2018

ANNUAL REPORT

CARMABI FOUNDATION

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Annual report 2018

FROM THE DIRECTOR

Curaçao is making progress to achieve important sustainability goals. Carmabi is honored to be engaged in these efforts and always strives to assist in developing strategies to combine economic development while safeguarding the island's natural resources, important in defining our nation's so they can be enjoyed by both locals and visitors in the future. While challenges are very real and serious, there is hope, and a growing understanding that good conservation will greatly contribute to people's well-being and the economic development of the island.

To help with Curaçao's ambitions to achieve a more sustainable society, Carmabi manages various nature parks on Curacao, including the Christoffelpark with the highest biodiversity on the ABC islands. These parks are a crucial component of Curaçao's tourism product, and increasingly more important given the global increase in the demand for ecotourism destinations. Carmabi's education programs have expanded to better educate the island's youth about the island's unique natural resources, both above and below the ocean's surface. These unique ecosystems are also studied by Carmabi's research department. Findings from these studies help to improve and develop management strategies and to advise the government in various key policy areas regarding the management of the island's marine and terrestrial resources.

In 2018 more the number of to our parks increased, Carmabi's education program grew and more researchers visited Curaçao. In 2018 in total 105 scientists visited Carmabi, to conduct a wide variety of research projects. In addition, 141 students participated in various courses that were taught at Carmabi bringing the total number of visitors to our science center to 246. In total 33 scientific publications were published based on work done at Carmabi.
The total number of visitors in the Christoffel National Park amounted to 47,090, an increase of 11% compared to 2017.

The total number of visitors in the Shete Boka National Park amounted to 89,383, an increase of 27% compared to 2016. In 2018 a total of 86,385 people visited the Hato Caves, an increase of 19%. Many improvements were made in our parks to increase their attractiveness and safety. For example, a viewing platform was installed in the Boka Tabla cave and a tower was built to facilitate deer spotting in the Christoffel National Park.

Our Education Department organizes terrestrial and marine educational programs for primary school children. The terrestrial program consists of tours in the Christoffel Park and the areas of Daaibooi & Shete Boka. The marine educational program focusses on coral reef ecosystems, interactive courses and a visit to Carmabi's Marine Education Center. In 2018 a total of 10,062 students participated in our programs of which 8,848 schoolchildren participated in the terrestrial education program and 1,114 in the marine education program and 100 in the secondary education program. Furthermore, Carmabi's Education Department introduced a new program ("Turtles and Plastic Waste"), organized a very successful Shark Week and created a permanent exhibition in the Savonet Museum on animals and plants in the Savonet area.

Annual report 2018

FROM THE DIRECTOR

What are our plans for 2019? Due to our recent collaboration with the government to further improve Carmabi's research facilities we expect a continued increase in the number of scientists visiting Curaçao.

Furthermore, we aim to further expand our research activities aimed at restoring degraded reef communities by rearing coral larvae to adult corals, a program that has recently been expanded to other islands in the Caribbean.

We hope to increase the number of parks that will be actively managed to protect these important areas and generate revenue through ecotourism, such as the Mangrove Park in Otrobanda and the recently announced marine protected SPAW area near Oostpunt.

In the parks presently managed we will start with the renovation of the parking place at the foot of the Christoffel mountain, the renovation of the restaurant at Shete Boka and as well as the frontdesk at Shete Boka.

We plan to further integrate the Carmabi educational programs into the curriculum of the schools and aim to modernize our Marine Education Center using the possibilities offered through virtual reality.

The year 2018 has been an excellent year. In 2019 we hope to do even better. No doubt 2019 will become an exciting year.

Paul Stokkermans
Director Carmabi

scientific research

VISITING SCIENTISTS

145 scientists visited Carmabi in 2018. In addition 175 students participated in Coral Reef Ecology courses and workshops that were taught by Carmabi and various universities and organizations from the Netherlands and the United States.

The number of visiting scientists and students in 2018 illustrates a continued positive trend of increasing visitors after the official opening of the new Science Center in 2013 (Figure 1).

Most scientists in 2018 were from the United States (64%) followed by the Netherlands (19%). Almost all of the scientists and students that worked at Carmabi stayed at the newly constructed laboratory/ dormitory facilities and the average duration of researchers staying at Carmabi increased significantly in 2018, resulting in a total of 7637 personal working days, i.e. one visiting scientist working one day were achieved and also signals an upward trend over the last few years (2017: 6619, 2016: 6827, 2015: 6536, 2014: 4256.

The occupation of the new science center increased to 67% (2017: 53%, 2016: 58%, 2015: 54%, 2014: 47%, 2013: 28%).

An overview of the areas in which researchers were active that visited or worked at Carmabi in 2018 is shown in Figure 2.

An overview of visiting scientists (PI name and home institute) is provided on page 3.

Several organizations, government departments, the press and others received free advice and information from the Carmabi Science Department during the year. We assisted in 57 cases, both oral and written. In 2018 the Carmabi Science Department was featured/ interviewed in 115 international (known) items for local TV, radio and newspapers.

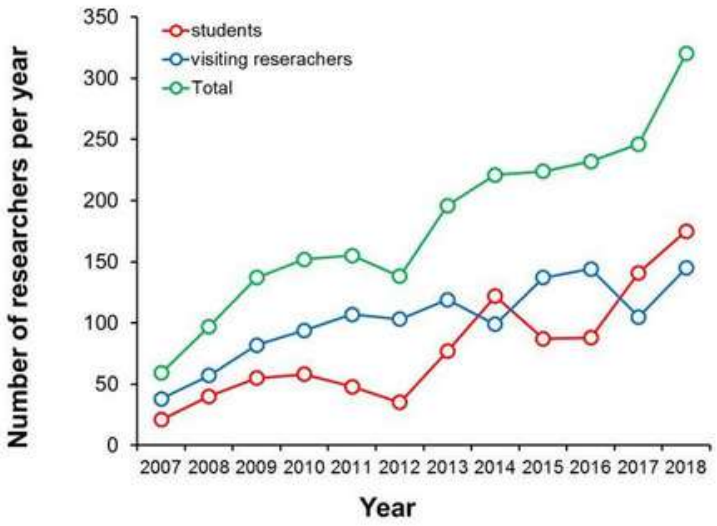


Fig. 1

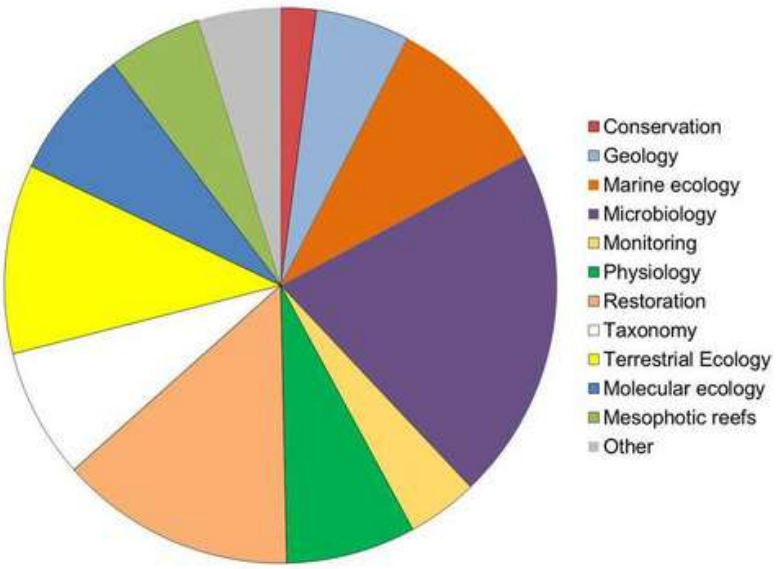


Fig. 2

scientific research

VISITING SCIENTISTS

Dr. Jocelyn Behm (Temple University, USA)
Drs. Devika Narain (Anton de Kom University, Surinam)
Dr. Kevin Tidgewell (Duquesne University, U.S.A.)
Dr. Andy Haas (Netherlands Institute for Sea Research, The Netherlands)
Dr. Pim Bongaerts (California Academy of Sciences, U.S.A.)
Dr. Ben Mueller (University of Amsterdam, The Netherlands)
Dr. Jasper de Goeij (University of Amsterdam, The Netherlands)
Dr. Jessica Goodheart (University of California, U.S.A.)
Dr. Nathan Kenny (Natural History Museum, U.K.)
Dr. Kevin Kocot (University of Alabama, U.S.A.)
Dr. Jean-François Flot (Universite Libre de Bruzelles, Belgium)
Dr. Jose Victor Lopez (Nova Southeastern University, U.S.A.)
Drs. Mischa Streekstra (Wageningen University, The Netherlands)
Dr. Mary Hagedorn (University of Hawaii, U.S.A.)
Dr. Iliana Baums (Penn State University, U.S.A.)
Dr. Kristen Marhaver (Marhaverlab, Curacao)
Dr. Jose Eirin-Lopez (Florida International University, U.S.A.)
Dr. Rhiannon Davies (Appleby College, Canada)
Dr. Jeremiah Jarrett (Central Connecticut State University, U.S.A.)
Dr. Joost den Haan (Max Planck Institute for Marine Microbiology, Germany)
Dr. Sara Kaiser (Smithsonian Center for Conservation Genomics, U.S.A.)
Dr. Jennifer Smith (Scripps Institution of Oceanography, U.S.A.)
SECORE Project (Various countries)
Dr. Emma Perry (Unity College, U.S.A.)
Haley Thoren (University of Illinois, U.S.A.)
Dr. Jose Daniel Zamora Mejias (National Autonomous University of Mexico, Mexico)
Dr. Roberto Emiliano Trejo Salazar (National Autonomous University of Mexico, Mexico)
Dr. Emily Chase (Acadia University, Canada)
Dr. Alex Worden (Monterey Aquarium research Institute, U.S.A.)
Dr. Laura Parfrey (University of British Colombia, Canada)
Dr. Claudio Slamovitz (Canadian Institute for Advanced Research, Canada)
Dr. Denis Tikhonenkov (Russian Academy of Sciences, Russian Federation)
Dr David Milner (University of Exeter, United Kingdom)
Dr. Melissa Peters (University of Ottawa, Canada)
Dr. N. King (University of California, Berkeley, U.S.A.)
Dr. Galina Prokopchuk (Institute of Parasitology Biology Centre, Czech Republic)
Dr. Forest Rohwer (San Diego State University, U.S.A.)
Dr. Cynthia Silveira (San Diego State University, U.S.A.)
Dr. Patrick Keeling (Canadian Institute for Advanced Research, Canada)
Dr. J. Lukes (Laboratory of Molecular Biology of Protists, Czech Republic)
Dr. Tom Richards (University of Exeter, United Kingdom)
Dr. Camille Poirier (Monterey Bay Aquarium Research Institute, U.S.A.)
Dr. Maria Herranz (University of British Columbia, Canada)
Dr. B. Leander (University of British Columbia, Canada)
Dr. Niels Van Steenkiste (University of British Columbia, Canada)
Dr. Stuart Sandin (Scripps Institution of Oceanography, U.S.A.)
Dr. Jen Smith (Scripps Institution of Oceanography, U.S.A.)
Dr. Andi Haas (Netherlands Institute for Sea Research, The Netherlands)
Drs. Laurent Delvoye (Vlissingen, The Netherlands)
Dr. Michele Pierotti (Smithsonian Tropical Research Institute, Panama)
Dr. Kelly Lazar (Clemson University, U.S.A.)
Werner de Gier (Naturalis Biodiversity Center, The Netherlands)
Dr. Inge van Dijk (NIOZ, The Netherlands)
Dr. Petra Visser (University of Amsterdam, The Netherlands)
Dr. Aschwin Engelen (University of the Algarve, Portugal)
Dr. Gerard Muijzer (University of Amsterdam, The Netherlands)
Christian Stolpe (Gent University, Belgium)
Dr. Vincent Post (Federal Institute for Geosciences and Natural Resources, Germany)
Dr. Victor Bense (Wageningen University, The Netherlands)
Dr. Judith van Bleijswijk (NIOZ, The Netherlands)
Dr. Bruce Fouke (University of Illinois Urbana-Champaign, U.S.A.)
Dr. Valerie Chamberland (SECORE, U.S.A.)

scientific research

PEER REVIEWED PUBLICATIONS

Thirty publications appeared in peer reviewed scientific journals based on work that was conducted at Carmabi, making 2018 one of the most productive year in terms of Carmabi's scientific output ever (Figure 3).

The results of some of these studies have been featured in magazines, news programs and educational websites around the world. Furthermore, 42 reports were produced by MSc students that did their master's thesis' project at Carmabi.

An overview of all peer reviewed scientific publications accepted for publication or published in 2018 is shown below.

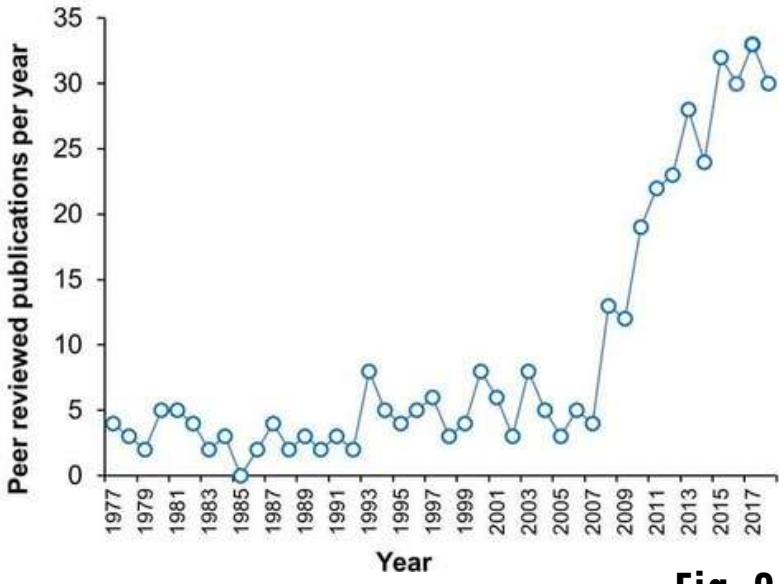


Fig. 3

1. Behm J, Waite BR, Hsieh ST, Helmus MR (2018)
Benefits and limitations of three-dimensional printing technology for ecological research. bioRxiv. 2018 Jan 1:283895.
2. Behm JE, van Buurt G, DiMarco BM, Ellers J, Irian CG, Langhans KE, McGrath K, Tran TJ, Helmus MR (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. BioInvasions Records (2019) Volume 8.
3. Benzoni F, Arrigoni R, Berumen Ml, Taviani M, Bongaerts P, Frade PR (2018)
Morphological and genetic divergence between Mediterranean and Caribbean populations of *Madracis pharensis* (Heller 1868) (Scleractinia, Pocilloporidae): too much for one species?. Zootaxa 4471(3):473-92.
4. Bos OG, Bakker PA, Henkens RJ, de Freitas JA, Debrot AO (2018)
Preliminary checklist of extant endemic species and subspecies of the windward Dutch Caribbean (St. Martin, St. Eustatius, Saba and the Saba Bank). Wageningen Marine Research; 2018 Oct 18.
5. Boyko CB, van Der Meij SE (2018)
A trifecta of Swiftian symbioses: stony corals, gall crabs and their parasites (Scleractinia; Brachyura: Cryptochiridae; Isopoda: Epicaridea and Cirripedia: Rhizocephala). Zoological Journal of the Linnean Society. Mar 14.
6. Brocke HJ, Piltz B, Herz N, Abed RMM, Palinska KA, John U, den Haan J, Nugues MM (2018)
Nitrogen fixation and diversity of benthic cyanobacterial mats on coral reefs in Curaçao. Coral Reefs: 1-14.
7. Caves EM, Green PA, Johnsen S (2018)
Mutual visual signalling between the cleaner shrimp *Ancylomenes pedersoni* and its client fish. Proc. R. Soc. B. 2018 Jun 27;285(1881):20180800.
8. Condor-Lujan B, Louzada T, Hajdu E, Klautau M. 2018.
Morphological and molecular taxonomy of calcareous sponges (Porifera: Calcarea) from Curaçao, Caribbean Sea. Zoological Journal of the Linnean Society.
9. de Bakker DM, Webb AE, van den Bogaart LA, van Heuven SM, Meesters EH, van Duyl FC (2018) Quantification of chemical and mechanical bioerosion rates of six Caribbean excavating sponge species found on the coral reefs of Curaçao. PloS one;13(5):e0197824.
10. Engelen AH, Aires T, Vermeij MJA, Herndl GJ, Serrao EA, Frade PR (2018).
Host differentiation and compartmentalization of microbial communities in the azooxanthelate cupcorals *Tubastrea coccinea* and *Rhizopsammia goesi* in the Caribbean. Frontiers in Marine Science, 5, 391.
11. Farfan G, Apprill A, Webb SM, Hansel CM (2018)
Coupled X-ray fluorescence and X-ray absorption spectroscopy for microscale imaging and identification of sulfur species within tissues and skeletons of scleractinian corals. Analytical chemistry.
12. Fricke, A, Titlyanova TV, Teichberg M, Nugues MM, Bischof K. 2018).
The Chlorophytes of Curaçao (Caribbean): a revised checklist for the south-west coast. Botanica Marina, 61(1), 33-46.

scientific research
PEER REVIEWED PUBLICATIONS

13. García-Hernández JE (2018)
Antagonistic behavior between two honeycomb cowfish, *Acanthostracion polygonius* Poey, 1876, at Curaçao. Coral reefs 1:1.
14. Hagedorn M, Page CA, ONeill K, Flores DM, Tichy L, Chamberland VF, Lager C, Zuchowicz N, Lohr K, Blackburn H, Vardi T, Moore J, Moore T, Vermeij MJA, Marhaver KL (2018)
Successful demonstration of assisted gene flow in the threatened coral *Acropora palmata* across genetically-isolated Caribbean populations using cryopreserved sperm. bioRxiv. 2018 Jan 1:492447.
15. Hartmann AC, Marhaver KL, Vermeij MJA (2018)
Corals in healthy populations produce more larvae per unit cover. Conservation Letters. 2018 May;11(3):e12410.
16. Hartmann AC, Marhaver KL, Klueter A, Lovci M, Closek CJ, Diaz E, Chamberland VF, Archer FI, Deheyn DD, Vermeij MJ, Medina M (2018)
Acquisition of obligate mutualist symbionts during the larval stage is not beneficial for a coral host. Molecular ecology. 2018 Dec 3.
17. Horká I, De Grave S, Fransen CHJM, Petrusek A, Duris Z (2018)
Multiple origins and strong phenotypic convergence in fish-cleaning palaemonid shrimp lineages. Molecular phylogenetics and evolution.
18. Iglesias TL, Dornburg A, Warren DL, Wainwright PC, Schmitz L, Economo EP (2018)
Eyes Wide Shut: The impact of dim-light vision on neural investment in marine teleosts. Journal of evolutionary biology. 2018 May 28.
19. Kenny NJ, de Goeij JM, de Bakker DM, Whalen CG, Berezikov E, Riesgo A (2018)
Towards the identification of ancestrally shared regenerative mechanisms across the Metazoa: A Transcriptomic case study in the Demosponge *Halisarca caerulea*. Marine genomics. 2018 Feb 1;37:135-47.
20. Kushida Y, Reimer JD.
Molecular phylogeny and diversity of sea pens (Cnidaria: Octocorallia: Pennatulacea) with a focus on shallow water species of the northwestern Pacific Ocean. Molecular phylogenetics and evolution. 2018 Nov 22.
21. Kwong WK, del Campo J, Mathur V, Vermeij MJA, Keeling PJ (2018)
A widespread coral-infecting apicomplexan contains a plastid encoding chlorophyll biosynthesis. bioRxiv. 2018 Jan 1:391565.
22. Ritger AL, Curtis AN, Chen CY (2018)
Bioaccumulation of mercury and other metal contaminants in invasive lionfish (*Pterois volitans/miles*) from Curaçao. Marine Pollution Bulletin, Volume 131, Part A: 38-44.
23. Rivera-Milán FF, Simal F, Bertuol P, Boomer GS (2018)
Population monitoring and modelling of yellow-shouldered parrot on Bonaire, Caribbean Netherlands. Wildlife Biology, 2018, wlb-00384.
24. Ruttenberg B, Caselle JE, Estep AJ, Johnson AE, Marhaver KL, Richter LJ, Sandin SA, Vermeij MJA, Smith JE, Grenda D, Cannon A (2018)
Ecological assessment of the marine ecosystems of Barbuda, West Indies: Using rapid scientific assessment to inform ocean zoning and fisheries management. PLoS ONE 13(1): e0189355.
25. Silveira CB, Roach TN, Villela H, Barno A, Reyes B, Rubio-Portillo E, Le T, Mead S, Hatay M, Luque A, Wegley-Kelly L (2018)
Biophysical and physiological causes of coral reef microbialization. bioRxiv. 2018 Jan 1:495481.
26. Titus BM, Blischak PD, Daly M (2018).
Genomic signatures of sympatric speciation with historical and contemporary gene flow in a tropical anthozoan. bioRxiv, 399360.
27. Titus BM, Daly M.
Reduced representation sequencing for symbiotic anthozoans: are reference genomes necessary to eliminate endosymbiont contamination and make robust phylogeographic inference?. bioRxiv. 2018 Jan 1:440289.
28. van der Veer HW, Cardoso JF, Mateo I, Witte JI, van Duyl FC (2018)
Occurrence and life history characteristics of tropical flatfishes at the coral reefs of Curaçao, Dutch Caribbean. Journal of Sea Research. 2018 Sep 21.
29. van Dijk KJ, Bricker E, van Tussenbroek BI, Waycott M (2018)
Range-wide population genetic structure of the Caribbean marine angiosperm *Thalassia testudinum*. Ecol Evol. 2018;00:1–14.
30. Votýpka J, Kment P, Kriegová E, Vermeij MJA, Keeling PJ, Yurchenko V, Lukeš J (2018)
High Prevalence and Endemism of Trypanosomatids on a small Caribbean Island. Journal of Eukaryotic Microbiology.

scientific research

SELECTED PROJECTS 2018

Successful demonstration of assisted gene flow in the threatened coral *Acropora palmata* using cryopreserved sperm

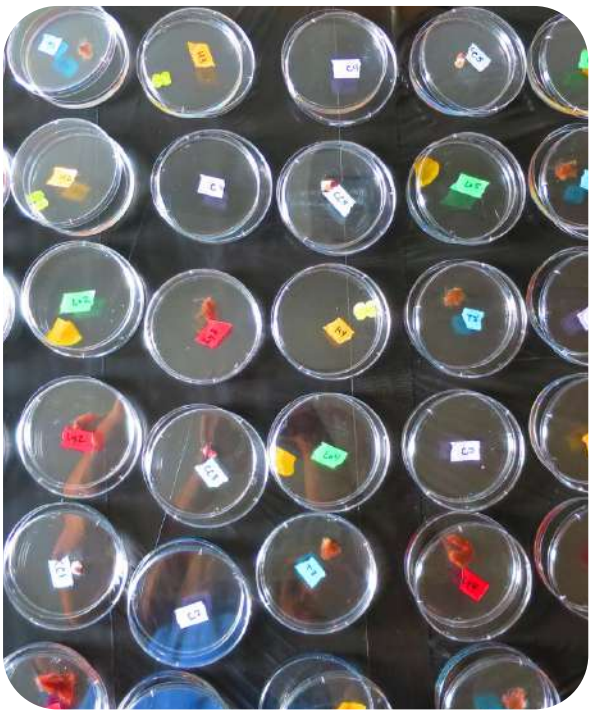
Scientists from the Smithsonian Conservation Biology Institute (SCBI), CARMABI and partners in Florida have become the first to use cryopreserved (frozen) coral sperm to support gene migration of coral populations that would otherwise remain geographically and genetically isolated. Because live corals are difficult to move safely between locations for breeding, the technique provides an effective way for conservationists to mix coral genes from different populations with the aim of making offspring more resistant to bleaching and disease.

The researchers used more than 150,000 live eggs collected from endangered elkhorn coral in Curaçao and fertilized them with frozen elkhorn coral sperm collected from three places in the Caribbean—Florida, Puerto Rico and Curaçao. The movement of genes between populations to speed up adaptation, called assisted gene flow, is an emerging tool in conservation. Assisted gene flow is already used in agriculture: crops from different regions of the world are mixed to find new drought-resistant, disease-resistant and pest-resistant varieties. The frozen sperm from each of the three populations successfully fertilized the live eggs, and the team transported 20,000 larvae to Mote Marine Laboratory and Aquarium in Florida and The Florida Aquarium Center for Conservation for settlement and rearing. The 1-month-old coral “recruits” represent one of the largest living wildlife populations ever created from cryopreserved material.

This project is a collaboration between the Smithsonian Conservation Biology Institute, the CARMABI Research Station in Curaçao, The Florida Aquarium Center for Conservation and Mote Marine Lab and was funded by Paul G. Allen Philanthropies.

Source: Smithsonian's National Zoo and Conservation Biology Institute (December 2018)

A diver takes a picture of the endangered elkhorn coral (Acropora palmata)



The effect of different algal species on the survival of coral larvae is being tested in the lab

scientific research

SELECTED PROJECTS 2018

New technique to restore coral reefs

Researchers at CARMABI have developed a new method to restore damaged coral reefs. The new method proves to be more effective, cheaper and less time-consuming than other ways to restore coral, has been tested in Curaçao.

The new “sowing” method involves the collecting of coral eggs and spawn, and the cultivating of coral larvae in a laboratory. These larvae are more prone to survive changing circumstances than corals that already live on the reefs. The coral larvae are being cultivated in the laboratory. They attach themselves to specially designed triangular seed-units. The triangular form of the seed-units has proven to nestle well in the small holes and the crevasses of the reef, which gives the polyps time to grow into a new colony. The research has shown that the method works and that the majority of the seed-units with polyps were firmly attached to the existing reef within a few weeks. One year later, more than half of the seed-units were found with at least one coral on them.

Earlier methods that involve the gluing of tiles with larvae one-by-one, or the replanting of shoots from coral that was broken off, are far more time-consuming and less effective. The transplanting of 10,000 individual corals with the “old” system involves hundreds to thousands of man hours per hectare, while coral degradation takes place on a surface of many more square kilometers. The new method doesn’t work in all cases. A number of conditions need to be met: the sea water needs to be clean, there should be a living reef in the area and certain fish species are needed that eat the algae that are damaging to the coral. This method serves to help the existing reef in its survival. It doesn’t build reefs.

Source: The Daily Herald (January 2018)

Nets used to collect coral gametes are staged on a reef right before coral spawning

School of Blue tangs (Acanthurus coeruleus) at Oostpunt

scientific research

SELECTED PROJECTS 2018

Successful International workshop on innovative reef restoration techniques at Carmabi

Between June 5th and 14th, participants from 7 Caribbean and South American nations took part in a workshop at Carmabi focused on coral restoration practices using coral larvae. The event was organized around the reproduction of one of the Caribbean brain coral species and 300000 gametes were collected and fertilized in the lab. 5000 young corals raised during the workshop were later outplanted on the reefs around Curacao. The workshop was organized by Carmabi in collaboration with Secore International, a US-based organization which develops and implements innovative reef restoration techniques together with Carmabi on Curaçao. Invitees to the workshop were active coral restoration practitioners from a.o. Colombia, The Dominican Republic, The Bahamas, Statia, Saba, Bonaire and Curaçao.

During the workshop participants acquired hands-on training on new techniques to rear coral larvae and allow them to settle on specially designed substrates that can be outplanted on (degraded) reefs. Furthermore Carmabi and Secore staff provided participants additional information on coral reef ecology, surveying techniques, and other approaches to halt the decline of degrading reef communities. The workshop ended on Thursday June 14th, and many participants mentioned they learned enough to start or to improve larvae-based restoration techniques in their own country, making this workshop one of the most successful ones in recent years which was in large part made possible through funding from the BEST 2.0 Programme of the European Union.

School of creole wrasses visiting a cleaning station (Clepticus parrae)

Coral on healthy reefs produce more offspring

In coral reef conservation and management, the prevailing metric of reef health is percent coral cover, a measurement commonly used with the assumption that each unit of live coral tissue has equivalent ecological value.

In this study led by researchers from Carmabi and Scripps Institution of Oceanography it is shown that the reproductive output of a coral population is not proportional to the cover of coral present.

Instead, when compared to declining populations nearby (near Willemstad), high cover coral populations (near Oostpunt) produced up to four times more larvae per square centimeter of tissue, resulting in up to 200 times higher larval production per square meter of reef. In the wake of unprecedented global coral bleaching, our findings suggest that the largest reductions in coral reproduction may occur when corals are lost from previously healthy populations.

scientific research

SELECTED PROJECTS 2018

Coral Live 2018

The Coral Live expedition team engaged students around the world with the wonders of the coral reefs and the human impact on these fragile ecosystems through a series of live broadcasts from 29 October to 09 November 2018. Covering less than 1 percent of the marine environment, coral reefs are home to 25 percent of marine species and important nursery habitats to edible fish.

It is estimated that 1 billion people depend on food from the reefs. Exploring this fascinating topic, Jamie Buchanan-Dunlop, educator and expedition leader, and Ellie Mackay, science communicator, brought corals to life for classrooms around the world.

Working with researchers at the Caribbean Research and Management of Biodiversity (CARMABI) research station, Jamie and Ellie hosted thirty interactive education broadcasts for teachers keen to bring science, geography and primary school learning to their classroom. Running on Digital Explorer's YouTube Live Channel, teachers were able to introduce their students to any of the five topics: an introduction to coral, coral ecosystems, corals and climate change, the deep reef and the coral adaptation.

Each day of broadcasts was dedicated to one of these themes and classes could choose from three different live broadcast formats running twice daily, live investigations, interviews with experts and Ask-Me-Anything sessions.

The impact of the Coral Live program from CARMABI is shown in Figure 4.

Fig. 4

scientific research

SELECTED PROJECTS 2018

NICO Expedition

The Netherlands Organization for Scientific Research (NWO) sent its research vessel RV Pelagia (Figure 5) on a seven-month voyage to the Dutch Caribbean early in 2018. The ship left Texel, in the Netherlands in December 2017 on a multi-disciplinary expedition called “NICO” (Netherlands Initiative Changing Oceans). Nearly 100 scientists, including those of CARMABI, worked for 186 days to answer research questions related to the state of our oceans, climate stability and sustainable economic activities. With NICO, Dutch scientists aimed to answer many of the fundamental questions in marine science, which are essential for planning and making decisions about our future livelihoods.

A source of inspiration for the expedition was the policy document published by the Dutch Government (Oceanennotitie) outlining the national view on ocean policies, emphasizing that healthy and resilient oceans are of prime relevance to the Netherlands including the Caribbean parts of the Kingdom. The NICO expedition first visited Curaçao, Aruba and Bonaire, where the ship stayed for the month of January 2018 to study the geochemistry of the ocean, geology, seabirds and the state of the island's near shore environments. The data collected during this expedition is currently being analyzed.

Source: DCNA

Fig. 5

scientific research

SELECTED PROJECTS 2018

Third Global Invertebrate Genomics Alliance Research Conference and Workshop (GIGA III) held on Curaçao

The Global Invertebrate Genomics Alliance (GIGA) is a collaborative network of diverse scientists studying invertebrate animal genomics. GIGA aims to promote standards that facilitate comparative approaches and collaborations across the international scientific community. The Third Global Invertebrate Genomics Alliance Research Conference and Workshop (GIGA III) took place in beautiful Curaçao from 19-21 October, 2018 (Figure 6). This meeting consisted of three days of scientific talks, breakout sessions, field trips, and a poster session. Many scientists stayed at CARMABI after the meeting to study a large number of research questions addressing single-cell genomics to conservation genomics.

Source: GIGA

Fig. 6

scientific research

SELECTED PROJECTS 2018

Klein Curaçao declared a Ramsar Site

The Netherlands has designated Klein Curaçao as its 55th Wetland of International Importance. The Site (Ramsar Site no. 2355) consists of the small, uninhabited island and the surrounding sea. The eastern shore features a near-pristine, well-developed and still growing coral reef system that supports an enormous diversity of marine organisms. Such self-sustaining reef systems are increasingly rare in the Caribbean: this is one of the few remaining healthy examples and is representative of Caribbean reef communities in general. Its dense populations of branching corals protect the coastline by dissipating wave energy.

The island is of global importance for its breeding population of the least tern *Sterna antillarum*, while a 600-meter stretch of sandy beach is the most important nesting area within Curaçao's jurisdiction for the critically endangered hawksbill and the endangered green sea turtle. The main threat to the Site is uncontrolled tourism, which may negatively affect the nesting activities of the sea turtles and terns.

Source: RAMSAR (September 2018)

Klein Curacao

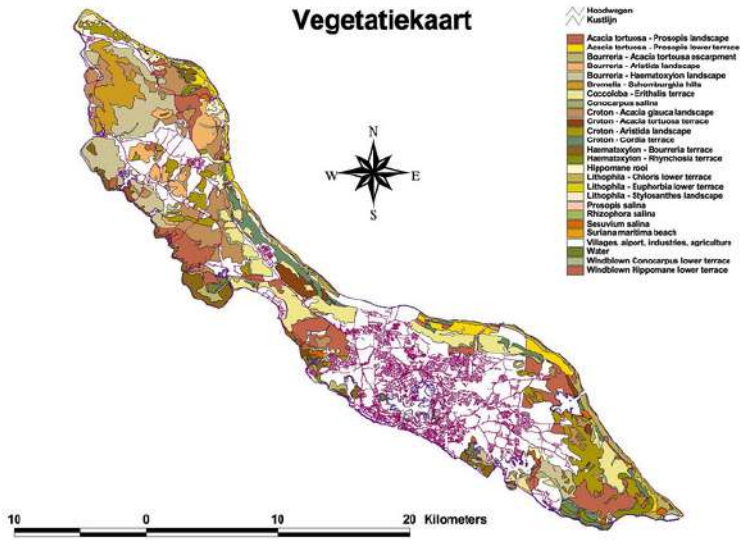
consultancy

RESEARCH & SERVICES

This department conducts terrestrial research and provides advisory services to private and governmental organizations on topics regarding terrestrial biology.

Below follows an overview of the activities carried out by or in which Carmabi biologist John de Freitas and/or Erik Houtepen were involved.

Besides the following, information, advisory and species determination services were provided (free of charge) on many occasions during the year, mainly to private persons.



Vegetatiekaart van Curaçao

Focus on the nature of the Christoffelpark

At the start of 2018, it was decided by the board of Carmabi to put more focus on the nature management of the Christoffelpark.

Several studies have been identified as necessary input for the final version of the nature management plan of the Christoffelpark. These projects will be discussed below.

Het Curaçaose Witstaart hert (Odocoileus virginianus curassavicus) in het Christoffelpark

Sabal Palm (Sabal antillensis) in het Christoffelpark

consultancy

SELECTED PROJECTS 2018

The second population study of the Sabal palm (*Sabal antillensis*)

In the run-up to the opening and management of the Christoffelpark in 1978 a survey was done in 1972 of the distribution of some 25 rare plant species in the Christoffelpark by Jan Voskens and the first population study of the Sabal palm in 1979 by MSC student Joke Winkelman.

The Sabal palm is the only indigenous palm species of the island and a prominent, iconic and emergent feature of the flora of the Christoffelpark (Fig. 7). Therefore, it was important to determine the status of this unique palm after several decades and also to see whether there would be signs of infestation of these palms by the red palm weevil that has caused significant mortality in palms in Willemstad and its suburban areas. The Sabal palm is also interesting because the number of (wild) goats in and around the Christoffelpark is much smaller as compared to the situation present at the opening of the park. This second survey of the palm was done by three Aeres Applied University students (Fig. 8) under the supervision of staff biologist John de Freitas. These students did a second survey of the endemic Sabal palm (*Sabal antillensis*) growing in and just outside the borders of the southern section of the Christoffelpark. The present study was set up to describe the present population structure and determine if a very significant reduction of the number of free roaming exotic goats since the late 1980s would have had any effect on the numbers and structure of the endemic Sabal palm population. At the opening of the park it was estimated by Coblentz (1980) that there were at least 3000 goats roaming freely in and around the Christoffelpark. At present the number of goats must be very low because they are hardly seen or heard during the day.

Fig. 7

consultancy

SELECTED PROJECTS 2018

continuation

The second population study of the Sabal palm (*Sabal antillensis*)

The same size categories for the specimen as used in the study of Winkelman were used in the present study with two small modifications. In all four of the used survey categories (Adult, Semi-adult, Juvenile and Seedling) there was a very significant increase in numbers as compared to the Winkelman's study. In the present survey we counted 1.030 adult palms, an increase of over 300% as compared to the 1.979 population. The most dramatic increase was found in the Seedling category with at present 3144 seedlings, an increase of over 2000%. On Curaçao there has also been a significant expansion of the palm distribution area as compared to the situation in 1979 (Fig. 9).

The largest part of the population occurs within the borders of the Christoffelpark with the only occurrences outside the park being on Seru Malé, Seru Para Mira and Seru Pasku. The area of Seru Gracia is still the location with the highest abundance of the Sabal palms. (Fig 10.)

Fig. 8

Fig. 10

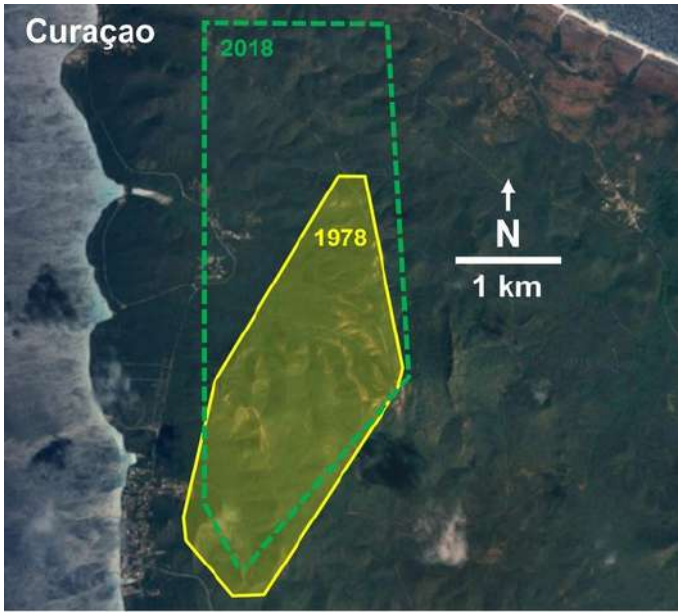


Fig. 9

consultancy

SELECTED PROJECTS 2018

Vegetation Mapping of the Christoffel Park

From September 3rd, 2018 till December 14th three 'International Land and Water Management' BSc students of Wageningen University stayed at CARMABI as part of their internships. For this purpose, the students assisted CARMABI staff biologists of the terrestrial department (De Freitas & Houtepen) in updating the plant community type map of the Christoffel Park. The plant community type map provides information on vegetation and geomorphological patterns of the Christoffel Park and this map is thus of great importance for research and park management purposes.

The first vegetation map (detail scale) was produced in 1985 (Fig. 11), and therefore a new map (after more than 30 years) would provide insight in the changes that has taken place in the park vegetation.

This is especially relevant because the number of goats inside the park and in the areas bordering the park has declined very significantly since the mid-1980s. The results will also be relevant for nature management on other Caribbean islands in which also exotic grazing mammals were introduced in colonial times (e.g. Bonaire and Aruba).

As a start of the project the 1985 vegetation map of the Christoffelpark (by Bokkestijn & Slijkhuis) as well as the 1985 map on which the sample points were indicated, were digitalized. During the period of the internship of the three BSc students 75 sample points of the 1985 project (with a total of 208 sample points) were revisited and the same data collected as in 1984/1985 in 10mx10m sample plots.

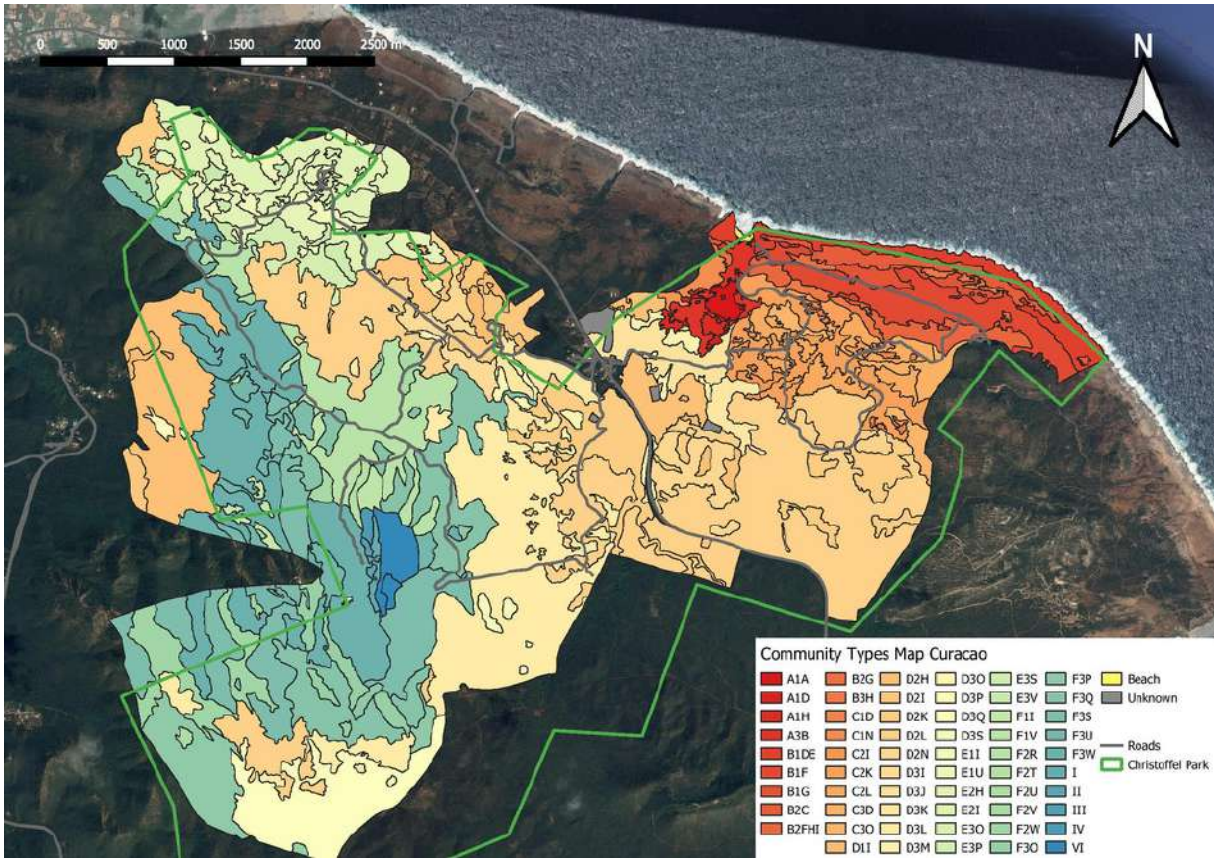


Fig. 11

consultancy

SELECTED PROJECTS 2018

continuation

Vegetation Mapping of the Christoffel Park

Due to the limited duration of the internship period of the students it was decided to focus the fieldwork on the vegetation/landscape units (five in total) that covered the largest surface areas in the park according to the 1985 study. The field data were collected according to the relevé method of the ITC (Netherlands), the same method used in the 1985 project. Besides abiotic parameters data collected included, height of the different layers of the vegetation, cover of each layer and each species. A soil sample of the sample plot was also taken to the lab to determine water and organic matter contents as well as pH of the soil.

The grazing intensity was determined by looking for the presence and counting the number of fecal pellets of grazing mammals present in the sample point area. Plotting of the occurrences of rare plant species in the park in both the 1984/1985 (Fig. 12) and present study show that most rare plant species are found in the higher parts of the Christoffelpark.

Fig. 13 shows two of the three Wageningen University BSc students during fieldwork in the lower parts of the Christoffel hill.

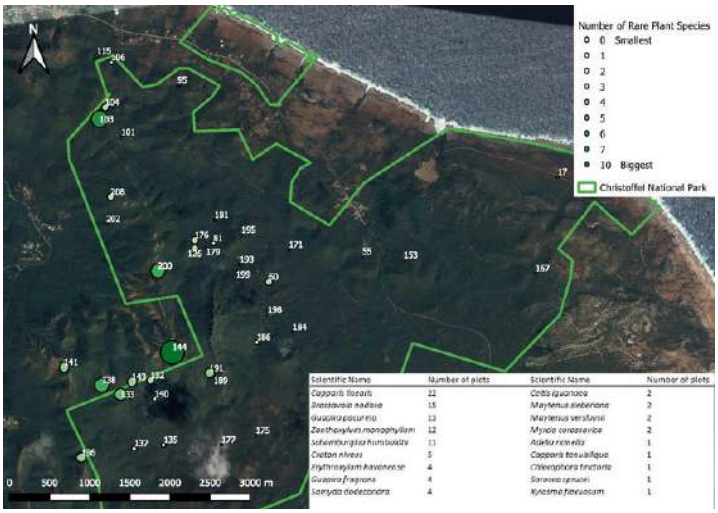


Fig. 12

Fig. 13

consultancy

SELECTED PROJECTS 2018

Monitoring fauna and flora of the Christoffel and Shete Boka National parks

On October 23rd, Carmabi started a monitoring program in order to collect data for nature management purposes. The highest priority will be put on monitoring the endemic Curacao deer (Christoffelpark) and the nesting of threatened sea turtles (Shete Boka park). Over time we also will expand the monitoring activities to other threatened animals in the park as well as rare plant species. The Christoffelpark is known as the area of highest biodiversity on Curacao and the Shete Boka beaches provide important nesting grounds for internationally endangered and protected sea turtles.

Deer monitoring is done by CARMABI park rangers during guided tours in the Christoffel Park that take place on several weekdays. With the data CARMABI aims to determine possible habitat preferences and get indications about trends in the deer population, indicating whether the number of deer increases, decreases or is stable. Two park rangers and park managers were trained by Erik Houtepen in the use of a GPS and field forms to collect monitoring data to start the monitoring in the parks. In the last quarter of 2018 three deer have been observed by CARMABI staff during tours.

Green Turtle

The importance of the Shete Boka National Park lies significantly in the presence the (sandy) beaches called boka's which provide turtles an opportunity to nest. The nesting activity of turtles is monitored by staff biologist Erik Houtepen assisted by a Christoffelpark ranger. To further develop the monitoring program, a team of volunteers has been assembled, which assist in the monitoring activities. This team consists of 8 people with various backgrounds, but all share a passion for nature conservation. These volunteers have received the necessary training to prepare them for effective assistance during the monitoring sessions. Houtepen restarted the sea turtle monitoring in the two parks in October and continued unit late December, but no evidence of nesting turtles was observed. In 2019 the sea turtle monitoring program will run the whole period of sea turtle nesting (March up until November).

consultancy

RESEARCH FACILITY SAVONET

Development of CARMABI research facilities at Landhuis Savonet

To further develop terrestrial research of the CARMABI National Parks, research facilities have been installed at Landhuis Savonet during the second half of 2018. The facilities include a conference room with a capacity of 40 people, an office and laboratory area and overnight accommodation for 2 CARMABI staff members or visiting researchers.

The research facilities up to date include two stereo microscopes, a large freezer, GPS devices, scopes and binoculars and a starting collection of relevant literature. 2019 will see the continued improvement of research facilities with possibly also a drying oven.

consultancy

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parkmanagement

CHRISTOFFELPARK & SHETE BOKA

Carmabi is assigned with the management of the Christoffel Park, the Savonet Museum, the National Park Shete Boka and the Hato Caves. With yearly approximately 40000 visitors in The Christoffel Park, 70000 visitors in National Park Shete Boka, and Hato Caves with 72000 visitors, these parks function as an important touristic attraction.

Besides that, the parks house an array of animal species, plants, trees and breeding spots for turtles. Carmabi conducts studies about these species and protects nature in the parks.

The Curaçao White Tailed Deer (Odocoileus virginianus curassavicus) in the Christoffelpark

Overview 2018

The year 2018 was bustling with activity in different areas and visitor numbers kept on rising in all three parks. Christoffel Park is moving in the direction of 50.000 visitors, the Shete Boka Park 90.000 and Hato Caves 86.000.

Where we were mainly focused on getting the procedures and overdue maintenance done in 2017, last year was marked by growing success and as a result harvesting high credits on social media such as Tripadvisor and Google. We could focus on our main targets such as nature management and organizing more events to attract more (local) visitors. In our communications we included more information on what we have to offer besides the climbing the Christoffel Mountain.

During two fairs in the Netherlands (Vakantiebeurs & 50+ beurs) our parks were also promoted. Monica Vrolijk, our Hato Caves entrepreneur, undertook this promotion. We invested in upgrading facilities at the Shete Boka National Park also aimed at facilities for visitors with physical disabilities to reach areas like the Boka Tabla Cave and Boka Kalki.

We provided more structures to provide shadow to enjoy the crashing waves more comfortably. The restrooms were renewed; the restaurant terrace overhauled with colorful tables and our ticket-office got a more friendly and safe appearance. To help people find their way around the parks, we installed more directional signs in different areas.

parkmanagement

NATURE MANAGEMENT

Sargassum invasion

Sargassum is a genus of brown macroalgae/ seaweed (class Phaeophyceae) in the order Fucales. Numerous species are distributed throughout the temperate and tropical oceans of the world, where they generally inhabit shallow water and coral reefs, and the genus is widely known for its planktonic (free-floating) species. In the first 6 months of 2018, our sea inlets (boka's) were invaded by large portions of Sargassum and had to be removed to prevent damage on our coral reefs and turtle nesting beaches. This was done successfully by our rangers and help from external contractors.

Monitoring endangered species

Erik Houtepen, the newly recruited Biologist of the Terrestrial Research and Consultancy Department, developed a new monitoring program to map deer and turtle nesting areas, which commenced in September 2018. At the same time, the Dutch Royal Navy built a deer and bird watching tower to replace the old one that almost collapsed. Deer are seen eating newly growing buffalo grass and drinking from the water reservoirs that were re-opened.

Cleaning up Sargassum in the Boka Tabla Cave

parkmanagement

EVENTS

Race bikers

In April the Christoffel Park and the North coast crowded with 103 race bikers for a short and/or long course. The course led through beautiful nature in the Christoffel area, Shete Boka and Watamula at the most western point of Curacao. It was a spectacular race for the participants over dirt roads, rock formation and coastal areas with beautiful views.

Open museum days

The open museum days in May, a collaboration with the other museums on the island, was well visited. In the third quarter of the year we had a successful Savonet Day, combined with a free entrance to the park, music, a folklore dance group and local food and we welcomed around 800 people that day of which 75% locals.

Fellowship to Barbados

Sue Shantely Lourens, our management assistant, won a fellowship to Barbados to attend the Museum Association of the Caribbean conference (MAC). This is a yearly conference, where professionals and enthusiasts meet to share their experiences and to discuss innovations for Caribbean museums. Sue Shantely came back with ideas to upgrade our Museum (Plantation House of Savonet) for the coming years and to discuss within the association of museums on Curacao the influence of society on cultural historic aspects.

Opening Permanent Exhibition Nos Naturalesa

In December 2018 a new permanent exhibition called “Nos Naturalesa” (Our Nature) in the Savonet Museum was opened. This was completely equipped by our Nature and Education department spearheaded by head of that department, Cor Hameete. It gives a wonderful insight in the flora and fauna that can be found in the Christoffel Park. The exhibition is a very important aspect of the excursions and education programs in the parks, which is visited by over 10.000 school children yearly.

Sunset tour in the Christoffelpark

Sue-Shantely Lourens in Barbados

A skeleton of the Curaçao White Tailed deer (Odocoileus virginianus curassavicus)

parkmanagement

SUPPORT

Agreement Foundation Monumentenfonds

Carmabi signed an agreement with Foundation Monumentenfonds with regards to the maintenance to be completed at Landhuis Savonet. This old country house is found in the Christoffel Park. Maintenance to the buildings inside this park falls under the responsibility of Carmabi, who manages the park. Landhuis Savonet is one of the oldest country houses of Curacao. The ticket sale of the park, the shop and the Savonet Museum currently reside in these buildings.

Plantation Savonet was one of the first plantations in Curaçao and, together with plantation Zorgvlied, it comprised almost 1,600 hectares of land. It supplied wool, maize, seeds, meat and wood. In the second half of the 19th century there were 2,400 sheep, 850 goats, 400 cows and 60 pigs around. In 2010 the Landhuis reopened after a thorough renovation and today serves as a cultural museum with information about the former plantation and the cultural history of Curaçao.

With the support and financial resources from Monumentenfonds, the Landhuis will be maintained with this project. Work will be completed on locks, roofs and roof tiles, windows and shutters. An important historical part of the Landhuis will also be restored. In April 2017, an old Plantation Bell was donated to the Landhuis. Mr. Nanno Nommensen found this Bell in the Zevenbergen area at the end of the sixties. He took the bell to the Netherlands but eventually decided to donate it to the Savonetmuseum. The old cradle (the part which mounts the bell) has been found later at Sint Hyronimus and donated to the Landhuis by Mr. Franklin Finies. The bell, in its cradle, will be mounted on a wooden beam and placed on the location where the original plantation bell was: on the wall of the terrace of the land house.

Signing the agreement with Monumentenfonds Curaçao

parkmanagement

MAINTAINANCE

Restorations in Shete Boka

A platform in the Boka Tabla Cave was placed. The grids for the platform have been donated by the BAM Group. Boka Tabla is one of the most popular spots in the National Park.

Carmabi has placed the platform and at the same time arranged for a new handrail for adults and children, making it possible for everyone to visit the spectacular place.

When it is not possible to enter the cave because of rough circumstances, there is now a door that closes the entrance of the cave. This enhances the safety of visitors in the park.

Earlier in the year, Carmabi already re-opened the road to Boka Pistol after renovation and the placement of a roof for shade.

Trails are improved and the platform at Boka Pistol has received a full transformation and the parking spot now also has a mobile guardhouse for the security guard. Visitors can enjoy the most spectacular part of the park from underneath a comfortable roof, providing shade and a bench for some rest after the short hike. The perfect spot for a picture of the powerful and breathtaking water spout.

Boka Pistol is also safely accessible again by car for those who are not up for the hike. The road towards it has been renovated.

The new platform in the Boka Tabla Cave

The door at the entrance of the Boka Tabla Cave

The new roof at Boka Pistol

parkmanagement

MAINTENANCE

New weather station

The Meteorological Department Curacao placed a new weather station in the Christoffelpark at Savonet. The opening was celebrated on March 21st (2019) and was done by Minister Zita Jesus-Leito. In the past there used to be a weather station at Savonet. However, this weather station has not been used for years. A second weather station will be placed at Seru Grasia.

These weather stations are very important. Because rain showers occur very locally on Curacao, measuring the weather with several weather stations is much more accurate. Before, Carmabi used only the available weather station located in Barber. But it sometimes happened that it was raining on Savonet and not in Barber or vice versa. In addition, the Christoffel Mountain has influence on the weather due to its height. This can now be measured with the second weather station at Seru Grasia. Also, the influence of the weather on the flora and fauna of Christoffelpark can be researched.

Official opening Meteo weather station with Minister Zita Jesus-Leito (March 2019)

Renovations at the Hato Caves

Renovations were completed at the Curacao Hato Caves. These renovations and innovations were necessary to provide a safe and pleasant environment for the continuously growing cruise tourists and visitors to the caves. A new entrance with a parking lot for 16 taxi's and cars has been created. This was to ensure the pedestrians and the cars have a separate access to the premises of the caves.

Much work has also been completed inside the caves. Handrails have been placed along the entire walkway in the caves so that people can safely admire the beautiful cave. In addition, extra lights have been placed on the low sections to prevent people from bumping their heads. In all work that has been done, the well-being of the animals - including the rare long-nosed bats - that inhabit the cave, have been extensively taken into account.

The new hand rails inside the Hato Caves

The Hato Caves & Carmabi Team

parkmanagement

DONATIONS DUTCH DEFENCE

Renovation Deer Watchtower

In October 2018, the Dutch Caribbean Defence renovated a watchtower at the Christoffelpark. The tower is known as the 'deer tower' because from this tower you can spot the Curacao white tailed deer. They often drink at a water bowl nearby the tower. The tower also offers a spectacular view of the Christoffelpark, the Savonet Manor, its plantation and the sea. Furthermore, the tower is used as a place to watch birds.

The process: renovating the watchtower

The watchtower is located at a place in the Christoffelpark where Buffalo grass grows (a hard grass type). Also you will find water bowls at this location. Deer often visit this place to drink and eat, the main reason why the deer watchtower is built on this location. Over the years the watchtower was in a poor condition. Thanks to the Dutch Caribbean Defence, it has now been completely renovated and put into use.

During the opening of the new Watchtower

Donation vehicle

In November 2018, a vehicle of the Royal Netherlands Marechaussee has been donated to Carmabi by the MICAR of the Royal Marine. Head of MICAR, commander Danny van den Bosch handed the keys of the former Marechausse car to the team of Carmabi. The Carmabi team, represented by director Paul Stokkermans and Park Rangers Cyrill Kooistra and Briand Victorina, received the car with great gratitude.

The vehicle provided excellent service for years, the vehicle also was transported to Sint Maarten to assist with repair and recovery proceedings after hurricane Irma. But, just like in the Netherlands, this type of vehicle is now replaced by a newer model. For Carmabi this is a fantastic addition that can be profited from for years. The vehicle has been completely renovated by the Car workplace of the MICAR. The vehicle can be used in the parks for emergency situations and for tours and activities.

The vehicle donated to Carmabi

parkmanagement

VISIT PIET HEIN DONNER

Piet Hein Donner visits national parks during a farewell trip as vice president of the Council of State

Piet Hein Donner, vice president of the Council of State in The Hague, visited Curaçao in November 2018. As part of his farewell journey as vice-president of the Council of State to all islands within the Dutch Caribbean, the National Parks of Curaçao were also visited.

The visit to the parks commenced at the ruins of the Zorgvlied plantation in the Christoffel National Park. The delegation was shown around by guide François van der Hoeven and director of Carmabi, Paul Stokkermans.

There was interest in the importance and preservation of the cultural heritage within the park. The visit ended with a visit to Boka Pistol in the Shete Boka National Park and a tour of the Savonet museum.

A plan is being prepared to protect all the ruins of the former Zorgvlied and Zevenbergen plantations within the Christoffel park in such a way that they do not deteriorate further. This is important because, as a result of vegetation overgrowth and the effect of rainwater, the ruins are slowly but surely disappearing. It is furthermore the intention that the dams are restored to their original state and function. The dams are essential for replenishing the groundwater, which is important for the flora and the creation of drinking places for the animals, including the Curaçao white-tailed deer.

A visit to the Zorgvlied Ruins

At Boka Pistol

The delegation and park staff at the Savonet Museum

parkmanagement

OVERALL VISITOR STATISTICS

Christoffelpark

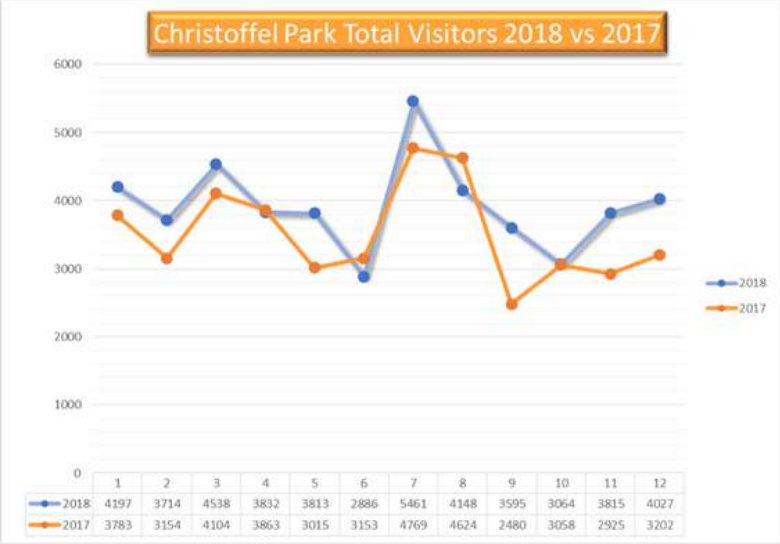
In 2018 a total of 47.090 people visited the Christoffelpark, whilst in 2017 this was a total of 42.401 people. This is an increase of 4.689 visitors and a percentage of 11% in comparison with 2017. Included in this number are local visitors and the visitors that participate in activities and tours. The total number of local visitors at the Christoffel Park in 2018 was 13.147 people. In 2017 we received 12194 local visitors. This is an increase of 8%. We speculate that this can be credited to the introduction of a discount ticket for people who are born on Curacao, and are visiting the island and the park during the summer and winter vacation time.

Visitors of the museum (separately sold tickets) consisted of 2.232 in 2018 compared to 1.905 in 2017, which indicates an increase.

Figure 14 shows the total amount of visitors during the year, compared to 2017.

In the Christoffel Park, visitors have the option to join different activities on a weekly basis such as jeep safari's, mountain hikes, moon and deer walks and bird spotting tours. The increase of tour operators that visit the park with tourists has resulted in a small growth in revenue and visitors.

We are also proud to report that the number of visitors of 47.090 in 2018 included local visitors.



	1	2	3	4	5	6	7	8	9	10	11	12
2018	4197	3714	4538	3832	3813	2886	5461	4148	3595	3064	3815	4027
2017	3783	3154	4104	3863	3015	3153	4769	4624	2480	3058	2925	3202

FIG. 14

The top of the Christoffel mountain

A thirsty Warawara in the Christoffelpark

parkmanagement

OVERALL VISITOR STATISTICS

Shete Boka Park

The Shete Boka National Park showed an increase of 27% visitors compared to 2017. 78.492 people visited the park in 2017. In 2018 there was a total visitor number of 89.383.

This number includes local visitors, tour operators and Cruise operators with touring busses. The total number of local visitors was 10.129 in 2018 and 7.397 in 2017. This means that Shete Boka had an increase of 27% of local visitors. This can be credited to lowering the ticket price for visitors with a local ID (Sedula). Figure 15 shows the total amount of visitors during the year, compared to 2017.

FIG. 15

Hato Caves

In 2018 a total of 86.385 people visited the Hato Caves. Whilst in 2017 this was a total of 72.141 visitors. This is an increase of 19%.

Figure 16 shows the total amount of visitors during the year, compared to 2017.

FIG. 16

parkmanagement

PERSONNEL

First Aid certificates and a rescue seat

First Aid certificates were received after a course that included all the team members. It is of high importance to have trained Park Rangers and personnel in case of emergency or in case an accident occurs in the park. We have also acquired a rescue seat to safely and quickly help visitors in case a small accident occurs on the mountain.

Staff changes

Two extra rangers came into service in 2017. They both started out as on call employees. By appointing one volunteer at the foot of the mountain, the rangers can perform other important duties on Wednesdays and in the weekends between 10 am and 2 pm.

We had three promotions, Briand Victorina was promoted to Security Officer, Edwords Alberto was promoted to Head Park Ranger and Ergelyn Cijntje was promoted to Front Office and administration employee.

Two employees, Raquel Tokaai-Redan and Allyson Philips have left the organization. We wish them both all the best.

We welcomed Ingrid van t'Hul as our new Facilities Coordinator per the 1st of June 2018

The team receiving their First Aid Certificate

The park rangers and director Paul Stokkermans

nature & environment education

EDUCATIONAL PROGRAMS

Terrestrial and marine programs

The Carmabi Nature and Environment Program consist of a Terrestrial Education Program (TEP), which includes guided tours within the parks, and a Marine Education Program (MEP), which includes educational programs and a visit to the Marine Education Center (MEC).

A total of 54 schools (of the total of 63) participated in the educational programs of the Nature and Environment Education Department. Most school participated with various age groups for as well the TEP as the MEP program.

In November 2018 we introduced a new program within MEP. Besides group 8 (11 year old) with the program 'Save Our Sharks' we also offer the program 'Turtles & plastic waste' for group 6 (9 year old).

Director Paul Stokkermans and Head of department NME Cor Hameete during the Curacao Clean Up.

By introducing a new exhibition in our Museum Savonet, named 'Nos Naturalesa' (Our Nature) various TEP programs got an addition. The students are guided through the museum and learn additional things about the local animals and plants followed by a guided tour through the parks. In 2018 a total of 10.126 pupils participated in the Carmabi educational program of which you find the specification in this annual report.

Part of the Nos Naturalesa Exposition (TEP)

Part of the exposition in the Marine Education Center (MEP)

nature & environment education

PARTICIPATION

Terrestrial Education Program

The Christoffelpark was visited by 9,434 pupils subdivided from class/group 1 to group 8 of our primary school system (ages vary from 4 till 12 years old). A specification can be found in figure 17.

The activities in the park focus on different themes such as our local birds, trees/ plants, reptiles, agriculture/ wells & ruins. The younger pupils, from group 1 and 2 visited the park as an introduction to the nature world around them during the so-called 'Mondi Misterioso' activity.

The aim of this activity is learning to care more for nature in a playful way by recognizing different flora and fauna. In our program 'reptiles' the pupils (group 3) learn all about reptiles and their habitat and niche in our nature

Group 4 went to the Christoffel Park for lessons on birds. The bird lessons involve obtaining knowledge about our local birds in theory and by observing birds within the park.

Group 5 visited the Christoffel Park to learn more about our trees and plants and got the opportunity to recognize the trees and plants in the park.

Groups 6 and 7 visited lessons on wells, agriculture and ruins in the area of Savonet & Zorgvlied in the Christoffel Park.

The focus for group 8 is the specific nature/ ecology of an island. All the lessons for the groups 4 up to 8 include a small exam; the result can be part of their school report.

Terrestrial Program (FieldProgram) TEP 2018	
Christoffelpark (Mondi Misterioso/ Nos Mondi) Group 1 & 2	1838
Christoffelpark (Reptiles) Group 3	1047
Christoffelpark (Birds, Para) Group 4	1301
Christoffelpark (Plants, Palu) Group 5	1154
Christoffelpark (Seaside, Savonet) Group 6	1072
Christoffelpark (Mountainside, Zorgvliet) Group 7	1167
Daaibooi Group 8	303
Shete Boka Group 8	916
Schoolvisits	50
Total:	**8848**

FIG. 17

Terrestrial Education Program

nature & environment education

PARTICIPATION

Marine Education Program

This year we continued with our Marine Education Program for group 8; corals and sharks. The teacher receives a book and teacher's guide on the Coral Reef Ecosystem from Carmabi. A specification can be found in figure 18.

The school introduction is followed by a visit to Carmabi Piscadera where the pupils follow an interactive program with presentations and a visit to the MEC. The focus is on the importance of the coral reef and the ecosystem with the shark as top predator.

This year the program "Turtles and plastic waste" is introduced, for pupils group 6. The program is a variety of presentations, video's, game-like assessments and also a visit to the MEC. Our aim is to show the beauty of underwater life and our turtles in particular. By showing the life of the turtles, pupils get awareness of the consequences of human action.

The influence of human action is explained by the focus on our (single use) plastic waste.

All over the world, also on Curacao, we are more aware that our ocean isn't a place to get rid of our waste and we realize and get to understand the consequences of our behavior.

The attention in our local media for our mangroves, sewer waste problem, and plastic waste makes our new program a logic addition to our education program.

In 2018 we made the visit to the MEC more interesting for children by making use of scavenger hunts in the MEC with iPad's. It's a cool and fun addition. For 2019 we are going to explore the possibilities for using Virtual Reality (VR) glasses. The visitors of the MEC can 'walk' through our Curacao Coral reef in a VR environment.

Marine Education Program (marine education center) MEP 2018	
Group 6: Turtles and plastic waste	28
Group 8: Corals and sharks	1086
Total:	1114

FIG. 18

Marine Education Program

nature & environment education

PARTICIPATION

Environmental Challenges

Education Program 'environmental challenges' for secondary education
On our island, just as in the rest of the world, there is increasing insight and awareness about the ecology of the oceans. We see more and more the results on which our way of life affects the sea.
In June the program for secondary education (vsbo, havo, vwo) is developed. The students get to see a list of local environmental problems (import of new species, sewer waste, plastic waste, etc.) by pictures and video's. A specification can be found in figure 19.

Then the students have brainstorm sessions resulting in recommendations for our different governmental departments.

The program can be held at Carmabi Piscadera or on the school location. The meetings during SharkWeek (with the schools havo/vwo KAP and RC) and a pilot-visit to MIL havo/vwo were very successful.

The program can be adapted for all grades and levels. Also the time-schedule can be adjusted.

'Environmental challenges' (secondary education) 2018	
Radulphus College and Kolegio Alejandro Paula (Sharkweek)	50
MIL (end of june, at school location)	50
Total:	100

FIG. 19

Vacation Plan / Other groups

Our TEP and MEP programs are also available for other groups, such as after-school projects, foundations for students, vacation-plans, etc. The Education Department made different programs for all ages and all levels. Thanks to our experience we can make or adjust a program if needed.

Students Radulphus College (Sharkweek) & the Curacao Clean up

nature & environment education

SHARKWEEK

Art, education and activities

During the Dutch Caribbean Sharkweek, various activities have been organised by the team of the Nature & Environment Education. The week started with a movie night on the beach, more than 250 people attended! The movie "A Plastic Ocean" was shown on a large LED Screen.

The team was on various locations during the Sharkweek. During the week different school classes were invited to come and talk about how we can protect our sharks. There was a mini-symposium. The entire week, the Marine Education Center was all about the Sharkweek 2018.

The day care "De Tantes" visited and there was an exposition of the SharkArt that was created by the schools (secondary education). By involving students and four local artists we provided a new and different way to spark interest within a new group of people in ecology.

On Friday and Saturday Jörgen Raymann (Save Our Sharks Ambassador) and DCNA-secretary Ron van der Veer also attended the various activities. Together with Carmabi Director Paul Stokkermans, they also visited the Minister of Health, Nature & Environment, Susanne Camelia-Römer and the Naval Commander of the Caribbean; Peter Jan de Vin.

The week was topped off with an open day at the Marine Education where the winners of the SharkArt contest were announced and various fun and educational activities were organized.

Movie night on the beach

Visiting the Minister Susanne Camelia-Römer

Visiting the Naval Commander of the Caribbean; Peter jan de Vin

nature & environment education

MUSEUM & CENTER

Marine Education Center & Nos Naturalesa

In 2018 the Marine Education Center (MEC) got various upgrades. A display cabinet with shells, aquariums with Mangroves, a turtle skeleton, shark artifacts, SharkArt, and more. The museum Savonet received a new permanent exhibition 'Nos Naturalesa'. The exhibition shows our local nature, explained through artifacts from local flora and fauna. Visiting groups of the TEP programs now have an extra addition to the excursions; a visit to the plantation house with insight in our local nature.

Exposition Nos Naturalesa

OTHER ACTIVITIES

In 2018 old **material got renewed** and new material has been created (such as our new program within MEP and info-sheets and worksheets on our website).

Students (secondary education/ high school) can make an appointment with our department for **assistance on various exam projects**, such as the "sector- of profielwerkstuk" (main thesis). We also provide information about further higher education, mainly the interest for Applied Biology (HBO) or Marine Biology (VWO).

We provide programs for special weeks at school, such as internships, extracurricular theme-week, etc. We **work together with partners** like Ryan de Jongh (mangrove restoring) and GreenKids (info-sessions at the University of Curacao with students LOFO/ teacher training course).

We also collaborated with the Curacao Beverage Botteling Company (CBBC) for a **tree-planting project** for their 80th anniversary on the island. We planted 80 trees (cultivated at Carmabi) at schools and social organizations. The project provided awareness among the participants, attention in the media and an extended network for the education department.

In 2018 we worked together with schools and participated in clean-ups. The biggest clean-up with over 100 students from Kolegio Alejandro Paula was during **the World Clean-up last September**. Besides the trash we collect is gives awareness among students of our environment and (plastic) waste.

SharkArt Models used during the Sharkweek

Planting Trees together with Myrthe Verhulst (CBBC)

marketing & communications

EXPOSURE OF OUR WORK

External consultancy

As of March 2018, Make My Day Marketing is hired to consult on communications and marketing for the Carmabi foundation.

Make My Day works on the necessary branding, publications, social media, website, memo's, year reports, prints and publications of Carmabi.

Figure 20 shows an overview of the marketing activities that were done in 2018

Movie Night at the Beach during Sharkweek

Activity	Amount
Press Releases	16
Media Agreements	7
Creation of Artwork	36 designs
Business Cards	0
Signs	13
Update / create new Website	10 hours per month
Update Social Pages	5 hours per month
Update Tripadvisor	8 hours
Contact with stakeholders	10 hours per month
Contact with media	5 hours per month
Reports (year report, presslist, contracts, activities)	4
Consultations/ Advice	5
Events	4

FIG. 20

marketing & communications

PRESS RELEASES

001 Tuesday, March 13
CARMABI CLEANS UP SARGASSUM IN NATIONAL PARK SHETE BOKA AND CHRISTOFFELPARK. NL/ENG/PAP

002 Thursday, March 29
CARMABI ORGANISES UNIQUE EASTER ACTIVITIES IN THE CHRISTOFFELPARK. NL/ENG/PAP

003 Friday, May 4
BREAK IN AT SAVONET (press informed) NL/PAP

004 Tuesday, May 8
NATIONAL PARK SHETE BOKA NUMBER 3 BEST CARIBBEAN ATTRACTION ACCORDING TO 10BEST.COM NL/ENG/PAP

005 Monday, June 4
KICK-OFF SHARKWEEK ON THE BEACH AT CARMABI WITH MOVIE SCREENING NL/ENG/PAP

006 Tuesday, June 19
SHARKWEEK ACTIVITIES WELL VISITED NL/PAP

007 Thursday, July 5
PLATFORM AT THE BOKA TABLA CAVE PROVIDES SPECTACULAR VIEW NL/ENG/PAP

008 Thursday, July 19
VISIT US AMBASSADOR TO THE CARMABI RESEARCH STATION NL/ENG/PAP

009 Thursday, July 19
COMMENT ON SARGASSUM: no Sargassum in Shete Boka & Christoffel Park (AD & Paradise FM) NL

010 Tuesday, August 28
MAINTANANCE 'LANDHUIS' SAVONET POSSIBLE THANKS TO MONUMENTENFONDS NL/ENG/PAP

011 Wednesday, August 22
ATTENTION FOR RENOVATIONS AT HATO CAVES NL/ENG/PAP

012 Sunday, August 12
SPEECH DIRECTOR DURING OPEN DAY AT THE CHRISTOFFELPARK PAP/NL

013 Tuesday, October 2
PIET HEIN DONNER VISITS NATIONAL PARKS DURING FAREWELL TOUR NL

014 Thursday, October 4
ANNIVERSARY CURAÇAO BEVERAGE BOTTLING COMPANY: 80 TREES PLANTED (SENT BY CBBC) NL/PAP

015 Monday, October 22
DUTCH CARIBBEAN DEFENSE RENOVATES WATCHTOWER IN CHRISTOFFELPARK NL/PAP

016 Sunday, November 11
CARMABI FOUNDATION RECEIVES VEHICLE FROM THE DUTCH DEFENCE: DONATION FOR THE NATIONAL PARKS NL/ENG/PAP

marketing & communications
DEPARTMENTS

Media agreements

In 2018 a total of 7 media agreements commenced or were renewed with new advertisements (see fig. 21). The marketing activities that derive from this are mainly focused on the Christoffel Park and Shete Boka National Park.

Partner	Contract
Airport Advertising	30 second video at arrival baggage claim and 2 types of folders in the flyerbox at the arrival area.
InCuracao Magazine	Full page advertisement and advertorial
Island Guide TV	Video advertisement in hotels and a mobile application.
Dolfijn FM	Radio Commercial Tourist Highlights
Hitradio	Radio Commercials
Paradise FM	Radio Commercials
Pasabon	Weekly advertising. Island spread magazine & mobile application

FIG. 21

General

Website & Online presence
A start has been made with the (new) website for Carmabi. Three quotations have been requested for the development and the proposed structure for the new website has been finalized. The Facebook pages of all departments have been checked and settings have been corrected where required.

Phone System (IVR)
A new phone system has been implemented. For this, a new structure was created (IVR) and a voice recording was done.

Research

A press release was written and disseminated to inform the public of the visit of the US Ambassador to the Carmabi Research Station in Piscadera.

Consultancy

Artwork was provided for the vacancy for volunteers for the nature monitoring projects.
A brochure for the endemic tree nursery was designed to provide attention to the importance of planting endemic tree species on our island.

Nature & Environment Education

Artwork for activities (vacation plan, opening “Nos Naturalesa”, Sharkweek), vacancy’s for volunteers, signage in the museum was created and placed where required.

World Ocean Day & Sharkweek June 2018
Press coverage, event organization, photography, artwork and communication materials were provided for the Sharkweek and the movie screening during World Ocean Day 2018 in June.

Assistance “Tree planting project” September 2018
Press coverage, photography and assistance was provided for the project in collaboration with the Coca Cola Company in Curacao for their 80th anniversary.

Opening “Nos Naturalesa” December 2018
Event support, signs, photography and press coverage was provided for the opening of the new permanent exhibition in the Savonet Museum.

Video “Turtles & Plastic waste” for group 6 December 2018
For the new educational program a short video was created to create awareness about the program.

marketing & communications

DEPARTMENTS

Parkmanagement

Maps.me

Visitors of the Christoffel Park often took the wrong direction because of an error in the popular navigation application maps.me. This issue was brought to the attention of the developers and has been resolved.

Separate communication Shete Boka Park & Christoffel Park.

Previously communications for the park were combined (1 advertisement for all parks) which resulted in less clear information about the opening times, activities and other important information. All artwork is now separated with clear communications per park. It is now also easier to be flexible when it comes to artwork for specific tours or events.

Radio Commercials

Two radio commercials were developed and created for the Christoffel Park and Shete Boka Park and are now running on the two major Dutch speaking radio stations Paradise FM and Dolfijn FM.

Brochures

New brochures were created for the Christoffel Park and Shete Boka Park and have been distributed to hotels, the airport and resort reception desks.

Artwork

For Christoffel Park and Shete Boka various advertisements and other artwork has been created: Advertisement Pasabon, Brochures, Advertisement for InCuracao Magazine, Leaflet for the “50+ beurs”, banner for the Open Day, banners for events (sun to moon walk, scavenger hunt) and various Facebook posts.

Tripadvisor

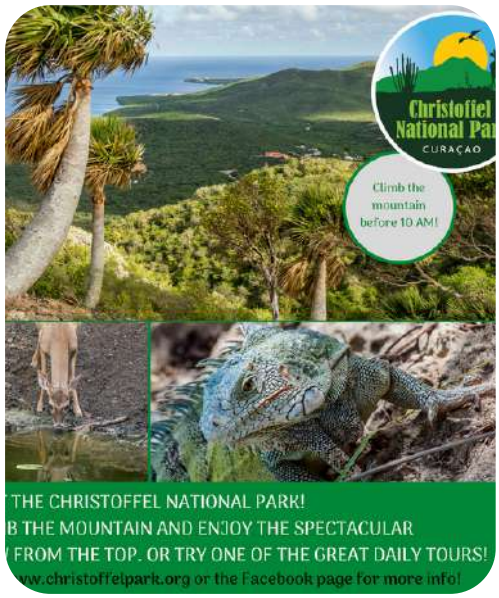
The management of the profiles for the Christoffel Park and Shete Boka Park have been claimed by Carmabi to provide important and necessary updates in the information provided on Tripadvisor and to monitor the reviews.

Press Releases

Press releases were written and disseminated about renovations, events and special activities or visits to our National Parks. (10 of the 16 press releases of 2018).

Clipping of the new Shete Boka Brochure

Clipping of one of the Facebook advertisements



Clipping of the advertising style used for Christoffelpark

general

DCNA MEETINGS

Boardmeetings on Saba and Aruba

Carmabi is a member of the Dutch Caribbean Nature Alliance (DCNA). The directors of the park organizations on the 6 Dutch Caribbean islands are board members of the DCNA. The office of the DCNA is on Bonaire. The objective of the DCNA is to safeguard the biodiversity and promote the sustainable management of the natural resources of the islands of the Dutch Caribbean, both on land and in the water, for the benefit of present and future generations, by supporting and assisting the protected area management organizations and nature conservation activities in the Dutch Caribbean.

The DCNA also manages a trust fund. This trust fund is funded by donors such as the Dutch Postcode Lottery and the Ministry of the Interior and Kingdom Relations. The purpose of the trust fund is to provide core funding to cover the operational costs of the designated marine protected area (marine nature park) and the designated terrestrial protected area (land nature park) on each of the islands of the Dutch Caribbean.

The DCNA holds two board meetings every calendar year. This year the meetings took place on January 23 & 24th on Saba and on October 29th and 30th on Aruba.

general

BOARD & STAFF PER APRIL 2019

Board
Clementine Walle, President
Kenneth Heidweiller, Vice President and Government Representative
Richard Cardose, Secretary
Pieter van den Berg, Treasurer
Edwin Flameling, Board Member
Odette Doest, Board Member
Tom Kok resigned as board president on the 28th of August 2018.

Patron
Professor Jaime Saleh, Former General Governor of the Netherlands Antilles

Carmabi ambassador in the Netherlands
André Cohen Henriquez

Management
Paul Stokkermans M. Sc. , Director
Mark Vermeij PhD, Vice Director

Research Department
Mark Vermeij PhD, Head of Department
Valery Chamberland, M.Sc. Researcher
Kelly Latijnhouwers, Restoration Technician

Parks Management Department
Dominique Adriaens, BA.Sc. Head of Department
Cyrill Kooistra, Deputy Head of Department/ Coordinator activities and Tours
Ingrid van 't Hul, Medewerker Facilitair Management
Sue Shantely Lourens, Management Assistant
Ergelijn Cijntje, Cashier and Administration
Araceli Ersilia, Front Desk Officer (Savonet)
Merelyn Albertoe, Front Desk Officer (Shete Boka)
Briand Victorina, Head Ranger
Edwords Alberto, Head Ranger
Melvin Martinez-Estevez, Ranger
Roengelo Doran, Ranger
Cheandel Maria, Ranger
Xiomara Concetion, Janitor

Nature and Environment Education (NME)
Cornelis Hameete M.Sc., Head of NME department

Advice and Consultancy Department
John de Freitas M.Sc. Head of Department
Erik Houtepen M.Sc. Consultant and BiologistHato Caves
Contracted to Indian Caves N.V. (Monica Vrolijk)

Administration Department
Ethline Isenia, Head Administration Department
Shahaira Martina, Assistant Financial Administration
Nancy Provacia, Administrative Assistant
Rosemary Olivo Busto, Janitor
Magda Inees, Janitor
Carlos Winterdaal, Technician

Communication and Marketing is outsourced to:
Make my Day Marketing (Lina Nijman)

Security Piscadera is outsourced to:
Megory Security

Security Shete Boka is outsourced to:
Hawks Eye Security

general

ON CALL STAFF

Savonet
Alietta Cijntje, Front Desk Savonet
Brenda Jantji, Front Desk Shete Boka
Richard Davelaar, Cleaning Shete Boka
Daisy Lourens

Junior Rangers
Adrion Plantijn
Jeremy Cijntje

Terrestrial Education Program (TEP)
Clarette (Retty) Schoop, Coordinator
Ruthline (Ruth) Bernadina
Sonaly (Naly) Rijnschot
Charetty Jansen Arien Liberia
Ruthsella Statius
Pietje Rosaria
Joycerette Bartholomeus

Marine Education Program (MEP)
Ruthsella Statius, Coordinator
Jonathan Estanista
Angelique Kok
Sabrine Tapoka
Tessa van der Zande
Huub van der Zande
Ruthson Cecilia
Padsy Elsevijf
MEC
Natiza Eisden
MEP on call staff
Tree Nursery
Heddy Bootsma-Benschop
Sheila Connor
Mistica Fermin-Canister
Gabriëla Hoyer
Tamira Koeiman
Liceth Mauricia
Gabriëla Mauricia
Jaydan Mauricia
Ingrid Profas
Syriana Wilson
Lyona Wilson
Araceli Wilson-Sprockel

Terrestrial Scientific Research
Ramphis Schoop
Javier Diaz
Anthony Sarkiss

Monitoring (Sea Turtle)
Evelyn te Nijenhuis
Miralda Panneflek
Joline ten Haken
Royses Ventura Perez
Richene Albertus

Left the organization in the past year
Rachel Tokaai-Redan, Employee Events and Sales
Allyne Philips, Ranger
Anthomar Lodowica, Ranger
Cees van Houten, Coördinator NME-MEP
Xiomara Flemming, Gids NME-TEP

general

DONATIONS 2018

Defensie Caribisch Gebied

Ambtenaren Credit Union (ACU)

BAM Group

Familie Hollander

Make My Day Marketing

Sabadeco

MCB Bank Curaçao

DCNA

Kabinet van de Gouverneur

Postcode Loterij

Secore

Wereldnatuur Fonds (WNF)

DCNA

Prins Bernhard Cultuur Fonds

Waitt Foundation

National Geographic