

BIONEWS

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Editor's Letter

Dutch Caribbean, October 2018

We start this BioNews edition with some excellent news: St. Eustatius has now become part of the "Yarari" Marine Mammal and Shark Sanctuary. The Yarari Sanctuary comprises all the waters of Bonaire, Saba and St. Eustatius and is intended to provide "a fine place" for marine mammals and sharks, where they will receive the necessary attention to ensure they are optimally protected.

The Economics of Ecosystems and Biodiversity (TEEB)-study that was finalized this year, by Wolfs Company together with Yabi Consultancy, provides insight in the value of nature to Aruba's economy. Aruba's natural capital value for tourism, culture, fishing and carbon exceeds US\$ 287 million per year with tourist expenditures contributing US\$ 269 million. These results highlight the importance of Aruba's nature to the well being of its people and economy.

During the NICO expedition 100 scientists spread out over 7 months from a wide range of research disciplines studied five ocean provinces including the Caribbean Sea. In March 2018 the research vessel arrived at the Dutch Caribbean Windward Islands (Saba, Saba Bank and St. Eustatius) where the last NICO expedition projects in the Dutch Caribbean took place. In this BioNews edition you can read about the first findings from the sixth leg of the expedition. The researchers mapped for the first time the seabed of the windward sides of Saba and St. Eustatius and further investigated what is believed the richest biodiversity area in the entire Dutch Kingdom: the Saba Bank.

The St. Maarten Nature Foundation recently researched the impacts of Hurricane Irma on St. Maarten coral reefs using Global Coral Reef Monitoring

Guidelines. They found that the general coral cover is reduced, but the Man of War Shoal Marine Protected Area showed greater resilience than reefs outside of the protected area.

We are also pleased to share findings from the interdisciplinary Circulation (Traveling Seagrasses in the Caribbean Sea) project. Last year Dr. Lucy Gwen Gillis and Dr. Rapti Siriwardane-de Zoysa visited Bonaire and Jamaica to explore together with Drs. Sabine Engel (via STINAPA) dynamics around the arrival, spread and management of a non-native seagrass species *Halophila stipulacea*, in comparison with an older native and so-called 'nuisance' species - the macroalgae *Sargassum* sp. The scientists mapped stakeholder perspectives, which offered diverse and nuanced perspectives on marine invasive and nuisance species, offering both local as well as regionally embedded visions and management strategies.

Lastly you can read about a valuable meeting on sustainable fisheries management. Representatives from 15 Caribbean marine national parks met last month on the island of Saba to focus on their role in contributing to sustainable fisheries. Marine protected areas (MPAs) play an important role in sustainable fisheries management by ensuring healthy local reef fish populations through e.g. the implementation of no-take fisheries regulations, such as in Saba National Marine Park, Statia Marine Park and Bonaire National Marine Park.

Happy reading!
The DCNA Team

St. Eustatius joins Yarari Marine Mammal and Shark Sanctuary

Excellent news: St. Eustatius has now become part of the "Yarari" Marine Mammal and Shark Sanctuary. St. Eustatius joined Bonaire and Saba when the Minister of Agriculture, Nature and Food Quality Mrs Carola Schouten and the Government Commissioner of St. Eustatius, Mr Marcolino Franco signed the Yarari declaration on September 20, 2018.

The number of Caribbean territories establishing a marine mammal and shark sanctuary is growing as the importance of these sea creatures becomes better understood. The next step is to implement monitoring and conservation practices. St. Eustatius National Parks Foundation (STENAPA)'s Marine Park Manager Jessica Berkel and Marine Park Ranger Francois Mille are eager to use their training to protect the various marine mammals and shark species found in the Dutch Caribbean waters.

"Marine mammals and sharks play an important role in the marine environment. Where there are more sharks, there are – contrary to what you might expect – more fish as well. That makes the established sanctuary important for the fishermen on the island", says Berkel.

The "Yarari " Marine Mammal and Shark Sanctuary was established in the Caribbean Netherlands on September 1, 2015. The name of the Sanctuary "Yarari" is an Taíno Indian word, meaning "a fine place". The Yarari Sanctuary comprises all the waters of Bonaire, Saba and St. Eustatius and is intended to provide "a fine place" for marine mammals and sharks, where they will receive the necessary attention to ensure they are optimally protected.

The Yarari Sanctuary will also participate in the CARI'MAM project, which kicks off in October this year and aims to develop a network of marine protected areas dedicated to the conservation of marine mammals in the Greater Caribbean and beyond. This network will aim at strengthening managerial skills and developing common tools for management and evaluation purposes. Furthermore, the proposed network includes a focus on the development of respectful, sustainable commercial operations for the observation of marine mammals (whale watching) across the Caribbean, compatible with marine mammal conservation.



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Aruba's Value of Nature

There is a strong link between economy and nature in the Dutch Caribbean due to our economic dependence on nature-based tourism. TEEB Aruba - The Economics of Ecosystems and Biodiversity- study that was finalized this year, by Wolfs Company together with Yabi Consultancy, provides insight in the value of nature to Aruba's economy. Aruba's natural capital value for tourism, culture, fishing and carbon exceeds US\$ 287 million per year with tourist expenditures contributing US\$ 269 million. These results highlight the importance of Aruba's nature to the well being of its people and economy.

In September 2015 Aruba and many other countries have adopted the 17 Sustainable Development Goals (SDGs), set by the United Nations, to put an end to poverty, inequality, and climate change by 2030. To reach these global goals Aruba needs to balance out three interconnected fields; social welfare, economic responsibility and ecological resilience.

In order to make sound decisions about the management of Aruba's ecosystems – which includes coastal marine ecosystems such as mangroves, coral reefs and seagrass beds – it is necessary to estimate the socio-economic value that these ecosystems provide to Aruba. The objective of the TEEB study was to quantify and integrate the value of the island's natural capital in long-term planning contributing to a sustainable economic development of the island. Wolfs Company have conducted similar TEEB studies on various Caribbean islands such as Bonaire, Saba, St. Eustatius and The Cayman Islands (Yabi, 2017).

Aruba is a very popular tourist destination within the Caribbean because of its warm climate and varied landscape including white beaches, coral reefs, mangroves, tropical shrubs and dry forests. Aruba depends on tourism and tourism depends on the natural capital. A natural capital assessment of tourist expenditures derived US\$ 269 million in value. The growth, employment benefits and economic rewards of the tourism industry are related to Aruba's environmental attributes. The coastal marine environment is especially important for the tourism sector on Aruba, which is the

main economic pillar of the island (Yabi, 2017). Loss of nature could result in a 50% decrease in visitor numbers. Half of all 1.6 million visitors indicated that they were prepared to pay additional fees for improved nature protection on the island (Polaszek et al., 2018).

Aruba's local population values nature highly. Over 80% of approximately 400 household surveyed want more natural history and cultural heritage to be taught in schools. Also, increased sized (marine) protected areas and increased fish catch were indicated as priority services. Aruba's inhabitants want to see a larger share of government budget going towards nature protection (Polaszek et al., 2018).

The small fishing industry on Aruba provides its related natural capital with a value of US\$ 4.45 million including 36% deriving from recreational fishing activity and nearly 50% from illegal fishing.

Carbon sequestration refers to the process of capture of carbon dioxide and its long-term storage (Zarate-Barrera & Maldonado, 2015). It has been proposed as a way to mitigate the effects of climate change from land use changes and burning of fossil fuels. Aruba's mangroves, tidal salt marshes, seagrass beds, tropical shrubs and dry forests are considered carbon sinks. Carbon sequestration value on Aruba is estimated to be worth nearly US\$ 109,000 per year mainly contributing to the tropical dry forest in the northwest of the island.

Want to know more?

TEEB Aruba:

wolfscompany.com/teeb-aruba-2/

Infographic TEEB Aruba:

create.piktochart.com/output/30531567-teebaruba

TEEB Bonaire:

wolfscompany.com/sem-porta-mollis-parturient/

TEEB Saba:

wolfscompany.com/teeb-saba/

TEEB St. Eustatius:

wolfscompany.com/teeb-st-eustatius/

Mapping and Studying Changing Coral Reefs: Is the Saba Bank still growing?

Researchers aboard the Pelagia research vessel have been collecting invaluable data on the Windward islands in the Caribbean during the sixth leg of the “Netherlands Initiative Changing Oceans (NICO)” marine expedition organized by the Royal Netherlands Institute for Sea Research (NIOZ Sea Research) and NWO-Science (ENW). They mapped for the first time the seabed of the windward sides of Saba and St. Eustatius and further investigated what is believed the richest biodiversity area in the entire Dutch Kingdom: the Saba Bank.

NICO expedition

During the NICO expedition 100 scientists spread out over 7 months from a wide range of research disciplines studied five ocean provinces (North Sea, Atlantic Ocean, Caribbean Sea, Gulf of Mexico and Bay of Biscay) with the aim to get a better understanding of our changing seas and oceans. This information is essential to make decisions on how to respond to climate change impacts such as rising sea levels and temperatures and ongoing acidification and eutrophication (NIOZ, 2018).

In March 2018 the research vessel arrived at the Dutch Caribbean Windward Islands (Saba, Saba Bank and St. Eustatius) where the last NICO expedition projects in the Dutch Caribbean took place.

Studying the Windward Islands

Fleur van Duyl (NIOZ Sea Research) and Erik Meesters (Wageningen Marine Research (WMR)) were the chief scientists of the sixth leg of the NICO expedition. An advantage was that their research team gained already much experience from previous expeditions to the Saba Bank.

Saba Bank

The Saba Bank is a submerged carbonate platform rising from a depth of 1.5 km. As a known biodiversity hotspot, the Saba Bank is of special interest to scientists because it has remained relatively pristine thanks to its remote location. Since 2011 several research expeditions by WMR

and NIOZ Sea Research took place to assess the state of the fisheries, coral reef health and shark populations (Bos et al., 2016; DCNA, 2017).

Growing or eroding?

Saba Bank’s coral reefs have suffered as well in recent decades from elevated seawater temperatures induced by global warming which resulted in Caribbean-wide bleaching events. During the bleaching event in 2005 the Saba Bank lost over 50% of its coral cover. In combination with ocean acidification and increased marine pollution, these environmental changes have reduced the capacity of corals to compete with other benthic organisms such as algae, cyanobacteria and sponges which can rapidly invade dead or weakened coral surface (Webb et al., 2018). The research team aims to understand the interaction between the environment and coral reef functioning and determine if and how a community shift changes the balance between calcium-carbonate accretion and eroding processes. In other words: Is the Saba Bank growing or eroding and which factors can explain these processes?

The carbonate budget

To answer these questions, different experiments and (long-term) measurements were taken by NIOZ Sea Research and WMR since 2011. During the NICO expedition the research team further investigated the carbonate budget –that is the coral growth (carbonate production) versus coral breakdown (carbonate erosion) budget of the overall Saba Bank (Webb et al., 2018).

To do so, they measured the chemistry of the seawater overlying the reef (including dissolved inorganic carbon concentrations and alkalinity, nutrients, phytoplankton, virus, salinity and oxygen levels) with CTD units and a new type of water sampler called Pumpy which can take simultaneous measurements from 2m to 10 cm above the bottom. The method is based on the principle that coral growth (calcium carbonate production) locally extracts dissolved carbon from the seawater surrounding the coral. On the other hand, bio-eroding organism such as sponges and worms break down the coral’s carbonate skeleton

which results in carbon release into the seawater. The measured dissolved carbon concentrations in seawater above the reef provides information on the overall reef growth/erosion rate and allows to quantify spatial and temporal variations (Webb et al., 2018).

Different benthic communities

On the Bank the chemistry dynamics were measured at seven stations with different reef habitat types including coral-, macroalgae-, crustose coralline algae (CCA) - and sand dominated communities located between 15 and 34m depth. The researchers further investigated the benthic-pelagic (seabed-ocean water) coupling of the different benthic habitats by taking measurements on organic matter (bio)deposition, mineralization, marine microbe community and oxygen dynamics in the benthic boundary layer (van Duyl and Meesters, 2018). This will provide insights in the processes influencing the community shifts from corals and CCA to more fleshy algae, cyanobacteria and benthic suspension feeders.

Mapping the seabed

Maps of our marine environment provide important information on the location of different ecosystems and help to identify areas of high conservation value. The remote windward sides of Saba and St. Eustatius have not been mapped before. The research team mapped for the first time the largely unknown benthic communities and bathymetry (topography of the seabed) on the windward sides with video transects and the multibeam echo sounder (see BioNews 13 for more information on bathymetry). Because of its high exposure the ecosystems here mostly thrive in the mesophotic region (more than 30 meters depth). Also the researchers expanded the mapping of different habitats (from 10 until 100m depth) and bathymetry on the Saba Bank with the aim to link the benthic habitat descriptions that result from the mapping to benthic metabolism (van Duyl & Meesters, 2018).

First findings

Hidden landscapes

The total of 25 km of photos and videos that were recorded on the Windward Islands show a large variety of habitat types including areas with patches of seagrass and coral-, algae-

and (volcanic) sand dominated communities (van Duyl & Meesters, 2018).

Very excited were the researchers about the first journey of exploration into two deep sinkholes at the northern part of the Saba Bank called the Luymes Bank. The large holes in the carbonate bottom have been created during periods that the bank was above sea. These holes range from 100m to several kilometers in diameter and are 100-300m deep. The researchers sent video equipment down these sink holes. At the bottom a mysterious landscape was encountered: a large community of calcareous algae that consists of thousands of little pillars that are between hundred and thousand years old (van Duyl & Meesters, 2018; Heinsman, 2018).

Healthy reefs

The researchers also discovered an extreme healthy reef in the southern part of the Saba Bank at 30 meters depth. A hopeful finding that there are still healthy reefs thanks to the Saba Bank's remote location.

For safeguarding Caribbean reefs action is urgently needed. Local stressors have been identified as the most significant drivers of reef degradation throughout the Wider Caribbean, particularly overfishing, introduced species, coastal development and pollution associated with increases in tourism visitation and local populations (Jackson, 2014). With effective conservation measures in place and management of the island's marine resources in the hands of dedicated professionals, there appears to be good prospects for their survival particularly if there is a political willingness to continue to protect them from harm.

The need to increase the resilience of our coral reefs has never been more pressing. Coral reefs are marine biodiversity hotspots that are not only invaluable for coastal protection but also have a high economic value through associated tourism and fisheries. The Dutch Caribbean islands are particularly dependent on the health of the coral reefs due to our economic dependence on nature-based tourism.

The Saba Bank

The Saba Bank is a large flat-topped seamount rising from a depth of 1.5 km. The upper area of the Saba Bank covers an area of +/- 268.000 hectares, an area roughly the size of the Dutch part of the Wadden Sea or, more evocatively, about the same size as Luxembourg (DCNA, 2017).

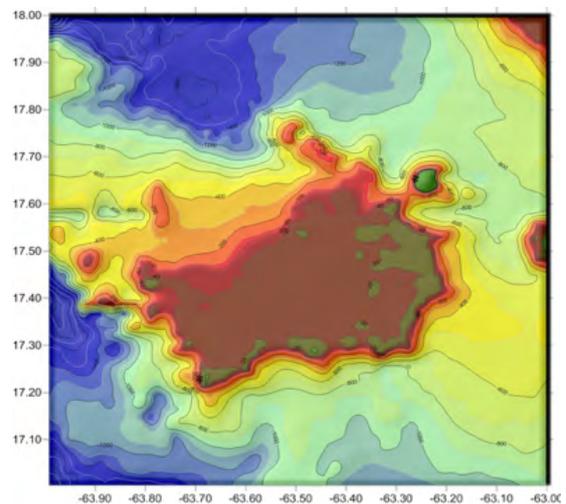
Most of the Bank lies at depths of 20 to 50 meters, but a considerable area to the east lies between 10 and 20 meters and has extensive reef development (Meesters et al., 1996). It reaches a plateau at a depth of about 15 m (Klomp and Kooistra, 2003).

Van der Land firstly explored the Bank in 1972. In 2010, after the constitutional change, the Saba Bank became the direct responsibility of the Netherlands. Since that time considerable resources have been spent on the Saba Bank including several research expeditions by Wageningen Marine Research and NIOZ Sea Research to assess the state of the fisheries, coral reef health and shark populations (Bos et al., 2016; DCNA, 2017).

Considered to be one of the world's marine biodiversity hotspots (Church and Allison, 2004), the Saba Bank is recognized under the Convention of Biological Diversity (CBD) as an Ecologically and Biologically Significant Area (EBSA). The Saba Bank

was listed as a protected area of regional importance under the SPAW-protocol (Protocol Concerning Specially Protected Areas and Wildlife of the Wider Caribbean) and designated as the world's 13th Particularly Sensitive Sea Area (PSSA) by the International Maritime Organisation (IMO) in 2012. In the same year it was officially declared a National Park, making it the largest National Park in the Netherlands (DCNA, 2017; DCNA, n.d.).

More information on the Saba Bank and previous expeditions can be found in the special edition of BioNews:
<https://www.dcnanature.org/wp-content/uploads/2018/09/BioNews-SabaBank-2.pdf>



Map of a large submerged carbonate platform: the Saba Bank. The island Saba is the "green dot" on the right. Image credit: Gerard Duineveld (NIOZ Sea Research)

More information on the NICO expedition:

www.nico-expeditie.nl

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St. Maarten: Post Hurricane Coral Assessment

The St. Maarten Nature Foundation scientifically researched the impacts of Hurricane Irma on St. Maarten coral reefs using Global Coral Reef Monitoring Guidelines. They found that the general coral cover is reduced, but the Man of War Shoal Marine Protected Area showed greater resilience than reefs outside of the protected area.

Reef monitoring data has been scientifically analysed to assess the impacts of hurricanes Irma and Maria on St. Maarten's coral reefs following the Global Coral Reef Monitoring Network (GCRMN) guidelines. The hurricanes caused reduction in coral cover on St Maarten reefs; however reef health improved due to a decrease in coral bleaching.

Unfortunately, macro algae cover increased after the hurricanes. This high algae cover threatens coral recruitment and coral growth. Caribbean coral reefs have been deteriorated to a macro algal state due to several factors such as the die off or overfishing of herbivores (such as parrotfish), climate change, human and natural disasters. Three months after the hurricanes water quality was decreased on all our reefs, water visibility was reduced by about sixteen meters.

"Coral cover (hard corals) has been significantly reduced from 6.1 % to 3.7% since the passage of the hurricanes, which is unfortunate but expected considering the intensity of Irma. Coral cover is still higher than observed in 2016 (3.5%). Scientific research found that coral cover mostly declines the year after large hurricanes, therefore we are concerned to observe a larger reduction of coral cover for this year. The decrease in coral bleaching could be favourable for the health of our corals and is likely caused by the lower sea water temperatures and the decreased visibility after the storms. We are worried about the higher algae cover, this could deteriorate our coral reefs even more" explained Nature Foundation's Projects Officer Melanie Meijer zu Schlochtern.

The strong surge and swells of the storms caused gorgonian corals (soft corals) and fleshy algae to be ripped off from our reefs, leading to more

exposure of coral recruits, sponges and calcareous coralline algae (CCA). After the hurricanes higher carnivorous fish biomass was found on the reefs. This increase of larger fish, especially groupers and snappers, was found to be extraordinary high in the Marine Protect Area's mostly healthy reefs, such as Proselyte Reef and Mike's Maze. Herbivorous fish biomass did not change significantly after the hurricanes, however fewer fish species were found.

"More accessible CCA can be profitable as it is used by juvenile corals to settle on and these juveniles can grow into larger corals and build our next generation of coral reefs. Larger pelagic fish can travel long distances. They may look for the best shelter against the impacts of the hurricanes and therefore moved to the reefs with the highest coral cover to find their needs", stated Achsah Mitchell GCRMN data analyst.

The results of the St Maarten's reef monitoring also show the significance of protecting our reefs, as coral reefs in the Marine Protected Area performed better and are healthier, with higher coral, gorgonian coral, CCA and sponge cover compared to other St Maarten Reefs outside the protected area. Reefs outside of the Marine Protected Area had significantly more macro algae cover than reefs within the Park. Also, greater densities of coral recruits, which indicate a greater number of healthy and reproducing corals, were found. Moreover, carnivorous fish and herbivorous fish had a greater biomass within the Marine Protected Area.

"If we do not protect our coral reefs, health, fish biomass and coral cover will decrease and our reefs will shift to a macro algae state. Algae cover was the lowest inside the Marine Protected Area, showing us the effectiveness of protecting our coral reefs. Our results demonstrate clearly the importance of our Marine Protected Area 'Man of War Shoal' for our fish stocks and coral reef preservation" stated Nature Foundation's Projects Officer Melanie Meijer zu Schlochtern.

The entire country benefits from reefs with higher coral cover and lower macro algae, these

reefs are also more resilient regarding disaster events, such as Hurricane Irma. “*The reefs in the Marine Protected Area showed greater resilience to hurricanes than reefs outside the protected area. Especially the lower macro algae cover makes reefs better suited for coral growth and recruitment and would therefore have a higher resilience for hurricanes and other threats. I recommend increasing coral reef protection, management and monitoring, especially within the Marine Protected Area*” explained Achsah Mitchell GCRMN data analyst.

Every year, the St Maarten Nature Foundation monitors St Maarten’s coral reefs scientifically using the GCRMN method to determine the health, composition and state of St Maarten reefs. With financial support made available by DCNA the Foundation was also able to monitor and analyze the reefs after the hurricanes in 2017.

Several dive sites in the Man of War Shoal Marine Protected Area and other important dive sites around the island were monitored pre-hurricanes in Augustus and post-hurricanes in December 2017. All measurements were conducted along a transect line and repeated five times on each dive site. First, abundance and biomass of all fish species were determined, secondly the cover of reef organisms (corals) were analyzed based on photo quadrats made during the dives and photo quadrats were assessed for coral health. Monitoring is also done looking for coral recruitments (juvenile corals) and algae coverage and height. Lastly, invertebrate species were counted and water quality was measured. Results were assessed, scientifically analyzed and interpreted by GCRMN data analyst Achsah Mitchell; the full report can be found in the Dutch Caribbean Biodiversity Database (DCBD).

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Unwelcome guests: Stakeholder perspectives on non-native seagrasses and macroalgal ‘nuisance’ species in Bonaire

By Rapti Siriwardane-Zoysa¹, Lucy Gwen Gillis¹, Sabine Engel² & Inés G. Viana³

Unlike coral reef and mangrove forest ecosystems, public recognition and multiple values of seagrass beds have only but recently been gaining increasing policy attention, particularly with regard to the urgency of their conservation and sustainable management. Dr. Lucy Gwen Gillis and Dr. Rapti Siriwardane-de Zoysa (researchers at the Leibniz Center for Tropical Marine Research/ZMT, Germany) arrived in Bonaire on fieldwork in January 2018, funded by an interdisciplinary project entitled CIRCULATIONS (Travelling Seagrasses in the Caribbean Sea), with Drs. Sabine Engel (via STINAPA) as their main cooperation partner in Bonaire. In combining insights from coastal ecology and multispecies anthropology, the team set out to explore dynamics around the arrival, spread and management of a non-native seagrass species *Halophila stipulacea* in Bonaire and Jamaica, in comparison with an older native and so-called ‘nuisance’ species - the macroalgae *Sargassum* sp.

The CIRCULATIONS project investigates contemporary examples of “positive” species invasions - or those that are perceived in more ambivalent terms. To this end, the scientists mapped stakeholder perspectives of the macroalgae *Sargassum* sp. (a suspected invasive) that has gained a lot more scientific and possibly media attention, as opposed to the relatively slower (and less politicized) ‘creep’ of the *Halophila stipulacea*, an invasive seagrass. While tracing their ecosystem functions and services, including the trajectories of arrival and planned management strategies, they also studied similarities and differences between Bonaire and Jamaica, as countries that have been impacted by the spread of a *Sargassum* sp- i.e. the macroalgae that is deemed to be clearly problematic in more ways than one. Whilst only Bonaire has been affected by non-native seagrass *Halophila stipulacea* with a presence that is at times narrated more ambivalently. However, it is only a matter of time before Jamaica is affected by the invasive *H. stipulacea*.

They interviewed a range of stakeholders spanning state agencies, scientists, NGOs, community-based organizations and businesses which included representatives from the Ministry of Agriculture, Nature and Food Quality (LNV), the department of Spatial Planning and Development (unit Nature and Environment) of the Public Entity of Bonaire (DRO), the DCNA, STINAPA, a recently formed fisher cooperative- Piskabon, Sea Turtle Conservation Bonaire (STCB), a divers' group, Jibe City, the WindSurf Place, and the Mangrove Centre. The stakeholders interviewed offered diverse and nuanced perspectives on marine invasive and nuisance species, offering both local as well as regionally embedded visions and management strategies. Meanwhile more interviews are being planned remotely, with stakeholders who the researchers could not meet during their first visit; the in-depth interviews were also combined with field visits to Klein Bonaire and a boat tour of mangrove spaces on the main island (organized by STINAPA).

The team presented their work at the DCNA on Tuesday evening as a public talk within the collaborative frame of the STINAPA-DCNA lecture series "Connecting People to Nature". The talk was entitled "Arrival Tales: Are stakeholder perceptions of the invasive seagrass *H. stipulacea* more positive compared to an older invasive predecessor the macroalgae *Sargassum* sp.?, followed by a lively discussion. They also worked closely with a Junior Rangers group, completing an interactive workshop at Lac Bay.

The diverse stakeholder perspectives revealed a high degree of ambivalence with regard to the management of *Halophila stipulacea*, which was first monitored by STINAPA between 2010/2011, and was earlier recorded in St. Maarten. What remains a core concern is the rapid increase and spread of this non-native seagrass particularly in spaces bereft of native *Thalassia testudinum* (turtle grass), together with its monitored encroachment into mangrove spaces around Lac Bay. Especially the effect this invasive species may have on ecosystem services and functions. Moreover, unlike the management of invasive and highly predatory lionfish across the Caribbean Sea, the removal of non-native seagrasses is perceived as being an immense challenge. As *H. stipulacea* is interlaced with native species, thus selective uprooting could undermine existing efforts at controlling their spread as fragments

will be dispersed in the process.

Moreover, unlike more aesthetically appealing and visible 'charismatic' ecosystems such as coral reefs and mangrove forests, there is scant public awareness (among locals and visiting tourists alike), when it comes to differentiating seagrasses from algae – particularly as they tend to be generically referred to as "seaweed". Indeed, public engagement in the eradication of lionfish (at least in shallower depths), were primarily successful due to the adventure and adrenaline rush that hunting was said to have brought.

The ecological importance of seagrass beds (and their public awareness) were linked to ongoing efforts in the conservation of turtles, as one of the island's flagship species – rather than an ecosystem in its own right unlike Bonaire's coral reefs and mangrove forests.

Perceptions towards its arrival could be clustered into four distinct groups of narratives and viewpoints as diversely expressed by policymakers, scientists, local fisher groups, and tour operators entailing dive, kayaking and windsurfing operators:

a) **Ecologically cautionary:** its presence being classified as negative was often framed in relation to the rapidity and ease at which it spread, also in relation to colonizing connective coastal ecosystem spaces such as within and around mangrove forests and patches in existing seagrass beds; the macroalgae *sargassum* was in contrast seen as native but more as a 'nuisance' species because of its multi-sensory implications – mainly with regard to smell and its effect on shoreline aesthetics. Sea grass on the other hand is harder to be spotted and smelled (unlike *sargassum*), hence scientists may have to work harder in communicating its presence to policy makers and the wider public;

b) **Ambivalent:** *Halophila stipulacea* could well become a 'frontier species' (with positive benefits in offering more options for turtle feeding and as nurseries for fish), particularly *sargassum* and any seagrass were positively perceived as inviting fish diversity; in spaces in which *Thalassia* sp. is seen to be overgrazed. However comparisons of nutritional values between these native and non-native seagrasses across turtle species remain understudied;

c) **Unselectively beneficial:** Despite incidents of both *sargassum* and seagrasses getting entangled with motors and nets, seagrasses in this context remained undifferentiated;

d) **Indifferent:** *Halophila stipulacea* could only be seen below water, and was therefore not a core concern among wind and kite surfers; however the presence of any seagrass meant that accessibility to shallower spaces were limited, and often resulted in their trampling. Moreover recreational users tended to perceive seagrass not as a distinct ecosystem in itself but more as a terrestrial 'weed' – rather with the same degree of mundanity assigned to those on a garden lawn;

e) **Opportunistically adaptable:** a few dive-related and other tour operators insinuated the possibility of adding more socio-economic values/functions through activities such as "seagrass snorkelling", which may eventually become as popular as reef diving or mangrove kayaking.

The findings also revealed how perceptions of species invasion in general, came to be entangled within Bonaire's existing landscape of policy concerns and challenges. Apart from concerns raised over the increasing population density after 2010 with cross-continental migrants and second-home owners moving to the island from Europe and North America, the exponential increase of cruise tourists en masse that contribute to further pressures placed on coastal ecosystems. Moreover, Bonaire's historic overemphasis on managing more terrestrially-invasive and nuisance species – from neem trees and its birdlife, to its highly politicised feral mammal (e.g. donkeys, pigs) and free-roaming livestock (i.e. goats) may well change over time given the ongoing process in securing UNESCO World Heritage status for Lac Bay.

Moreover, the preliminary fieldwork findings draw attention to how nuances in meanings (and historic transformations) inherent in identifying, labelling and in selectively 'red-alerting' implications of non-native species shape public perceptions and policy priorities that in turn change over time. What makes a non-native an 'invasive' is not merely an ecological question, but also presents a host of socio-economic and political puzzles in terms of how the diverse futures of island seacoasts are eventually imagined and contested by its public, scientists and policymakers. As a marine researcher aptly stated during a public discussion, "*we (as scientists) always have to be careful why we say it, how we say it, and to whom we say it to - when you spin a story...*"

Acknowledgments

The authors gratefully acknowledge a host of stakeholders who lent their time and patience in discussing a range of issues during a spate of in-depth interviews in January 2018. All interviews and informal discussions have been duly anonymised. We also thank Dr. Demian Willette, Loyola Marymount University – also a partner of the CIRCULATIONS project – in offering guidance in relation to the fieldwork.

Meanwhile, organizations and individuals interested in contributing to the ongoing study (by offering their insights and perspectives) are encouraged to contact Rapti Siriwardane (rsi@leibniz-zmt.de) or Lucy Gillis (lucy.gillis@leibniz-zmt.de).

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Caribbean Marine Park Managers Dive into Fisheries Management

Representatives from 15 Caribbean marine national parks recently met on the island of Saba in the Caribbean Netherlands to focus on their role in contributing to sustainable fisheries.

Hosted by the Saba Conservation Foundation, this regional gathering included park managers from Saba, Sint Eustatius, Bonaire, the British Virgin Islands, the Turks & Caicos Islands, Honduras and Belize. The park managers were joined by fishers, fisheries policy advisors and fisheries data officers from Bonaire, Saba and Sint Eustatius, plus fisheries scientists from the US and Mexico, and regional NGO and academic partners.

Marine protected areas (MPAs) are an important tool in fisheries management. Large, multi-use MPAs such as the Saba Bank National Park, Cayos Cochinos Marine Natural Monument in Honduras and Port Honduras Marine Reserve in Belize play a key role in ensuring sustainable local fisheries harvests.

Mrs. Celia Mahung, Executive Director of the Toledo Institute for Development and Environment comments: *"In Belize, fishers are allocated specific fishing areas, based on historical use, and they also have access to deep water fishing. MPA co-managers work on creating awareness of regulations and ensuring compliance to build sustainable fisheries for future generations."*

"We cannot do this on our own", says Mrs. Mahung. "Fishers in turn help us by recording catch data, and a combination of local knowledge and science is used in adaptive management for commercial species. MPA managers, leaders of fishing organizations and international partners work with the Belize Fisheries Department to make sound decisions about sustainable levels of catch and to ensure the implementation of best practices for wise fisheries management," she explains.

Smaller marine protected areas also have an important role to play in ensuring healthy local reef fish populations through the implementation of no-take fisheries regulations, such as in Saba National Marine Park, Statia Marine Park and Bonaire National Marine Park. These parks support valuable tourism industries associated

with diving and snorkelling. They also contribute to sustainable fisheries by protecting large and highly reproductive fish within park boundaries, whose young then spill over into surrounding fishing areas.

Statia Marine Park Manager, Ms. Jessica Berkel, explains: *"Our marine parks bring about positive benefits for tourism and for fisheries, but as managers we face many challenges. Effective enforcement is needed to ensure that fish can grow and reproduce, and to ensure protection of the largest, most fertile fish and lobsters. In some parks, pressure from recreational fishing can be high but goes unmonitored. Meaningful communications with park users and dynamic education programs for youth are essential."*

"By exchanging ideas and sharing expertise with other managers we can keep pace with advances in fisheries management in the region, such as new enforcement strategies and technology, and community programs for research and monitoring. We can see how to better support monitoring and management actions to protect coral reef ecosystems in our own parks."

Parks Manager at the Saba Conservation Foundation, Mr. Kai Wulf, comments about the meeting: *"We've gained new insights into fisheries biology, ecology and management strategies from top regional fisheries scientists. Visiting Mexican lobster specialist, Dr. Eloy Sosa Cordero, was impressed by the fisheries data we've collected on Saba and was enthusiastic about the opportunity we have to apply this data to inform sustainable fisheries."*

"In other countries, fishers and MPA managers have participated in field visits to learn about sustainable fishing practices and share management experiences. Such exchanges, plus small project funding, technical support and sharing of monitoring findings with fishers and communities are among the next steps we look forward to taking," commented Mr. Wulf.

Making the most of the visitors on-island, the Saba Conservation Foundation Junior Rangers participated in a hands-on lobster session with Dr. Sosa Cordero. Some faced their fears and got up close with live lobsters. Others learned what it's like to work as a marine biologist and lobster researcher. They all learned fun facts about the life cycle of lobsters and their distribution throughout the Caribbean.

The meeting was an initiative of the MPAConnect Network which is comprised of marine protected areas in 10 Caribbean countries and territories, working in partnership with the Gulf and Caribbean Fisheries Institute and the US National Oceanic and Atmospheric Administration's Coral Reef Conservation Program, with funding from the US National Fish and Wildlife Foundation. Six regional MPAConnect learning exchanges have been held to date, each bringing together MPA managers from around the Caribbean to share experiences and discuss best practices relating to priority management themes such as marine law

enforcement, protected area financing, coral reef monitoring, and MPA outreach and education programs. For more information please contact mpaconnect@gcfi.org.

About the Gulf and Caribbean Fisheries Institute (GCFI): When the Gulf and Caribbean Fisheries Institute was founded in 1947, the riches in our seas appeared limitless. Originally GCFI helped develop new ways to exploit the region's marine resources and to develop new fisheries based upon this perception of an inexhaustible sea. However, it wasn't long until the degradation of marine resources and threats to regional fisheries were documented. GCFI now works to advance the goals of sustainable use, wise management, conservation, and restoration of fisheries in the region. GCFI provides a platform for the exchange of information and perspectives among decision-makers, scientists, managers, educators, resource users, and students. For more information please visit www.gcfi.org

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CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Birds	Suitability study and re-forestation of exclosures facilitating the Yellow-shouldered Amazon Parrots (<i>Amazona barbadensis</i>) on Bonaire	BON	Echo: Julianka Clarenda
Coral Reef ecosystems	Larval biology of corals and reef microbiology	CUR	Marhaverlab, Curacao: Kristen Marhaver CARMABI
Coral Restoration	Cryopreservation of Caribbean coral species	CUR	Marhaverlab, Curacao: Kristen Marhaver CARMABI
Fisheries	Social Mapping (Funded by WWF-NL)	BON SAB EUX	WWF-NL: Pieter van Baren KITLV: Stacey Mac Donald
Fisheries	Market & Supply Chain Analysis study (Funded by WWF-NL)	BON SAB EUX	WWF-NL: Pieter van Baren The Good Fish Foundation: Michelle Boonstra
Fisheries	Historical fisheries (Funded by WWF-NL)	BON SAB EUX	WWF-NL: Pieter van Baren Terramar Museum Bonaire: Ruud Stelten
Fisheries	Testing and comparing various lionfish traps to study their potential use in a directed lionfish fishery (funded by WWF-NL)	SAB	SCF (SBMU): Ayumi Kuramae Izioka 7Senses: Madelon van Eelderink & Evert-Jan van Hasselt Interns: Michael Beekhuizen and Alex van der Last
Invasive species	Research into mitigation measures for Sargassum Seaweed	SXM	NFSXM: Tadzio Bervoets Government of St. Maarten
Plants	Testing effective ways to grow native plants	BON	Echo: Johan van Blerk
Plants	Germination of seeds of indigenous trees of Curaçao	CUR	CARMABI: John de Freitas
Reptiles	Lesser Antillean iguana nest research (funded by WWF-NL)	EUX	RAVON: Tim van Wagenveld, Ronald Zollinger

Long Term Projects

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Coral Reef Ecosystems	Deep Reef Observation Project (DROP) (ARMS: Autonomous Reef Monitoring Structures)	CUR	Smithsonian: Carole Baldwin
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
Coral Reef Restoration	St. Maarten's Coral Restoration Project	SXM	NFSXM: Tadzio Bervoets, Melanie Meijer zu Schlochtern CRF
Coral Reef Restoration	Development of restoration methods for threatened Caribbean coral species	BON, CUR, SAB	CRF Bonaire: Augusto Montbrun, Francesca Virdis SECORE Project CARMABI: Mark Vermeij UvA: Valerie Chamberland
Coral Reef Restoration	Artificial structures that encourage larvae settlement and discourage the growth of competitor species	CUR	University of Illinois: Amy Wagoner Johnson, Bruce Fouke, Gabriel Juarez San Diego State University: Forest Rohwer CARMABI: Kirsten Marhaver, Mark Vermeij
Database	Dutch Caribbean Species Register: Taxonomic knowledge system Dutch Caribbean (http://www.dutchcaribbeanspecies.org/)	All	Naturalis: Sander Pieterse, Hanco Bakker, Bert Hoeksema
Endemic species	Overview endemic species	SAB EUX SXM	WUR: Dolfi Debrot, Oscar Bos, Rene Henkens Naturalis: Hanco Bakker
Interstitial biodiversity	Moleculair biodiversiteit analysis of marine communities by metabarcoding	EUX	Naturalis: Arjen speksnijder ANEMOON: Niels Schrieken
Invasive species	Global Register of Introduced and Invasive Species GRIIS	All	IUCN Invasive Species Specialist Group ISSG: Shyama Pagad

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Invasive species	CIRCULATIONS (Connectivities between Islands Alters Traveling Invasive Seagrasses)	BON	Development and Knowledge Sociology, ZMT: Rapti Siriwardane Mangrove Ecology, ZMT: Lucy Gillis Algae and Seagrass Ecology, ZMT: Inés González Viana
Marine ecosystems	Taxonomy and biodiversity in Lac Bay	BON	STINAPA Sabine Engel, Caren Eckrich Ecosub: Godfried van Moorsel CEAB: Daniel Martin
Marine ecosystems	Marine species discoveries in the Dutch Caribbean	All	Naturalis: Bert Hoeksema CNSI CARMABI
Marine Litter	Clean Coast Bonaire (Citizen science project, OSPAR methodology)	BON	Boneiru Duradero: Sharon Bol, Carolyn Caporusso
Molluscs	Population dynamics and role in the food chain of the Queen Conch <i>Lobatus gigas</i> in the Dutch Caribbean Territories	EUX, SAB, SXM	WUR: Aad Smaal, Leo Nagelkerke, Martin de Graaf Erik Boman (PhD candidate) SCF (SBMU): Ayumi Kuramae Izioka CNSI
Public Health	DNA waterscan: Monitoring disease vectors in the Caribbean (mosquitoes and midges)	CUR EUX	Naturalis: Klaas-Douwe B. Dijkstra ECPHF: Teresa Leslie CBHRI: Delia-Maria Goilo (NWO DUCAMID project)
Reforestation	Reforestation Project on St. Eustatius	EUX	Mac & Field: Tim van Wagensveld & Stacey Mac Donald STENAPA: Clarisse Buma LVV: Gershon Lopes
Sponges	Bioersion of reefs by coral-excavating sponges	BON,CUR, SAB, EUX	NIOZ: Fleur van Duyl WUR: Erik Meesters, Didier de Bakker (PhD student)
Sponges	The role of sponges as key ecosystem engineers of coral reef ecosystems Pumping iron: can iron availability fuel the sponge loop and affect coral reef community structure? (Misha Streekstra)	CUR	Uva: Jasper de Goeij, Benjamin Mueller CARMABI: Mark Vermeij PhD students: WUR: Misha Streekstra UvA: Sarah Campana*, Meggie Hudspich*, Niklas Korner* * Part of the ERC project "SPONGE ENGINE — Fast and efficient sponge engines drive and modulate the food web of reef ecosystems"

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
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
Coral Reef Ecosystems	Seawater chemistry of CO ₂ system and nutrients as drivers of benthic community structure and carbon metabolism of coral reef ecosystems of different trophic status in the Caribbean	SAB, SABA BANK	NIOZ: Gert Jan Reichart, Lennart de Nooijer, Alice Webb (PhD student) WUR: Didier Bakker
Coral Reef Ecosystems	Benthic-pelagic coupling on coral reefs of the Saba Bank and Saba	SAB, SABA BANK	NIOZ: Fleur van Duyl
Coral restoration	Artificial Reefs On Saba and Statia (AROSSTA)	SAB EUX	VHL: Alwin Hylkema, Marlous Heemstra WUR: Dolfi Debrot STENAPA: Jessica Berkel SCF: Kai Wulf, Aymi Kuramae Izioka CNSI: Johan Stapel Students: Marijn van der Laan, Daniel Heesink, Marit Pistor, Callum Reid, Jan Koschorrek
Environmental	Caribbean island biogeography meets the anthropocene	AUA, BON, CUR, EUX, SXM	VU: Jacintha Ellers, Matt Helmus, Wendy Jesse (PhD. Student), Jocelyn Behm (Postdoc) 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)

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
NWO Projects in the Dutch Caribbean			
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
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	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. CNSI
Invasive species	Global defaunation and plant invasion: cascading effects on seagrass ecosystem services	BON	WUR: Marjolijn Christianen, Fee Smulders (PhD student) Smithsonian: Justin Campbell (coordinator Caribbean wide research project), Olivier Kramer STINAPA: Sabine Engel
Reptiles	Ecology and conservation of green and hawksbill turtles in the Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	RuG: Per Palsbøll, Jurjan van der Zee (PhD student) WUR: Lisa Becking, Marjolijn Christianen STCB: Mabel Nava STINAPA CARMABI STENAPA CNSI
Tourism and sustainable development	Vulnerability is dynamic: Enhancing adaptive governance to climate change for Caribbean tourism through interactive modelling	CUR	WUR: Jillian Student, Machiel Lamers UOC: Filomeno A. Marchena

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
BO-projects in the Dutch Caribbean (Min EZ)			
Coral Reef Ecosystems	BO-43-021.04-003 – Inventory corals Includes monitoring and research of the longest coral reef time-series in the world (since 1973)	BON, CUR	WUR: Erik Meesters
DCBD	BO-43-021.04-001 - Expansion knowledge system Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	WUR (Alterra): Peter Verweij
Environmental Hazards	BO-43-021.04-008 - Sunscreen and risks for coral reefs	BON	WUR: Diana Slijkerman
Fisheries	BO-11-019.02-006 - Fish stocks and fisheries Caribbean Netherlands	EUX, SAB, BON	WUR: Dolfi Debrot CNSI: Kimani Kitson-Walters PiskaBon, STINAPA SCF: Kai Wulf, Ayumi Kuramae, interns: Michael Beekhuizen and Alex van der Last
Marine biodiversity	BO-43-021.04-002 – Saba Bank – Marine biodiversity	SAB	WUR: Erik Meesters (benthic communities), Dolfi Debrot, Thomas Brunel, Leo Nagelkerke (fish stocks)
Marine mammals & sharks	BO-43-021.04-005 – Management plan marine mammal and shark sanctuary Yarari	SAB, EUX	WUR: Dolfi Debrot, Dick de Haan, Meike Scheidat, Ayumi Kuramae Izioka SCF (SBMU): Ayumi Kuramae Izioka
Marine mammals	BO-43-021.04-009 Acoustic monitoring of cetacean distribution	SAB	WUR: Dolfi Debrot, Dick de Haan, Hans verdaat SCF: Kai Wulf, Ayumi Kuramae
Marine mammals	BO-43-021.04-007 – Marine mammals in the Dutch Caribbean	BON, SAB, EUX	WUR: Dolfi Debrot, Dick de Haan, Meike Scheidat
World Heritage nomination	BO-43-021.04-004 – World Heritage nomination Bonaire National Marine Park	BON	WUR: Dolfi Debrot Wolfs Co.: Esther Wolfs UNESCO: Josephine Langley DRO: Frank v Slobbe CARMABI: Mark Vermeij, John de Freitas Curacao Footprint Foundation: Leon Pors

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
“Nature Funding” 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: 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: Julianka Clarenda DRO: Frank van Slobbe
Reforestation	Reforestation Project	BON	Echo: Julianka Clarenda DRO: Frank van Slobbe
Invasive species	Goat eradication and control in Washington Slagbaai National Park	BON	STINAPA 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
Terrestrial ecosystems	Combating Erosion and Nature Restoration on Bonaire	BON	Bonaire Agri & Aqua Business BV: Sherwin Pourier Wayaká Advies BV: Jan Jaap van Almenkerk DRO: Frank van Slobbe
Terrestrial ecosystems	Cave and karst nature reserve	BON	DRO: Frank van Slobbe CARIBSS: Fernando Simal
Nature communication	Campaign environment and nature on Bonaire	BON	DRO: Frank van Slobbe, Peter Montanus
Agriculture	Horticultural Project	SAB	Government of Saba: Randall Johnson
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: Randall Johnson

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
“Nature Funding” Projects in the Dutch Caribbean (Min EZ)			
	Yacht mooring project	SAB	Government of Saba SCF: Kai Wulf
	Saba national park	SAB	Government of Saba SCF: Kai Wulf SABARC: Ryan Espersen
	Crispeen trail project	SAB	Government of Saba: Robert Zagers SCF: Kai Wulf
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
EU-BEST funded Projects in the Dutch Caribbean			
Marine ecosystems	Marine Park Aruba	AUA	Directie Natuur en Milieu: Gisbert Boekhoudt TNO: Kris Kats
Coral Reef Restoration	Pop-Up Nursery and Coral Restoration (Oil Slick Leap)	BON	CRF: Francesca Viridis
Coral Reef Restoration	Restoration Ecosystem Services and Coral Reef Quality (Project RESCO)	SAB, EUX	WUR: Erik Meesters SCF (SBMU): Ayumi Kuramae Izioka STENAPA: Clarisse Buma Turks & Caicos Reef Fund

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
EU-BEST funded Projects in the Dutch Caribbean			
Conservation	Watershed & Biodiversity Conservation of Roi Sangu valley	BON	Echo: Julianka Clarenda
Ecosystem services	MOVE, Facilitating MAES (Mapping and Assessing the state of Ecosystems and their Services) to support regional policy in OVerseas Europe: mobilizing stakeholders and pooling resources	AUA, BON, SAB, EUX	Fundo Regional para a Ciência e Tecnologia, Portugal (consortium leader) Wolfs Company: Esther Wolfs
Reptiles	Enacting a news regional recovery plan for the Lesser Antillean iguana: an endangered ecological keystone species	EUX	STENAPA: Clarisse Buma
Terrestrial ecosystems	North Saba National Park, Phase I	SAB	Government of Saba: Menno van der Velde SCF: Kai Wulf SABARC Nature2: Kalli De Meyer Coastal Zone Management: Duncan MacRae

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CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Birds	Flamingo Abundance	BON	DRO: Frank van Slobbe Cargill STINAPA: Paulo Bertuol
Birds	Monitoring vulnerable parrot nests (remote camera sensing work)	BON	Echo: Julianka Clarenda, Sam Williams
Birds	Yellow-shouldered Amazon parrot roost counts	BON	Echo: Julianka Clarenda DRO: Peter Montanus STINAPA: Albert Christiaan
Birds	Bird Monitoring (Caribbean Waterbird Census)	BON SXM	STINAPA: Paulo Bertuol EPIC: Adam Brown
Birds	Tern monitoring (artificial nesting islands)	BON	STINAPA: Paulo Bertuol Cargill DRO WUR: Dolfi Debrot
Birds	Terrestrial Bird and Habitat Monitoring	BON CUR SAB SXM EUX	Echo: Julianka Clarenda STINAPA: Paulo Bertuol, Caren Eckrich STENAPA Curassavica: Michelle da Costa Gomes Nature Foundation: Binkie van Es
Birds	Red-billed Tropicbird monitoring	SAB EUX	STENAPA SCF: Kai Wulf
Birds	Pelican monitoring	SXM	NFSXM: Melanie Meijer zu Schlochtern
Coral reef ecosystems	Global Coral Reef Monitoring Network	BON CUR SAB EUX SXM	STINAPA: Caren Eckrich CARMABI: Mark Vermeij SCF (SBMU): Ayumi Kuramae Izioka STENAPA: Jessica Berkel NFSXM: Tadzio Bervoets CNSI: Johan Stapel, Kimani Kitson-Walters
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
Environmental	Water quality testing	SXM	NFSXM: Tadzio Bervoets EPIC: Natalia Collier

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Environmental	Nutrient (phosphate, ammonium, nitrate and nitrite) monitoring of St Eustatius' coastal waters	EUX	CNSI: Johan Stapel
Fish	Shark monitoring: - Shark sightings - Shark Abundance, distribution and movements (tagging, acoustic telemetry)	AUA BON CUR SAB SXM EUX	WUR: Erwin Winter, Dolfi Debrot, Martin de Graaf FPNA: Giancarlo Nunes STINAPA: Caren Eckrich CARMABI: Mark Vermeij SCF(SBMU): Ayumi Kuramae Izioka, Guido Leurs STENAPA: Jessica Berkel NFSXM: Tadzio Bervoets
Fish	Spawning monitoring: Red hind surveys on Moonfish Bank	SAB	SCF (SBMU): Ayumi Kuramae Izioka
Fish	Fish and fishery monitoring (Barracuda's, sharks and eagle rays, tarpons, marine mammals, (fishing) boats, fisherman)	BON	STCB: Mabel Nava
Insects	Bee tracking	BON	Echo: Julianka Clarenda
Invasive species	Goat and/or donkey removal: - Washington Slagbaai National Park - Lac Bay area (exclusion plots) - Quill National Park (exclusion plots)	BON EUX	STINAPA: Paulo Bertuol WUR: Dolfi Debrot DRO: Frank van Slobbe 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): Ayumi Kuramae Izioka STENAPA: Jessica Berkel
Invasive species	Feral pig population assessment (trapping)	BON	Echo
Mammals	Bat monitoring	AUA BON	FPNA WildConscience: Fernando Simal, Linda Garcia

CATEGORY	SUBJECT	ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Mammals	Dolphin monitoring (since 1999)	BON	Ron Sewell
Mammals	Marine Mammal Monitoring (noise loggers Saba Bank)	AUA SAB EUX SXM	WUR: Dick de Haan, Dolfi Debrot SCF (SBMU): Ayumi Kuramae Izioka AMMF: Angiolina Henriquez STENAPA: Jessica Berkel (sighting forms) NFSXM: Tadzio Bervoets (sighting forms) SCCN
Molluscs	Conch (<i>Strombus gigas</i>) on St. Eustatius, Saba Bank, Anguilla	SAB EUX	WUR: Martin de Graaf, Erik Boman (PhD student) SCF (SBMU): Ayumi Kuramae Izioka
Plants	Monitoring of tree growth and survivorship in reforestation areas	BON	Echo: Julianka Clarenda
Reptiles	Lesser Antillean Iguana: Monitoring population density & removing invasive Green Iguana and hybrids (Mohamed bin Zayed Species Conservation Fund)	EUX	STENAPA: Clarisse Buma RAVON: Tim van Wagensveld UvA: Thijs van den Burg
Reptiles	Boa and Cascabel Monitoring	AUA	FPNA Toledo Zoological Society: Andrew Odum
Reptiles	Red-bellied racer snake monitoring	EUX	CNSI: Kimani Kitson-Walters
Reptiles	Behavior of the endemic Aruban Whiptail lizard	AUA	FPNA Auburn University: Jeff Goessling
Seagrass and mangrove ecosystems	Seagrass and mangrove monitoring (BON: also conch and benthic fauna)	BON EUX SXM	STINAPA: Sabine Engel, Caren Eckrich WUR: Klaas Metselaar NFSXM: Tadzio Bervoets CNSI: Kimani Kitson-Walters
Reptiles	Sea turtle monitoring: -Satellite tracking -Nest monitoring -In water surveys (BON, CUR, SXM) -Fibropapillomatosis presence (BON)	AUA, BON, CUR, SAB, EUX, SXM	TurtugAruba Foundation STCB: Mabel Nava CARMABI (STCC): Sabine Berendse STENAPA: Jessica Berkel SCF: Kai Wulf NFSXM: Tadzio Bervoets

List of Acronyms

AUA	Aruba
BON	Bonaire
CUR	Curaçao
SAB	Saba
EUX	St. Eustatius
SXM	St. Maarten
AMMF	Aruba Marine Mammal Foundation
BEST	Biodiversity and Ecosystem Services in Territories of European overseas
BO project	Policy Supporting Research project
CARIBSS	Caribbean Speleological Society
CARMABI	Caribbean Research and Management of Biodiversity Foundation
CEAB	The Blanes Centre for Advanced Studies, Spain
CRF	Coral Restoration Foundation
DCNA	Dutch Caribbean Nature Alliance
DCBD	Dutch Caribbean Biodiversity Database
DRO	Directorate of Spatial Planning and Development, Bonaire
DLVV (Santa Rosa)	Department of Agriculture, Livestock, Fishery and Farmers market (Santa Rosa), Aruba
EcoPro	Ecological Professionals Foundation
ECPHF	Eastern Caribbean Public Health Foundation
EPIC	Environmental Protection in the Caribbean
FPNA	Fundacion Parke Nacional Arikok, Aruba
HAS	HAS University of Applied Sciences, the Netherlands
LVV	Department of Agriculture, Animal Husbandry & Fisheries, St. Eustatius
MinLNV	Ministry of Agriculture, Nature and Food Quality
NFSXM	Nature Foundation St. Maarten

Naturalis	Naturalis Biodiversity Center, The Netherlands
NIOZ	NIOZ Royal Institute for Sea Research, the Netherlands
NIOZ Sea Research	Royal Netherlands Institute for Sea Research
NWO	NWO Netherlands Organisation for Scientific Research
RAVON	Reptielen Amfibieën Vissen Onderzoek Nederland
RuG	University of Groningen, the Netherlands
RU	Radboud University Nijmegen, the Netherlands
SABARC	Saba Archaeological Center
SBMU	Saba Bank Management Unit
SCF	Saba Conservation Foundation
Smithsonian	Smithsonian's National Museum of Natural History
STCB	Sea Turtle Conservation Bonaire
STCC	Sea Turtle Conservation Curacao
STENAPA	St. Eustatius National Parks Foundation
STINAPA	National Parks Foundation Bonaire
UsA	University of St. Andrews, Scotland
UU	University of Utrecht, the Netherlands
UvA	University of Amsterdam, the Netherlands
VHL	University of Applied Sciences VHL, the Netherlands
VU	VU University Amsterdam, the Netherlands
Wildconscience	Wildlife Conservation, Science and Education
WNF	World Wide Fund for Nature
WUR	Wageningen University and Research Centre, the Netherlands
WUR (Alterra)	Wageningen Environmental Research, the Netherlands

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.

“Duvat, V. et al. (2018).

High human influence on beach response to tropical cyclones in small islands: Saint-Martin Island, Lesser Antilles. *Geomorphology*.”

“Rocha et al. (2018).

Mesophotic coral ecosystems are threatened and ecologically distinct from shallow water reefs. *Science* 361: 281-284.”

“Rivera-Milán, F.F., Simal, F., Bertuol, P., Boomer, G.S. (2018).

Population monitoring and modelling of yellow-shouldered parrot on Bonaire, Caribbean Netherlands. *Wildlife Biology*.”

“Pavlowich, T., Webster, D.G., Kapuscinski, A.R. (2018).

Leveraging sex change in parrotfish to manage fished populations. *Elem Sci Anth* 6(1), p.63.”

Student Reports

“Verschuur, J. (2018).

The impact of uncertain Antarctic ice sheet dynamics for future coastal erosion. A probabilistic approach for a data-scarce environment in the Caribbean. (case study St. Maarten)”

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 DCBD.
Please e-mail us: research@DCNAnature.org

Calendar

More events to add to this calendar?
Please e-mail us: research@DCNANature.org

October

Whole month	Event	Sea and Learn, Saba
Dates tbc	Meeting	15th meeting of the Scientific Committee of the Inter-American Sea Turtle Convention (IAC). Honduras
1-5	Meeting	Seventieth meeting of the CITES Standing Committee (SC70), Sochi, Krasnodar, Russian Federation
3-5	Workshop	Regional Workshop on Fish and Fisheries Products Trade in the Caribbean. Panama City, Panama.
4	Event	World Animal Day
8-12	Conference	Caribbean Water and Wastewater Association (CWWA). Monebay, Jamaica.
13	Event	International Migratory Bird Day
13	Event	International Day for Disaster Reduction (IDDR)
16-17	Meeting	CARIMAM launch meeting, Fort-de-France, Martinique.
19-21	Conference	3rd bi-annual Global Invertebrate Genomics Alliance Conference and Workshop (GIGAIII), Curaçao
23-25	Meeting	XII Meeting of National Committees and Focal Points of the IHP-LAC. UNESCO. Panama.
21-29	Meeting	13th Meeting of the Conference of the Contracting Parties to the Ramsar Convention on Wetlands (COP13), Dubai, United Arab Emirates
29-30	Meeting	DCNA Board meeting, Aruba.
24	Event	Sustainability Day
24	Event	International Day of Climate Action
29-1 Nov	Meeting	RedLAC meeting, Santa Cruz de la Sierra, Bolivia.
30-1 nov	Meeting	3rd Meeting of the WECAFC/CRFM/OSPESCA/CFMC Working Group on Queen Conch. Panama.

November

5-9	Conference	71st Annual Conference of GCFI & Special Session on Coral Reefs, San Andres, Colombia.
12-14	Symposium	Third International Symposium on Mangroves as Fish Habitat, Kuala Lumpur, Malaysia.
14	Workshop	CARIBMEPA (Caribbean Marine Environment Protection Association) workshop. Cozumel, Mexico.
16	Conference	WHO/PAHO III Global Conference on Health and Climate Change: Special Focus on Small Island Developing States (SIDS). Grenada.
	Meeting	IV Taller Internacional de investigaciones sobre manejo de ecosistemas frágiles. Cuba.
17-27	Expedition	Saba Bank expedition, Wageningen Marine Research
Tbc – last week of November	Meeting	Steering committee of the GCRMN-Caribbean initiative



The International Coral Reef Initiative (ICRI) has declared 2018 the third International Year of the Reef (IYOR 2018)

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