

# BIONEWS

ISSUE 19 - 2018

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## Editor's Letter

Dutch Caribbean, November 2018

The Nature Fund from the Netherlands' Ministry of Agriculture, Nature and Food Quality (LNV) (previously Ministry of Economic Affairs), has helped Coral Restoration Foundation Bonaire to take the next step in restoring Bonaire's shallow reefs. Throughout the past two years, 5,000 Staghorn corals (*Acropora cervicornis*) were outplanted back to Bonaire's shallow coral reefs, which brings the total of outplanted acroporid corals since 2013 to 20,000. In this article you can read more about how CRFB has reached this ambitious goal, their restoration methods, first monitoring results, local community and visitor involvement and future plans.

Before Hurricanes Irma and Maria struck St Eustatius in September 2017, the islands had recorded the possibly highest known density of Bridled Quail-doves in the region. In the December 2017 edition of BioNews, we provided an overview of the results of two population assessments of the Bridled Quail-dove (*Geotrygon mystacea*) that had been conducted that year. This article provides the results of a third assessment that was conducted eight months after the two major hurricanes impacted St. Eustatius. The

study found a continuing decline in the population size and highlights concerns on the survival of this species.

Two years ago the DCNA organized the first of its kind shark tagging expedition to the Saba Bank and St. Maarten as part of the Dutch Postcode Lottery funded "Save our Sharks" project. Eight shark researchers with a support crew and two camera teams captured and tagged tiger sharks on St. Maarten and the Saba Bank. During the expedition, scientists and conservationists from the Saba Conservation Foundation, Nature Foundation St. Maarten, Florida International University and Sharks4Kids equipped five tiger sharks with satellite tags in order to track their movements and presence to determine how best to manage and protect these important apex predators. Up to now, two tiger sharks with satellite tags named 'Sea fairy' and 'Quinty' have provided the research team with some interesting preliminary results. The sharks indicate a similar migration track following the Aves ridge, a ridge in the Eastern Caribbean Sea of about 500 km in length probably of volcanic arc origin.

The St. Maarten Nature Foundation launched the Adopt a Shark program during St. Maarten Shark Week in June 2018, but due to the continued demand of adopting a shark the Foundation decided to extend the program up to the end of this year. With the support of 'Adopting a Shark' they can continue shark research and tagging activities and will learn more about the sharks in our waters, providing us the knowledge to better protect them. The 'Adopt a Shark St Maarten' Program is also part of the DCNA's 'Save our Sharks' project.

On Bonaire there is a big problem with erosion. In areas with sparse vegetation, intense rainfall events (such as those occurring on Bonaire) can loosen the soil material, after which it is transported away towards the ocean by (rain)water flowing over the surface. A three year-project

to reduce Bonaire's erosion problem, improve water management and restore some of Bonaire's natural areas is currently in progress thanks to funding by the Ministry of Agriculture, Nature and Food Quality (LNV) through the Nature Fund. The "Combating Erosion and Nature Restoration" project started at the end of 2016 and will end in October 2019. In this article you can read about Nick Roos's research findings on the erosion issue.

Last but not least, we thrilled to report another new bird for Bonaire and for the Kingdom of the Netherlands!

**Enjoy!**  
**The DCNA Team**

## Coral Restoration Bonaire

*By F. Viridis & B. Hickey (CRFB)*

**The Nature funding from the Netherlands' Ministry of Agriculture, Nature and Food Quality (LNV) (previously Ministry of Economic Affairs), has helped Coral Restoration Foundation Bonaire (CRFB) to take the next step in restoring Bonaire's shallow reefs. Throughout the past two years, 5,000 Staghorn corals (*Acropora cervicornis*) were outplanted back to Bonaire's shallow coral reefs, which brings since 2013 the total of outplanted acroporid corals to 20,000. To accomplish this ambitious goal, the capacity of the nursery was expanded and a comprehensive monitoring program was established. The Foundation also took an important step strengthening its logistics and network to become a more independent organization.**

### Local Dive Operators Involvement

Partnering with local dive shops has been key to the success of CRFB's programs since the beginning. These dive operators (CRFB Dive Shop Members) execute a practical restoration program that not only re-grows local reefs, but engages the community and builds their businesses with paying customers that return year after year to help maintain the nurseries and the reefs they helped replant. Through a successful

educational program, local dive operators train regularly resident and tourist scuba divers who are the actual volunteer man power of the island coral restoration program.

The Foundation was established thanks to the support of Dive Buddy Dive Resort with Harbour Village Beach Club and Eden Beach Resort joining later. Thanks to the Nature Funding for the BES islands, this partnership has expanded once again. Two new local dive operators, Goodive and Tropical Divers have also joined the Foundation, bringing the total number of dive shops supporting coral restoration on Bonaire to five. This funding was crucial catalyst in allowing smaller dive shops to join the cause.

Thanks to the expanded dive shop membership facilitated by the project, the Foundation has increased its educational presence throughout the island. Recognizing the importance of involvement from all parts of the community for a restoration program to succeed, future plans focus on three components: 1) a greater presence with the island's youth through increased educational programs in schools and a more intensive involvement with the STINAPA Jr. Rangers program, 2) reaching more of the visiting and local divers by getting more dive shops involved with

the program, and 3) continued awareness and educational communications with residents of the island.

The locations for each nursery were surveyed and approved by the Bonaire National Marine Park (BNMP) with Goodyve's coral nursery located at Something Special and Tropical Divers' at Calabas Reef. Both dive shop's nursery has five trees and can hold up to a total of 500 Elkhorn and Staghorn corals. Trained staff members are responsible for nursery maintenance and related coral outplanting activities in the area. As the network of Dive Shop Members expands, more and more trained manpower is available for the actual restoration of Bonaire's reefs.

### Coral Outplantings and Restoration Sites

To guarantee the production of the 5,000 corals needed to restore the four snorkeler accessible sites, an expansion of the main production nursery was necessary. The nursery in Klein Bonaire was expanded to 51 trees, bringing that nursery's capacity to 6,522 corals (+54%), and allowing for enough corals to remain in the nursery after the project for future restoration efforts.

Four snorkel-accessible sites around Bonaire were selected, upon BNMP approval: Playa Lechi, Jeff Davis Memorial, Salt Pier, and Pink Beach. The number of corals needed for each of the four restoration site has been determined according to the abundance restoration criteria listed by NOAA in the 2015 Recovery Plan for Staghorn corals, which requires the establishment of approximately 25% of live Staghorn Coral cover in the restored areas (National Marine Fisheries Service, 2015). With these criteria, each site is comprised of 1,250 Staghorn corals spread over 150m<sup>2</sup>.

The restoration technique used by CRFB is known as coral gardening, whereby fragments from a healthy, robust wild population are fragmented and grown in nurseries on Christmas tree-like trees. These trees are structures with a PVC trunk and fiberglass branches on which coral fragments are suspended.

When the fragments have reached maturity, they are then outplanted to degraded reef areas. Between January 2017 and March 2018, according

to the planned activities, 1,250 nursery-reared coral colonies from 11 different genotypes were outplanted at Playa Lechi, Jeff Davis Memorial, Salt Pier, and Pink Beach, covering an area of 600 m<sup>2</sup>, for a total of 5,000 Staghorn corals. Outplanting requires the use of supporting horizontal bamboo structures elevated 10-20 cm from the bottom in order to support the corals in the first phase of their growth on the rubble bottom and limit the predators' abundance. At each site, 50 square bamboo structures were installed at each restoration site. Each structure supports 25 corals of the same genotype.

### Coral Monitoring Program

The outplanted corals at the four restoration sites have been carefully tagged and monitored over time, taking pictures at the outplanting day, two weeks, three months, six months and one year after outplanting them. The pictures have been subsequently analyzed using CPCe to gather coral cover and mortality data of the different corals genotypes.

The data collection is still in progress, but preliminary results on the first two sites, show large differences in growth between the locations. On average coral cover at Jeff Davis increased linearly 0.06% per day or 21.6% per year with very little mortality. In front of the main urbanised area, at Playa Lechi, growth was erratic and mostly negative (E. Meesters & F. Viridis, unpublished data). Environmental conditions in front of Kralendijk are presumed to be responsible for the lack of growth and high mortality of the restored staghorn corals there.

The monitoring will continue after the funding period has concluded, data analysis and the results will be published in cooperation with Wageningen University. The systematic assessment of this data will guide the Foundation toward doing more of what works, giving key insights into restoration site selection factors, genotype performance, and overall coral coverage after one year. This will allow for adapted and refined strategies, based on knowledge acquired from both field work experience and both quantitative and qualitative results of the monitoring program, that better allocate the Foundation's limited resources.

## What's next?

Great progress has been made growing and replanting branching *Acropora* corals in Bonaire and throughout the Caribbean. The restoration success of Coral Restoration Foundation Bonaire with *Acropora cervicornis* (staghorn coral) has been especially noteworthy, thanks to the simplification of logistics and built capacity, the Foundation has been able to scale up its restoration program effectively, and the techniques used to achieve those results are now being duplicated elsewhere in the Caribbean.

Based on the coral restoration experience gained over the years and recognizing the urgency of the threats facing our reefs, CRFB is now embracing a more comprehensive vision and expanding to new techniques, to give Bonaire's reefs a helping hand on an ecological scale, focusing on not only genetic diversity, but species diversity as well. These new techniques and species will be part of a broader, more inclusive reef restoration approach the Foundation has recently adopted.

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## St. Eustatius: Bridled Quail-Dove Population Continues Declining

*By Hannah Madden (CNSI), Frank Rivera-Milán (USFWS) and Kevin Verdel (Utrecht University)*

**In the December 2017 edition of BioNews, we provided an overview of the results of two population assessments of the Bridled Quail-dove (*Geotrygon mystacea*) that had been conducted that year. This article provides the results of a third assessment that was conducted eight months after two major hurricanes impacted St. Eustatius.**

The Bridled Quail-dove can grow to a length of around 12 inches (30 cm) and weigh around 230 grams. Perched on a branch, the dove emits a mournful 'who-whoooo' call that echoes through the forest. Nevertheless, this is a shy and secretive species that usually walks or flies away when humans approach.

While it is usually seen alone or in pairs, aggregations of over a dozen may occur, especially in the non-breeding season. Local names include "wood dove" and "wood hen", indicating its preference for forest and woodland habitat.

Despite being classified as Least Concern by the International Union for the Conservation of

Nature, with such a limited geographic range (listed as 'uncommon to rare in the Lesser Antilles and extremely rare in Puerto Rico') and the fact that it is losing habitat, populations of the Bridled Quail-dove are decreasing across the region and its status could be upgraded to Vulnerable. It is said to be absent from Anguilla, Barbados, St. Vincent, Grenada and the Grenadines.

The Bridled Quail-dove is a regionally endemic species in the family Columbidae that, on Statia, is only found in upper elevations of the Quill (above ~150m) and inside the crater. It is easily distinguished from other dove species by the torquoise patch on its neck and white stripe (bridle) under the eye. With its habit of wandering the forest floor during daylight hours in search of food (seeds, fruits and the occasional gecko or snail), observant hikers are likely to spot this bird. Activity and breeding are very much dependent on rainfall, and the dove is sensitive to hurricanes and extended periods of drought. Similar to other Columbids, the Bridled Quail-dove lays clutches of two eggs in a flimsy nest made of twigs up to six meters above the forest floor. Bridled Quail-doves

do not fare well in areas of human activity and numbers have declined across the species' range, presumably due to habitat loss, but also due to hunting and predation by invasive mammals such as the Black Rat (*Rattus rattus*).

Irma and Maria were the first recorded category five hurricanes to hit the Windward Islands, and while Statia was spared extensive infrastructural damage in urban areas, its forest ecosystems did not fare so well. According to a recent publication by Eppinga and Pucko (2018), an average of 93% of tree stems on Statia and Saba were defoliated; 83% lost primary/secondary branches, 36% suffered substantial structural stem damage, and average tree mortality was 18% (with mortality being almost twice as high on Statia than Saba).

Our pre-hurricane assessment in May 2017 was initially encouraging, with an estimated 1,030 (standard error [SE] = 275, 95% confidence interval [CI] = 561-1,621) quail-doves across its local habitat of 440 hectares, possibly the highest known density in the region. Post-hurricanes, in November, we repeated the surveys and recorded decrease of around 22% in the population to 803 (SE = 208, 95% CI = 451-1,229). Nevertheless, we feared that the population would continue to decline as a result of hurricane-induced habitat degradation and the negative impacts of severe vegetation damage, loss of vegetation cover, food limitation, and increased predation.

We repeated surveys in May 2018, hoping to coincide with the quail-dove's peak breeding season. However instead of the usual ~70 transects, we had to walk a total of 255 transects in order to detect sufficient doves for analysis. No doves were heard calling, most likely as a result of delayed breeding, and only 32 were detected during 2018 surveys compared with ~92 in previous years. As expected, the quail-dove population continued declining in May 2018 (-76% compared with May

2017) and is currently very small at around 253 individuals (SE = 105, 95% CI = 83-486). With such a small population there is a very real risk that Bridled Quail-doves could become extirpated on St. Eustatius.

Reduced survival and reproduction, and thus abundance fluctuations at low numbers, could lead to local extirpation. Because of the life-history characteristics shared by members of the family Columbidae (e.g., early maturity and short lifespan), conservation efforts are now urgently required. Although survival and reproduction rates of the Bridled Quail-dove on Statia are poorly understood, Black Rats are present in all vegetation types within the terrestrial protected areas. Management of these invasive mammalian predators within the dove's range is needed as a first step towards increasing reproduction and survival, and therefore population recovery to pre-hurricane levels, of this highly vulnerable species.

The authors are grateful to St. Eustatius National Parks Foundation for granting permission to conduct surveys in the Quill National Park. Thanks to funding by the Dutch Ministry of Economic Affairs (now Ministry of Agriculture, Nature and Food Quality (LNV)) under their Nature Fund initiative, a rodent control project, facilitated through the Caribbean Netherlands Science Institute (CNSI), is running on St. Eustatius. We also wish to thank the many generous donors who contributed to BirdsCaribbean's post-hurricane fundraising appeal, which covered Dr. Rivera-Milán's costs to help conduct surveys in November 2017. The end date of this project was recently extended to October 2019.

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## Two Dutch Caribbean Tagged Tiger Sharks Follow Similar Migration Patterns in the Caribbean

**Two years ago the DCNA organized the first of its kind shark tagging expedition to the Saba Bank and St Maarten as part of the Dutch Postcode Lottery funded "Save our Sharks" project. Eight shark researchers with a support crew and two camera teams captured and tagged tiger sharks on St Maarten and the Saba Bank using an expedition ship. During the expedition, scientists and conservationists from the Saba Conservation Foundation (SCF), Nature Foundation St. Maarten (NFSXM), Florida International University (FIU) and Sharks4Kids equipped five tiger sharks with satellite tags in order to track their movements and presence to determine how best to manage and protect these important apex predators.**

Wildlife Computer SPOT (Smart Position or Temperature Transmitting) satellite tags were attached to the first dorsal fin of large tiger sharks. These tags transmit to satellites, which allow the sharks to be tracked through the ARGOS satellite system for up to 4 years. The tag uses radio transmissions, so the satellite unit must be exposed to air in order to transmit. Each time the dorsal fin breaks the surface a geo location provides an approximate location with an accuracy of up to 250 meters.

Up to now, two tiger sharks with satellite tags named 'Sea fairy' and 'Quinty' have provided the research team with some interesting preliminary results. The sharks indicate a similar migration track following the Aves ridge, a ridge in the Eastern Caribbean Sea of about 500 km in length probably of volcanic arc origin.

*"The preliminary data we have been receiving is starting to show some interesting results in terms of the migratory patterns of tiger sharks in the Eastern Caribbean Sea. Not only is this data important but it is also critical for the transboundary management of a marine species critical to the health of our Caribbean Sea. Sharks are apex predators and as such keep the ocean food chain healthy, a food chain which in turn supports regional fisheries for example. With recent shark finning and fishing activities occurring in the wider Caribbean including incidents in Curacao, Dominica and Aruba it behoves nation states in the Caribbean to establish*

*a Wider Caribbean Management Plan for the species,"* commented Tadzio Bervoets, Project Manager for the DCNA Save our Shark Project. Shark Quinty was tagged under the supervision of Dr. Mike Heithaus on the Saba Bank. This 3.43 meter female tiger shark provided regular location updates. Quinty left the Saba Bank following the Aves ridge down south and subsequently swam all the way to Trinidad and Tobago, a territory known for its shark finning activities. The last received location of Quinty was close to Barbados about a year ago.

Another Shark dubbed Sea fairy was the first shark which was equipped with a satellite tag in this region and surfaced very frequently, providing researchers with a wealth of location and movement information. Sea fairy was a 2.40 meter female tiger shark at the moment it was tagged in the waters of St Maarten. She stayed the first months around St Maarten while doing forays to Anguilla, St. Barths, Saba and the Saba Bank. In May 2017 Sea fairy migrated south following the Aves ridge in a similar movement pattern as tiger shark Quinty. After spending two months at the Aves ridge Sea Fairy explored the open Caribbean Sea and headed to Puerto Rico and Dominican Republic. The last location received for Sea Fairy was close to Puerto Rico also about a year ago.

*"Sea fairy's movement patterns can indicate a nursing area for tiger sharks around St. Maarten, spending their juvenile years in sand and seagrass habitat before migrating around the Caribbean when large enough in size and maturity. It is interesting to see that both actively tracked sharks are showing similar migration routes following the Aves ridge, which may supply the sharks with an abundant food source"* stated Nature Foundation's Project Officer Melanie Meijer zu Schlochtern.

*"In the coming year, we will expand our shark movement study and will install another satellite tag on a tiger shark on St. Maarten and two more sharks will be equipped with a satellite tag on Aruba. This research will improve our understanding of the life characteristics of sharks and will provide knowledge about the population structure, abundance and migration of sharks in the Caribbean"* explained Melanie Meijer zu Schlochtern.

Sharks are often portrayed as being dangerous killing machines, however the facts show the opposite. Occasionally shark bites do happen, however no unprovoked attack has been ever recorded on St. Maarten. It is more likely that one gets killed by a coconut falling on ones head than

by a shark. The species are actually the victims of human impacts such as poach-ing, finning, over-fishing and irresponsible coastal development pressure. Worldwide over 100 million sharks are killed per year resulting in half of all shark species being threatened or endangered with extinction.

## Adopt a Shark Program St Maarten

*Nick Roos, Master student VU (Vrije Universiteit Amsterdam)*

**The St Maarten Nature Foundation launched the "Adopt a Shark" program during St Maarten Shark Week in June 2018, but due to the continued demand of adopting a shark the Foundation decided to extend the program up to the end of this year.**

*"It is important that we work together to ensure the survival of our shark population, with the 'Adopt a Shark' program we are trying to engage the community in our efforts to protect sharks and give them the opportunity to be involved in a large scale scientific research project on St. Maarten. We certainly think this a great opportunity for kids and people interested in science to learn more about research, sharks and marine life on St. Maarten"* stated Nature Foundation's Project Officer Melanie Meijer zu Schlochtern.

Different tags are being applied on adopted sharks; such PIT tags, FLOY tags and even high-tech acoustic tags have been deployed on certain sharks. A PIT tag is a microchip which gives us a unique live time barcode and a Floy tag is used to identify the shark by anyone who catches or sees the shark close-up. An acoustic tag sends out acoustic signals which are detected with acoustic receivers, thereby giving information on how much time the shark spends around a certain location, providing us valuable information about their movement patterns. DNA samples will provide information about the sharks its relationships and their length measurements provide the knowledge about the ages and growth of the sharks.  
*"By donating a contribution to the Nature*

*Foundation you can adopt a St Maarten shark, you will receive a certificate of adoption and can decide on the name of the shark. As soon as the shark is tagged updates and pictures about the shark will be sent to you. With the support of 'Adopting a Shark' we can continue our shark research and tagging activities, we will learn more about the sharks in our waters, providing us the knowledge to better protect them"* explained Melanie Meijer zu Schlochtern.

Worldwide sharks are the most misunderstood species on the planet as they are repeatedly displayed as villains and being dangerous; however they are actually the victims of humans poaching, finning, overfishing and coastal development activities. Worldwide over 100 million sharks are killed per year; as a result half of all shark species are threatened or endangered. Sharks, as top predators, play a crucial role in maintaining balance and health within our aquatic ecosystem. Besides, they are important for tourism; many divers would like to see sharks, which makes a shark worth more alive (\$200,000) than dead (\$50).

The 'Adopt a Shark St Maarten' Program is part of the DCNA's 'Save our Sharks' project funded by the Dutch National Postcode Lottery.

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## Erosion around Kralendijk, Bonaire

*Nick Roos, Master student VU (Vrije Universiteit Amsterdam)*

**On Bonaire there is a big problem with erosion. In areas with sparse vegetation, intense rainfall events can loosen the soil material, after which it is transported away towards the ocean by rainwater flowing over the surface. Not only causes this a loss of fertile soil, it also has negative consequences for aquatic life and plants along the coast, such as the coral reefs of Bonaire and the species which depend on them. On top of that, scuba diving and snorkeling is an important tourist attraction in, for instance, the capital of Kralendijk where erosion is relative high.**

Erosion of soil can be influenced by many factors, such as the infiltration rate of the soil and the vegetation cover. Many human activities, such as deforestation, overgrazing by goats and urbanization affect these factors, and thus the erosion. A low capacity of the urban drainage system and poor spatial planning compound these effects.

An three year-project to reduce Bonaire's erosion problem, improve water management and restore some of Bonaire's natural areas is currently in progress thanks to funding by the Ministry of Agriculture, Nature and Food Quality through the Nature Fund. The "Combating Erosion and Nature Restoration" project started at the end of 2016 and will end in October 2019. It is led by Bonaire Agri and Aqua Business NV (Sherwin Pourier), Wayaká Advies (Jan Jaap van Almenkerk) and coordinated by the Island Government, Directorate of Spatial Planning and Development.

The Vrije Universiteit (VU) and Universiteit van Amsterdam (UvA) are teaming up with partners from Bonaire (Wayaká Advies) to do research into these erosion issues. Nick Roos, a MSc Hydrology student at the VU, examined the causes of erosion by determining the most important soil and hydrologic characteristics of different land types around the capital of Kralendijk. In the picture he is measuring how thick the layer of deposited soil is in the Saliña di Vlijt. This appears to be 50 cm in some areas. This is fertile soil that flowed from higher areas into the Saliña during heavy rainfall and is testimony to the magnitude of the erosion issues in the area. Using his measurements, he developed a hotspot map indicating which areas probably constitute most to the erosion.

His research is a start to determine where action could be taken to reduce erosion and gives input for the type of measure that may be suited for such an area. Most promising measures, are the reduction of paved areas and overgrazing. New methods (e.g. permeable asphalt and more vegetation) are doable and cost friendly ideas to achieve the goal of increasing infiltration in paved areas. Overgrazing is a problem that could be solved by controlling areas for grazing. By fencing off more areas from goats, sheep and donkeys, grazing pressure on multiple areas is reduced. Therefore allowing vegetation to grow and reduce soil erosion. (Roos, 2018).

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## Crowned Slaty Flycatcher: another new bird for Bonaire and for the Kingdom of the Netherlands

By Peter-Paul Schets

In BioNews 11 (2017) an article was dedicated to the eight bird species that in 2016 and 2017 were added to the Bonaire-bird list. One of these, Pied Water-tyrant, was even new for the Kingdom of the Netherlands.

Less than one kilometer from the location where that bird was recorded for the first time in January 2016, Peter-Paul Schets found another tyrant-flycatcher which was never recorded before on Aruba, Bonaire and Curaçao.

In the early morning of 3 September 2018 Schets visited Bonaire's LVV-grounds and sewage plant. At around 7 AM he noticed a mainly greyish flycatcher that reminded him of a phoebe or a pewee. The birds made short sallies to catch insects and repeatedly returned to the same or a nearby bare branch. Schets realized this bird was not in the Sibley guide (birds of North America) or in the field guides for the ABC-islands. He took many pictures that he sent to several birders in the Netherlands. It did not take long before Bert Pieterse answered this bird mostly resembled

a Crowned Slaty Flycatcher (*Griseotyrannus aurantioatrocristatus*), a species of South America. An unexpected finding because of the southern distribution of that species, but comparison of photos of that species led Schets to the conviction that this was indeed the bird he had seen. Shortly afterwards its identification was confirmed by several experienced birders.

Finding this species on Bonaire is exceptional as its regular range is much more to the south. It mainly breeds in central and in the southern half of South America and migrates in austral winter rarely further north than Orinoco River. There are very few records outside South America. In 2007 it was recorded in Panama and in 2008 in Louisiana, USA.

This record once again shows birding on Bonaire can be very rewarding. Finding another new species for this island probably is just a matter of time.



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CATEGORY	SUBJECT	DC 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	<b>Echo:</b> Julianka Clarendra
Coral Reef ecosystems	Larval biology of corals and reef microbiology	CUR	<b>Marhaverlab, Curacao:</b> Kristen Marhaver <b>CARMABI</b>
Governance	Disaster governance on St. Maarten in the wake of hurricane Irma	SXM	<b>WUR:</b> Joey de Hamer (student) <b>NFSXM:</b> Tadzio Bervoets
Fisheries	Social Mapping (Funded by WWF-NL)	BON SAB EUX	<b>WWF-NL:</b> Pieter van Baren <b>KITLV:</b> Stacey Mac Donald
Fisheries	Market & Supply Chain Analysis study (Funded by WWF-NL)	BON SAB EUX	<b>WWF-NL:</b> Pieter van Baren <b>The Good Fish Foundation:</b> Michelle Boonstra
Fisheries	Historical fisheries (Funded by WWF-NL)	BON SAB EUX	<b>WWF-NL:</b> Pieter van Baren <b>Terramar Museum Bonaire:</b> Ruud Stelten
Fisheries	Testing and comparing various lionfish traps to study their potential use in a directed lionfish fishery (funded by WWF-NL)	SAB	<b>SCF (SBMU):</b> Ayumi Kuramae Izioka <b>Interns:</b> Michael Beekhuizen and Alex van der Last
Invasive species	Ecological impacts of Coralita People's perception and management of Coralits (*part of NWO "Exotic plant species in the Caribbean: foreign foes or alien allies?")	SAB EUX	<b>UU:</b> Elizabeth Haber, Jetske Vaas (PhD students)
Invasive species	Research into mitigation measures for Sargassum Seaweed	SXM	<b>NFSXM:</b> Tadzio Bervoets <b>Government of St. Maarten</b>
Plants	Testing effective ways to grow native plants	BON	<b>Echo:</b> Johan van Blerk
Plants	Germination of seeds of indigenous trees of Curaçao	CUR	<b>CARMABI:</b> John de Freitas
Reptiles	Lesser Antillean iguana nest research (funded by WWF-NL)	EUX	<b>RAVON:</b> Tim van Wagensveld, Ronald Zollinger
Sharks	Silky shark research on the Saba Bank	SAB	<b>SCF(SBMU):</b> Ayumi Kuramae Izioka <b>Oceaware:</b> Guido Leurs

## Long Term Projects

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Coral Reef Ecosystems	Deep Reef Observation Project (DROP) (ARMS: Autonomous Reef Monitoring Structures)	CUR	<b>Smithsonian:</b> 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	<b>Waitt Institute (Blue Halo Curaçao):</b> Kathryn Mengerink
Coral Reef Ecosystems	Diadema Antillarum Population Assessment	EUX	<b>CNSI:</b> Kimani Kitson-Walters <b>VHL:</b> Alwin Hylkema <b>STENAPA:</b> Jessica Berkel
Coral Reef Restoration	St. Maarten's Coral Restoration Project	SXM	<b>NFSXM:</b> Tadzio Bervoets, Melanie Meijer zu Schlochtern <b>CRF</b>
Coral Reef Restoration	Plant a million coral initiative (IntelliReefs)	SXM	<b>NFSXM:</b> Tadzio Bervoets, Melanie Meijer zu Schlochtern <b>SeaLegacy, Reeflife Restoration and Sea to Sky ventures</b>
Coral Reef Restoration	Development of restoration methods for threatened Caribbean coral species	BON, CUR	<b>CRF Bonaire:</b> Augusto Montbrun, Francesca Viridis <b>SECORE Project</b> <b>CARMABI:</b> Mark Vermeij <b>UvA:</b> Valerie Chamberland
Coral Reef Restoration	Artificial structures that encourage larvae settlement and discourage the growth of competitor species	CUR	<b>University of Illinois:</b> Amy Wagoner Johnson, Bruce Fouke, Gabriel Juarez <b>San Diego State University:</b> Forest Rohwer <b>CARMABI:</b> Kirsten Marhaver, Mark Vermeij
Database	Dutch Caribbean Species Register: Taxonomic knowledge system Dutch Caribbean ( <a href="http://www.dutchcaribbeanspecies.org/">http://www.dutchcaribbeanspecies.org/</a> )	All	<b>Naturalis:</b> Sander Pieterse, Hanco Bakker, Bert Hoeksema

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Endemic species	Overview endemic species	SAB EUX SXM	<b>WUR:</b> Dolfi Debrot, Oscar Bos, Rene Henkens <b>Naturalis:</b> Hannco Bakker
Interstitial biodiversity	Moleculaire biodiversiteit analysis of marine communities by metabarcoding	EUX	<b>Naturalis:</b> Arjen speksnijder <b>ANEMOON:</b> Niels Schrieken
Invasive species	Global Register of Introduced and Invasive Species GRIIS	All	<b>IUCN Invasive Species Specialist Group</b> <b>ISSG:</b> Shyama Pagad
Invasive species	CIRCULATIONS (Connectivities between Islands Alters Traveling Invasive Seagrasses)	BON	<b>Development and Knowledge Sociology, ZMT:</b> Rapti Siriwardane <b>Mangrove Ecology, ZMT:</b> Lucy Gillis <b>Algae and Seagrass Ecology, ZMT:</b> Inés González Viana
Marine ecosystems	Taxonomy and biodiversity in Lac Bay	BON	<b>STINAPA</b> Sabine Engel, Caren Eckrich <b>Ecosub:</b> Godfried van Moorsel <b>CEAB:</b> Daniel Martin
Marine ecosystems	Marine species discoveries in the Dutch Caribbean	All	<b>Naturalis:</b> Bert Hoeksema <b>CNSI</b> <b>CARMABI</b>
Marine Litter	Clean Coast Bonaire (Citizen science project, OSPAR methodology)	BON	<b>Boneiru Duradero:</b> 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	<b>WUR:</b> Aad Smaal, Leo Nagelkerke, Martin de Graaf Erik Boman (PhD candidate) <b>SCF (SBMU):</b> Ayumi Kuramae Izioka <b>CNSI</b>
Public Health	DNA waterscan: Monitoring disease vectors in the Caribbean (mosquitoes and midges)	CUR EUX	<b>Naturalis:</b> Klaas-Douwe B. Dijkstra <b>ECPHF:</b> Teresa Leslie <b>CBHRI:</b> Delia-Maria Goilo (NWO DUCAMID project)
Reforestation	Reforestation Project on St. Eustatius	EUX	<b>Mac &amp; Field:</b> Tim van Wagensveld & Stacey Mac Donald <b>STENAPA:</b> Clarisse Buma <b>LVV:</b> Gershon Lopes
Sponges	Bioerosion of reefs by coral-excavating sponges	BON, CUR, SAB, EUX	<b>NIOZ:</b> Fleur van Duyl <b>WUR:</b> Erik Meesters, Didier de Bakker (PhD student)

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Sponges	<p>The role of sponges as key ecosystem engineers of coral reef ecosystems</p> <p>Pumping iron: can iron availability fuel the sponge loop and affect coral reef community structure? (Misha Streekstra)</p>	CUR	<p><b>Uva:</b> Jasper de Goeij, Benjamin Mueller  <b>CARMABI:</b> Mark Vermeij  <b>PhD students:</b>  <b>WUR:</b> Misha Streekstra  <b>UvA:</b> 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"</p>
NWO Projects in the Dutch Caribbean			
Bioproducts	Stand-alone production of algal products for food, feed, chemicals and fuels	BON	<p><b>WUR:</b> R.H. Wijffels  <b>CIEE:</b> Rita Peachey</p>
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	<p><b>NIOZ:</b> Fleur van Duyl, Steven van Heuzen (PostDoc), Alice Webb (PhD student)  <b>STENAPA</b>  <b>CNSI</b></p>
Coral Reef Ecosystems	Seawater chemistry of CO <sub>2</sub> 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	<p><b>NIOZ:</b> Gert Jan Reichart, Lennart de Nooijer, Alice Webb (PhD student)  <b>WUR:</b> Didier Bakker</p>
Coral Reef Ecosystems	Benthic-pelagic coupling on coral reefs of the Saba Bank and Saba	SAB, SABA BANK	<p><b>NIOZ:</b> Fleur van Duyl</p>
Coral restoration	Artificial Reefs On Saba and Statia (AROSSTA)	SAB EUX	<p><b>VHL:</b> Alwin Hylkema, Marlous Heemstra  <b>WUR:</b> Dolfi Debrot  <b>STENAPA:</b> Jessica Berkel  <b>SCF:</b> Kai Wulf, Aymi Kuramae Izioka  <b>CNSI:</b> Johan Stapel</p>
Environmental	Caribbean island biogeography meets the anthropocene	AUA, BON, CUR, EUX, SXM	<p><b>VU:</b> Jacintha Ellers, Matt Helmus, Wendy Jesse (PhD. Student), Jocelyn Behm (Postdoc)  <b>CNSI</b></p>

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
NWO Projects in the Dutch Caribbean			
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	<b>KITLV, Leiden University:</b> Gert Oostindie (Project director) <b>KITLV, Leiden University:</b> 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	<b>UU:</b> Henk Dijkstra, <b>NIOZ:</b> Peter Herman, Rebecca James (PhD student) <b>TU Delft:</b> Julie Pietrzak <b>STENAPA</b> <b>CNSI</b>
Geomorphological	4D crust-mantle modelling of the eastern Caribbean region: toward coupling deep driving processes to surface evolution - Reconstructing past climate change	EUX	<b>UU:</b> Wim Spakman <b>NIOZ:</b> Lennart de Nooijer <b>Alfred Wegener Institute Germany</b> <b>CNSI</b>
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	<b>(1) UU:</b> Jetske Vaas (PhD student), Peter Driessen, Frank van Laerhoven and Mendel Giezen <b>(2) UU:</b> Elizabeth Haber (PhD student), Martin Wassen, Max Rietkerk, Maarten Eppinga. <b>CNSI</b>
Invasive species	Global defaunation and plant invasion: cascading effects on seagrass ecosystem services	BON	<b>WUR:</b> Marjolijn Christianen, Fee Smulders (PhD student) <b>Smithsonian:</b> Justin Campbell (coordinator Caribbean wide research project), Olivier Kramer <b>STINAPA:</b> Sabine Engel
Reptiles	Ecology and conservation of green and hawksbill turtles in the Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	<b>RuG:</b> Per Palsbøll, Jurjan van der Zee (PhD student) <b>WUR:</b> Lisa Becking, Marjolijn Christianen <b>STCB:</b> Mabel Nava <b>STINAPA</b> <b>CARMABI</b> <b>STENAPA</b> <b>CNSI</b>

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
NWO Projects in the Dutch Caribbean			
Seagrass	Thalassia Experimental Network (TEN): vulnerability of seagrasses to nutrient pollution (eutrophication) and decline of grazing animals	BON	<b>Smithsonian:</b> Justin Campbell (coordinator Caribbean wide research project), Olivier Kramer <b>WUR:</b> Marjolijn Christianen
Tourism and sustainable development	Vulnerability is dynamic: Enhancing adaptive governance to climate change for Caribbean tourism through interactive modelling	CUR	<b>WUR:</b> Jillian Student, Machiel Lamers <b>UOC:</b> Filomeno A. Marchena
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	<b>WUR:</b> Erik Meesters
DCBD	BO-43-021.04-001 - Expansion knowledge system Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	<b>WUR (Alterra):</b> Peter Verweij
Environmental Hazards	BO-43-021.04-008 - Sunscreen and risks for coral reefs	BON	<b>WUR:</b> Diana Slijkerman
Invasive species	Supported action plan on professional goat farming	BON	<b>WUR:</b> Francesca Neijenhuis
Fisheries	BO-11-019.02-006 - Fish stocks and fisheries Caribbean Netherlands	EUX, SAB, BON	<b>WUR:</b> Dolfi Debrot <b>CNSI:</b> Kimani Kitson-Walters <b>PiskaBon, STINAPA</b> <b>SCF:</b> Kai Wulf, Ayumi Kuramae, interns: Michael Beekhuizen and Alex van der Last
Marine biodiversity	BO-43-021.04-002 – Saba Bank – Marine biodiversity	SAB	<b>WUR:</b> Erik Meesters (benthic communities), Dolfi Debrot, Thomas Brunel, Leo Nagelkerke (fish stocks)

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
BO-projects in the Dutch Caribbean (Min EZ)			
Marine mammals & sharks	BO-43-021.04-005 – Management plan marine mammal and shark sanctuary Yarari	SAB, EUX	<b>WUR:</b> Dolfi Debrot, Dick de Haan, Meike Scheidat, Ayumi Kuramae Izioka <b>SCF (SBMU):</b> Ayumi Kuramae Izioka
Marine mammals	BO-43-021.04-009 Acoustic monitoring of cetacean distribution	SAB	<b>WUR:</b> Dolfi Debrot, Dick de Haan, Hans verdaat <b>SCF:</b> Kai Wulf, Ayumi Kuramae
Marine mammals	BO-43-021.04-007 – Marine mammals in the Dutch Caribbean	BON, SAB, EUX	<b>WUR:</b> Dolfi Debrot, Dick de Haan, Meike Scheidat
World Heritage nomination	BO-43-021.04-004 – World Heritage nomination Bonaire National Marine Park	BON	<b>WUR:</b> Dolfi Debrot <b>Wolfs Co.:</b> Esther Wolfs <b>UNESCO:</b> Josephine Langley <b>DRO:</b> Frank v Slobbe <b>CARMABI:</b> Mark Vermeij, John de Freitas <b>Curacao Footprint Foundation:</b> Leon Pors
“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	<b>STINAPA:</b> Sabine Engel <b>WUR:</b> Klaas Metselaar <b>STCB:</b> Mabel Nava <b>DRO:</b> Frank van Slobbe
Sustainable Agriculture	The sustainable agriculture and rural development program (POP Bonaire)	BON	<b>Bonaire Agri &amp; Aqua Business BV:</b> Sherwin Pourier <b>Wayaká Advies BV:</b> Jan Jaap van Almenkerk <b>DRO:</b> Frank van Slobbe
Invasive species	Feral Pig Control	BON	<b>Echo:</b> Julianka Clarenda <b>DRO:</b> Frank van Slobbe
Reforestation	Reforestation Project	BON	<b>Echo:</b> Julianka Clarenda <b>DRO:</b> Frank van Slobbe
Invasive species	Goat eradication and control in Washington Slagbaai National Park	BON	<b>STINAPA</b> <b>DRO:</b> Frank van Slobbe
World Heritage nomination	World Heritage Nomination Bonaire Marine Park and/or other interconnected sites	BON	<b>Wolfs Company:</b> Esther Wolfs, Boris van Zanten, Amilcar Guzman, Viviana Lujan <b>DRO:</b> Frank van Slobbe

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
"Nature Funding" Projects in the Dutch Caribbean (Min EZ)			
Terrestrial ecosystems	Combating Erosion and Nature Restoration on Bonaire	BON	<b>Bonaire Agri &amp; Aqua Business BV:</b> Sherwin Pourier <b>Wayaká Advies BV:</b> Jan Jaap van Almenkerk <b>DRO:</b> Frank van Slobbe
Terrestrial ecosystems	Cave and karst nature reserve	BON	<b>DRO:</b> Frank van Slobbe <b>CARIBSS:</b> Fernando Simal
Nature communication	Campaign environment and nature on Bonaire	BON	<b>DRO:</b> Frank van Slobbe, Peter Montanus
Agriculture	Horticultural Project	SAB	<b>Government of Saba:</b> Randall Johnson
Recreation	Hiking trails	SAB	<b>Government of Saba:</b> Robert Zagers
Pollution	Tent Reef Protection	SAB	<b>Government of Saba:</b> Robert Zagers
Invasive species	Goat buy-back program	SAB	<b>Government of Saba:</b> Randall Johnson
	Yacht mooring project	SAB	<b>Government of Saba</b> <b>SCF:</b> Kai Wulf
	Saba national park	SAB	<b>Government of Saba</b> <b>SCF:</b> Kai Wulf <b>SABARC:</b> Ryan Espersen
	Crispeen trail project	SAB	<b>Government of Saba:</b> Robert Zagers <b>SCF:</b> Kai Wulf
Community outreach	Nature Awareness project	EUX	<b>Government of St Eustatius</b> <b>STENAPA:</b> Clarisse Buma <b>CNSI:</b> Johan Stapel, Hannah Madden
Nature management	Strengthening management of nature	EUX	<b>Government of St Eustatius</b> <b>STENAPA:</b> Clarisse Buma
Invasive species	Rodent assessment and control	EUX	<b>Government of St Eustatius</b> <b>CNSI:</b> Johan Stapel, Hannah Madden <b>ECPHF:</b> Teresa Leslie
Coral ecosystems	Coral restoration	EUX	<b>Government of St Eustatius</b> <b>STENAPA:</b> Jessica Berkel <b>CNSI:</b> Johan Stapel
Erosion	Erosion control	EUX	<b>Government of St Eustatius</b> <b>CNSI:</b> Johan Stapel

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
EU-BEST funded Projects in the Dutch Caribbean			
Marine ecosystems	Marine Park Aruba	AUA	<b>Directie Natuur en Milieu:</b> Gisbert Boekhoudt <b>TNO:</b> Kris Kats
Coral Reef Restoration	Pop-Up Nursery and Coral Restoration (Oil Slick Leap)	BON	<b>CRF:</b> Francesca Virdis
Coral Reef Restoration	Restoration Ecosystem Services and Coral Reef Quality (Project RESCO)	SAB, EUX	<b>WUR:</b> Erik Meesters <b>SCF (SBMU):</b> Ayumi Kuramae Izioka <b>STENAPA:</b> Clarisse Buma <b>Turks &amp; Caicos Reef Fund</b>
Conservation	Watershed & Biodiversity Conservation of Roi Sangu valley	BON	<b>Echo:</b> Julianka Clarendra
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	<b>Fundo Regional para a Ciência e Tecnologia, Portugal</b> (consortium leader) <b>Wolfs Company:</b> Esther Wolfs
Reptiles	Enacting a news regional recovery plan for the Lesser Antillean iguana: an endangered ecological keystone species	EUX	<b>STENAPA:</b> Clarisse Buma
Terrestrial ecosystems	North Saba National Park, Phase I	SAB	<b>Government of Saba:</b> Menno van der Velde <b>SCF:</b> Kai Wulf <b>SABARC</b> <b>Nature2:</b> Kalli De Meyer <b>Coastal Zone Management:</b> Duncan MacRae

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Birds	Flamingo Abundance	BON	<b>DRO:</b> Frank van Slobbe <b>Cargill</b> <b>STINAPA:</b> Paulo Bertuol
Birds	Monitoring vulnerable parrot nests (remote camera sensing work)	BON	<b>Echo:</b> Julianka Clarenda, Sam Williams
Birds	Yellow-shouldered Amazon parrot roost counts	BON	<b>Echo:</b> Julianka Clarenda <b>DRO:</b> Peter Montanus <b>STINAPA:</b> Albert Christiaan
Birds	Bird Monitoring (Caribbean Waterbird Census)	BON SXM	<b>STINAPA:</b> Paulo Bertuol <b>EPIC:</b> Adam Brown
Birds	Tern monitoring (artificial nesting islands)	BON	<b>STINAPA:</b> Paulo Bertuol <b>Cargill</b> <b>DRO</b> <b>WUR:</b> Dolfi Debrot
Birds	Terrestrial Bird and Habitat Monitoring	BON CUR SAB SXM EUX	<b>Echo:</b> Julianka Clarenda <b>STINAPA:</b> Paulo Bertuol, Caren Eckrich <b>STENAPA</b> <b>Curassavica:</b> Michelle da Costa Gomes <b>Nature Foundation:</b> Binkie van Es
Birds	Red-billed Tropicbird monitoring	SAB EUX	<b>STENAPA</b> <b>SCF:</b> Kai Wulf
Birds	Pelican monitoring	SXM	<b>NFSXM:</b> Melanie Meijer zu Schlochtern
Coral reef ecosystems	Global Coral Reef Monitoring Network	BON CUR SAB EUX SXM	<b>STINAPA:</b> Caren Eckrich <b>CARMABI:</b> Mark Vermeij <b>SCF (SBMU):</b> Ayumi Kuramae Izioka <b>STENAPA:</b> Jessica Berkel <b>NFSXM:</b> Tadzio Bervoets <b>CNSI:</b> 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	<b>WUR:</b> Erik Meesters, Didier de Bakker (PhD student) <b>NIOZ:</b> Fleur van Duyl, Rolf Bak

CATEGORY	SUBJECT	DC ISLANDS	ORGANIZATION(S): LEAD SCIENTIST(S)
Environmental	Water quality testing	SXM	<b>NFSXM:</b> Tazio Bervoets <b>EPIC:</b> Natalia Collier
Environmental	Nutrient (phosphate, ammonium, nitrate and nitrite) monitoring of St Eustatius' coastal waters	EUX	<b>CNSI:</b> Johan Stapel
Fish	Shark monitoring: - Shark sightings - Shark Abundance, distribution and movements (tagging, acoustic telemetry)	AUA BON CUR SAB SXM EUX	<b>WUR:</b> Erwin Winter, Dolfi Debrot, Martin de Graaf <b>FPNA:</b> Giancarlo Nunes <b>STINAPA:</b> Caren Eckrich <b>CARMABI:</b> Mark Vermeij <b>SCF(SBMU):</b> Ayumi Kuramae Izioka, Guido Leurs <b>STENAPA:</b> Jessica Berkel <b>NFSXM:</b> Tazio Bervoets
Fish	Spawning monitoring: Red hind surveys on Moonfish Bank	SAB	<b>SCF (SBMU):</b> Ayumi Kuramae Izioka
Fish	Fish and fishery monitoring (Barracuda's, sharks and eagle rays, tarpons, marine mammals, (fishing) boats, fisherman)	BON	<b>STCB:</b> Mabel Nava
Insects	Bee tracking	BON	<b>Echo:</b> Julianka Clenda
Invasive species	Goat and/or donkey removal: - Washington Slagbaai National Park - Lac Bay area (exclusion plots) - Quill National Park (exclusion plots)	BON EUX	<b>STINAPA:</b> Paulo Bertuol <b>WUR:</b> Dolfi Debrot <b>DRO:</b> Frank van Slobbe <b>STENAPA</b>
Invasive species	Lionfish abundance and control	BON CUR SXM SAB EUX	<b>STINAPA:</b> Paulo Bertuol (50 meter traps) <b>CARMABI:</b> Mark Vermeij <b>NFSXM:</b> Tazio Bervoets <b>SCF (SBMU):</b> Ayumi Kuramae Izioka <b>STENAPA:</b> Jessica Berkel
Invasive species	Feral pig population assessment (trapping)	BON	<b>Echo</b>
Mammals	Bat monitoring	AUA BON	<b>FPNA</b> <b>WildConscience:</b> Fernando Simal, Linda Garcia

CATEGORY	SUBJECT	DC 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	<b>WUR:</b> Bart van Noort, Dolfi Debrot <b>SCF (SBMU):</b> Ayumi Kuramae Izioka <b>AMMF:</b> Angiolina Henriquez <b>STENAPA:</b> Jessica Berkel (sighting forms) <b>NFSXM:</b> Tadzio Bervoets (sighting forms) <b>SCCN</b>
Molluscs	Conch ( <i>Strombus gigas</i> ) on St. Eustatius, Saba Bank, Anguilla	SAB EUX	<b>WUR:</b> Martin de Graaf, Erik Boman (PhD student) <b>SCF (SBMU):</b> Ayumi Kuramae Izioka
Plants	Monitoring of tree growth and survivorship in reforestation areas	BON	<b>Echo:</b> Julianka Clarendra
Reptiles	Lesser Antillean Iguana: Monitoring population density & removing invasive Green Iguana and hybrids (Mohamed bin Zayed Species Conservation Fund)	EUX	<b>STENAPA:</b> Clarisse Buma <b>RAVON:</b> Tim van Wagenveld <b>UvA:</b> Thijs van den Burg
Reptiles	Boa and Cascabel Monitoring	AUA	<b>FPNA</b> <b>Toledo Zoological Society:</b> Andrew Odum
Reptiles	Red-bellied racer snake monitoring	EUX	<b>CNSI:</b> Kimani Kitson-Walters
Reptiles	Behavior of the endemic Aruban Whiptail lizard	AUA	<b>FPNA</b> <b>Auburn University:</b> Jeff Goessling
Seagrass and mangrove ecosystems	Seagrass and mangrove monitoring (BON: also conch and benthic fauna)	BON EUX SXM	<b>STINAPA:</b> Sabine Engel, Caren Eckrich <b>WUR:</b> Klaas Metselaar <b>NFSXM:</b> Tadzio Bervoets <b>CNSI:</b> 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	<b>TurtugAruba Foundation</b> <b>STCB:</b> Mabel Nava <b>CARMABI (STCC):</b> Sabine Berendse <b>STENAPA:</b> Jessica Berkel <b>SCF:</b> Kai Wulf <b>NFSXM:</b> Tadzio Bervoets

## Monitoring and Research Wishlist

### 1. Coastal water quality/nutrients and interaction with groundwater:

**Note:** Recently during the NICO expedition researchers looked at this around Bonaire and Curaçao.

- *Possible link to fish diseases/incidence of Fibropapillomatosis in green turtles in Lac, Lagoon and Curaçao can be used to determine the linkages with water quality, pollutants in sediments, etc serving as indicators, or sentinels for the health of these important ecosystems.*
- *Pollutants (oil, heavy metals, pesticides, endocrine disruptors, plastics, microbial etc) entering coastal waters (subterraneously) from land and their effects on marine organisms (Curaçao).*
- *Quantifying terrestrial hydrological controls on nutrient and sediment fluxes into shallow seas (Bonaire).*
- *Stoichiometric aspects of nutrient enrichment on Caribbean reefs (Curaçao).*
- *What do coral communities do "well" in places where they are not expected? What makes corals cope with more nutrients, warmer waters etc? (Curaçao)*
- *Design of cheap but effective waste water systems (using waste to generate biomass, energy etc.) (Curaçao)*
- *Water quality & pollutants in sediment of Spanish Lagoon (Aruba).*

### 2. Climate Change

- *Evaluation of the most probable effects of climate change and sea level rise (all islands), including risk analysis in coastal zones including coral reefs and recommendations for coastal zone management and climate proofing.*
- *Effects on sea turtles and their nesting beaches.*
- *Effects of changing temperatures and hurricane damage on cloud forest of Saba.*
- *Develop an effective terrestrial monitoring program to enable hurricane damage and recovery assessment.*

The Dutch Caribbean nature conservation organisations are in need for research projects on specific topics to safeguard biodiversity and promote the sustainable management of the natural resources of the islands.

## Monitoring and Research Wishlist

### 3. Hydrology

- *Mapping of groundwater levels and flows [Bonaire].*
- *Nearshore-offshore mixing (Curaçao).*
- *A thorough study of Simpson Bay 's hydrology and water quality, particularly related to land-based sources of pollution. Identify key sources of pollution and track them back to their source (St. Maarten).*

### 4. Morphodynamics

(near shore coastal hydrodynamics, current models):

- *Currents and sand transportation (and production from Halimeda) in Lac (Bonaire) – very important to management of this Ramsar site. **Note:** HVL student is investigating this*
- *Investigate all sand producing organisms to better understand where sand (and beaches) come from (Curaçao).*
- *Effects on beach accretion and depletion Statia and potential of reef restoration/beach restoration.*
- *Sedimentation rates [St. Maarten].*

### 5. Yarari Sanctuary

- *Marine mammals: aerial survey (SSS islands (Saba Bank and waters surrounding Saba, St. Maarten and St. Eustatius), seasonal presence, isolation and abundance as well as seasonal migratory destination(s) and population history of humpback and Bryde's whales in the Dutch Caribbean.*
- *Sharks: Ecological role of Saba Bank for sharks (nursery for nurse sharks, tigersharks, silky sharks?).*

The Dutch Caribbean nature conservation organisations are in need for research projects on specific topics to safeguard biodiversity and promote the sustainable management of the natural resources of the islands.

## Monitoring and Research Wishlist

### 6. Invasive species:

- Follow up studies of impact of rats (and cats) on nesting tropic birds.
- The effects of the invasive seagrass *Halophila stipulacea* on the native seagrasses in the area of Lac Bay, St. Eustatius and St. Maarten, and the ecological impacts (e.g on green turtles feeding in Lac [and Lagun], Bonaire and St. Eustatius; on conch feeding and recruitment [aggregations of juvenile conch under *Halophila* in Statia], sea urchins, etc.) **Note:** NWO funded Projects by Marjolijn Christianen (WUR) are looking at this in relation to sea turtles. Also Erik Boman (WUR) & CNSI looked at this in relation to conch.
- *Scaevola taccada* (White inkberry/Beach naupaka) spread and potential impact on sea turtle nesting on Klein Bonaire.
- Donkey, cat, pig population size distribution and grazing impact on Bonaire. **Note:** Echo is working on a pig control programme.
- Management of *Corallita* **Note:** A running NWO project is focusing on this
- Trapping lionfish in deep waters. **Note:** A project is running by WUR and WNF on the Saba Bank.
- Impact and potential management plans for invasive species. This includes: monkeys, iguanas, mongoose, african land snail, racoons, red eared slider (St. Maarten).
- Invasive species (size, distribution, threat management): boa, rubber vine, tilapia, goats, rats, cats, dogs, cane toad (Aruba).

### 7. Birds

- Migratory birds – patterns, habitat use with an emphasis on nesting species (Bonaire).
- **Yellow shouldered parrot:**
  - ◇ Genetics of yellow shouldered parrot (establish uniqueness of Bonairean Parrot as compared to Venezuelan islands).
  - ◇ What is the effective (i.e., breeding) population size of lora as compared to the total population.
- **Flamingos**
  - ◇ Ecology of the flamingos, in particular the Pekelmeer and flamingo sanctuary. Food availability and fluctuations and effects on breeding success.

The Dutch Caribbean nature conservation organisations are in need for research projects on specific topics to safeguard biodiversity and promote the sustainable management of the natural resources of the islands.

## Monitoring and Research Wishlist

### 8. Carrying capacity/management effectiveness

- *BNMP reef carrying capacity and implications for management (only old and dubious data available, urgent need for an update under current circumstances and how carrying capacity is influenced by management, e.g. can carrying capacity be increased with proper management. Consider also new types of recreation such as kite surfing and assess actual effects).*
- *Effectiveness of nature management, both marine and terrestrial (is management having an effect and what management actions should be improved or instated?)*
- *Saba/Statia trails (effects of use, potential mitigation measures?)*
- *Assess effectiveness of restoration efforts (e.g. reforestation, are the right species being planted, is the focus on rare species correct or counterproductive? **Note:** Echo is working on this on Bonaire). Aruba would like to see reforestation of native, endangered, and key fauna supporting flora.*
- *Study the difference between cruise tourism and stay-over tourism regarding their pressure on the terrestrial and marine environment, taking into consideration the infrastructure needed to accommodate these types of tourism [Bonaire]. **Note:** Wolfs Company did a study on this.*

### 9. Fisheries research

- **Conch:** *vertical (depth) migration of conch.*
- **Commercial fish species:** *identify reproductive season or peak spawning period and area and assess connectivity between islands.*
- **Saba Bank:**
  - ◇ *carrying capacity of main target species (red snappers and lobster (also part of BO program) Feasibility of habitat restoration/artificial habitat for lobster fisheries on the Saba Bank.*
  - ◇ *Unused stocks: identify potential and sustainability of currently unused fish stocks such as diamond-back squid, swimming crabs.*

The Dutch Caribbean nature conservation organisations are in need for research projects on specific topics to safeguard biodiversity and promote the sustainable management of the natural resources of the islands.

## Monitoring and Research Wishlist

### 10. Sociological study of nature perception in the community

**NOTE:** Echo did a study on perception of parrots in the community in 2012, this could be a starting point. Also Stacey Mac Donald (KITLV, Leiden University, NWO funded project) is looking at this on the BES islands. Another project focusing on this is the Nature Awareness Project by CNSI (nature funded project).

- *How does the local community perceive nature and nature conservation and to what degree do they enjoy nature, how might this be improved? How effective is current communication, if any, to improve enjoyment of nature in the community and perception of the need to protect nature?*
- *Sustainable tourism – perception/expectations of tourists and residents as tourism grows (Bonaire).*
- *Invasive species control on islands where free-roaming livestock is a cultural norm – changing traditions in a changing world (Bonaire).*
- *Sociological/anthropological study of the cultural value of the endangered Lesser Antillean iguana *Iguana delicatissima*. How often is it caught? Perceived as a delicatessen? (St. Eustatius)*
- *Assess the extent of current pollution from land by plastic bags, styrofoam and other plastic debris. How willing are people to change their behavior vis a vis plastic bags, and what would be needed to effectively curb the continued generation of this type of marine debris.*

### 11. DNA barcoding to monitor biodiversity

(is already running on St Eustatius by Naturalis)

- *Biodiversity inventory: terrestrial. (St. Maarten and Aruba (also marine))*
- *Endemic, Endangered, and Keystone species (size, distribution, conservation management): Shoco (continue program), Bats (continue program), Prikichi, Santanero, Cascabel (renew program), Pollinators, Key fauna supporting flora (Aruba).*
- *Natural history Flora and Fauna distribution.*

### 12. Improve baseline data on sharks

(continue Shark research, especially shark tagging, movement and abundance).

The Dutch Caribbean nature conservation organisations are in need for research projects on specific topics to safeguard biodiversity and promote the sustainable management of the natural resources of the islands.

## Monitoring and Research Wishlist

### 13. Coral reefs

- *Which herbivores can be used to reverse coral to algal phase shifts? Which algae are consumed and which ones aren't? (Curaçao)*
- *Effects of habitat fragmentation and its effect on gene flow on coral reefs (Curaçao).*
- *The contribution of waterflow to reef health (Curaçao).*
- *Shipping impacts to nearshore coral reef environments (Bonaire).*
- *GCRMN reef monitoring (Sint Maarten needs funding for long-term project).*

### 14. Economic valuation of key habitats (St. Maarten)

### 15. Environmental impact assessment landfill (St. Maarten)

### 16. Anthropogenic stressors:

- *Effects, potential mitigation measures: Off-road vehicles (Aruba).*
- *Carrying capacity of (1) Off-road vehicles, (2) Conchi – (3) Natural Pool, Caves (Aruba).*

### 17. Sargassum: predictions, impacts, management (All).

### 18. Fibropapillomatosis in green turtles: cause, spread and severity of the disease (Bonaire, Curaçao).

The Dutch Caribbean nature conservation organisations are in need for research projects on specific topics to safeguard biodiversity and promote the sustainable management of the natural resources of the islands.

## Monitoring and Research Wishlist

### Additional notes:

The following are research questions from previous years and still very much valid for Aruba, Curaçao and St. Maarten. They are mostly completed or underway on the Caribbean Netherlands' islands but some are still valid.

### Collection and evaluation of baseline data

*including species inventories and production/updating of habitat maps for key habitats and species including:*

- **Marine environments**  
(coral reefs, seagrass beds, mangrove forests):
  - ◇ **Habitat maps** for all marine ecosystems: Aruba, Bonaire (windward side), Saba [done], Saba Bank, St Eustatius [done], St Maarten
  - ◇ *Revised habitat maps for the leeward shore: Bonaire [done], Curacao [note that there are habitat maps for Bonaire and Curaçao produced by Fleur van Duyl but these are now decades out of date. Recently a report from WUR came out (Mücher et al. Hyperspectral Coral Reef Classification of Bonaire). During the NICO expedition bathymetric data has been collected by Dr. Henk de Haas (NIOZ) for the Dutch Caribbean islands but this data still needs to be analyzed.*
- **Terrestrial environments:**
  - ◇ **Habitat maps** for Aruba [habitat maps produced and ground truthed by CARMABI exist for all islands except Aruba]
  - ◇ **Species inventories** (all islands) [Statia starting soon]
  - ◇ *Cost effective methods for assessing terrestrial habitat change [remote sensing is now being proposed for monitoring]*
  - ◇ *Detailed inventories and mapping for **key ecosystems** including*
    - › Cactus habitats (Bonaire)
    - › Elfin forest (Saba)
    - › Boven forest types (Statia)
  - ◇ *Baseline data and population dynamics (including reproductive biology and conservation ecology) for **key species** including:*
    - › Caribbean coot
    - › Northern Caracara
    - › Red bellied racer (Saba, Statia)

The Dutch Caribbean nature conservation organisations are in need for research projects on specific topics to safeguard biodiversity and promote the sustainable management of the natural resources of the islands.

## List of Acronyms

<b>AUA</b>	<b>Aruba</b>
<b>BON</b>	<b>Bonaire</b>
<b>CUR</b>	<b>Curaçao</b>
<b>SAB</b>	<b>Saba</b>
<b>EUX</b>	<b>St. Eustatius</b>
<b>SXM</b>	<b>St. Maarten</b>
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.

### "Behm et al. (2018).

First records of the mourning gecko (*Lepidodactylus lugubris* Duméril and Bibron, 1836), common house gecko (*Hemidactylus frenatus* in Duméril, 1836), and Tokay gecko (*Gekko gecko* Linnaeus, 1758) on Curaçao, Dutch Antilles, and remarks on their Caribbean distributions. *BiolInvasions Records* 7, in press."

### "Burgess, C.P. et al. (2018).

Estimating damages from climate-related natural disasters for the Caribbean at 1.5 °C and 2 °C global warming above preindustrial levels. *Regional Environment change*."

### "Kitson-Walters, K. (2018).

St. Eustatius GCRMN Caribbean Final Report 2017."

### "IPCC(2018).

GLOBAL WARMING OF 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty."

### "Sandusky, H. et al. (2018).

Management of moored fish aggregation devices (FADs) in the Caribbean. *Collect. Vol. Sci. Pap. ICCAT*, 74(5): 2230-224."

### "Schnurr et al. (2018).

Reducing marine pollution from single-use plastics (SUPs): A review. *Marine Pollution Bulletin* 137: 157-171."

### "Veer, H.W. et al. (2018).

Occurrence and life history characteristics of tropical flatfishes at the coral reefs of Curaçao, Dutch Caribbean. *Journal of Sea Research* 142: 157-166."

## Student Reports

### "Roos, N. (2018)

Erosion around Karlendijk, Bonaire."

### "Sweeney, L.F. (2018).

Assessing the impact of *Antigonon leptopus* on Saba and St. Eustatius."

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](mailto:research@DCNAnature.org)

## Calendar

**More events to add to this calendar?**  
Please e-mail us: [research@DCNANature.org](mailto:research@DCNANature.org)

### November

2-4	Conference	16th International American Cetacean Society Conference, California, US.
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.
23-26	Meeting	IV Taller Internacional de investigaciones sobre manejo de ecosistemas frágiles. Cuba.
17-27	Expedition	Saba Bank expedition, Wageningen Marine Research
27	Meeting	8th Meeting of the Fisheries Commission BES, Bonaire.
Tbc – last week of November	Meeting	Steering committee of the GCRMN-Caribbean initiative

### December

3-7	Meeting	Eighth Technical Meeting for our Biodiversity Protocol (#SPAWSTAC8) Panama City, Panama.
5	Event	World Soil Day
5-7	Conference	International Conference on Plastics in the Marine Environment, Singapore.
7	Symposium	AcroporaNet symposium, Hogeschool Van Hall Larenstein, Leeuwarden, the Netherlands
7-9	Meeting	32nd International Coral Reef Initiative General Meeting, Nairobi, Kenya
13-17	Workshop	Junior Ranger Workshop, Aruba.
10-14	Symposium	Coral Restoration and Intervention-Science Symposium, Key Largo, Florida, USA.
10-14	Meeting	Sharks MOS <sub>3</sub> - 3rd Meeting of the Signatories to the Memorandum of Understanding on the Conservation of Migratory Sharks. Monaco.
15-18	Workshop	Coral Restoration Workshop. Summerland Key, Florida.
16-25	Expedition	Saba Bank Expedition WMR



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

## Members of the Dutch Caribbean Nature Alliance



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DCNA's activities are generously supported by  
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Bionews is funded by the Ministry of Agriculture,  
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## References

### Erosion around Kralendijk, Bonaire

Roos, N. (2018). Erosion around Kralendijk, Bonaire. Msc. student report.

### Crowned Slaty Flycatcher: another new bird for Bonaire and for the Kingdom of the Netherlands

Robb, R. (2013). Crowned Slaty Flycatcher (*Empidonomus aurantioatrocristatus*), version 1.0. In Neotropical Birds Online (T. S. Schulenberg, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/nb.croslf1.01>

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