce environmental damage Development of an area specific net environmental and economic benefit analysis (NEEBA) to support oil spill mitigation decisions; with St. Eustatius as example	EUX	WUR: Tinka Murk, Sophie Vonk (PhD student) Lei Wageningen UR: Stijn Reinhard CNSI
Interstitial biodiversity	Moleculair biodiversity analysis of marine communities by metabarcoding	EUX	Naturalis: Arjen speksnijder ANEMOON: Niels Schrieken
Invasive species	Combatting the economic and ecological impacts of overgrazing on inhabited islands	BON	UsA: Michaela Roberts (PhD student)
Marine ecosystems	Marine species discoveries in the Dutch Caribbean	All	Naturalis: Bert Hoeksema CNSI CARMABI
Molluscs	Population dynamics and role in the food chain of the Queen Conch <i>Lobatus gigas</i> in the Dutch Caribbean Territories	EUX, SAB	WUR: Aad Smaal, Leo Nagelkerke, Martin de Graaf Erik Boman (PhD student) SCF (SBMU) CNSI
Public Health	DNA waterscan: Monitoring disease vectors in the Caribbean (mosquitoes and midges)	EUX	Naturalis: Kevin Beentjes ECPHF: Teresa Leslie
Sustainability	Sustainable development Dutch Caribbean (TripleP@Sea Program) - Are human activities a risk for ecosystem services? - Green Statia or how to regain balance between nature and agriculture?	EUX	WUR: Diana Slijkerman WUR (Alterra): Rene Henkens CNSI

Long term projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Terrestrial biodiversity	Baseline assessment and DNA barcoding of specimens	EUX	Naturalis: Michael Stech, Berry van der Hoorn STENAPA CNSI
Terrestrial biodiversity	Testing surrogates to establish conservation priorities	EUX	Naturalis: Jeremy Miller STENAPA
NWO Projects in the Dutch Caribbean			
Bioproducts	Stand-alone production of algal products for food, feed, chemicals and fuels	BON	WUR: R.H. Wijffels CIEE: Rita Peachey
Coral Reef Ecosystems	Caribbean coral reef ecosystems: interactions of anthropogenic ocean acidification and eutrophication with bioerosion by coral excavating sponges - Bioerosion and climate change	BON, SAB, EUX	NIOZ: Fleur van Duyl, Steven van Heuzen (PostDoc), Alice Webb (PhD student) STENAPA CNSI
Environmental	Caribbean island biogeography meets the anthropocene	AUA, BON, CUR, EUX, SXM	VU: Jacintha Ellers, Matt Helmus, Wendy Jesse (PhD. Student) CNSI
Environmental psychology	Confronting Caribbean Challenges: Hybrid Identities and Governance in Small-scale Island Jurisdictions - Behavioral differences between/ within the BES islands when it comes to nature conservation and cultural heritage.	BON, SAB, EUX	KITLV, Leiden University: Gert Oostindie (Project director) KITLV, Leiden University: Stacey Mac Donald (PhD student)
Geosciences	Stability of Caribbean coastal ecosystems under future extreme sea level changes (SCENES) - The effects of climate change on calcifying algae	BON, EUX, SXM	UU: Henk Dijkstra, NIOZ: Peter Herman, Rebecca James (PhD student) TU Delft: Julie Pietrzak STENAPA CNSI
Geomorphological	4D crust-mantle modelling of the eastern Caribbean region: toward coupling deep driving processes to surface evolution - Reconstructing past climate change:	EUX	UU: Wim Spakman NIOZ: Lennart de Nooijer Alfred Wegener Institute Germany CNSI

Long term projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
NWO Projects in the Dutch Caribbean			
Invasive species	Exotic plant species in the Caribbean: foreign foes or alien allies? (1) Socio-economic impacts of invasive plant species (2) Ecological impacts of invasive plant species- Utrecht University	BON, SAB, EUX	(1) UU: Jetske Vaas (PhD student), Peter Driessen, Frank van Laerhoven and Mendel Giezen (2) UU: Elizabeth Haber (PhD student), Martin Wassen, Max Rietkerk, Maarten Eppinga.
Reptiles	Ecology and conservation of green and hawksbill turtles in the Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	RuG: Per Palsbøll, Marjolijn Christianen, Jurjan van der Zee (PhD student) WUR: Lisa Becking STCB: Mabel Nava CARMABI STENAPA CNSI
BO-projects in the Dutch Caribbean (Min EZ)			
Coral Reef Ecosystems	BO-11-019.02-038– Analysis photo-material coral reefs	BON, CUR	WUR: Erik Meesters
Coral Reef Ecosystems	BO-11-019.02-022 –Inventory corals Includes monitoring and research of the longest coral reef time-series in the world (since 1973)	BON, CUR	WUR: Erik Meesters
Conservation	BO-11-019.02-060 – Status of nature conservation of the Caribbean Netherlands (for new nature policy plan)	BON, SAB, EUX	WUR: Dolfi Debrot
DCBD	BO-11-019.02-002 - Expansion knowledge system Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	WUR (Alterra): Peter Verweij
Fisheries	BO-11-019.02-055 – Fisheries Dutch Caribbean	SAB, EUX	WUR: Dolfi Debrot
Marine biodiversity	BO-11-019.02-008 – Saba Bank – Marine biodiversity	SAB	WUR: Erik Meesters

Long term projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
BO-projects in the Dutch Caribbean (Min EZ)			
Marine mammals & sharks	BO-11-019.02-054 – Yarari marine mammal and shark sanctuary	BON, SAB	WUR: Dolfi Debrot
World Heritage nomination	BO-11-019.02-050 – World Heritage nomination Bonaire National Marine Park	BON	WUR: Dolfi Debrot
“Nature Fund” Projects in the Dutch Caribbean (Min EZ)			
Coastal ecosystems (Lac Bay: Mangroves and seagrass beds)	Ecological restoration Lac Bay and South coast, Bonaire	BON	STINAPA: Sabine Engel WUR: Dolfi Debrot, Klaas Metselaar STCB: Mabel Nava DRO: Frank van Slobbe
Sustainable Agriculture	The sustainable agriculture and rural development program (POP Bonaire)	BON	Bonaire Agri & Aqua Business BV: Sherwin Pourier Wayaká Advies BV: Jan Jaap van Almenkerk DRO: Frank van Slobbe
Invasive species	Feral Pig Control	BON	Echo: Nathan Schmaltz DRO: Frank van Slobbe
Reforestation	Reforestation Project	BON	Echo: Lauren Schmaltz DRO: Frank van Slobbe
Invasive species	Goat eradication and control in Washington Slagbaai National Park	BON	STINAPA DRO: Frank van Slobbe
Coral ecosystems	Coral Restoration	BON	CRF Bonaire: Augusto Montbrun DRO: Frank van Slobbe
World Heritage nomination	World Heritage Nomination Bonaire Marine Park and/or other interconnected sites	BON	Wolfs Company: Esther Wolfs, Boris van Zanten, Amilcar Guzman, Viviana Lujan DRO: Frank van Slobbe

Long term projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
"Nature Fund" Projects in the Dutch Caribbean (Min EZ)			
Terrestrial ecosystems	Erosion control and nature restoration	BON	Bonaire Agri & Aqua Business BV: Sherwin Pourier Wayaká Advies BV: Jan Jaap van Almenkerk DRO: Frank van Slobbe
Agriculture	Agricultural Project	SAB	Government of Saba: Menno van der Velde
Recreation	Hiking trails	SAB	Government of Saba: Robert Zagers
Pollution	Tent Reef Protection	SAB	Government of Saba: Robert Zagers
Invasive species	Goat buy-back program	SAB	Government of Saba: Menno van der Velde
Community outreach	Nature Awareness project	EUX	Government of St Eustatius STENAPA: Clarisse Buma CNSI: Johan Stapel, Hannah Madden
Nature management	Strengthening management of nature	EUX	Government of St Eustatius STENAPA: Clarisse Buma
Invasive species	Rodent assessment and control	EUX	Government of St Eustatius CNSI: Johan Stapel, Hannah Madden ECPHF: Teresa Leslie
Coral ecosystems	Coral restoration	EUX	Government of St Eustatius STENAPA: Jessica Berkel CNSI: Johan Stapel
Erosion	Erosion control	EUX	Government of St Eustatius CNSI: Johan Stapel

Long term projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
EU-BEST funded Projects in the Dutch Caribbean			
Marine ecosystems	Marine Park Aruba	AUA	Directie Natuur en Milieu: Gisbert Boekhoudt
Coral Reef Ecosystems	Restoration Ecosystem Services and Coral Reef Quality (Project RESCO)	SAB, EUX, SXM	WUR: Erik Meesters, Niels Wagenaar and Silvan Allard (students) SCF STENAPA NFSXM Turks & Caicos Reef Fund
Conservation	Watershed & Biodiversity Conservation of Roi Sangu valley	BON	Echo: Lauren Schmaltz

Monitoring overview

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Birds	Flamingo Abundance	BON	DRO: Frank van Slobbe Cargill STINAPA: Paulo Bertuol
Birds	Monitoring vulnerable parrot nests (remote camera sensing work)	BON	Echo: Nathan Schmaltz
Birds	Yellow-shouldered Amazon parrot roost counts	BON	Echo: Lauren Schmaltz DROB: Peter Montanus STINAPA: Paulo Bertuol
Birds	Bird Monitoring (Caribbean Waterbird Census)	AUA BON	FPNA DLVV: Tatiana Becker STINAPA: Paulo Bertuol
Birds	Tern monitoring (artificial nesting islands)	BON	STINAPA: Paulo Bertuol Cargill DROB WUR: Dolfi Debrot
Birds	Terrestrial Bird Monitoring Program for Bonaire	BON	Echo: Nathan Schmaltz STINAPA
Birds	Red-billed Tropicbird monitoring	SAB EUX	STENAPA SCF: Kai Wulf WUR: Dolfi Debrot
Birds	Pelican monitoring	SXM	NFSXM: Melanie Meijer zu Schlochtern
Coral reef ecosystems	Coral Bleaching Monitoring	SXM	NFSXM: Tadzio Bervoets
Coral reef ecosystems	Global Coral Reef Monitoring Network	BON CUR SAB EUX SXM	STINAPA: Caren Eckrich CARMABI: Mark Vermeij SCF (SBMU): Jens Odinga STENAPA: Jessica Berkel NFSXM: Tadzio Bervoets CNSI
Corals reef ecosystems	Doobies Crack reef damage recovery survey	EUX	STENAPA: Erik Houtepen
Corals reef ecosystems	Staghorn coral field monitoring survey	EUX	STENAPA: Jessica Berkel

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Coral reef ecosystems	Monitoring and research of the longest coral reef time-series in the world (since 1973) (Part of BO-11-019.02-022 – Inventory corals)	BON CUR	WUR: Erik Meesters, Didier de Bakker (PhD student) NIOZ: Fleur van Duyl, Rolf Bak
Ecosystems	Seagrass and mangrove monitoring (BON: also conch and benthic fauna)	BON SXM	STINAPA: Sabine Engel, Caren Eckrich WUR: Klaas Metselaar NFSXM: Tadzio Bervoets
Environmental	Water quality testing	SXM	NFSXM: Tadzio Bervoets EPIC: Natalia Collier
Environmental	Nutrient (phosphate, ammonium, nitrate and nitrite) monitoring St Eustatius' coastal waters	EUX	CNSI: Johan Stapel
Fish	Shark monitoring: - Shark sightings - Shark Abundance, distribution and movements (tagging, acoustic telemetry)	BON CUR SAB SXM EUX	WUR: Martin de Graaf, Erwin Winter STINAPA: Caren Eckrich CARMABI: Mark Vermeij SCF(SBMU): Jens Odinga STENAPA: Jessica Berkel NFSXM: Tadzio Bervoets
Fish	Spawning monitoring: Red hind surveys on Moonfish Bank	SAB	SCF (SBMU): Jens Odinga WUR: Martin de Graaf
Insects	Bee tracking	BON	Echo: Nathan Schmaltz
Invasive species	Goat and/or donkey removal: - Washington Slagbaai National Park - Lac Bay area (exclusion plots) - Quill National Park (exclusion plots)	BON EUX	STINAPA WUR: Dolfi Debrot DROB STENAPA
Invasive species	Lionfish abundance and control	BON CUR SXM SAB EUX	STINAPA: Paulo Bertuol (50 meter traps) CARMABI: Mark Vermeij NFSXM: Tadzio Bervoets SCF (SBMU): Jens Odinga STENAPA: Jessica Berkel
Invasive species	Monkey Monitoring: abundance and distribution	SXM	NFSXM: Tadzio Bervoets
Invasive species	Feral pig population assesment (trapping)	BON	Echo: Nathan Schmaltz, Sam Williams UsA: Michaela Roberts

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST
Mammals	Bat monitoring	AUA BON	FPNA
Mammals	Dolphin monitoring (since 1999)	BON	Ron Sewell
Mammals	Caribbean Humpback Acoustic Monitoring Programme (CHAMP)	BON, AUA	NOAA: Heather Heenehan, Sofie Van Parijs, Peter Corkeron,
Mammals	Marine Mammal Monitoring (noise loggers Saba Bank)	SAB	WUR: Dick de Haan SCF (SBMU): Jens Odinga
Molluscs	Conch (<i>Strombus gigas</i>) on St. Eustatius, Saba Bank, Anguilla	SAB EUX	WUR: Martin de Graaf, Erik Boman (PhD student)
Natural resource use	Fishery monitoring (including lionfish, shark bycatch and marine mammal sightings)	SAB EUX	WUR: Martin de Graaf SCF (SBMU): Jens Odinga Gem City Consulting: Erik
Plants	Reforestation Klein Bonaire	BON	STINAPA: Johan van Blerk
Plants	Phenology of bats in cacti landscapes of Aruba	AUA	WildConscience: Linda Garcia, FPNA
Reptiles	Lesser Antillean Iguana: Monitoring population density & removing	EUX	STENAPA RAVON: Tim van
Reptiles	Boa and Cascabel Monitoring	AUA	FPNA, Toledo Zoological Society: Andrew Odum
Reptiles	Sea turtle monitoring: -Satellite tracking -Nest monitoring	AUA, BON, CUR, SAB, EUX, SXM	TurtugAruba Foundation STCB: Mabel Nava CARMABI (STCC): Sabine

List of Acronyms

AUA	Aruba	NFSXM	Nature Foundation St. Maarten
BON	Bonaire	Naturalis	Naturalis Biodiversity Center, The Netherlands
CUR	Curaçao	NIOZ	NIOZ Royal Institute for Sea Research, the Netherlands
SAB	Saba	NWO	NWO Netherlands Organisation for Scientific Research
EUX	St. Eustatius	RAVON	Reptielen Amfibieën Vissen Onderzoek Nederland
SXM	St. Maarten	RuG	University of Groningen, the Netherlands
AMMF	Aruba Marine Mammal Foundation	SBMU	Saba Bank Management Unit
ANEMOON	Analyse Educatie en Marien Oecologisch Onderzoek	SCF	Saba Conservation Foundation
ASDF	Aruba Sustainable Development Foundation	Smithsonian	Smithsonian's National Museum of Natural History
BEST	Biodiversity and Ecosystem Services in Territories of European overseas	STCB	Sea Turtle Conservation Bonaire
BO project	Policy Supporting Research project	STCC	Sea Turtle Conservation Curacao
BU	Bangor University, United Kingdom	STENAPA	St. Eustatius National Parks Foundation
CARMABI	Caribbean Research and Management of Biodiversity Foundation	STINAPA	National Parks Foundation Bonaire
CIEE	Council of International Educational Exchange, Bonaire	TUD	Delft University of Technology, the Netherlands
CRF	Coral Reef Foundation	UsA	University of St. Andrews, Scotland
DCNA	Dutch Caribbean Nature Alliance	UU	University of Utrecht, the Netherlands
DCBD	Dutch Caribbean Biodiversity Database	UvA	University of Amsterdam, the Netherlands
DRO	Directorate of Spatial Planning and Development, Bonaire	VHL	University of Applied Sciences VHL, the Netherlands
DLVV (Santa Rosa)	Department of Agriculture, Livestock, Fishery and Farmers market (Santa Rosa), Aruba	VU	VU University Amsterdam, the Netherlands
EcoPro	Ecological Professionals Foundation	Wildconscience	Wildlife Conservation, Science and Education
ECPHF	Eastern Caribbean Public Health Foundation	WNF	World Wide Fund for Nature
EPIC	Environmental Protection in the Caribbean	WUR	Wageningen University and Research Centre, the Netherlands
FPNA	Fundacion Parke Nacional Arikok, Aruba	WUR (Alterra)	Wageningen Environmental Research, the Netherlands
LVV	Department of Agriculture, Animal Husbandry & Fisheries, St. Eustatius		

Reports and Publications Overview

Below you will find an overview of the reports and publications on biodiversity related subjects in the Dutch Caribbean that have recently been published.

Bakker, D.M. de, van Duyl, F.C., Bak, R.P., Nugues, M.M., Nieuwland, G., & Meesters, E.H. (2017).
40 Years of benthic community change on the Caribbean reefs of Curaçao and Bonaire: the rise of slimy cyanobacterial mats. *Coral Reefs*, 1-13.

Ballantine, D. L., Ruiz, H., Lozada-Troche, C., & Norris, J. N. (2016).
The genus *Ramicrusta* (Peyssonneliales, Rhodophyta) in the Caribbean Sea, including *Ramicrusta bonairensis* sp. nov. and *Ramicrusta monensis* sp. nov. *Botanica Marina*, 59(6), 417-431.

Boeken, M. (2016).
Breeding Success of Red-Billed Tropicbirds *Phaethon aethereus* on the Caribbean Island of Saba. *Ardea*, 104(3), 263-271.

Andradi-Brown, D. A., Vermeij, M. J., Slattery, M., Lesser, M., Bejarano, I., Appeldoorn, R, et al. (2016).
Large-scale invasion of western Atlantic mesophotic reefs by lionfish potentially undermines culling-based management. *Biological Invasions*, 1-16.

Dijk, I. van, de Nooijer, L. J., & Reichart, G. J. (2017).
Trends in elementa incorporation in hyaline and porcelaneous foraminifera as a function of pCO₂. *Biogeosciences*, 14(3), 497.

Graaf, M. de, Houtepen, E., Tichelaar, E., Miller, D.C.M., Brunel, T., Nagelkerke, L.A.J. (2016)
Status and trends reef fish and coastal fisheries Bonaire (Caribbean Netherlands): report card 2014-2015, Wageningen Marine Research (University & Research centre), Wageningen Marine Research report Co87/16. 73pp.

Hoeksema, B. W., & Fransen, C. H. (2017).
Host switch by the Caribbean anemone shrimp *Periclimenes rathbunae* in Curaçao. *Coral Reefs*, 1-1.

Hoeksema, B.W., J.D. Reimer, R. Vonk (2016)
Editorial: biodiversity of Caribbean coral reefs (with a focus on the Dutch Caribbean), *R. Mar Biodiv*, doi: 10.1007/s12526-017-0641-3

Lemaitre, R. (2017).
Discovery of a new species of hermit crab of the genus *Pylopaguropsis* Alcock, 1905 from the Caribbean: "den commensal" or "cleaner"? (Crustacea, Anomura, Paguridae). *ZooKeys*, (646), 139.

Nagelkerke, L.A.J. (2016)
Fish communities and fisheries of the Dutch Caribbean: status and trends, Abstract in scientific journal of proceedings, 1st Annual AcroporaNet Symposium

Niedbala, W., & Ermilov, S. G. (2017).
New species of ptyctimous mites (Acari, Oribatida) from the Caribbean. *Systematic and Applied Acarology*, 22(2), 241-252.

Van Tienderen, K. M., & van der Meij, S. E. (2017).
Extreme mitochondrial variation in the Atlantic gall crab *Opecarcinus hypostegus* (Decapoda: Cryptochiridae) reveals adaptive genetic divergence over *Agaricia* coral hosts. *Scientific Reports*, 7.

Verhey, N. (2016)
Restoring the dry ecosystem of Bonaire, International network for seed-based restoration

Student Reports

Hildebrand, J. (student), Graaf, M. de (supervisor), Hylkema, A. (tutor) (2017)
Status and trends of the coral reef ecosystem around Saba 2016 – Netherlands Antilles, A report based on four benthic health indicators of the GCRMN method

Oleana, S. (student), Postma, F. (thesis supervisor), Dam, M. van., Holm, G. (client supervisor) (2016)
An insight into Saba's heritage properties for the purpose of World Heritage nomination

"Vlugt, C. van der (Msc. student), Nagelkerke, L. (supervisor), Graaf, M. de (supervisor) (2016)
Status and trends of coral reef health indicators on Saba (Caribbean Netherlands)"

These reports and publications can be found in the Dutch Caribbean Biodiversity Database (DCBD) (<http://www.dcbd.nl>). The DCBD is a central online storage facility for

all biodiversity and conservation related information in the Dutch Caribbean.

If you have research and monitoring data, the DCNA secretariat can help you to get it housed in the Dutch Caribbean Biodiversity Database (DCBD). *Please e-mail us: research@DCNANature.org*

Calendar



December

4-17	Conference	"Thirteenth meeting of the Conference of the Parties to the Convention on Biological Diversity, Cancun, Mexico"
6	Symposium	"Sustainable Caribbean", the Palacae on the Dam, Amsterdam, the Netherlands"
8	Symposium	Saba Bank Symposium, Den Helder, the Netherlands

January

5	Event	Natural Bird Day
11-20	Expedition	Research expedition Smithsonian Institute, CuraSub, Bonaire
24-26	Workshop	"Commonwealth Marine Economies Programme (CME Programme)
28	Event	Annual Roost Count (Yellow-shouldered Amazon parrots) Echo, Bonaire

February

2	Event	World Wetlands Day
6	Event	Dutch Postcode Lottery Gala, the Netherlands
8	Webinar	Coral Spawning Research and/or Larval Propagation in the Caribbean (http://www.reefresilience.org)
6-10	Conference	European Conference of Tropical Ecology, Brussels, Belgium
7-9	Workshop	"Inception Workshop of project GCP/SLC/202/SCF "Climate Change Asaptation for Eastern Caribbean Fisheries", Barbados"
15	meeting	10th meeting of the IAC Consultative Committee, Washington, DC
17-20	Event	Great Backyard Bird Count, Worldwide (http://gbbc.birdcount.org)
20-24	Meeting	Sustainable Ocean Initiative (SOI) Capacity-Building Workshop for the Wider Caribbean and Central America, Coasta Rica
21-23	Meeting	Caribbean Sustainable Development Forum, Aruba
21-23	Symposium	UN Bahamas Symposium on Implementing the 2030 Agenda for Sustainable Development in Small Island Developing States (SIDS), Bahamas
20-24	Workshop	"CBD Sustainable Ocean Initiative (SOI) Capacity-Building Workshop for the Wider Caribbean and Central America – San José, Costa Rica"
21-23		"CBD Sustainable Ocean Initiative (SOI) Capacity-Building Workshop for
20-24		the Wider Caribbean and Central America – San José, Costa Rica"

Calendar



Photo by: © Kai Wulf

March

3	Event	"World Wildlife Day
11	Meeting	First meeting Animal Welfare Dutch Caribbean by stichting Dierenlot, Red Palm Village, Bonaire
13	Meeting	3rd Meeting of the Contracting Parties to the Protocol Concerning Pollution from Land-Based Sources and Activities in the Wider Caribbean Region (LBS), French Guiana
14	Conference	SPAW 9th Conference of Parties, French Guiana
15-17	Meeting	17th Intergovernmental Meeting of the Caribbean Environment Programme, French Guiana
21	Event	World Planting Day
21-23	Meeting	Wider Caribbean Sea Turtle Conservation Network (WIDECAST) annual meeting, Curacao
21-23	Meeting	DCNA Board Meeting, St. Eustatius
22	Event	World Water Day
31-Mar	Event	Visit of Her Royal Highness Princess Beatrix of the Netherlands, patron of DCNA, to FPNA, Aruba to launch expansion of Aruba's National Park.

April

3-4	Course	Spaans Lagoon management and capacity building plan, Aruba. Invite extended by FPNA to Dutch Caribbean Park Managers to participate.
11-13	Meeting	Meeting of the WECAFC/OSPESCA Working Group on Sharks under project GCP/SLC/013/USA Conservation and Management of Sharks and Rays in the Wider Caribbean Region, Barbados
21	Event	World Fish Migration Day
22	Event	Earth Day
26-28	Meeting	Forum of the Countries of Latin America and the Caribbean on Sustainable Development (LAC RFSD), Mexico City, Mexico

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Ministry of Economic Affairs,

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Editorial Letter

L.E. Becking & H.W.G. Meesters (2017) Saba Bank Symposium: summary and recommendations. Wageningen Marine Research, Policy Letter 1700555 JA-bc /BO-11-019.02-008

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These reports and publications can be found in the Dutch Caribbean Biodiversity Database (DCBD) (<http://www.dcbd.nl>). The DCBD is a central online storage facility for

all biodiversity and conservation related information in the Dutch Caribbean.

If you have research and monitoring data, the DCNA secretariat can help you to get it housed in the Dutch Caribbean Biodiversity Database (DCBD). *Please e-mail us: research@DCNANature.org*

