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## Welcome to BioNews

BioNews is a monthly newsletter featuring recent biodiversity research and monitoring on and around the six islands of the Dutch Caribbean. BioNews also provides an overview of recent publications, current research and monitoring activities, and upcoming events.

For any questions or feedback, or if you would like to make a contribution, please contact us at [research@DCNAnature.org](mailto:research@DCNAnature.org)



Photo credit: Benjamin Mueller

## Editor's Notes

In this month's issue of BioNews, we focus on the subject of coral reef rehabilitation and the different ways in which it can be undertaken. Coral reef rehabilitation is rapidly becoming one of today's most talked about topics within coral reef conservation, as difficult to control threats such as climate change and ocean acidification continue to increase in magnitude. Here we look at how each of the islands of the Dutch Caribbean are establishing local coral reef restoration programs, with a spe-

cial emphasis on the work carried out on Bonaire by the Coral Restoration Foundation Bonaire and on Curaçao by SECORE International, the CARMABI Foundation and the University of Amsterdam.

Invasive species are another serious conservation issue faced by our islands, and in this edition we take a look at how Sint Eustatius is coping with the arrival of an invasive green iguana, which outcompetes the native Lesser Antillean iguana for food and habitat.

We continue to profile the Dutch Caribbean research institutes first presented in BioNews 20, this time focusing on the directors and staff as well as the research and projects of CIEE Research Station and Caribbean Netherlands Science Institute.

Updates are also given on the 8<sup>th</sup> meeting of the Dutch Caribbean Committee of Marine Biodiversity and Fisheries.

*Happy reading!*

## Coral Reef Rehabilitation in the Dutch Caribbean

**The Dutch Caribbean islands are recognized worldwide for their healthy reefs and outstanding dive sites. Nevertheless, while these reefs are showing signs of resilience and recovery from recent bleaching events (6), they still face a large number of local, regional and global threats such as eutrophication and development, bleaching, diseases and hurricanes as well as ocean acidification and climate change. In light of the accelerated decline of many coral species and a rise in hard-to-control threats, coral reef conservation efforts have begun to focus on active rehabilitation of populations of threatened coral species.**

The Caribbean population of two important reef-building species, staghorn coral (*Acropora cervicornis*) and elkhorn coral (*Acropora palmata*) especially suffered from white band disease in the late 1970s and early 1980s with close to 95% of the population whipped out. Having collapsed throughout the entire Caribbean Region, both coral species are now listed as Critically Endangered under IUCN's Red List of Threatened Species. *A. cervicornis* and *A. palmata* used to dominate shallow reefs in the region and create a 3D framework that served as habitat for a myriad of other organisms including important

commercial fish and their juveniles. In light of the important ecological role that both corals play, they have been especially targeted for rehabilitation.

On Bonaire, early rehabilitation attempts focused on the use of Reef Balls, but these were rapidly abandoned due to resulting low coral recruitment. Hurricane Lenny (1999) and Hurricane Omar (2008) caused significant damage to the remaining shallow water populations of staghorn and elkhorn coral on the island's west coast. Nowadays, the Coral Restoration Foundation Bonaire (CRF Bonaire) leads coral



## Continued: Coral Reef Rehabilitation in the Dutch Caribbean

restoration efforts on the island. The foundation was established in 2012 in partnership with Dive Buddy Dive Resort; today it is sponsored by two more dive operators, Eden Beach Resort and Harbour Village Beach Club, and is supported by both the local government and the Bonaire National Marine Park. In just four years, CRF Bonaire has made incredible strides in its mission to *“develop affordable, effective strategies for protecting and restoring the shallow water population of staghorn and elkhorn corals along the coastlines of Bonaire and Klein Bonaire”* (CRF Bonaire, 2015).

The coral propagation and reef restoration technique used by CRF Bonaire is known as coral gardening and is the most commonly used within the Caribbean. This method uses the natural process of asexual reproduction of staghorn and elkhorn coral through fragmentation to provide new coral clones for population growth (5). Small fragments are taken once from healthy wild populations, fragmented and grown in underwater nurseries and then transplanted to degraded reef areas. While this coral rehabilitation method was until recently believed to be restricted to branching species, Coral Restoration Foundation in the Florida Keys is currently growing blade fire coral, pillar coral and boulder star coral in their offshore nursery using the same method.

CRF Bonaire currently has four mid-water nurseries around the island with a total coral production of 8500 corals every 6 to 8 months. Within each nursery are rows of what most described as “Christmas

tree-like trees”, structures with a PVC trunk and coral fragments suspended on branches made of fiberglass (see image). A “full” tree can hold anywhere from 100 to 160 corals. Presently, there are 12 *A. cervicornis* and 11 *A. palmata* genotypes (i.e. coming from different parental colonies) within the nurseries. A recent series of field experiments conducted by Meesters et al. (4) in the CRF Bonaire nurseries found a very fast and high regeneration of cut surfaces on fragments and mother colonies (99.6%), with cut surfaces completely healed within 2 to 3 weeks. Growth rates were also found to be excellent, at about 2.5 cm per month.

Once the healthy fragments have reached sufficient maturity (this takes on average 8 months), they are transplanted to degraded reef areas. Two corals transplanting methods are used to stabilize fragments on the restoration sites: “gluing” fragments to rocky substrate using marine epoxy or tying fragments to horizontal structures, elevated 20 cm from the bottom. Tying corals on the structure allows transplantation on unstable substrate and keep the corals, initially small, relatively far from the bottom and less affected by predators.

Meesters et al. (4) found transplant growth of staghorn in CRF Bonaire nurseries to be very high, almost 14 cm per year per branch tip. They also found that the rate of survival was 100% after 7 weeks and was not affected by the differing environmental conditions of transplant sites. *“Results show clearly that current restoration practices by CRFB of transplanting Staghorn colonies to different locations is likely to be an excellent way to restore the Staghorn fields of Bonaire. The measured survival, regeneration, and growth rates indicate that current restoration practices of CRFB are highly sustainable and may create viable clusters of staghorn colonies which may initiate the regrow of staghorn corals into thick fields.”* (Meesters et al. (4)). To date, CRF Bonaire has transplanted close to 6000 coral colonies in 7 restoration sites around Bonaire.

In May 2015, Ocean Encounter Curaçao launched the Coral Restoration Foundation Curaçao Program with the support of Coral Restoration Foundation International and the Coral Restoration Foundation Bonaire. As with CRF Bonaire, the main objective is to restore the Curaçao’s shallow water reef system. The first coral nursery was immediately set up with ten “trees” holding elkhorn and staghorn coral fragments. A similar coral reef nursery project, but on a much smaller-scale, was recently launched on Saba. Sea and Learn started this project last October in partnership with the Coral Restoration Foundation, Samford University, Saba Conservation Foundation, Youth Environmental Leadership Program (YELP) and Sea Saba Dive Center (BioNews 22, page 8).



One of CRF's coral nursery with "Christmas tree-like" structures.  
Photo credit: Beth Watson/ CRF Bonaire





Elkhorn coral (*Acropora palmata*) transplanted by CRF Bonaire, two years later.  
Photo credit: Patrick Ragot/CRF Bonaire

On Curaçao, researchers of SECORE International, the CARMABI Foundation and the University of Amsterdam have been investigating since 2010 the effectiveness of another coral propagation method that employs larval seeding rather than coral fragmentation. Unlike coral gardening, larval seeding is based on the sexual reproduction of corals. This method allows for genetic recombination, which is essential for corals to adapt to the environmental conditions experienced by coral reefs at present. Male and female gametes are typically collected on the reef during coral spawning events, fertilized and

grown in a laboratory setting and then transplanted to degraded reef areas. SECORE has developed a technique whereby male and female gametes are caught in the wild using non-invasive techniques and those gametes are fertilized *in vitro* to raise large numbers of genetically unique corals that could harbor the genetic make-up to survive on present day Caribbean reefs.

Several studies by Chamberland et al (1;2) have looked into the potential of this method to rehabilitate threatened elkhorn coral populations on Curaçao. In 2011, collected gametes were reared in a land-based nursery for one year and then transplanted to shallow waters (1). Survival was quite high: seven of the nine colonies survived and kept growing four years later. Even more exciting: two colonies were observed spawning, which is “the first time that an endangered Caribbean coral species was raised from larvae and grown to sexual maturity in the field” (Chamberland et al (1)). Since then, many more elkhorn corals have been outplanted but “coral offspring are no longer kept in aquaria very long; they are outplanted two to three weeks after they settle to reduce associated costs and labor and has proven to be more successful than long-term periods in nurs-

*Meesters et al. suggest combining characteristics of coral gardening and larval seeding to create a hybrid approach that would increase growth, survival and genetic diversity.*



## Continued: Coral Reef Rehabilitation in the Dutch Caribbean

eries" (Valérie F. Chamberland, personal comment). A study published in July 2015 by Chamberland et al. (2) reported that the survival rate of *A. palmata* settlers outplanted two weeks after settlement was 6.8 times higher than that of settlers kept in a land-based nursery, and was much more cost-effective.

Larval seeding has also successfully been used for other coral species. SCORE International, in partnership with the CARMABI Foundation and the University of Amsterdam, has successfully reared and outplanted thousands of brain coral offsprings in reefs under a variety of conditions. Only time will tell now whether these brain corals can help strengthen degraded reef areas in the long-run.

Researchers from CARMABI as well as from the University of California, the University of Amsterdam and Pennsylvania State University have begun to investigate the potential of larval seeding for pillar coral (*Dendrogyra cylindrus*); this coral has a very low recruitment rate that compromises its recovery (3). Rapid embryonic development was documented and two of the larvae fertilized in the lab and successfully reared to primary polyp settler stage survived for over 7 months. While these results show some success, further research on a much larger scale is now needed.

The use of either coral gardening or larval seeding to rehabilitate local damaged reef areas is dependent on many factors, as both methods have shown great potential as well as certain limitations. One very positive impact of coral gardening is its effect on the education of locals and visitors by involving volunteers in the restoration program. Volunteers for CRF Bonaire help with many crucial tasks such as maintaining nurseries and transplant sites as well as monitoring fragment growth and survival. However, coral gardening carries the risk of creating coral populations with little genetic variability due to its reliance on fragmentation. In their study of the



15-month-old Brain coral (Mussidae).  
Photo credit: Valérie Chamberland

CRF Bonaire nurseries, Meesters et al. (4) found that parental origin of the transplanted fragments significantly affected damage regeneration and growth rates. Larval seeding, on the other hand, is more likely to lead to genetic diversity, which implies more long-term success of restoration efforts. Both methods, however, are "limited by costs and labor that are mostly related to the outplanting phase as each coral fragment/offspring needs to be carried to the reef and attached to the substrate manually which is extremely time consuming and costly" (Valérie F. Chamberland, personal comment). Meesters et al. (5) suggest combining characteristics of both to create a hybrid approach that would increase growth, survival and genetic diversity.

Several knowledge gaps within the Dutch Caribbean must be filled to help increase the genetic variation within coral restoration efforts, such as the identification of genotypes used in reef restoration efforts, the genetic variation of natural populations of corals and the long-term success of restoration methods. Most importantly, coral rehabilitation alone cannot be successful in safeguarding our reefs. To ensure long-term success, restoration must come hand in hand with the active and effective management of local, regional and worldwide threats.

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# 8<sup>th</sup> meeting of the Dutch Caribbean Committee for Marine Biodiversity and Fisheries

Bonaire, November 24, 2015

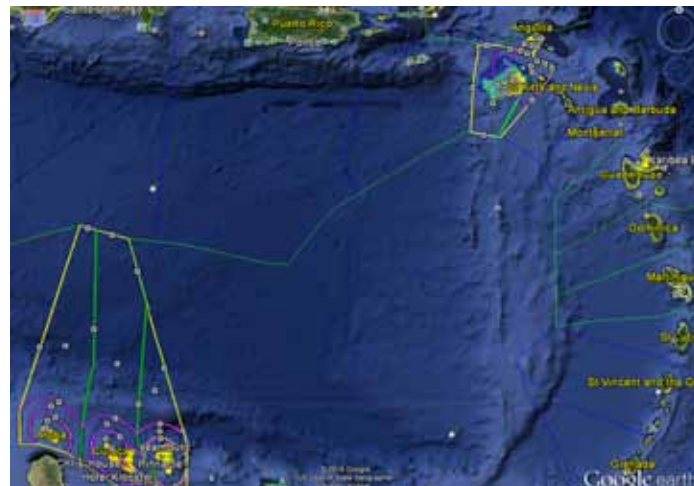
By Paul Hoetjes

**On November 24<sup>th</sup> 2015, the Committee for the joint management of Marine Biodiversity and Fisheries (CMBF) of the Dutch Caribbean (aka EEZ Committee) met on Bonaire for its twice yearly meeting. The EEZ Committee consists of representatives of each of the islands and the Netherlands, who have signed the agreement for joint management of the EEZ waters (EEZ agreement).**

Currently the members are Bonaire, Curaçao, Saba, St. Eustatius and the Netherlands. Permanent observers to the meetings are the Dutch Caribbean Coastguard, the Dutch Caribbean Nature Alliance (DCNA) and the Dutch Ministry of Infrastructure and Environment (I&M), which is responsible for shipping and marine pollution. Aruba, as yet not a signatory member to the EEZ agreement, was present as an observer at the meeting. Other invited observers at the meeting were the French *Agoa* Sanctuary of Marine Mammals and the PEW Charitable Trusts Shark Conservation Program.

The main news at this 8<sup>th</sup> meeting of the Committee was of course the establishment of the Yarari Marine Mammal & Shark Sanctuary two months earlier in September. One of the objectives of this meeting was to develop a Plan of Action for the Sanctuary, both for sharks and for marine mammals. The French *Agoa* Sanctuary of Marine Mammals and the PEW Charitable Trusts Shark Conservation Program gave presentations of their work as background information for this. DCNA presented their shark conservation program.

The meeting agreed to a first outline of a Plan of Action for the Yarari Sanctuary that will be refined and discussed further at the next meeting. The PoA out-



The Dutch Caribbean EEZ (yellow outlines)  
Photo credit: Google Earth

line has four main objectives to direct its actions to improve protection of marine mammals and of sharks. These are: 1) cooperation to strengthen regional protection; 2) improve knowledge through research and monitoring; 3) develop guidelines and regulations to reduce impacts of human interaction; and 4) outreach to sensitize and engage the general public, fishermen and other stakeholders to get their support, and, particularly in regard to shark conservation, improve compliance with protective regulations.

This was the first time that Curaçao participated as a signatory member of the Committee. Representatives from the island provided an overview of their recent activities in the marine environ-

ment. This was an impressive list, ranging from the establishment of four new Ramsar sites—three of which include the marine environment—to a survey of the coral reefs at 150 sites around the island, making Curaçao probably the best surveyed island in the world. Curaçao has signed a Memorandum of Agreement with the Waite foundation to develop an Ocean Policy Plan and has committed to subsequently implement that plan. Curaçao is also working on strengthening its research institutions, CARMABI and the Sea Aquarium/Curaçao Substation, so as to become a regional leader in the natural (marine) sciences.

The next EEZ Committee meeting is scheduled on Curaçao in March 2016.



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Photo ID side view of a male iguana after tagging.  
Photo credit: Thijs van den Burg

## Endangered Dutch Iguana species put on the map

By Thijs van den Burg (MSc University of Amsterdam) and Bart Kluskens (Stichting RAVON)

**With the accession of the islands of Bonaire, Saba and St. Eustatius as special municipalities of the Kingdom of the Netherlands, the list of 'Dutch' reptiles and amphibians has broadened. Of particular interest is the endemic Lesser Antillean Iguana which is native to St. Eustatius. Unfortunately, a range of factors has put the population of this iguana in danger of disappearing from the island. Despite estimates from the past, it remains unclear how small and viable the population is. Monitoring the population of the Lesser Antillean Iguana on St. Eustatius is therefore of the utmost importance. For the first time, the actual size of the population will be mapped and long-term monitoring has been added to the island's conservation agenda.**

### Why are we doing this?

Once widely distributed across 14 islands throughout the northern part of the Lesser Antilles, the population of the Lesser Antillean Iguana (*Iguana delicatissima*) now has a very restricted range. Based on historic data, the population is believed to have declined by approximately 70% since the arrival of Europeans (Knapp et al., 2014). As a result, this extraordinary species (listed as Endangered on the IUCN Red List) now only occurs on a few islands, including the Dutch island of St. Eustatius where the population is now at risk of becoming extirpated.

Past assessments have indicated that the population of the Lesser Antillean Iguana on St. Eustatius is very small, with estimates of 300 individuals in 1992, <300 individuals in 2000, and 425 (275-650) individuals in 2004 (Fogerty et al., 2004). The most recent

population estimates from 2012 indicate that the iguana population has decreased and now lies on the low side of the range of the 2004 survey (Debrot et al., 2013). It should also be noted that far fewer nesting sites were found, presumably due to a loss of suitable nesting habitat.

The species is threatened by a range of non-native introduced predators such as dogs and cats (Debrot et al., 2014), which, in combination with habitat loss caused by grazing, may soon result in the extinction of this species within the Kingdom of the Netherlands. To prevent this from happening, a conservation action plan has been put together which includes long-term monitoring of the species; a comprehensive population census is already being conducted.



## Controlling the Invasive Green Iguana

Much attention has recently been placed on controlling the invasive green iguana (*Iguana iguana*) since an individual was found on the island in February of this year. No one is exactly sure how this iguana arrived on Sint Eustatius, but what is certain is that it poses a significant threat to the population of local Lesser Antillean iguanas. Green iguanas out-compete them for food, habitat as well as inter-breed with them. Local experts are currently surveying certain areas to make sure that no other green iguanas are on the loose, and have asked residents for their assistance. Thanks to funding provided by the Ministry of Economic Affairs in the Netherlands, several local foundations and government departments in collaboration with IMARES and local experts are preparing a rapid “search and destroy” mission in combating the invasive green iguana. The hope is that they can be stopped before they spread and become difficult to control.

### Methods

**Technique:** In order to map the population of the Lesser Antillean Iguana and for future research and conservation purposes, the iguanas were marked using the bead-tagging method. Many iguana conservation initiatives worldwide use this technique as it is considered non-invasive (Binns et al. 2007). To facilitate the identification of individual iguanas, a permanent and unique colour-code was inserted into the reptiles’ nuchal crest skin just beneath the crest spines. With this method, the animals do not need to be recaptured as the bead-tag enables the identification of individuals from a distance. The survey on St. Eustatius began in April 2015. An opportunistic sampling method was used due to a lack of knowledge on iguana locations and population densities.

**Fieldwork:** Because the species is arboreal and therefore lives predominantly in treetops and thorny bushes, Lesser Antillean Iguanas were captured using a telescopic pole with a noose. When possible, they were caught by hand. Once captured, a bead-tag was inserted into the iguanas’ dorsal crest; a cloth was first put over each animal’s head to minimize stress. Once the skin was cleaned with alcohol, a hollow needle was inserted and a metal wire guided through it. Glass coloured beads were arranged in the same order on both sides of the crest and secured by flattening the metal wire on either side. A database has been set up to keep track of all the unique color-codes already in use. For each captured iguana, length and weight measurements, presence of parasites and morphological abnormalities were also recorded. Furthermore, photographs were taken of the captured animals to facilitate identification.

**Monitoring and Management:** Between April and October 2015, 70% of Statia’s surface area was monitored so as to assess the island’s population of Lesser Antillean Iguanas. During this time, 266 animals were caught, of which 189 animals were tagged with a bead code. Research and monitoring will be carried-on long-term in co-operation with St. Eustatius

National Parks (STENAPA) and as part of current and future student projects. By doing so, we hope to gain a better estimate of the current iguana population as well as any population growth or decline. Furthermore, this research will provide valuable insights into the iguana’s distribution throughout the island and its habitat use and preferences. These findings will provide the much-needed data needed to implement effective management strategies for the conservation of this endangered species.

This research was made possible in collaboration with STENAPA and through financial contributions from the FONA Conservation Fund and the International Reptile Conservation Foundation. Thijs van den Burg laid the foundation for this research as part of his Population Genetic Structure assessment in the context of an MSc at the University of Amsterdam. Our gratitude goes out to Hannah Madden, Ambrozius van Zanten (STENAPA) and Tim Wagenveld (MSc Wageningen University) for their assistance during fieldwork. We would also like to thank John Binns (International Reptile Conservation Foundation) for supplying materials and research protocols.

**For more information on the conservation program, please visit: [www.SOSiguana.org](http://www.SOSiguana.org)**



The Lesser Antillean Iguana in its natural environment.  
Photo credit: Thijs van den Burg



## Members of the Dutch Caribbean Nature Alliance



**Aruba**  
Fundacion Parke  
Nacional Arikok  
tel: +297-585-1234  
[www.arubanationalpark.org](http://www.arubanationalpark.org)



**Bonaire**  
STINAPA Bonaire  
tel: +599-717-8444  
[www.stinapa.org](http://www.stinapa.org)



**Curaçao**  
CARMABI  
tel: +599-9-462-4242  
[www.carmabi.org](http://www.carmabi.org)



**Curaçao**  
Stichting Uniek Curaçao  
tel: +599-9-462-8989  
[www.uniekcuracao.org](http://www.uniekcuracao.org)



**Bonaire**  
STCB  
tel: +599-717-2225  
[www.bonaireturtles.org](http://www.bonaireturtles.org)

# Science directors and staff of CIEE and CNSI

## CIEE Research Station Bonaire

CIEE Research Station Bonaire has a very important role in the advancement of scientific research within the Dutch Caribbean and welcomes many students and visiting scientists from around the world. The research station maintains a small academic staff to conduct research, educational and advisory activities. Other staff members also help maintain the facility and support the efforts of visiting researchers and scientists in a variety of ways including logistics, field research and assistance in the lab.

Dr. Rita Peachey has been the Director of CIEE since 2006 and is currently leading a long-term research project on the health of Bonaire's coral reefs. Her current focus is the expansion of the CIEE Research Station and advising CIEE headquarters on a new global initiative to increase access to Science, Technology, Engineering and

Math programs for CIEE students. She is also the Executive Director of the Association of Marine Laboratories of the Caribbean.

CIEE Research Station Bonaire has five additional staff members. The Coral Reef Ecology Faculty (Dr. Enrique Arboleda) co-teaches Independent Research and Marine Ecology Field Methods. There is also a dive safety officer, a program coordinator, a logistics coordinator and a facilities manager. Several seasonal interns also help CIEE staff with education, research, and

outreach initiatives. And of course, not to be forgotten is Dushi, the research station's service dog and most beloved staff member!

CIEE Research Station faculty and staff are involved in a number of research projects, including investigations of long-term changes in the coral and benthic community around Bonaire, the impacts of recreational SCUBA diving on Bonaire's reefs, and studies of invasive lionfish. Details of current projects can be found in the Research and monitoring tables.



CIEE team and their students from the spring 2016 program who presented their independent research projects. Photo credit: CIEE

## Caribbean Netherlands Science Institute

The most recent science institute to open on our islands is the Caribbean Netherlands Science Institute (CNSI) on St. Eustatius. Unlike CIEE and CARMABI, CNSI has just three "official" staff members: a Director (Dr. Johan Stapel), an administrator and a research technician. Prior to this position, Johan Stapel was a researcher at IMARES (Wageningen University) where he worked on, amongst many others things, the set up of a framework for a Multifunctional Knowledge Centre on Statia.

CNSI is formally administered by the NIOZ Royal Netherlands Institute for Sea Research. The CNSI Director is secretary to a Steering Group installed by the NIOZ Board to advise the Board on implementation and endorsing policy development and management decisions. The Steering Group consists of representatives of relevant Dutch scientific organizations and

the governments of The Netherlands and St. Eustatius. The tasks of the CNSI Director include implementation of CNSI, policy preparation and the day-to-day management of the institute under responsibility of the NIOZ Director. Three different User Groups advise the CNSI Director on organizing logistics and facilities for outreach and education, natural sciences and social sciences and help draft the institute's knowledge agenda for the Caribbean. The proposed launch of a Dutch Caribbean Advisory Panel awaits the results from a mid-term evaluation that was recently carried out.

CNSI is currently involved in many projects that tie in with its mission to encourage and facilitate research into issues of scientific, social and economic relevance within the Caribbean Netherlands. The science institute is participating alongside STENAPA, SCF and



Participants and teachers in the summer school 'Small Island Natural Resource Development' (February 2016). Far left and right in the front row Masru Spanner and Pepita Cannegieter and third from the right in the back row Johan Stapel, the three staff members of CNSI. Photo credit: Johan Stapel

NFSXM in several research projects led by IMARES, and it is also involved in most of the current projects of the Netherlands Organisation for Scientific Research (NWO) within NWO's Caribbean Research Programme as well as in a number of other long-term projects focused on local biodiversity and environmental management (see Research and monitoring tables on page 9-13).



## Research Overview

Below you will find an overview of the research projects for which fieldwork took place on the islands of the Dutch Caribbean.

Category	Subject	Islands	Organization(s): Lead scientist(s)
Amphinomida	Fluorescence on the marine fireworm <i>Hermodice carunculata</i>	BON	CIEE: Enrique Arboleda
Birds	Suitability study and reforestation of exclosures facilitating the Yellow-shouldered Amazon Parrots ( <i>Amazona barbadensis</i> ) on Bonaire.	BON	Echo: Lauren Schmaltz WUR: Quirijn Coolen (student)
Cnidaria	Cubozoans of Bonaire	BON	CIEE: Rita Peachey, Austin Lin
Coral Reef ecosystems	Comparing reef fish survey techniques between UVC and sDOV	EUX	IMARES: Martin de Graaf STENAPA, Min EZ, CNSI
Economics of ecosystems	The Economics of Ecosystems and Biodiversity (TEEB) on Aruba	AUA	Wolfs Company: Esther Wolfs VU University Amsterdam: Pieter van Beukering YABI consultancy: Francielle Laclé
Environmental	Environmental DNA (eDNA)		CIEE: Rita Peachey, Dr. Enrique Arboleda Indiana University: Stephen Glaholt
Environmental	Effects of an exotic ecosystem engineer on a multi-trophic native community	EUX	VU: Jacintha Ellers (Principle Investigator), Wendy Jesse (PhD Student), Jasper Molleman (Msc. student)
Invasive species	Research into mitigation measures for Sargassum Seaweed	SXM	NFSXM: Tadzio Bervoets Government of St. Maarten
Invasive species	Invasive seagrass-sea turtle interactions (*Part of NWO project: Ecology and conservation of green and hawksbill turtles in the Dutch Caribbean)	BON	STCB: Mabel Nava RuG: Marjolijn Christianen, Moniek Gommers (Msc. student) WUR: Lisa Becking
Invasive species	(1) Roaming grazer impacts on forest regeneration (2) Predation by feral chickens on forest fauna and flora (3) Status of the Giant African Landsnail on Statia and prospects for its control or eradication.	EUX	IMARES: Dolfi Debrot STENAPA VHL: Jelmer van Belle, Lara Uphoff (student) and Friso Dalm (student) LVV: Anthony Reid CNSI
Invasive species	The effect of goats on soil erosion, in Bonairean Scrublands - WSNP	BON	WUR: Asha Vergeer STINAPA: Paulo Bertuol
Invasive species	Lionfish ecology	CUR	DC: Amelia Ritger CARMABI
Management	An policy assessment on pest management in Washington Slagbaai National Park.	BON	WUR: Nikkie van Grinsven STINAPA: Paulo Bertuol
Mammals	Spatial and temporal distribution of whales (acoustic loggers Saba Bank)	SAB	IMARES: Dick de Haan Min. EZ: Paul Hoetjes SCF, NFSXM, CNSI
Plants	Germination of seeds of indigenous trees of Curaçao	CUR	CARMABI: John de Freitas
Plants	Testing effective ways to grow native plants	BON	Echo: Daniel Fishburn, Nathan Schmaltz
Plants	Groasis Study: testing the effectiveness of Groasis boxes on pioneer plant species	BON	BU: Daniel Fishburn, Echo
Reptiles	Sea turtle conservation in spite of climate change (*Part of NWO project: Ecology and conservation of green and hawksbill turtles in the Dutch Caribbean)	BON	STCB: Mabel Nava RuG: Marjolijn Christianen, Sandra Striegel (Msc. student) WUR: Lisa Becking
Zooplankton	Zooplankton Response to UV light	BON	CIEE: Rita Peachey, Sara Buckley, Austin Lin

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#### Saba

Saba Conservation Foundation  
tel: +599-416-3295  
[www.sabapark.org](http://www.sabapark.org)



#### St. Eustatius

##### STENAPA

tel: +599-318-2884  
[www.statiapark.org](http://www.statiapark.org)



#### St. Maarten

##### Nature Foundation

tel: +721-544-4267

[www.naturefoundationsxm.org](http://www.naturefoundationsxm.org)



#### St. Maarten

##### Emilio Wilson Estate FDN

tel: +1-721-524-1516

[www.sxmconservation-foundations.org/ewef](http://www.sxmconservation-foundations.org/ewef)



#### Bonaire

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## Long Term Projects

Category	Subject	Island	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	Environmental factors driving recruitment success in Caribbean corals	CUR	UvA: Valerie Chamberland (PhD student) CARMABI SECORE Foundation
Coral Reef Ecosystems	Development of restoration methods for threatened Caribbean coral species	BON, CUR, SAB	CRF Bonaire: Augusto Montbrun, Francesca Viridis SECORE Project CARMABI: Mark Vermeij UvA: Valerie Chamberland (PhD student) SCF, Sea Saba, Samford University: Jennifer Rahn
Coral Reef Ecosystems	Dissolved Organic Matter released by macroalgae as a possible food source of bioeroding sponges	BON, CUR	NIOZ: Benjamin Müller (PhD student), Fleur van Duyl CARMABI FORCE Project
Coral Reef Ecosystems	Bioerosion of reefs by coral-excavating sponges	BON, CUR, SAB, EUX	NIOZ: Fleur van Duyl IMARES: Erik Meesters, Didier de Bakker (PhD student)
Coral Reef Ecosystems	Developing a plan to manage the waters around Curaçao sustainably, profitably, and enjoyably for this and future generations	CUR	Waitt Institute (Blue Halo Curaçao)
Database	Dutch Caribbean Species Catalog: Taxonomic knowledge system Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	Naturalis: Sander Pieterse & Berry van der Hoorn
Environmental	Zero nutrient discharge of domestic waste (water) nutrients and total reuse of nutrients in agriculture and aquaculture in Caribbean Islands (TripleP@Sea Program)	EUX	WUR: Grietje Zeeman, Marc Spiller CNSI
Environmental	Sustainable ecosystem management and use by marine communities in two exemplary regions (TripleP@Sea Program)	BON, EUX	WUR: Linde van Bets (PhD student); Arthur Mol, Jan van Tatenhove; Machiel Lamers IMARES: Han Lindeboom CNSI
Environmental	Effects of dispersants on the fate of oil in realistic conditions (C-IMAGE consortium, TripleP@Sea Program)	EUX	WUR: Tinka Murk, Marieke Zeinstra-Helfrich (PhD student) CNSI
Environmental	Ecotoxicological aspects of rational application of chemicals in response to oil spills to reduce environmental damage (C-IMAGE consortium, TripleP@Sea Program)	EUX	WUR: Tinka Murk, Justine van Eenennaam (PhD student) CNSI
Environmental	Ecotoxicological aspects of rational application of chemicals in response to oil spills to reduce environmental damage Development of an area specific net environmental and economic benefit analysis (NEEBA) to support oil spill mitigation decisions; with St. Eustatius as example	EUX	WUR: Tinka Murk, Sophie Vonk (PhD student) Lei Wageningen UR: Stijn Reinhard CNSI
Fish	Status of shark and fish communities in the Dutch Caribbean	BON, CUR, SAB, EUX, SXM	IMARES: Martin de Graaf
Fish	Fish and Fisheries Research Programme	EUX	IMARES: Martin de Graaf Min. EZ Dept LVV CNSI
Interstitial biodiversity	Molecular biodiversity analysis of marine and terrestrial communities by metabarcoding	EUX	Naturalis: Arjen speksnijder ANEMOON: Niels Schrieken
Invasive species	Combatting the economic and ecological impacts of overgrazing on inhabited islands	BON	UsA: Michaela Roberts (PhD student)
Mangrove ecosystems	Mangrove restoration Lac Bay, Bonaire	BON	STINAPA: Sabine Engel IMARES: Dolfi Debrot WUR: Klaas Metselaar DROB
Marine ecosystems	Marine biodiversity baseline study St. Eustatius	EUX	Naturalis: Bert Hoeksema STENAPA CNSI
Molluscs	Population dynamics and role in the food chain of the Queen Conch Lobatus gigas in the Dutch Caribbean Territories	EUX, SAB	WUR: Aad Smaal, Leo Nagelkerke IMARES: Martin de Graaf Erik Boman (PhD student) SCF (SBMU): Dahlia Hassell CNSI

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Public Health	DNA waterscan: Monitoring disease vectors in the Caribbean (mosquitoes and midges)	EUX	Naturalis: Kevin Beentjes ECPHF: Teresa Leslie
Sustainability	Sustainable development Dutch Caribbean (TripleP@Sea Program) - Are human activities a risk for ecosystem services? - Green Statia or how to regain balance between nature and agriculture?	EUX	IMARES: Diana Slijkerman Alterra: Rene Henkens CNSI
Terrestrial biodiversity	Baseline assessment and DNA barcoding of specimens	EUX	Naturalis: Michael Stech, Berry van der Hoorn STENAPA CNSI
Terrestrial biodiversity	Testing surrogates to establish conservation priorities	EUX	Naturalis: Jeremy Miller STENAPA

### NWO Projects in the Dutch Caribbean

Coral Reef Ecosystems	Caribbean coral reef ecosystems: interactions of anthropogenic ocean acidification and eutrophication with bioerosion by coral excavating sponges - Bioerosion and climate change	BON, SAB, EUX	NIOZ: Fleur van Duyl, Steven van Heuzen (PostDoc), Alice Webb (PhD student) STENAPA CNSI
Environmental	Caribbean island biogeography meets the anthropocene	EUX, SXM (Planned for other islands)	VU: Jacintha Ellers, Matt Helmus, Wendy Jesse (PhD. Student) CNSI
Environmental psychology	Confronting Caribbean Challenges: Hybrid Identities and Governance in Small-scale Island Jurisdictions - Behavioral differences between/within the BES islands when it comes to nature conservation and cultural heritage.	BON, SAB, EUX	KITLV, Leiden University: Gert Oostindie (Project director) KITLV, Leiden University: Stacey Mac Donald (PhD student)
Geosciences	Stability of Caribbean coastal ecosystems under future extreme sea level changes (SCENES) - The effects of climate change on calcifying algae	BON, EUX, SXM	UU: Henk Dijkstra, NIOZ: Peter Herman, Rebecca James (PhD student) TU Delft: Julie Pietrzak STENAPA CNSI
Geomorphological	4D crust-mantle modelling of the eastern Caribbean region: toward coupling deep driving processes to surface evolution - Reconstructing past climate change	EUX	UU: Wim Spakman NIOZ: Lennart de Nooijer Alfred Wegener Institute Germany CNSI
Invasive species	Exotic plant species in the Caribbean: foreign foes or alien allies? (1) Socio-economic impacts of invasive plant species (2) Ecological impacts of invasive plant species-Utrecht University	BON, SAB, EUX	(1) UU: Jetske Vaas (PhD student), Peter Driessen, Frank van Laerhoven and Mendel Giezen (2) UU: Elizabeth Haber (PhD student), Martin Wassen, Max Rietkerk, Maarten Eppinga. CNSI
Reptiles	Ecology and conservation of green and hawksbill turtles in the Dutch Caribbean	BON, CUR, (Planned for other islands)	RuG: Per Palsbøll, Marjolijn Christianen, Jurgan van der Zee (PhD student) WUR: Lisa Becking STCB: Mabel Nava CARMABI STENAPA CNSI

### BO-projects in the Dutch Caribbean

DCBD	BO-11-019.02-002 - Expansion knowledge system Dutch Caribbean	AUA, BON, CUR, SAB, EUX, SXM	Alterra: Peter Verweij
Fish	BO-11-019.02-055 Fisheries inventory (EEZ Curaçao)	CUR	IMARES: Martin de Graaf
Invasive species	BO-11-019.02-045 -Multifunctional approach harmful for harmful exotic species Caribbean Netherlands	BON, SAB, EUX	IMARES: Dolfi Debrot
Marine biodiversity	BO-11-019.02-008 – Saba Bank research programme 2011-2016	SAB	IMARES: Erik Meesters
Natural resource use	BO-11-019.02-049 – Saba Bank – Fisheries	SAB	IMARES: Martin de Graaf
Natural resource use	BO-11-019.02-050 – World Heritage nomination Bonaire National Marine Park	BON	IMARES

Don't see your monitoring program on the list or incorrect information?

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If you have research or monitoring data, the DCNA secretariat can help you to get it housed in the Dutch Caribbean Biodiversity Database (DCBD). This database is a central online resource with all biodiversity and conservation related information for the Dutch Caribbean.

## Monitoring Overview

*Below you will find an overview of the monitoring work that is currently running in the Dutch Caribbean. Monitoring work for which fieldwork took place in this month is highlighted.*

Category	Subject	Islands	Organization(s): Lead scientist(s)
Birds	Flamingo Abundance	BON	DROB: Frank van Slobbe Cargill STINAPA: Paulo Bertuol
Birds	Monitoring vulnerable parrot nests (remote camera sensing work)	BON	Echo: Nathan Schmaltz
Birds	Yellow-shouldered Amazon parrot roost counts	BON	Echo: Sam Williams DROB: Frank van Slobbe
Birds	Bird Monitoring (Caribbean Waterbird Census)	AUA BON	FPNA DLVV: Facundo Franken STINAPA: Paulo Bertuol , Caren Eckrich
Birds	Tern monitoring(artificial nesting islands)	BON	STINAPA: Paulo Bertuol Cargill DROB IMARES: Dolfi Debrot
Birds	Terrestrial Bird Monitoring Program for Bonaire	BON	STINAPA: Fernando Simal
Birds	Nesting Sea Birds	BON	STINAPA: Paulo Bertuol
Birds	Bird monitoring	SAB EUX, SXM	EPIC: Adam Brown
Birds	Red-billed Tropicbird monitoring	SAB EUX	STENAPA SCF: Kai Wulf IMARES: Dolfi Debrot
Birds	Population assessment of the Bridled Quail-dove	EUX	STENAPA
Coral reef ecosystems	Coral Bleaching Monitoring	SXM	NFSXM: Tadzio Bervoets
Coral reef ecosystems	Survival rate of Scleractinian Corals and Diadema antillarum) in Oranjebaai. (Permanent monitoring transects)	EUX	Gem City Consulting: Steve Piontek
Coral reef ecosystems	Global Coral Reef Monitoring Network	SAB, EUX	IMARES: Martin de Graaf SCF (SBMU): Dahlia Hassell Gem City Consulting: Steve Piontek STENAPA: Jessica Berkel CNSI Min. EZ
Corals reef ecosystems	Staghorn coral field monitoring survey	EUX	STENAPA: Jessica Berkel
Coral reef ecosystems	Monitoring and research of the longest coral reef time-series in the world (since 1973)	BON CUR	IMARES: Erik Meesters, Didier de Bakker (PhD student) NIOZ: Fleur van Duyl, Rolf Bak
Ecosystems	Invasive seagrass monitoring	BON EUX	STINAPA: Sabine Engel, Caren Eckrich Gem City Consulting: Steve Piontek
Ecosystems	Seagrass monitoring	SXM	NFSXM: Tadzio Bervoets
Ecosystems	Mangrove monitoring	SXM	NFSXM: Tadzio Bervoets



Ecosystems	Seagrass/conch/mangrove/ benthic fauna, Lac Bay Restoration	BON	STINAPA: Sabine Engel, Caren Eckrich WUR: Klaas Metselaar
Environmental	Water quality testing	SXM	NFSXM: Tadzio Bervoets EPIC: Natalia Collier
Fish	Shark monitoring: -Shark sightings -Shark Abundance, distribution and movements (tagging, acoustic telemetry)	SAB SXM EUX	IMARES: Martin de Graaf, Erwin de Winter SCF(SBMU): Dahlia Hassell NFSXM: Tadzio Bervoets STENAPA: Jessica Berkel
Fish	Spawning monitoring: Red hind surveys on Moon-fish Bank	SAB	SCF (SBMU): Dahlia Hassell IMARES: Martin de Graaf
Invasive species	Goat and/or donkey removal: -Washington Slagbaai National Park - Lac Bay area (exclusion plots) - Quill National Park (exclusion plots)	BON EUX	STINAPA: Evo Cicilia IMARES: Dolfi Debrot DROB STENAPA
Invasive species	Lionfish abundance and control	BON CUR SXM SAB EUX	STINAPA: Paulo Bertuol (50 meter traps) CARMABI: Mark Vermeij NFSXM: Tadzio Bervoets SCF (SBMU): Dahlia Hassell STENAPA: Jessica Berkel
Invasive species	Monkey Monitoring: abundance and distribution	SXM	NFSXM: Tadzio Bervoets
Invasive species	Feral pig population assessment (trapping)	BON	Echo: Nathan Schmaltz, Sam Williams UsA: Michaela Roberts
Mammals	Bat monitoring	AUA BON	FPNA WildConscience: Fernando Simal, Linda Garcia
Mammals	Dolphin monitoring (since 1999)	BON	Ron Sewell
Molluscs	Conch ( <i>Strombus gigas</i> ) on St. Eustatius, Saba Bank, Anguilla	SAB EUX	IMARES: Martin de Graaf, Erik Boman (PhD student) SCF (SBMU): Dahlia Hassell
Natural resource use	Fishery monitoring (including marine mammal sightings and use of escape vents to reduce by-catch)	SAB EUX	IMARES: Martin de Graaf SCF (SBMU): Dahlia Hassell Gem City Consulting: Steve Piontek
Plants	Reforestation Klein Bonaire	BON	STINAPA: Herman Sieben
Plants	Phenology of bats in cacti landscapes of Aruba	AUA	WildConscience: Linda Garcia, FPNA
Reptiles	Lesser Antillean Iguana: Monitoring population density	EUX	RAVON: Bart Kluskens STENAPA
Reptiles	Boa and Cascabel Monitoring	AUA	FPNA, Toledo Zoological Society: Andrew Odum
Reptiles	Red bellied Racer snake population survey	EUX	Gem City Consulting: Steve Piontek
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

## 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.*

### Haseth, C.P. de, C.P., S. Strik, A.O. Debrot (2015)

The Southern Lapwing (*Vanellus chilensis*) breeding in the Dutch Caribbean and notable new records for the Caribbean Martin (*Progne dominicensis*) and Killdeer (*Charadrius vociferus*), *The Journal of Caribbean Ornithology*, Vol. 28: 25-27

### Piontek, S. (Gem City Consulting) (2015)

Final report St.Eustatius Global Coral Reef Monitoring Network

### Leeuwen, S. van, S. M. Boeken, A. Hovestadt (2015)

The land snails of Saba, *Spirula* (journal of the Dutch Malacological Society) nr. 404, p. 23-29

### Scisciolo T. de, E.N. Mijts, T. Becker, M.B. Eppinga

Beach Debris on Aruba, Southern Caribbean: Attribution to local land-based and distal marine-based sources, *Marine Pollution Bulletin* 106, p. 49-57

### Sorenson, L. (2016)

This Little Island is a Haven for Migratory Shorebirds ([www.birdscaribbean.org/2016/03/this-little-island-is-a-haven-for-migratory-shorebirds/](http://www.birdscaribbean.org/2016/03/this-little-island-is-a-haven-for-migratory-shorebirds/))

## Internship Reports

### Coolen, Q.T., M. Holmgren, P. van Hooft, A.O. Debrot. J. de Freitas (2016)

The impact of feral goat herbivory on the vegetation of Bonaire

### Ende, B. van den (MSc. student WUR), M. Holmgren, P. van Hooft, A.O. Debrot (2015)

How do the distribution and abundance of columnar cacti relate to microsite types and goat grazing pressure?

### Geurts, K. (Msc. student WUR), M. Holmgren, P. van Hooft, A.O. Debrot (2015)

The abundance of feral livestock in the Washington Slagbaai National Park, Bonaire

### Grinsven, N. van (Msc. student WUR), P. van Hooft, M. Holmgren, D. Debrot (2016)

Diet preference of roaming goats (*Capra hircus*) on columnar cacti in Bonairian scrublands.

## List of Acronyms

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



# Calendar

An overview of nature conservation and management related events of this month and the coming months.

## March

3	Event	World Wildlife day
6-11	Conference	14 <sup>th</sup> International Coastal Symposium, Sydney, Australia
10-12	Conference	5 <sup>th</sup> International Conference on Biodiversity, Madrid, Spain
22	Meeting	Fishery Commission Caribbean Netherlands, Curaçao
23	Meeting	Committee for Marine Biodiversity and Fisheries of the Dutch Caribbean EEZ (EEZ Committee), Curaçao
22-24	Workshop	1 <sup>st</sup> Caribaeen Initiative Research & Conservation Workshop, Fort-de-France, Martinique

## April

5-7	Conference	Boosting biodiversity research cooperation - A NetBiome roadmap for European (sub) tropical Overseas, Brussels, Belgium
5,6,7	Meeting	DCNA Board Meeting, Sint Maarten
17-23	Workshop	Biophysical monitoring and socio-economic monitoring of coral reefs based on the regional guidelines developed by the GCRMN- Caribbean, Discovery Bay Marine Lab of the University of the West Indies, Jamaica (GCRMN, SPAW-RAC)
19	Meeting	Consultative Committee of Experts of the Inter-American Sea Turtle Convention (IAC), Videoconference from Washington DC
22	Event	Earth Day
22-22 May		15 <sup>th</sup> year of Caribbean Endemic Bird Festival, BirdsCaribbean

## May

5	Webinar	Illegal trafficking of Caribbean birds ( <a href="http://bit.ly/1rxjzIA">http://bit.ly/1rxjzIA</a> ), BirdsCaribbean
14	Event	Global big day
14-22	Conference	Blue Week 2016, An International Conference to Promote Blue Growth and Investment. St. George's, Grenada

## June

18-26	Event	Dutch Caribbean Shark Week 2016 (Save Our Sharks Project Dutch Postcode Lottery)
19-24	Symposium	13 <sup>th</sup> International Coral Reef Symposium, Honolulu, Hawaii USA

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

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### DCNA Contact Information

Dutch Caribbean Nature Alliance | Kaya Finlandia 10<sup>a</sup> | Kralendijk, Bonaire | Dutch Caribbean  
+599-717-5010 | [research@DCNAnature.org](mailto:research@DCNAnature.org) | [www.DCNAnature.org](http://www.DCNAnature.org)

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Dutch Caribbean Nature Alliance | Kaya Finlandia 10<sup>a</sup> | Kralendijk, Bonaire | Dutch Caribbean  
+599 717 5010 | [info@DCNA.nature.org](mailto:info@DCNA.nature.org) | [www.DCNA.nature.org](http://www.DCNA.nature.org)