Annual report
Carmabi Foundation
2014

Carmabi Annual Report 2014

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CARMABI

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FROM THE DIRECTOR

Many positive developments occurred in the year 2014. The parks have done well in terms of an increasing number of visitors and improvements to its infrastructure. The Science Center which was opened in 2013 by the Dutch king has become fully operational and currently receives visitors from all over the world. Part of the old Carmabi building has been renovated to become Carmabi's new Marine Education Center. Friends, associates, partners and the Government have provided much support to Carmabi's activities in 2014 which is highly appreciated by the Carmabi board and staff and contributed to 2014 being a very successful year.

Carmabi's research department has done very well. In 2014 a total of 99 scientists visited Carmabi to conduct a wide variety of research projects. In addition, 122 students participated in various courses that were taught at Carmabi. In total 23 scientific publications were published based on work done at Carmabi. More scientific insight in the ecological processes shaping Curaçao's reefs is essential for improving existing and new strategies to ensure the long term survival of these unique assets of our island.

The number of visitors in the Christoffelpark increased to 41,286 visitors in 2014 (10,973 local and 30,313 foreign) and the number of visitors in the Shete Boka Park rose to 78,325 visitors. The Savonet museum was visited by 3,195 visitors. The parks management department built a new entrance at the the Shete Boka park with increased bathroom capacity and the watch towers that have been constructed in 2013 have been in full use in 2014. While the number of incidents has dropped to zero within opening hours, the number of incidents outside opening hours has unfortunately increased.

Our Nature and Environment Education Department is responsible for guided tours for primary school children in the Christoffel Park, Daaibooi, Shete Boka and the Kabouterbos as well as school visits. In 2014 almost 10,000 school children visited the parks led by our 5 volunteer guides or learned about the island's nature at school. So far the focus has been mainly on terrestrial nature, but we are now also working on the development of a marine education program. This program includes lessons at school, a presentation on the importance of coral reefs to the population of Curaçao and a visit to our Marine Education Center (MEC).

In order to compensate for the drop in subsidies and increasing costs we have expanded our commercial activities. In 2014 a dive center was build at our Piscadera location and we outsourced the management of the restaurant at

Savonet.

What is our outlook for 2015? In 2015 we plan to start preparations for the renovation of the old Carmabi building. The old Carmabi building was build in 1955 and a new wing was added in 1965. Since then the building has never been maintained and as a result is in bad shape. The renovation will be funded by the Curaçao government.

With respect to nature Carmabi is worried about the lack of adequate legislation to better protect and manage threatened and endangered species of flora and fauna and critical habitats, both on land as in the sea. A draft nature policy plan has been in existence for many years without being approved by the successive governments. The lack of a solid policy framework currently results in a case by case approach regarding decision making regarding the island's nature. There is also no formal legislation establishing our national parks which jeopardizes adequate management. The same can be said for wild flora and fauna. Carmabi therefore strongly requests the government to put in place necessary nature legislation and move nature management to a higher level.

Paul Stokkermans
Director Carmabi

1 CARMABI'S MISSION

Carmabi's mission is to work towards a sustainable society, in which the sustainable management of nature leads to benefits that future generations can also enjoy. All parts of our community should be involved in this process.

Carmabi's primary goals are therefore:

- To conduct or facilitate research to support effective nature management, nature conservation, nature restoration, and nature development;
- The acquisition, conservation, protection, management, restoration and development of natural areas in the broadest sense, including objects or places of value to geology, history and/or archaeology;
- To create awareness within the community, especially school children, regarding the contribution they can make to achieve sustainable development on Curaçao.

2 SCIENTIFIC RESEARCH

2.1 Visiting scientists

99 scientists visited Carmabi in 2014. In addition 122 students participated in Coral Reef Ecology courses and workshops that were taught by Carmabi and various universities from the Netherlands, Colombia, Surinam and the United States. The number of visiting scientists and students in 2014 illustrates a continued positive trend that is probably facilitated by the official opening of the new Science Center in 2013. Most scientists in 2013 were from the United States (45% 2013: 36%; 2012: 40%; 2011: 40%) followed by the Netherlands (26%; 2013: 22%; 2012: 46%; 2011: 22%; 2010: 26%) (Figure 1). Almost all of the scientists and students that worked at Carmabi stayed at the newly constructed laboratory/ dormitory facilities. A total of 4256 personal working days (i.e. one visiting scientist working one day) were achieved. This is approximately the same as in 2013 (4226), but signals an upward trend when compared with earlier years, i.e., 2012 (4329), 2011 (3752) and 2010 (1767 days) indicating that visiting scientists spend longer periods of time on the island. An overview of the areas in which all researchers that visited Carmabi were active is shown in Figure 1. An overview of visiting scientists (PI name and home institute) is provided below:

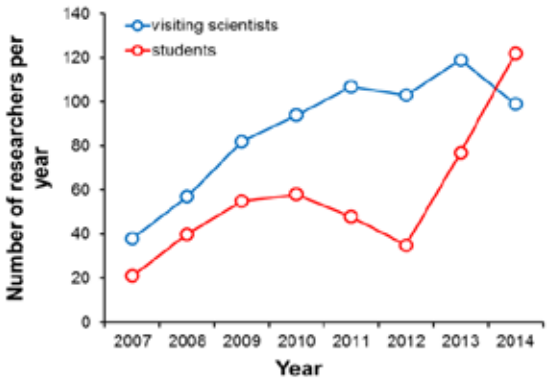
Amy Apprill (Woods Hole Oceanographic Institution) USA
Ashlee Lillis (North Carolina State University) USA
Bert Hoeksema (Naturalis Biodiversity Center) NL
Bjorn Kok (Hogeschool Zeeland) NL
Bruce Fouke (University of Illinois) USA
Dennis de Ruiter (Hogeschool Rotterdam) NL
Dirk Petersen (Secore Foundation) Germany
Iliana Baums (Pennsylvania State University) USA
Jill Harris (Scripps Institution of Oceanography) USA
João Messias (Institute for Systems and Robotics) Portugal
Joris Gommers (Hogeschool Zeeland) NL
Juan Sanchez (Universidad de los Andes) Colombia
Judy Lang (AGGRA) USA
Kenan Matterson (University of Alabama) USA
Konstantinos Theodoridis (University of Amsterdam) NL
Kristen Marhaver (NSF Fellow) USA
Lalitha Asirvadam (Scripps Inst. of Oceanography) USA
Lisa Ropke (SECORE Foundation) Germany
Maggy Nugues (University of Perpignan) France
Marinus Huige (University of Amsterdam) NL
Mark Warner (University of Delaware) USA
Michael Thomas (FL State Collection of Arthropods) USA
Michele Pierotti (Smithsonian Tropical Res. Inst.) Panama
Niek Dreessen (Hogeschool Zeeland) NL
Oscar van der Velde (Polytechnic Univ. of Catalonia) Spain
Paul Hearty (Univer.of N. Carolina at Wilmington) USA
Peter Straub (Richard Stockton College) USA
Petra Visser (University of Amsterdam) NL
Rolf Bak (Neth. Inst. Sea Research) NL
Skylar Snowden (Pittsburgh Zoo and Aquarium) USA
Stephanie Archer (North Carolina State University) USA
Stuart Sandin (Scripps Institution of Oceanography) USA
Todd LaJeunesse (Penn State University) USA
Valerie Chamberland (University of Amsterdam) NL
Wesley Malcorps (Hogeschool Zeeland) NL
Feliz Sahebdin (Anton de Kom University) Surinam

2.2 Peer reviewed scientific publications

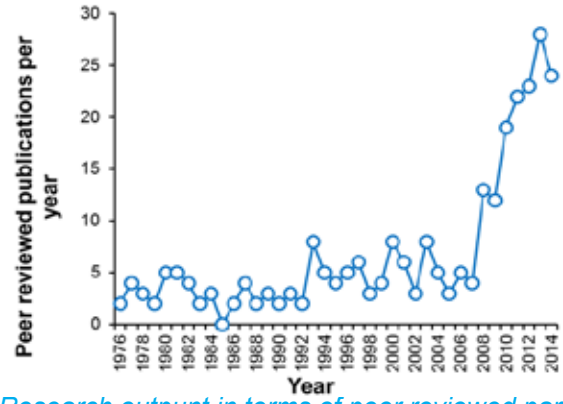
Twentythree publications appeared in peer reviewed scientific journals based on work that was conducted at Carmabi.making 2013 a very productive year in terms of Carmabi's scientific output. The results of some of these studies have been featured in magazines, news programs and educational websites around the world. Furthermore, 23 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 2014 is shown below:

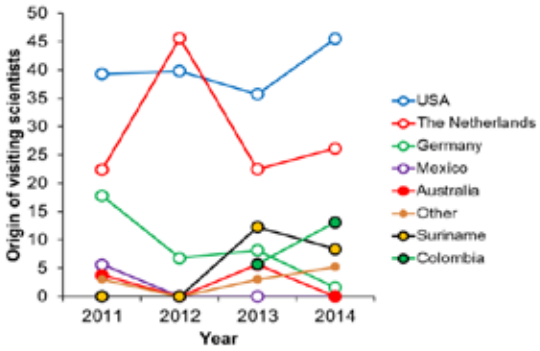
Alexander BE, Liebrand K, Osinga R, van der Geest HG, Admiraal W, et al. (2014) Cell turnover and detritus production in marine sponges from tropical and temperate benthic ecosystems. PLoS ONE 9(10): e109486. doi:10.1371/



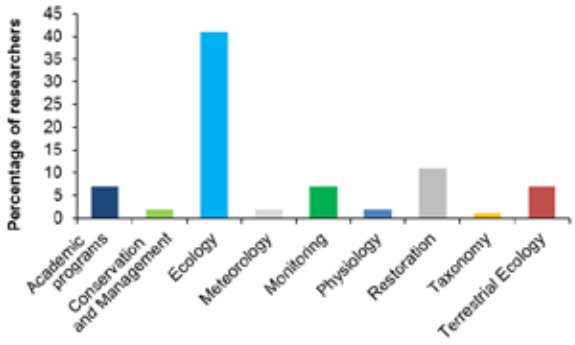
Increase in reserachers visiting Carmabi between 2007 and 2014.



Research outpunt in terms of peer reviewed papers through time



Trends in origin of researchers visiting Carmabi in 2011-2014.



Areas of expertise of visiting researchers in 2014

journal.pone.0109486.

Atherton S, Hochberg R (2014). The evolution of the reproductive system of Urodasys (Gastrotricha: Macrodasyida). Invertebrate Biology 133: 314-323.

Debrot AO, Vinke E, van der Wende G, Hylkema A, Reed JR (2014) Deepwater marine litter densities and composition from submersible video-transects around the ABC-islands, Dutch Caribbean. Mar. Pollut. Bull. 88: 361-365.

Debrot AO, de Leon R, Esteban N, Meesters HGW Meesters (2013*) Observations on the whale shark (*Rhincodon typus*) in the Dutch Caribbean. Caribbean Journal of Science 47: 344-349.

Debrot AO, Esteban N, Bervoets T, Hoetjes PC, Scheidat M. (2013*) Marine mammals of the north-eastern Caribbean Windward Dutch Islands: Saba, St Eustatius, St Maarten, and the Saba Bank. Caribbean Journal of Science, 47: 159-172.

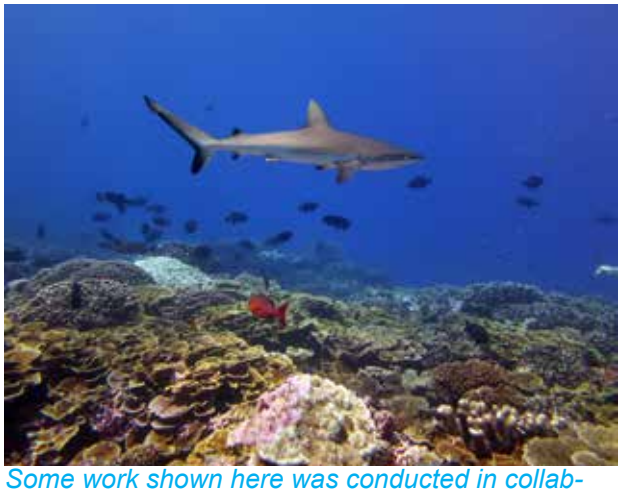
Den Haan J, Visser PM, Ganase AE, Gooren EE, Stal LJ, van Duyl FC, Vermeij MJA, Huisman J (2014) High nitrogen fixation rates by cyanobacteria in algal turf communities on a Caribbean coral reef. Coral reefs 33:1003–1015.

Ertz D, Tehler A, Irestedt M, Frisch A, Thor G, van den Boom P (2014) A large-scale phylogenetic revision of Roccellaceae (Arthoniales) reveals eight new genera. Fungal Diversity, 1-23.

Fricke A, Teichberg M, Nugues MM, Beilfuss S, Bischof K (2014). Effects of depth and ultraviolet radiation on coral reef turf algae. Journal of Experimental Marine Biology and Ecology: 461, 73-84.

Garg N, Kapono C, Lim YW, Koyama N, Conrad D, Rohwer F, Vermeij MJA, Dorrestein PC (2014) Mass spectral similarity for untargeted metabolomics data analysis of complex mixtures. International Journal of Mass Spectrometry. Online first.

Grol MG, Rypel AL, Nagelkerken I (2014). Growth potential and predation risk drive



Some work shown here was conducted in collaboration with US universities in the middle of the Pacific where large fish are still abundant.

ontogenetic shifts among nursery habitats in a coral reef fish. Marine Ecology Progress Series 502: 229-244.

Gust KA, Najar FZ, Habib T, Lotufo GR, Piggot AM, Fouke BW, ... & Perkins EJ (2014) Coral-zooxanthellae meta-transcriptomics reveals integrated response to pollutant stress. BMC genomics, 15(1), 591.

Kelly LW, Williams GJ, Barott KL, Carlson CA, Dinsdale EA, Edwards RA, Haas AF, Haynes M, Lim YW, McDole T, Nelson CE, Sala E, Sandin SA, Smith JE, Vermeij MJA, Youle M, Rohwer F (2014) Local genomic adaptation of coral reef-associated microbiomes to gradients of natural variability and anthropogenic stressors. PNAS 111: 10227–10232.

Lim YW, Cuevas D, Silva GGZ, Aguinaldo K, Dinsdale E, Haas A, Hatay M, Sanchez S, Wegley L, Dutilh B, Harkins T, Lee C, Warren T, Sandin SA, Smith JE, Zgliczynski B, Vermeij MJA, Rohwer F, Edwards RA. (2014) Sequencing At Sea: Challenges and Experiences in Ion Torrent PGM Sequencing during the 2013 Southern Line Islands Research Expedition. PeerJ 2:e520.

Loh TL , Pawlik JR (2014) Chemical defenses and resource trade-offs structure sponge communities on Caribbean coral reefs. Proc Natl Acad Sci USA 111(11):4151-6

Mueller B, van der Zande RM, van Leent PJM, Meesters EH, Vermeij MJA, van Duyl FC (2014) Effect of light availability on dissolved organic carbon (DOC) release by Caribbean reef algae and corals. Bulletin of Marine Science 90: 875-893.

Mueller B, de Goeij JM., Vermeij MJA, Mulders Y, van der Ent E, Ribes M, van Duyl FC (2014) Natural diet of coral-excavating sponges consists mainly of dissolved organic carbon (DOC). PloS ONE 9(2), e90152

Prada C, McIlroy SE, Beltrán DM, Valint DJ, Ford SA., Hellberg ME, Coffroth MA (2014). Cryptic diversity hides host and habitat specialization In a gorgonian-algal symbiosis. Molecular Ecology 23: 3330-2340.

Quéré G, Steneck RS, Nugues MM (2014) Spatiotemporal and species-specific patterns of diseases affecting crustose coralline algae in Curaçao. Coral Reefs: 1-15.

Richards VP, DeBiasse MB, Shivji MS (2014) Genetic evidence supports larval retention in the Western Caribbean for an invertebrate with high dispersal capability (*Ophiothrix suensonii*: Echinodermata, Ophiuroidea). Coral Reefs: 1-13.

Sivaguru M, Fried GA, Miller CAH, Fouke BW (2014) Multimodal Optical Microscopy Methods reveal polyp tissue morphology and structure in Caribbean reef building corals. J. Vis. Exp. (91), e51824, doi:10.3791/51824.

Taylor MS, Stahl-Timmins W, Redshaw CH, Osborne NJ (2014). Toxic alkaloids in *Lyngbya majuscula* and related tropical marine cyanobacteria. Harmful Algae 31: 1-8.

Van der Meij SET (2014) Host species, range extensions, and an observation of the mating system of Atlantic shallow-water gall crabs (Decapoda: Cryptochiridae). Bull Mar Sci. 90(4): (online first).

van Tussenbroek BI, Corte´s J, Collin R, Fonseca AC, Gayle PMH, et al. (2014) Caribbean-wide, long-term study of seagrass beds reveals local variations, shifts in community structure and occasional collapse. PLoS ONE 9(3): e90600. doi:10.1371/journal.pone.0090600.

Willette, D.A., J. Chalifour, A.O Debrot, W.J. Miller, H. Oxenford, S.C.C. Steiner, F. Védie (in press) Continued expansion of the globally invasive marine angiosperm *Halophila stipulacea* in the Eastern Caribbean. Aquatic Botany 112: 98-102.

Wolf A, Nugues MM, Wild C (2014) Distribution, food preference, and trophic position of the corallivorous fireworm *Hermodice carunculata* in a Caribbean coral reef. Coral Reefs: 1-11.

*) delayed publication

Scientific reports & Books

Mumby PJ, Flower J, Chollett I, Box SJ, Bozec YM, Fitzsimmons C, Forster J, Gill D, Griffith-Mumby R, Oxenford HA, Peterson AM, Stead SM, Turner RA, Townsley P, van Beukering PJH, Booker F, Brocke HJ, Cabañillas-Terán N, Canty SWJ, Carricart-Ganivet JP, Charlery J, Dryden C, van Duyl FC, Enríquez S, den Haan J, Iglesias-Prieto R, Kennedy EV, Ma-

hon R, Mueller B, Newman SP, Nugues MM, Cortés Núñez J, Nurse L, Osinga R, Paris CB, Petersen D, Polunin NVC, Sánchez C, Schep S, Stevens JR, Vallès H, Vermeij MJA, Visser PM, Whittingham E, Williams (2014) Towards Reef Resilience and Sustainable Livelihoods: A handbook for Caribbean coral reef managers. University of Exeter, Exeter. 172 pages

Smith SR, van der Burg WJ, Debrot AO, van Buurt G, de Freitas JA (2014) Key elements towards a joint invasive alien species strategy for the Dutch Caribbean. IMARES report C020/14 PRI report number 550.

Van der Burg J, De Freitas JA, Debrot AO (2014) Seed germination methods for native Caribbean trees and shrubs with emphasis on species relevant for Bonaire. IMARES report 551.

2.4 Free advice, outreach and consultation

Several organizations, government departments, the press and others received free advice and information from the Carmabi Science Department during the year. We assisted in 157 (2013: 111, 2012: 72) cases, both oral and written. In 2014 the Carmabi Science Department was featured/ interviewed in 167 (2013: 86, 2012: 57) (known) items for local TV, radio and newspapers.

2.4 Research

Carmabi contributed to and aided with the compilation of the largest dataset ever compiled on the changes in Caribbean reef communities between 1970 and 2012, an initiative led by Dr. J. Jackson in collaboration with the Global Coral Reef Monitoring Network (GCRMN). The study takes an new approach in separating local drivers of community change to yield a more insightful perspective to ask questions like, for example, do all reefs decline equally? Where do the best Caribbean reefs occur? What local factors foremost contribute to reef decline. In the end, data for corals, macroalgae, sea urchins and fishes from a total of more than 35,000 quantitative reef surveys from 1969 to 2012 were collected and compiled. This is the largest amount of quantitative reef survey data ever compiled and greatly exceeds that used for earlier Caribbean assessments. Preliminary analyses have indicated that parts of Curaçao (Oostpunt especially) are now ranked among the best three reef systems left in the Caribbean in addition to coral reefs on Bermuda and the Flower Garden Banks (USA).

Together with a large number of international collaborators gathered within SECORE (see: www.secore.org), Carmabi actively participated in the design of new methods by which the abundance of threatened coral species can be increased around Curacao by raising the larvae of these endangered species. A marine biologist (Valerie Chamberland) continued to work at Carmabi with external funds for another 3 years to further expand the knowledge base to further improve coral restoration techniques and better understand the earliest life stages of corals. A collaborative project with SCRIPPS

Institution of Oceanography and San Diego State University (both U.S.A.) was also continued (for the 6th year) on a degraded reef near Westpunt (Curacao) to better understand the processes acting on degraded reefs that will hopefully lead to better management tools to restore these reefs.

During the coral spawning, Carmabi researchers collaborated with various US universities to investigate which factors contribute to the survival of the earliest life stages in corals. Successful survival ensures that coral reefs can basically regrow and adult corals that died due to natural or human-induced causes are replaced. Preliminary findings illustrate that both microbes and algae contribute to higher mortality and less successful settlement compared to historic baselines. It was also found that corals from the Eastpoint area produce approximately

4 times more coral larvae than corals elsewhere on the island and that these larvae (i.e., from Eastpoint) also survive and settle better.

Carmabi continued its membership on the boards of the IUCN National Committee of the Netherlands, Dutch Caribbean Nature Alliance (DCNA), the collaborative coral research network AcroporaNet, SECORE Board of Scientific Advisors, Executive Board of the Association of Marine Laboratories in the Caribbean (AMLC) and is part of the oil-spill response team on Curacao (RAC/ REMPTEIC-Carib).

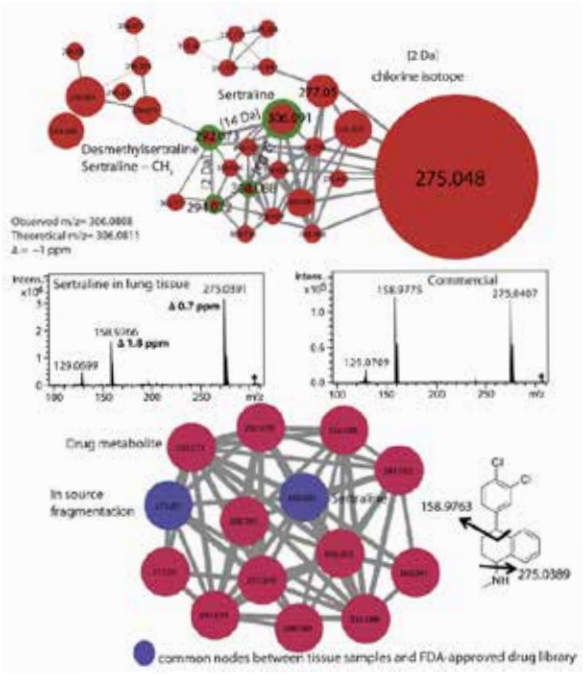
2.5 Selected research projects

Below one finds some examples of some of the projects carried out at Carmabi and whosefindings were published in 2014. All these studies are available on request from Carmabi.

2.5.1 Mass spectral similarity for untargeted metabolomics data analysis of complex mixtures

Garg N, Kapono C, Lim YW, Koyama N, Conrad D, Rohwer F, Vermeij MJA, Dorrestein PC (University of California at San Diego, USA)

The comparative analyses of mass spectrometry data of microbial communities at the molecular level is difficult to perform, especially in the context of a host. The challenge does not lie in generating the mass spectrometry data, rather much of the difficulty falls in the realm of how to derive relevant information from this data. The informatics based techniques to visualize and organize datasets are well established for metagenome sequencing; however, due to the scarcity of informatics strategies in mass spectrometry, it is currently difficult to cross correlate two very different mass spectrometry data sets from microbial communities and their hosts. We highlight that molecular networking can be used as an organizational tool of tandem mass spectrometry data, automated database search for rapid identification of metabolites, and as a workflow to manage and compare mass spectrometry data from complex mixtures of organisms. To demonstrate this platform,



While techniques used in studies like the Garg et al. one appear complex, they show how findings from coral reefs can be applied to other study systems, in this case human diseases.

we show data analysis from hard corals and a human lung associated with cystic fibrosis.

2.5.2 Natural diet of coral-excavating sponges consists mainly of dissolved organic carbon (DOC)

Mueller B, de Goeij JM., Vermeij MJA, Mulders Y, van der Ent E, Ribes M, van Duyl FC (NIOZ/ University of Utrecht, the Netherlands)

CCoral-excavating sponges are the most important bioeroders on Caribbean reefs and increase in abundance throughout the region. This increase is commonly attributed to a concomitant increase in food availability due to eutrophication and pollution. We therefore investigated the uptake of organic matter by two coral-excavating sponges and tested whether they are capable of consuming dissolved organic carbon (DOC) as part of their diet. A device for simultaneous sampling of water inhaled and exhaled by the sponges was used to directly measure the removal of DOC and bacteria in situ. During a single passage through their filtration system 14% and 13% respectively of the total organic carbon (TOC) in the inhaled water was removed by the sponges. These findings suggest that similar to various reef sponges coral-excavating sponges also mainly rely on DOC to meet their carbon demand. We hypothesize that excavating sponges may also benefit from an increasing production of more labile algal-derived DOC (as compared to coral-derived DOC) on reefs as a result of the ongoing coral-algal phase shift.

2.5.3 High nitrogen fixation rates by cyanobacteria in algal turf communities on a Caribbean coral reef

Den Haan J, Visser PM, Ganase AE, Gooren EE, Stal LJ, van Duyl FC, Vermeij MJA, Huisman J (University of Amsterdam, the Netherlands)

Algal turf communities are ubiquitous on coral reefs in the Caribbean and are often dominated by N2-fixing cyanobacteria. However, it is largely unknown (1) how much N2 is actually fixed by turf communities and (2) which factors affect their N2 fixation rates. Therefore, we compared N2 fixation activity by turf communities at different depths and during day and night-time on a degraded versus a less degraded coral reef site on the island of Curacao. N2 fixation rates during the daytime significantly exceeded those during the night. N2 fixation rates by the turf communities did not differ between the degraded and less degraded reef. Both our study and a literature survey of earlier studies indicated that turf communities tend to have lower N2 fixation rates than cyanobacterial mats. However, at least in our study area, turf communities were more abundant than cyanobacterial mats. Our results therefore suggest that turf communities play an important role in the nitrogen cycle of coral reefs. N2 fixation by turfs may contribute to an undesirable positive feedback that promotes the proliferation of

algal turf communities while accelerating coral reef degradation.

2.5.4 Effects of depth and ultraviolet radiation on coral reef turf algae

Fricke A, Teichberg M, Nugues MM, Beilfuss S, Bischof K (University of Bremen, Germany)

Despite the increasing dominance of turf algae in coral reefs, few studies have investigated their physiological and ecological responses to changes in abiotic factors. We tested the effects of depth and ultraviolet radiation on turf algae at different levels of successional stages using two experiments. Depth-related differences were found for all turf algal communities. UVR had no effect on turf algal communities regardless of successional stage. This study highlights the presence of high light and UV tolerant species. The high UV tolerance of turf communities may confer a competitive advantage over other more sensitive coral reef biota, such as corals. This study demonstrates that turf algae are dynamic communities exhibiting species-specific resistance to environmental changes.

2.5.5 Chemical defenses and resource trade-offs structure sponge communities on Caribbean coral reefs

Loh TL , Pawlik JR (University of North Carolina Wilmington, USA)

Ecological studies have rarely been performed at the community level across a large biogeographic region. Sponges are now the primary habitat-forming organisms on Caribbean coral reefs. Recent species-level investigations have demonstrated that predatory fishes (angelfishes and some parrotfishes) differentially graze sponges that lack chemical defenses, while co-occurring, palatable species heal, grow, reproduce, or recruit at faster rates than defended species. Our prediction, based on resource allocation theory, was that predator removal would result in a greater proportion of palatable species in the sponge community on overfished reefs. We tested this prediction by performing surveys of sponge and fish community composition on reefs having different levels of fishing intensity across the Caribbean. Species composition of sponge communities depended more on the abundance of sponge-eating fishes than geographic location. Spongivore abundance explained 32.8% of the variation in the proportion of palatable sponges, but when data were limited to geographically adjacent locations with strongly contrasting levels of fishing pressure (Cayman Islands and Jamaica; Curaçao, Bonaire, and Martinique), the adjusted R(2) values were much higher (76.5% and 94.6%, respectively). Overfishing of Caribbean coral reefs, particularly by fish trapping, removes sponge predators and is likely to result in greater competition for space between faster-growing palatable sponges and endangered reef-building corals.

2.5.6 Caribbean-wide, long-term study of seagrass beds reveals local variations, shifts in community structure and occasional collapse

van Tussenbroek BI, Corte´s J, Collin R, Fonseca AC, Gayle PMH, et al. (Universidad Nacional Autonoma de Mexico, Mexico)

The CARICOMP monitoring network gathered standardized data from 52 seagrass sampling stations at 22 sites (mostly Thalassia testudinum-dominated beds in reef systems) across the Wider Caribbean twice a year over the period 1993 to 2007 (and in some cases up to 2012). Wide variations in community total biomass (285 to >2000 g dry m−2) and annual foliar productivity of the dominant seagrass T. testudinum (<200 and >2000 g dry m−2)

were found among sites. Solar-cycle related intra-annual variations in T. testudinum leaf productivity were detected at latitudes > 16°N. Hurricanes had little to no long-term effects on these well-developed seagrass communities, except for 1 station, where the vegetation was lost by burial below ~1 m sand. At two sites (5 stations), the seagrass beds collapsed due to excessive grazing by turtles or sea-urchins (the latter in combination with human impact and storms). The low-cost methods of this regional-scale monitoring program were sufficient to detect long-term shifts in the communities, and fifteen (43%) out of 35 long-term monitoring stations (at 17 sites) showed trends in seagrass communities consistent with expected changes under environmental deterioration.

2.5.7 Local genomic adaptation of coral reef-associated microbiomes to gradients of natural variability and anthropogenic stressors

Kelly LW, Williams GJ, Barott KL, Carlson CA, Dinsdale EA et al. (San Diego State University, USA)

Microbial communities associated with coral reefs influence the health and sustenance of keystone benthic organisms (e.g., coral holobionts). The present study investigated the community structure and metabolic potential of microbes inhabiting coral reefs located across an extensive area in the central Pacific. We found that the taxa present correlated strongly with the percent coverage of corals and algae, while community metabolic potential correlated best with geographic location. These findings are inconsistent with prevailing biogeographic models of microbial diversity (e.g., distance decay) and metabolic potential (i.e., similar functional profiles regardless of phylogenetic variability). Based on these findings, we propose that the primary carbon sources determine community structure and that local biogeochemistry determines finer-scale metabolic function.

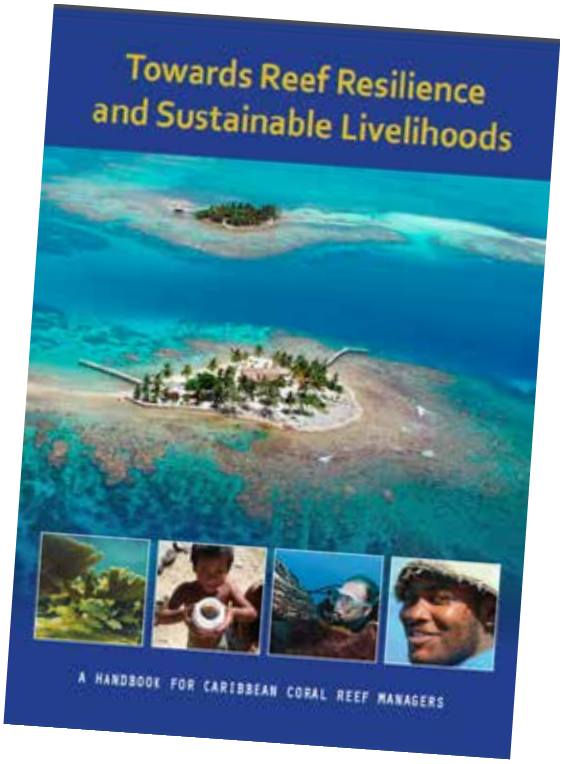
2.5.8 Restoration of Critically Endangered populations of the Elkhorn coral (Acropora palmata)

Valerie Chamberland (CARMABI/ University of Amsterdam, The Netherlands)

Prior to the 1980s, the Elkhorn coral (Koral kachu grandi, *Acropora palmata*) was a dominant shallow-water reef building species that pro-

vided shelter for a large variety of other reef organisms and significantly contributed to coastal protection during storms and hurricanes. In the early 1980s their abundance declined by >95% caused by a white band disease outbreak and has remained at low densities without noticeable recovery since then. As a result, *A. palmata* was listed as "critically endangered" under the IUCN Red List. To facilitate this species' recovery, the SECORE Foundation, in collaboration with CARMABI and the Curaçao Sea-Aquarium, launched a restoration program in Curaçao in 2010 aimed at developing the techniques required to assist the recovery of depauperate *A. palmata* populations throughout the Caribbean. In contrast to more commonly used methods that depend on the production of offspring by fragmenting existing colonies, SECORE uses sexually produced offspring (i.e., more genetically diverse offspring) which are reared in nursery conditions at the Sea-Aquarium prior to their reintroduction to the reef. Since the beginning of this project, SECORE has succeeded in developing methods to reintroduce large numbers of offspring to the reef.

Between 2012 and 2014, SECORE carried out an experiment at the Curaçao Sea-Aquarium to investigate the following questions: (1) Do young corals grow and survive better if nursed over extended periods of time in an aquarium system compared to corals grown under natural conditions? (2) What are the cost benefits of introducing corals shortly after settlement compared to nursing them over extended periods of time? To address the aforementioned questions, two weeks old and one year old A. *palmata* were introduced to the reef in August 2012 while a third population of young corals remained in the SECORE nursery at the Curaçao Sea-Aquarium. All corals were monitored regularly for 2 ½ year and the results show that survival and growth are both greatly enhanced in natural conditions. Indeed, the corals placed on the reef after 2 weeks survived 5 times better compared to those that remained in aquaria. The individuals that were placed on the reef at the age of one year quickly increased their growth rate and were over 6 times larger and 4 times higher than their counterparts nursed in aquaria over an extended period of time. A cost-calculation exercise further showed that keeping corals in aquaria generates excessive costs which increase exponentially through time due to monthly system maintenance expenses and low coral survival. Overall, these



The first ever handbook for Caribbean reef managers produced by the FORCE project.

findings indicate that when given the appropriate conditions to develop and settle, young *A. palmata* are capable of coping with natural conditions, and (2) that extended nursing periods in aquaria is sub-optimal, both from biological and financial standpoints.

2.5.9 Towards Reef Resilience and Sustainable Livelihoods: A handbook for Caribbean coral reef managers

Mumby PJ, Flower J, Chollett I, Box SJ, Bozec YM, Fitzsimmons C, Forster J, Gill D, Griffith-Mumby R, Oxenford HA, Peterson AM, Stead SM, Turner RA, Townsley P, van Beukering PJH, Booker F, Brocke HJ, Cabañillas-Terán N, Canty SWJ, Carricart-Ganivet JP, Charlery J, Dryden C, van Duyl FC, Enríquez S, den Haan J, Iglesias-Prieto R, Kennedy EV, Mahon R, Mueller B, Newman SP, Nugues MM, Cortés Núñez J, Nurse L, Osinga R, Paris CB, Petersen D, Polunin NVC, Sánchez C, Schep S, Stevens JR, Vallès H, Vermeij MJA, Visser PM, Whittingham E, Williams (University of Exeter, United Kingdom)

In 2009, the European Union funded a collaborative research programme between scientists in the Caribbean, Europe, Australia, and the United States. The project was entitled 'Future of Reefs in a Changing Environment' (FORCE) and sought to help coral reef managers undertake their important work by providing targeted scientific study of the issues, and identify tools and solutions. The research team was broad, with representation across natural and social sciences, a vital combination given that management mostly comprises the modification of peoples' behaviour and because reefs are important to so many peoples' livelihood and quality of life. The content and format of this book was developed with the generous input of reef managers througout the region. The intent was to cover a wide range of critical topics and provide policy and management options throughout. In doing this, the manual draws on thousands of scientific studies, not just those undertaken by the FORCE project teams. The broad authorship reflects the input of many researchers to this book. Jason Flower devoted a year of his life to coordinating, writing and editing sections with the collective of authors. He worked closely with the Project's manager, Rosanna Griffith-Mumby, to help deliver the vision for the book. The core writing team are listed at the front of the authorship and followed by the wider authorship – in alphabetical order – all of whom made critical contributions. If you'd like to find out more about the project, please visit www.force-project.eu where you'll also find links to many resources including a Caribbean-wide online geographic information system (GIS) with specially-prepared datasets to aid reef management. Within each section are practical stand-alone 'briefs'. These briefs offer concise information on particular reef-related issues, utilising some of the most recent scientific research to inform manage-

ment actions. Each of the briefings is a unique grab-and-go resource. The accessible format also provides a useful resource for students, researchers, policy-makers and anyone interested in the future of Caribbean coral reefs.

For more information, including the freely available manual, see: http://www.force-project.eu/

2.6 Academic programs

University of Amsterdam (The Netherlands)

Petra Visser and Mark Vermeij

The 'International Excursion Tropical Marine Biology' of the University of Amsterdam visited Carmabi in January 2013 with 25 students. This course, focusing on the diverse marine life on coral reefs, is the main field excursion of the Master program Limnology and Oceanography of the UvA, but is also open for students from other master programs. The course was taught by Mark Vermeij and Petra Visser with assistance of Joost den Haan and Valerie Chamberland. Every day started with a lecture on reef organisms and their ecology. Emphasis was on corals and algae, but the biology and ecology of other reef organisms were also discussed. During the rest of the day, the students were underwater, in the laboratory or studying on the identification of the many coral and macro algal species they observed at the reefs. During the field and lab work, students practiced to make surveys of the benthic community composition, to measure temperature and light profiles, and to determine photosynthetic rates of corals and macro algae using PAM fluorometry. In small groups, students designed their own research plan on a specific topic and performed field and lab work on this topic during one week. During the last week of the course, they focused on data analysis and writing of their report.

Students of the University of Amsterdam set out to learn about the diversity of Caribbean reef algae.

2.7 Research: Long term developments

Carmabi is finished upgrading its research facilities and capabilities to provide Curaçao with a modern biological station that will support and improve existing and new management strategies to safeguard the island's natural resources. Recent developments have increased local awareness of the loss of natural areas and the need to protect such areas to preserve the island's identity. The new facilities will triple the amount of laboratory space already available at Carmabi. The upgrading of Carmabi's laboratories and accommodations for visiting scientists has been made possible primarily through financial support of from the Dutch Government through the SEI initiative, the Curaçaoan Government, the Dutch Ministry of Education, Culture and Science (OCW) and Carmabi itself.

3 PARKS AND MUSEUM

The Savonet Museum in the middle of the Christoffel Park.

3.1 General

The parks department had a really good year in 2014. While aiming for stable visitor rates in comparison to 2013, there was actually a significant growth in the number of visitors in both the Christoffelpark and the Shete Boka park.

3.2 Visitor statistics

Christoffel Park

According to the Caribbean Tourism Organization Curacao received 450.953 tourists in 2014. That was a 2.5 percent increase over the previous year. The growth of the number of visitors was driven by a dramatic improvement in Canadian tourism, with 12,406 tourists and a 29.7 percent increase over the previous year. That helped mitigate a drop of 13.9 percent in tourist arrivals from the United States.

In 2014 a total of 41.286 people visited the Christoffelpark, 28.1 percent increase over the previous year. This increase is much larger than the growth of the tourism in general. This might be because the Canadian tourism partly replaced the tourism from the United States, and the Canadians might be more interested in the nature that Curacao has to offer.

In the Christoffelpark visitors have the option to join activities. Every week jeepsafari's and hikes are offered. A total of 154 regular activities were organized with 598 participants. Additionally 38 special events were held, such

as evening hikes with a full moon or camping trips. These special events had a total of 885 participants. Also during the holidays 18 kids activities were organized with 1185 participants in total.

Savonet Museum

Different efforts were made to increase the visitor numbers to the Savonet museum, which is much lower than we expected. The combination ticket to the Christoffelpark is actively promoted in the ticket office. This aims to convince park visitors to also go and have a look at the Savonet Museum. Unfortunately the majority of visitors declines. A special "dushi deal" was developed that combined the entrance of the museum with the entrance to Shete Boka and also a lunch at the restaurant at Shete Boka. The total number of visitors for the Savonet museum showed a 10.9 percent increase over 2013 with 3195 visitors in 2014.

Shete Boka

The total number of visitors for Shete Boka increased with 8.3% over 2013. The park was visited by 78.325 people. The growth is due to an increase of foreign visitors with 9.931 tourists. This neutralized the drop of local visitors with 323 people (25.6 %).

The decline in the local visitor's rate is somewhat surprising. Some local visitors did not apply for the local fee and instead paid the standard fee used for tourists, but probably more activities should be organized to stimulate local people to visit the parks multiple times. The turnover of the Shete Boka park increased 76.9% over 2013. This increase was due to the increased number of visitors and the increased entrance fee for tourists.

3.3 Infrastructure

Christoffel Park

The infrastructure of the Christoffelpark remains in a worrisome state. The path to the top of the Christoffel mountain is heavily eroded. The renovation of the path to the top hasn't taken place yet due to lacking funds. Also the Christoffelpark fence is very old and in a bad state. Again, because of lack of funds the fence can not be replaced. The parking place at the foot of the Christoffelpark mountain poses another problem. Because of the water coming down from the mountain the parking place is heavily eroded and visitor cars, especially the small ones, get often stuck in the erosion gullies and have to be pulled out. The parking place has to be completely renovated. In 2015 we hope to find funds to do so. Also the path to the top of Seru Gracia is in bad shape and some small repairs have been made.

Shete Boka

Our infrastructure at Shete Boka has improved a lot last year. In March a permit was requested for the construction of a hiking trail between Boka Kalki and Boka Pistol. The trail will reduce the number of small accidents and will prevent visitors from taking alternative routes, getting lost and stepping on rare vegetation types. In December we received word that the necessary permits were granted and immediately the construction of the trail was started and is expected to be finished in 2015.

Construction of new entrance building at Shete Boka

The advertisement of Carmabi's parks and museums at the airport..

In Shete Boka there used to be only two restrooms. This was inadequate for the number of visitors that visited the park, especially when tour busses were present at the park. Also facilities for disabled people were lacking. Therefore the realization of new restroom facilities with more restrooms and also one suited for handicaped people became a priority. The restrooms were combined with a space for the cashier selling the tickets. To save costs, an alternative building method was proposed. The idea was to make use of empty glass bottles integrated in the walls. The permit requests were submitted in April. and granted in September and with generous financial support of the CTB the construction was started in October. The project was also supported by "Betonindustrie Brievengat" who donated all the concrete for the roof of the building and Kusters trading who donated ANG 5,000 and KEIM who gave a discount on their paint.

At Shete Boka the restaurant has been without electricity for many years because the electricity cables coming from the main road were stolen. After the necessary permits were received new cables were installed and the restaurant was connected to the grid. This project was made possible with generous support from the road construction company MNO Vervat.

Hato Caves

The infrastructure of the Hato caves is steadily being improved. Various parts of the paths inside the caves have been renovated. A new attraction has been created in the form of a cactus garden. The path to the restaurant has been asphalted. Also almost 100 meters of a cactus fence on the outside perimeter of the area around the caves has been planted.

Savonet Museum

In May 2013 lightning destroyed the part of top of one of the side walls. Also a lot of electrical equipment was destroyed. For this reason a lightning conductor was installed. Also surge protectors were installed to prevent future damage from lightning hitting the soil and entering

the building through the electrical cables.

Consolidation Zevenbergen ruins

The Christoffelpark comprises three former plantations: Savonet, Zorgvliet and Zevenbergen. The buildings of the former plantation of Savonet have been renovated in 2010. The buildings of the other two plantations

Future techno school at work with the consolidation of the Zevenbergen ruins

are ruins. CARMABI aims to consolidate the ruins because of their great historical value. Thanks to the intern/volunteer Bert Switters the Zevenbergen ruins, especially the plantion house, received quite some attention. Permits were received that made it able to start with the consolidation of the plantation house ruins. Several groups of volunteers helped clear the inside of the plantation house of vegetation and a beginning was made with the consolidation of the walls.

3.4 Junior Ranger program

This project started in 2013. The basic idea is that youngsters from Banda Bou can work in the different parks during the weekends, where they learn about different aspects of nature conservation. They are guided by a senior ranger and get specific workshops that can help with their development. This project helps Carmabi as well as the youngsters, that are financially rewarded. This project is supported by various donors.

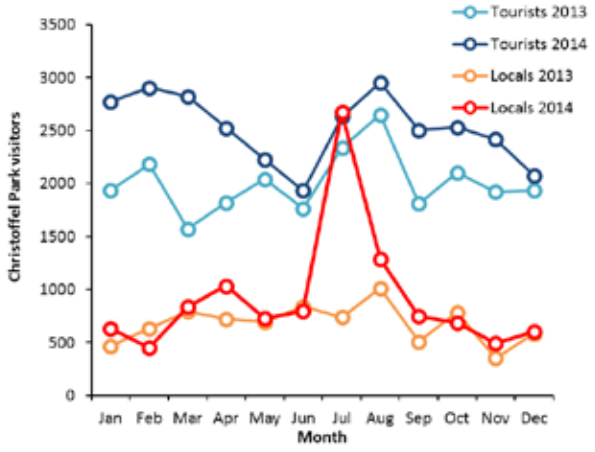
3.5 Marketing

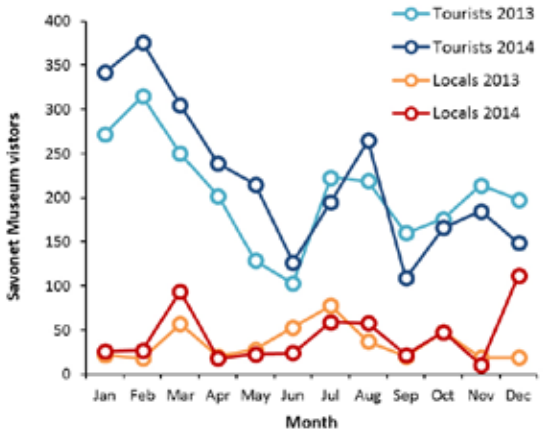
Marketing to increase visitor rates in all parks is done in various ways. Articles were written about the parks and an advertisement was placed in the CHATA booklet, which is placed in every CHATA accommodation on the island. Activities were promoted through social media and three discount specials were promoted through dushi deals media. The park also contributed in a few community projects, like "the Climb for the Roses" and the scouting Jamboree, that generated a lot of free publicity. Furthermore leaflets are distributed regularly in many hotels and carrental companies.

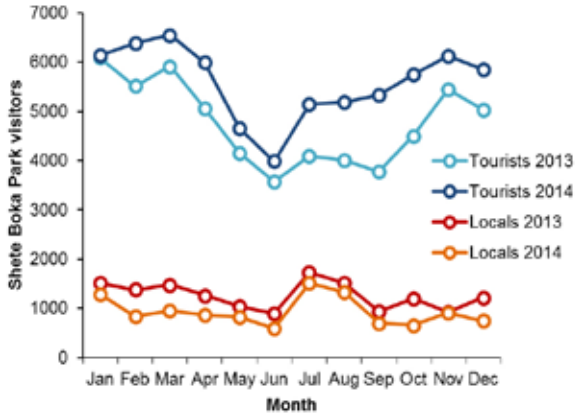
Junior ranger English training

3.6 Security

Because of the increasing number of car break-ins in Shete Boka, two watch towers







Visitor numbers for the Christoffel and Shete Boka Parks and the Savonet Museum in 2013 and 2014.

were constructed near two of the bays (bokas) where tourist park their cars to visit the bays. These are the bays at Boka Wandomi and Boka Kalki. Security guards manned the watch towers during opening hours from 9.00 h in the morning till 17.00 h in the afternoon. The number of incidents has since been zero. Unfortunately some visitors have now been robbed outside opening hours. The Shete Boka park has no fence so visitors can enter the park freely outside opening hours. For this reason we have closed the park entrance with a chain to prevent tourists from entering the park before 9.00 in the morning and after 17.00 h in the afternoon. Fisherman can still enter because they have been given keys to unlock the chain. We hope that future attacks on tourists will be prevented in this way.

3.7 Future Techno School

The "Future Techno school" did a 2 week project in the park. With 5 - 12 students, they worked daily in different areas in the park, clearing the car route on the sea side of the park, finishing the new bird cages behind the entrance building and consolidating the ruins of plantation house Zevenbergen.

3.8 Sea turtle nest monitoring

The working relationship with Sea Turtle Conservation Bonaire (STCB) has been great in 2014. STCB made it possible to start up a sea turtle conservation program on Curaçao, by providing the necessary training and additional partnerships were formed with WIDECAST and the Barbados Sea Turtle Project. This really helped the park department achieving research goals, improve management and create awareness. Sea turtle monitoring and conservation was also included in the Junior ranger project in 2014.

From June until December Boka Mansalina and Boka Braun were checked three times a week

Confirming a green turtle nest during training at Klein Curacao

for turtle activity. To do this monitoring work, Park manager Sabine Berendse did a two week training in Barbados at the end of May. In this training she learned to recognize turtle tracks, how to confirm nests and how you are supposed to register activity. In August she did an additional training with STCB, because the circumstances at Bonaire are a lot more like they are on Curacao, in comparison to Barbados. In September the Carmabi rangers received a training form an experienced STCB employee, Gielmond Eghberts.

To inform the public about the turtle activity on Curaçao and what they can do to help, a special facebook page was made, which is called "Sea Turtle conservation Curaçao". This is promoted as a Carmabi project. This page instantly got around 300 likes and a lot of messages were sent here about turtle activity on the island. This was really helpful in getting a better view on the turtle activity on Curaçao.

A real important person in the turtle monitoring was Carmabi park ranger Wolter Samboe. He was involved with the original monitoring work in 1993. Due to his experience a few nests were found that otherwise might have been missed. Besides the activity on the two Shete Boka beaches, there has been turtle activity on Kas Abou, Porto Marie, Avila, Blue Bay, Marriot, Ascencion and Klein Curaçao.

3.9 Staff changes

To replace Roelly Juliana, Edwords Albertoe was hired. Edwords had some experience in the park as a junior ranger and had just finished

Visitors look at the Christoffel moountain, the highest point on the island..

his school. He proved to be a hard worker and showed a lot of initiatives. In April senior ranger Pedro Andrea left the organization due to his retirement. This vacancy was filled in August by two part timers: Gregory Kasteneer and Jurwin Rifaela.

3.10 Parks preview 2015

For 2015 the parks department will aim to maintain the visitor rate for the parks at the present level and will put some efforts in raising the visitor rates for the museum. In the Christoffelpark, maintenance will focus on the roads mostly used by visitors. Secondly the roads leading to Zevenbergen and Seru Gracia will be kept open. Furthermore attention will go out to the trail up the mountain, since that is the most used hiking trail on the island and measures have to be taken to prevent further erosion.

Two experienced senior rangers will leave the organization to enjoy their retirement. Oswald Ricardo will leave in February and Wolter Samboe will retire in May.

The restaurant at the Christoffelpark will be outsourced to a third party. This will be an extra income and an extra service to our visitors. For Shete Boka the hiking trail between Boka Kalki and Boka Pistol will be completed. If the necessary permits can be acquired a playground will be constructed just behind the entrance of the park. The idea is that it will be an educational and turtle themed playground. The inlets where turtle's might come to nest will be cleaned and during the nesting season the beaches will be monitored. Sea turtle monitoring will also take place on Klein Curacao in 2015. A lot of volunteers applied to help out with the monitoring and several requests have been made for presentations about sea turtles. Briand Victorina

will go to Barbados for 3 weeks in May 2015, to get an intensive sea turtle monitoring course. Also in September researchers form Imares, RUG and WUR will be on the island to set up a study, which is part of a larger research project that will be conducted throughout the Caribbean. The management of the Hato Caves wants to renovate the park entrance and restroom facilities. Depending on the funding one or both of these things will be done.

4 NATURE AND ENVIRONMENTAL EDUCATION (NME)

The school program consists of park visits and school visits. The parks were visited by in total 52 schools. The visited parks included the Christoffelpark, Daaibooi, and Shete Boka. In

total 3 schools were visited for classroom teaching. The number of schools is dropping because of the clustering of schools. In 2014 in total 9,590 kids participated in the Carmabi educational program of which you find the specification below. The number of students has been dropping because the number of students per class is dropping. The number of classes and therefore the number of tours has remained the same however. Therefore also the cost involved has remained the same.
The Christoffelpark was visited by 3,416 students from groups 6 and 7 which was a decrease compared to last year when 4,189 students visited the park. Shete Boka was visited by 1,050 students from group 8 which was an increase compared to last year when 729 visited the park. Daaibooi was visited by 464 students from group 8.
A total of 1,227 pupils of groups 4 went to the Christoffelpark for lessons on birds. The bird lessons involve obtaining knowledge about our local birds in theory and by observing birds within the park. In total of 2,517 of groups 1, 2 and 3 went to the Christoffelpark for lessons on nature. The groups 1,2 and 3 in former years went to the Kabouterbos but this is not possible anymore because the Kabouterbos unfortunately is largely inundated by water. Lessons on trees in the Christoffelpark were visited by 740 pupils of group 5.

Through the school visits 176 students of group 5 were reached for lessons on the Micro World. The Micro World program entails the use of a microscope.

The existing education program is almost completely focused on terrestrial nature however because all tours offered are in nature areas on land. The nature underwater did not receive much attention. Therefore, in 2014, a number of preparations were started to realize in addition a marine education component. A marine education component will balance the education focus because attention will now be devoted equally to both terrestrial nature and marine nature.

The program for the marine education component will exist of three parts. First the students will follow some introductory lessons on school. The school introduction is followed by a visit to Carmabi where the students will attend a presentation on the coral reef. The focus will be on the importance of the coral reef for the ordinary citizen. After this presentation the Marine Education Center (MEC) will be visited

KIDS CITY 2014

On Saturday 28th and Sunday 29th of June 2014 the CARMABI education department was present with an information and activities booth at the Kids City Festival 2014 event, hosted by Fundashon Orea pa Hubentut. The theme of the event was "Nature City" and Carmabi fitted perfectly in this theme with its Nature and Environmental Education team. The event was aimed at children between 4 and 14 years

Experiencing how a sea turtle has to crawl on the beach to lay her eggs

of age. At our booth, the visitors could: (1) get general information about Carmabi Foundation, its nature parks and Curaçao's nature in general; (2) participate actively in nature-education activities (workshops, games, etc.) and (3) buy educational and promotional materials (flyers, plant cards, park t-shirts, etc.) related to Curacao's nature and nature parks.

The booth was divided in two areas: (1) A general exposition/information area at the front side of the booth in which various specimens of conserved animals, skeletons and stuffed animals were exposed. (2) A workshop area/ theater at the back side of the booth in which visitors could see various educational films and experience interactive workshops, such the Microscopy workshop entitled "Micro World". Visitors were mostly attracted to our booth by our giant turtle back and our collection of preserved specimens. Once attracted to these objects our team tested their current knowledge on our local birds and trees and fed their interest in our nature with interesting facts and nature documentaries on e.g. our local bats species, the journey of a sea turtle and Curaçao's natural diversity. The youngest children received a picture of sea animals which they could color on-site. The event was moderately visited, but those who visited the CARMABI booth have certainly obtained valuable information on our nature and environment.

The Carmabi NME crew at the information booth

5 ADVISORY AND CONSULTANCY SERVICES

The advisory department executed a number of consultancy studies both on terrestrial and marine topics. Clients included governments of several islands in the Caribbean, governmental organizations, private persons and commercial organizations. Examples of some scientific reports published in 2014 are shown below.

5.1 Free advisory services

The department of advisory and consultancy services has offered free advisory services to a number of persons, entities and projects in case of small requests. Small free advisory services include: the determination of plant and animal species, information on the local flora and fauna on the island (including threatened species), information on seasonal patterns and restoration potential of the local biodiversity, potential use and value of indigenous plants in reforestation and landscaping, information on habitat types on the island and their characteristics and value.

5.2 Events and activities in which the department participated

CURADOET Volunteers help Carmabi to upgrade its nursery of indigenous tree species

March 21 this year was the day of the first CuraDoet volunteer day on Curacao and was organized by the CuracaoCares Foundation. Carmabi had posted its tree nursery project as one of the projects for which volunteers could enroll to help on March 21. Besides a Carmabi biologist (C. de Lannoy) and one Carmabi student (Lex Kranendonk) eight enthusiastic volunteers (Vali Eleonora, Gianne Martis-Balentien, Nicolas Ayala, Ilse Constancia, Alfred Rosheuvel, Elior Boeldak en Jenny Kroonstadt) came to help Carmabi that day to transplant plants from smaller to larger plastic containers in order to give the plants room for further growth. The volunteers also helped to better

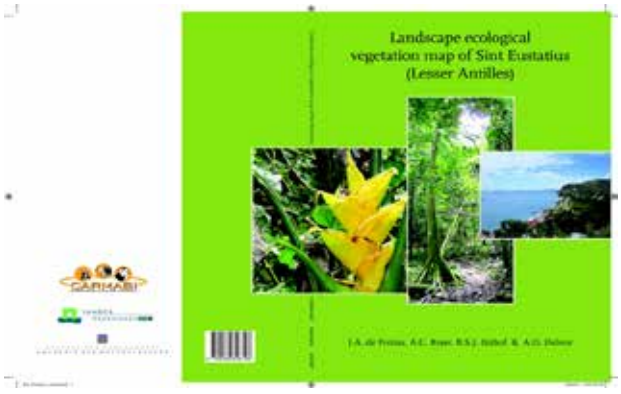
Some of the volunteers in action

organize and clean up the area of the nursery and extract the seeds from the fruits of a few of those indigenous tree species. These seeds could then be used in the germination experiments taking place in the small greenhouse Carmabi had constructed on its premises with funding from the Prins Bernhard Cultuurfonds Caribisch Gebied.

Participation as speaker at celebratory seminar on the occasion of the opening of CNSI (Caribbean Netherlands Science Institute) in St. Eustatius

CNSI organized on April 24 and 25 a celebratory seminar as opening activity of its facilities on the island of St. Eustatius. The CNSI at St. Eustatius is a research facility that supports basic, strategic, applied, societal and policy relevant research and education in the fields of the natural sciences, social sciences and humanities. Biologist John de Freitas participated as speaker and spoke about the content and value

of the then very recently released color landscape ecological vegetation map of St. Eustatius. The title of his presentation was: 'Landscape ecological vegetation map of St. Eustatius'. In his speech de Freitas described the most important vegetation types and their occurrences on the island. He also described the main developments (improvement and deterioration) in the vegetation of the island by comparing the results of the Carmabi study to the vegetation survey done by Stoffers in the 1950s and other parameters. The vegetation mapping project is only the first vegetation mapping project done since the map published by Stoffers in 1956. The book and map has been published by Royal Netherlands Academy of Sciences and is the result of a co-operation between Imares (Netherlands), Carmabi and the Royal Netherlands Academy of Sciences.



The cover of the book that accompanies the color ecological vegetation map (1:37,500) of St. Eustatius

Development of a mangrove park in the area of Rif (Otrabanda)

This year also the two biologists of the department (John de Freitas and Clifford DeLannoy) participated in meetings and presentations to stakeholders aimed at developing and creating support for a mangrove park in the area of Rif(O). This mangrove area is located between the Holiday Beach Hotel and the Benny Leito swimming pool area. An important objective this year was creating support among the most important stakeholders. Seed germination experiments carried out in the greenhouse of Carmabi. Two hbo-students were active in this project this year. Lex Krandendonk (Van Hall Larenstein University of Applied Sciences/

Tropical Forestry and Nature Management) did experiments from February –June with seeds of several indigenous tree species. He produced two reports: 1) Seed germination methods for native Caribbean trees and shrubs with emphasis on the species Bourreria succulenta. 28 pp; and 2) Seed germination methods for native Caribbean trees and shrubs with emphasis on the species *Zanthoxylum monophyllum*. 24 pp. Has Hogeschool student Yoeri Godfried (Toegepaste Biologie) arrived at the end of September to continue with the experiments and will stay till February 2015.

Reforestion project on klein Bonaire

In January some 50 indigenous young trees from the Carmabi nursery were sold and

shipped for this reforestation project that has been going on for a number of years now. On April 28 this project was visited by John de Freitas and Joost van der Burg (Plant Research International / Wageningen University) under the guidance of Elsmarie Beukenboom who is managing the project. A meeting was also attended at the DROB in order to discuss with DROB and other stakeholders on Bonaire the possible role of Carmabi and PRI in the planned reforestation program on Bonaire.

Curacao Barn owl research

Alberto de Rosa, PhD student of the Utah State University and University of Groningen visited Curacao July 22-25 in order to start its PhD research on the Curaçao and Bonaire barn owl. This research is a follow-up on the research done by John de Freitas and his students in the 1980s and that resulted in a publication in the Caribbean Journal of Science: The Curaçao barn owl: status and diet, 1987-1989. A number of barn owl nesting and roosting sites that were active in the 1980s were visited with Alberto by John de Freitas and Clifford de Lannoy. Alberto will study the extent in which island barn owl populations are different from mainland populations (Venezuela) based on food, call vocalizations, characteristics of nesting and roosting places and genetic traits. This research will give insight in how to better prevent loss of biodiversity. For more information: www.pubotat.com.

5.3 Consultancy assignments

Seed germination methods

In this research Carmabi contributed data it had on the germination of indigenous or related plant species. Researchers and institutes were contacted as this type of data could be available in 'grey literature', but it proved to be very difficult to obtain relevant data. The data presented in the report gives in any case some basis to start with germination experiments on the islands.

Nature information folders Cave of Hato

The management of the Cave of Hato set up a cactus garden of indigenous and a few exotic cacti and wanted an information folder with the names of and interesting info on the cactus species. We also reviewed and updated a nature information folder they were using for guided tours along a trail they set up in the protected area.

Survey of rare indigenous plants that occur along the road from the Sta. Cruz entrance of the Christoffelpark to the top of the Seru Gracia hill

The Dutch Ministry of Defense has some important communication equipment on top of the Seru Gracia. Certain parts of the road leading to the top of this hill are in really bad shape and the Ministry has set up a plan to improve this road. Because the area is a conservation area in the E.O.P. Curaçao the Ministry needed to have a survey done in order to map the occurrences of rare plant species along the road leading to the top of the hill. During the improvement phase of the road these plants will have to be protected from damage due to the construction or if they have to be sacrificed they will have to be replanted. The occurrences of the rare plants (including CITES Appendix II protected species) have been registered using a GPS apparatus and mapped afterwards. With this document the Ministry can submit for its permit in order to be able to start with the construction activities. The rare species documented include: *Acanthocereus tetragonus* (kadushi di kolebra), *Bromelia humilis* (teku), C*ynophalla linearis* (kedebèshi), *Guapira pacurero* and *Zanthoxylum monophyllum* (koubati).

Reforestation requirements for windparks of

Tera Kòrá and Playa Kanoa

New windturbines have been installed by the managing company of both windparks on the island. Based on the permit that NuCapital has obtained for realizing the capacity expansion of the windturbines the company must repair the damage that was done to the natural vegetation during the construction phase. In both studies we surveyed the damage to the natural vegetation resulting from the construction phase and the transportation and installation of necessary equipment and material. We also proposed indigenous plant species that can be used in repairing the damage to the vegetation in the different areas of the windparks. Sites were also indicated and described where the reforestation experiments could be done using the indigenous plant species. These sites could also be used as control sites (exclosures without active replanting with indigenous species).

5.4 Reports

The advisory and consultancy department furthermore co-authored or produced the following reports:

Freitas, J.A. de, A.C. Rojer, B.S.J. Nijhof & A.O. Debrot. 2014. Landscape ecological vegetation map of Sint Eustatius (Lesser Antilles). Amsterdam, Netherlands: Royal Netherlands Academy of Sciences, Institute for Marine Resources and Ecosystem Studies, Caribbean Research and Management of Biodiversity. 66 pp.

Lannoy, C. de & J. de Freitas. 2014. Vegetation survey northern hillside premises CBCS, Scharloo, Curaçao. Carmabi Report. 13 pp.

Lannoy, C. de & J. de Freitas. 2014. Notitie survey zeldzame en belangrijke plantensoorten langs de weg naar Seru Gracia buiten het Christoffelpark. Carmabi Report. 15 pp.

Smith, S.R., W.J. van der Burg, A.O. Debrot, G. Van Buurt & J.A. de Freitas. 2014. Key elements towards a joint invasive alien species strategy for the Dutch Caribbean. Imares report C020/14; PRI Report 550. 102 pp.

Van der Burg, J. J. de Freitas, A. Debrot. 2014. Seed germination methods for native Caribbean trees and shrubs (with emphasis on species relevant for Bonaire). Plant Research International/Carmabi/Imares. 17 pp. (PRI Report 551).

John de Freitas as speaker at the opening seminar of CNSI and showing the very recently published color vegetation map to the audience.

6 OTHER ACTIVITIES

6.1 New divecenter at Carmabi

In June of 2013 Carmabi partnered up with PADI 5 Star Dive Center DiveVersity Piscadera as their primary dive partner. In January of 2014 constructions started on a brand new facility which will host the dive center and allows up to 40 visiting researchers to store their dive equipment. The new facilities were opened in June 2014.

"The Diveshop" is a dive center with an outstanding reputation. It is the first, and up to the date of writing, the only dive center on Curacao to be awarded a PADI Green Star Award for their environmental awareness efforts and is a Project Aware 100% Aware partner. In addition to their environmental efforts DiveVersity Piscadera has been selected as PADI World Wide Dive Center of the Month twice.

The dive center will and is providing all researchers, students and Carmabi staff with all their diving needs. By taking care of all logistics, training and safety precautions related to diving, they reduce the workload on researchers, students, supervisors and Carmabi staff allowing them to spend more time on their primary tasks. DiveVersity has been our partner in diving for several years. Opening a dive center on the premises of the research station was a logical next step for both parties.

6.2 Lionfish control website launched to improve removal efforts

Since 2009, the invasive lionfish is observed on Curacaoan reefs. Although beautiful in appearance, several scientific studies have shown that this species is seriously the number of native juvenile fish. Fish species that are important to local fisheries (eg. purunchi) or to the preservation of coral reefs (eg. parrotfish) are believed to become reduced in number due to lionfish predation. On islands where the lionfish arrived earlier than on Curacao, such effects have been quantified, whereby some estimate that lionfish can reduce native juvenile fish populations by up to 80%.Curaçao and Bonaire started removal efforts relatively rapidly after the lionfish's arrival relative to other islands and research by Stinapa (Bonaire) and Carmabi showed that the number of lionfish in areas where they are hunted are 3 to 4 times lower than elsewhere. These results were published in the scientific journal "Endangered Species Research," and can be requested from Carmabi by anyone interested in the study's findings.

To further optimize the control of the invasive lionfish, the Dutch Caribbean Nature Alliance worked in collaboration with Carmabi to produce an online map where those involved in culling lionfish can enter where they have been, how many fish they have caught etc. so other can see on a map where lionfish numbers

are already low and consequently direct their efforts elsewhere. Eventually this system will maximize the lionfish eradication efforts on the islands as areas with no lionfish can be avoided and areas less often frequented can be identified and visited.

The website can be found at: http://www.lionfishcontrol.org/. Future users can create an account on the same page and then enter data through a simple system. In the near future, this system will be expanded to enable everyone on the island to enter observations made under and above water, and in doing so, get, for example, a better picture of the number of sea turtles around Curacao or pinpoint areas suffering from poaching or pollution.

6.3 Succesful coral rearing workshop for endangered coral species

The lecture was given in the framework of an annual workshop organized by Secore in collaboration with Carmabi, where international participants together catch reproduction material of the endangered elkhorn and hertshorn coral for the cultivation of young corals. Curaçao offers a home to some of the last, highly endangered elkhorn and hertshorn coral populations that reproduce themselves still. The field workshop is part of a five-year research project on Curaçao. The results of this project will contribute to coral conservation in the Caribbean and around the world. During the lecture, given by, among others, Dirk Petersen of the Secore Foundation in Germany and Mike Brittsan of Columbus Zoo and Aquarium, United States, different techniques

were presented for the breeding of coral larvae. Each year, about 20 persons from universities and aquariums all over the world attend these 2 week workshops on Curacao.

Source: Amigoe 8/14/2014

6.4 Parties on Curacao succesfully collaborate to improve research possibilities on the island

Scientific director of Carmabi, Mark Vermeij, zoologist Carole Bladwin from the American Smithsonian Institution and Dutch Schrier from the Curasub, Substation Curaçao, gave a presentation for the council of Ministers on setting up an extensive research center – hopefully in collaboration with the government, to anticipate Curaçao's increasing popularity in the field of scientific research.The presentation was made possible through the agency of independent parliamentarian Glenn Sulvaran, who has been dedicating himself to putting Curaçao on the map as knowledge center in the marine biology, both regionally and worldwide. He sees a huge potential for a research center on the island, not only with regard to marine biology but also geology. He proudly mentions the example of the so-called 'Ser'i Domi-model'. Sulvaran explains as follows: "Aforementioned model was developed based on certain rocks that were found in the waters of Curaçao to determine possible locations for oil drilling. Parties are also to consider the enormous potential offered by underwater research into undiscovered materials, organisms that could possibly be used in the medical industry. After all, there's billions involved with this industry", the parliamentarian said enthusiastically. After an invitation of Sulvaran, Vermeij was previously given the chance to address the Latin American Parliament (Parlatino). Instead of mentioning the doom-scenarios about the condition of the reefs, he drew attention to the success stories in the Caribbean area, to learn from such. This led to Sulvaran and Melvin 'Mac' Cijntje (PS), as members of the Environment and Tourism Committee of Parlatino, submitting a draft basic legislation to protect the underwater nature and the coast in Latin America and the Caribbean area. The basic law was presented to the chairman of the committee. Specifically, it regards the collective protection of the coral reefs, mangroves and sea grass areas and has been approved awaiting final signing in May 2015.

Source: Amigoe 6/29/2014

6.5 Bats Recaptured in Venezuela

Exactly one year ago, researchers from STINAPA Bonaire's Natural and Historic Resources Unit recaptured a Long-nosed Bat (Leptonycteris curasoae) on Bonaire originally tagged on Curaçao, confirming that this species migrates between the islands. Over the last year, Aruba was added to the list when bats ringed on Bonaire were recaptured on Aruba. These recaptures demonstrated that there is a meta-population of Long-nosed Bats moving between all three islands. Thanks to ongoing monitoring of this nocturnal flying mammal by a team of dedicated researchers, we now know that these bats migrate as far as Venezuela.
In March 2014, three Long-nosed Bats tagged on Aruba and one on Bonaire were recaptured in Venezuela by a team of scientists, led by Dr. Jafet Nassar from the Venezuelan Institute for

Scientific Research (IVIC). The recaptures took place close to the city of Coro in the state of Falcón in mainland Venezuela. This was the 'missing piece of the puzzle' of the migratory and long-distance movements of these amazing creatures. This exciting discovery is the product of more than five years of monitoring by STINAPA Bonaire, CARMABI, Fundacion Parke Nacional Arikok (united in the Bat Conservation Program of the ABC Islands – PPRABC) and the Venezuelan Institute of Scientific Research. During this time, more than 6,000 individual bats were captured and tagged.
The Long-nosed Bat has an important ecological role on the ABC islands as a key pollinator species for several species of columnar cacti. This discovery adds to our understanding of mammalian ecology and the population dynamics of this keystone species and could have significant implications for the management and conservation of bat populations on the Dutch Caribbean islands and abroad.
(PPRABC is a member of RELCOM – The Latin American and Caribbean Network for Bat Conservation).

6.6 International conference on biodiversity and climate change Guadeloupe 2014

Carmabi Biologist Clifford de Lannoy formed part of the Curaçao delegation, together with the Prime Minister of Curaçao Mr. Ivar Asjes and a policy officer of the Ministry of Health, Environment and Nature, that attended the International Conference on Biodiversity and Climate Change held in Le Gosier, Guadeloupe from 22nd to 25th of October 2014. The prime Minister was invited to attend this conference by OCTA. Carmabi's participation was, as all participating NGO's, sponsored by the Guadeloupian regional government, Région Guadeloupe. The main theme of the Conference was: "From strategies to action: Turning the biodiversity and climate change challenges in the EU Outer most Regions (ORs) and Overseas Countries and Territories (OCTs) into opportunities". The working sessions consisted of presentations of the individual OCT Member States on best practices and discussions on challenges, gaps and the proposed 'Roadmap'. During the Conference five themes (namely: Building Resilience, Tackling Biodiversity Loss, Developing Blue-Green Economy, Advancing Research, and Financial Resources) were evaluated by delegates to analyze the implementation of 'The Message from Reunion Island' and to determine the obligations of each Member State for the period 2015-2020. This took place according to the result of the 2014 UN Samoa Conference, the Aichi targets and COP12 biodiversity Treaty.

Clifford de Lannoy participated in the theme session 'Tackling Biodiversity Loss' and assisted the Prime Minister in the formulation of his presentation about Curacao's biodiversity and the 'best practice' in deep coral reef research. The prime minister gave the presentation during the political segment that followed the conference. During this political segment the 'Message from Guadeloupe' was adopted. This document will be used to further formulate an action plan for the period of 2015 – 2020.

6.7 Seaturtle monitoring started on Curacao

Curaçao has taken another step forward in the protection of some of the island's most charismatic and threatened species – sea turtles. On February 18 and 19 the Secretary pro tempore of the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), accompanied by the Dutch delegate to the IAC, of the Ministry of Economic Affairs, and the director of Sea Turtle Conservation Bonaire met with the Curaçao Ministry of Health, Environment and Nature, officials from the Ministry of Foreign Affairs as well as CARMABI and Uniek Curaçao, to start the development of a moni-

toring program to assess the number of nesting and in-water sea turtles of Curaçao. This information will then be used to determine if sea turtles are in- or decreasing in number on Curaçao. Last year brought increased protection for sea turtles on Curaçao with the establishment of four new Ramsar sites in February and the banning of destructive gillnet practices, which will go into effect in May 2014, after a five year exoneration period. It will still take strict enforcement of rules and regulations to control persistent illegal gillnetting. The recent discussions with the IAC Secretary have led to a collaborative agreement to monitor Shete Boka's beaches throughout the sea turtle nesting season (May – December) and monitor sea turtles at one of the key feeding areas on Curaçao – Boka Ascencion. The data collected will not only track Curaçao's sea turtle nesting trends, but will contribute to a regional dataset that monitors Caribbean population trends. Curaçao has taken another step forward in the protection of some of the island's most charismatic and threatened species – sea turtles. On February 18 and 19 the Secretary pro tempore of the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), accompanied by the Dutch delegate to the IAC, of the Ministry of Economic Affairs, and the director of Sea Turtle Conservation Bonaire met with the Curaçao Ministry of Health, Environment and Nature, officials from the Ministry of Foreign Affairs as well as Carmabi and Uniek Curaçao, to start the development of a monitoring program to assess the number of nesting and in-water sea turtles of Curaçao. This information will then be used to determine if seaturtles are in- or decreasing in number on Curacao. Sea turtles are long-lived species that reach sexual maturity after 20 – 30 years of age and migrate great distances at different stages of their lives. These unique life history features necessitate international cooperation and long-term monitoring programs to best understand and safeguard these endangered species. Once amazingly abundant, Caribbean sea turtles have seen rapid decline since the time of European expansion in the Americas. Scientists estimate that in the 1600's, over 90 million Green Turtles swam the Caribbean seas. Today the number is estimated at 300,000. Hawksbills have plunged 99.7% from 11 million to 30,000. Both Green Turtles and Hawksbills nest on Curaçao.Today, fishing gear entanglement, illegal harvesting, coastal development, marine pollution and climate change are still putting serious pressure on sea turtle populations, which remain threatened with extinction not only in the Caribbean, but across the globe.

6.8 Information on Oostpunt including Carmabi 's concerns regarding the proposed zoning plan

Carmabi has produced various informative documents to inform Curaçaoan and other interested parties about the unique nature that can be found near/ at Oostpunt, both below and above the water surface. In addition, Carmabi has produced various documents that overview the Foundation's concerns regarding the proposed development of Oostpunt as published

on the website of the Curaçaoan Government. These documents serve to share existing concerns to promote discussion and inform stakeholder groups on aspects that have not been addressed in the Oostpunt study made available

on the Government's website. We also like to stress that Carmabi does not oppose sustainable and "smart" development of the Oostpunt area, we simply believe that the proposed plans are not suitable to discuss future possible options and will contribute to the loss of unique ecosystems that make the island stand out positively in the Caribbean region....
The information is substantial and is best downloaded from: www.reserachstationcarmabi.org where you can find all documents under "Latest news" on the left.

6.9 Visit consul of Colombia

The recently appointed consul of Colombia on Curaçao, Mrs Astrid Valladares Martinez, visited Carmabi on 24 September 2014 to visit with 30 students from the Universidad de los Andes in Bogota and their Professor Juan Armando Sanchez. The Colombian students stay at Carmabi to take a week-long coral reef course thought by Professor Sanchez.

After the consul was welcomed by director Mr. Paul Stokkermans and Professor Sanchez, she engaged in a conversation with the Colombian students. First the consul explained her work at the consulate and Professor Sanchez explained why the group is on Curacao. The easy access and the relatively healthy state of the island's reefs in comparison to other Caribbean locations were, amongst others, mentioned as the main reasons why the Colombian group chose Curaçao as a location for their field course.

Then the students were given the opportunity to ask the consul questions. The questions were many and related to topics such as the procedures to obtain a visa, the work of the consulate, tourism, the pollution of the ocean, the deterioration of coral reefs and the current debate on Oostpunt. The visit was originally planned for 10 minutes, but due to the pleasant atmosphere eventually lasted one hour.

6.10 Large conference on coral reef science and management comes to Curaçao

The 37th Scientific Conference of the Association of Marine Laboratories of the Caribbean (AMLC) will be hosted by the CARMABI Research Institute on Curaçao in May 2015. The main venue for this meeting will be the Hilton Hotel on Curaçao's leeward shore, right next to CARMABI.This event will bring students, long time scientists, and all with an interest in marine science and policy together for a five-day meeting, focusing on presentations (including "as I see it"-type presentations), productive interactions, and field trips. The meeting is open to anyone and has seen a rapidly growing attendance over the last few years as the only Caribbean-focused meeting of its kind. The meeting will encompass on all aspects of marine science and management. One aspect that will be addressed during this meeting is the changed dynamics that shape present day reefs. Better understanding these dynamics, which are fundamentally different from processes shaping reef communities in the past, will help inform the science and present day management of tropical marine ecosystems. The theme of the meeting will therefore be: "Marine Ecosystem Conservation and Policy - The Way Forward". Coral reefs are renowned for their

high diversity and breadth of interactions. The resulting ecological complexity provides countless opportunities for students of community ecology, as well as a similar number of challenges for managers of these ecosystems. We invite participants to share new findings on the fundamental workings of (degraded) coral reef ecosystems, and adjacent ecosystems such seagrass beds, mesophotic communities, and mangrove areas. Studies using coral reef systems to test classical ecological theories or to develop new ones are encouraged. Experimental and observational studies of demography, behavior, and physiology provide the raw material for scientists, managers, and the public to advance their understanding of coral reef ecosystems. Effective management and conservation depends upon such fundamental appreciation of the basic ecological workings of reef organisms. Publications resulting from this meeting will be published in a special issue of the peer-reviewed journal PeerJ dedicated to this conference. Further, by bringing together participants from a broad collection of geographic and taxonomic specialties, the AMLC hopes that this meeting provides a setting for the synthesis of new ecological ideas. The AMLC hopes to see you in Curaçao.

6.11 Visit IPKO

On the 8th of January 2014 Carmabi was visited by a delegation of the IPKO (Inter Parlementair Koninkrijks Overleg) which was held this year on Curacao. In the IPKO meeting the parliaments of Holland, St. Maarten, Aruba and Curaçao meet to discuss common issues. Director Paul Stokkermans gave a presentation to the delegation about Carmabi's work. Many questions were asked by the delegation members. After the presentation the delegation toured the Carmabi premises. The tour was guided by the secretary of the Carmabi board, Mr. Jeffey Sybesma and by director Stokkermans.

6.12 Carmabi represents Curaçao on large United Nations meeting on small island problems

The Curacaoan government had asked Vermeij to represent Curacao during the 'Third International Conference on Small Island Developing States' (SIDS) that was held in Apia/Samoa. During this four day conference of the United Nations, representatives of small islands from all around the world spoke with representatives of the UN and other (continental) countries about the problems that are specific for small islands and generally not appreciated in full by larger countries. Especially the rising sea level was a major theme during the meeting and several low-lying Pacific island nations are already evacuating coastal areas that are slow-

ly submerging. The Secretary-General of the Third International Conference on Small Island and Developing States, Wu Hongbo, characterized the summit, the largest of its kind in the Pacific, as "extraordinary." Briefing journalists in Apia, Samoa, Mr. Wu said 297 partnerships between governments, businesses, civil society and UN entities had been announced during the four days. "Without a doubt, these partnerships leave a legacy with impact," Mr. Wu said. He added that the Department of Economic and Social Affairs (DESA), which he heads, will take on the responsibility of reporting on the commitments' progress to hold the participants to account. The partnerships are in the areas of sustainable economic development, climate change and disaster risk management, social development, sustainable energy, ocean health, and water and sanitation, food security and waste management. They are in line with the conference's outcome document, nicknamed the Samoa Pathway, which was unanimously endorsed at the last plenary session today."The time for speeches is over," Samoan Prime Minister Tuilaepa Lupesoliai Sailele Malielegaoi said in his closing statement. "We must now set sail with determination that the course of action we have chartered here… will be delivered to achieve our priorities." The UNFCCC is the parent treaty of the 1997 Kyoto Protocol. In this context, Ms. Figueres is overseeing talks between countries for a universally accepted climate treaty to be hammered out in 2015 in Paris.Following today's events, the UN flag was formally lowered over the Tuana'imato sports complex, symbolically returning the site to the Government of Samoa.

Source: UN News

6.13 Scientists from all over the world gather on Curaçao to improve monitoring of Earth's coral reefs

The Global Coral Reef Monitoring Network (GCRMN), data arm of the International Coral Reef Initiative (ICRI) recently published a groundbreaking report. "Status and Trends of Caribbean Coral Reefs: 1970-2012". In this report, edited by GCRMN science coordinator Jeremy Jackson, a number of startling conclusions are drawn from a region-wide assessment of forty years of coral reef data. The report concluded coral reef monitoring in the wider Caribbean is "scattered, disorganized, and largely ineffective". The weaknesses and inefficiency of the current coral monitoring network, is in part due to the lack of information dissemination and inconsistency in application of monitoring methods and approaches through-

out the region. The GCRMN in the Caribbean currently suffers from reduced functionality, at three levels of action: data collection, information archiving and dissemination, and internal network communication. Those weaknesses are often coupled with challenges of securing adequate funding as a means to support systematic and sustainable coral reef monitoring. This has potentially contributed to losses of information and capacity building due to major gaps in the exchange of approaches and expertise within the region. To address these dysfunctions and the urgent need for a more effective coral reef monitoring in the wider Caribbean region, a workshop was convened in Curacao during August 6th -8th 2014. with funding provided by the SPAW-RAC, UNEP-CEP and The Dutch Ministry of Economic Affairs. This event was organized under the leadership of the latter two institutions, along with NOAA, the Wait Foundation, the GCRMN science coordinator and the UNEP coral reef Unit.Coral reef experts from different monitoring programs, including those on Curacao, as well as sub-regional so-called 'monitoring nodes' who collected coral reef monitoring data for GCRMN in the past, and regional and international organizations, came together to discuss how to better coordinate ongoing Caribbean coral reef monitoring and stimulate and support monitoring in areas that lack the people or expertise for sustained monitoring efforts. The workshop aimed to support the coral reef monitoring in the wider Caribbean region, so far represented through the GCRMN. Its object was to revitalize and organize the coordination of the coral reef monitoring made across the region by providing concrete solutions that would improve the network capacities.

6.14 Carmabi presents during opening Caribbean Netherlands Science Institute at St Eustatius

The Caribbean Netherlands Science Institute (CNSI) at St Eustatius was officially opened on the 24th of April 2014 by means of a symposium in attendance of all partners and other stakeholders. Carmabi "kicked off" the presentations for a large audience, including St. Eustatius' dignitaries, about the earliest life stages of corals. The mission of this knowledge center is to realize a permanent scientific presence in the Caribbean Netherlands with research and outreach facilities, with accommodation for scientists. This mission is based on the vision that the Caribbean and the Netherlands share a mutual responsibility for the sustainable development of the Caribbean Netherlands islands and their marine territories. Working toward this goal requires an understanding of each other's institutional organizations, historical and cultural backgrounds, management and development priorities and natural and societal resources. CNSI is therefore committed to multidisciplinary knowledge development and human and institutional capacity building by providing (nature) education for local schools, nature organisations and farmers, academic and professional education and training, and organising courses, workshops and meetings in cooperation with local organisations. It is clear that the sustainability of these small island economies cannot be regarded in isolation and should be addressed within the context of the greater Caribbean region as to encourage a sustainable socioeconomic impulse in the region.

6.15 Meetings DCNA 2014 on St. Eustatius and Aruba

Carmabi is a member of the Dutch Caribbean Nature Alliance (DCNA) and the directors of the park organizations on the 6 Dutch Caribbean islands together form the board of the DCNA. DCNA's objective is to safeguard the biodiversity and promote the sustainable management of the natural resources of all islands of the Dutch Caribbean on land and under water for the benefit of present and future gen-

erations. To achieve this goal DCNA supports and assists park management organizations and nature conservation activities in the Dutch Caribbean. DCNA manages a trust fund with contributions of donors such as the Dutch Postcode Lottery and the Ministry of the Interior and Kingdom Relations. The purpose of the trust fund is to eventually provide sustainable funding to cover the operational costs of one marine and one land park on each island of the Dutch Caribbean. The Trustfund requires 24 million Euro before parks will receive any funds.

The DCNA organizes two meetings every year and in 2014 the meetings were held on St. Eustatius (March 17-19) and Aruba (October 21-23). The St. Eustatius meeting mainly focused on the need for DCNA to increase and improve its fundraising capacities and a fieldtrip to nesting areas of the Tropic Bird and sea turtles was organized as an example of St. Eustatius' conservation successes. During the Aruba meeting DCNA's future role in the wider Caribbean region was discussed.

6.16 Visit Politur

On November 10th, twenty police agents from Politur, led by Major Egon Pieter visited Carmabi at Piscadera. Politur is the tourism police that was established to improve the police force's service to tourists. Politur has stations at Mambo Beach, Piscadera (WTC) and Westpunt.

The Politur agents were given a presentation by Carmabi director Paul Stokkermans about Carmabi's work and afterwards took part in a tour of the Carmabi premises at Piscadera. The visit of Politur has been very timely as many of Carmabi's activities lie in the area of tourism, for example its management of nature parks such as the Christoffelpark and the Shete Boka park. Especially in the latter, the number of thefts from cars and robberies had increased. This has already been acknowledged by the Curaçao Tourism Board, which already supported Carmabi by financing two watchtowers with guards at Boka Wandomi and Boka Kalki in the Shete Boka Park. As a result the number of incidents has decreased to zero, but after opening hours the number of incidents has increased. To address such issues Carmabi intends to collaborate more with the police and with Politur in particular. To reduce the incidents outside opening hours Carmabi has closed the access road for cars outside opening hours to prevent tourists enter the park by car. Local fisherman received a key so they can enter the park at any time. The agents of Politur experienced their visit to Carmabi as very interesting and useful and Carmabi and Politur made new agreements to jointly strive to future improvements of the security of visitors to our parks and the Science Center.

7 BOARD

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8 SPONSORS & VOLUNTEERS

Sponsors: Bellevue Curaçao NV, Beton Industrie Brievengat, Centrale Bank, Curaçao Tourism Board (CTB), Curadoet, Davrite Private Foundation, International Union for Conservation of Nature (IUCN), Karakter, Kusters trading, Lighthouse Club, Maduro & Curiels Bank (MCB), MeesPierson, Napa, Nationale Postcode Loterij, Ocean Encounters, Paint and more (KEIM), Percy Henriquez Fonds, Prins Bernhard Cultuurfonds Caribisch Gebied, Reefcare, Rotary Club, UNESCO. United Trust Company, Vrienden van Carmabi. **Volunteers:** Bert Switters, Bruce Fouke and students University of Illinois, Carel de Haseth, Dayenne Molenaar, Chris Richards, Dirk Ooms, Eddy Baetens, Eileen Lucia, Eric Newton, Francois van der Hoeven, Frensel Mercelina, Gerard van Buurt, Future techno school, Helma Maduro, Jacob Gelt Dekker, Jo-Anda Violenus, Joes Grimmelt, John Dohmen, Kareljan Williams, Kim Zuiderduin, Kimberley Moreira, Meneka Rosa, Mijanou Cornelis, Nienke Eshuis, Anita de Moulin, Priscella de Lannoy-Martines, Ryan de Jongh, Suail Neman, Thelia Lieuw Sjong, Vienna Mendeszoon, Yvonne Losano. **Volunteers bat research:** Adiela Adamus, Aldo Silvano, Alexander de Rooij, Andy Loefstok, Bert Switters, Carl Vinck, Chris Richards,Clifford Martina,Connor Doest, Diandra Angelica, Durvin de Lannoy, Gianne Balentien, Gilliard Bonifacio, Gitland Garmes, Hubèrt Isenia,-Jennifer Nisbeth, Jonathan Cremona, Joris van Vliet, Jumarley Angela, Kevin Maria, Lex Kranendonk, Luz Maria, Mariahelena Mercelina, Mariela Romero, Marijke Hoos, Miriam Bleeker, Myra Rauchbaar, Odette Doest, Percival Jules, Raichel Virginie, Randolph de Lannoy, Rita Koopmanschap, Rutchinel Bernadina, Savine Boersema, Shakur Bernadina, Signalda Olario, Therese Eustatia,Ulisses Bonifacio, Vanessa Sophia

9 FINANCIAL OVERVIEW

BALANCE SHEET AS OF DECEMBER 31, 2014
(after proposal of result appropriation)

	2014 ANG	2013 ANG
Assets		
Non-current assets		
Property and plant	1,020,036	705,637
Other fixed assets	329,070	284,103
	1,349,106	989,740
Current Assets		
Receivables	147,233	223,551
Stock	27,996	14,921
Cash and cash equivalents	346,057	357,248
	521,286	596,720
Total assets	1,870,392	1,586,460

	2014 ANG	2013 ANG
Equity and liabilities		
Equity		
Capital	106	106
Earmarked reserve	30,046	36,982
Retained earnings	754,909	605,796
	785,061	642,884
Non current liabilities		
Non interest bearing loans and borrowings	154,000	154,000
Deferred income investment grants	239,290	9,033
	393,290	163,033
Current Liabilities		
Deferred income project grants	156,173	146,989
Pension contribution payable	13,293	15,572
Taxes and social security payable	46,607	60,593
Other liabilities	475,968	556,389
	692,041	779,543
Total equity and liabilities	1,870,392	1,586,460

STATEMENT OF OPERATIONS FOR THE YEAR 2014

	2014 ANG	2013 ANG
Income		
Grants	449,400	449,467
Earmarked grants	41,369	76,218
Admission fees	1,195,623	894,522
Rental income	216,749	171,252
Other income	533,838	633,915
	2,436,979	2,225,375
Expenses		
Personnel expenses	1,359,477	1,332,756
Depreciation expenses	88,191	75,233
Other operating expenses	850,648	822,591
	2,298,316	2,230,580
Result for the year	138,663	(5,205)
Interest income	3,514	7,230
Result for the year	142,177	2,025
Appropriation for the year		
Retained earnings	142,177	2,025
	142,177	2,025

10 PERSONNEL

Board
Peter Bongers, President
Jeffrey Sybesma PhD, Secretary
Alvin Francisco, Treasurer
Edwin Flameling, Board Member
Olga Lodowica, Board Member
Olga Saleh-Kostrzewski, Board Member
Kenneth Heidweiller, Board Member

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, Deputy and Scientific Director

Research Department
Mark Vermeij PhD, Head of Department
Valerie Chamberland, M.Sc., Researcher

Parks Management Department
Sabine Berendse, Head of Department
Cyrill Kooistra, Head Ranger and Deputy Head of Department
Wolter Samboe, Senior Ranger (Events)
Gregory Kastaneer, Senior Ranger
Jurwin Rifaela, Senior Ranger
Briand Victorina, Ranger
Edwords Alberto, Ranger
Araceli Ersilia, Front Desk Officer
Merelyn Albertoe, Front Desk Officer
Rachel Tokaai, Assistant Events and Sales
Xiomara Concetion, Janitor
On Call Staff: Alietta Cijntje (Front Desk), Sharlette Victorina (Front Desk), Sue-Shantely Lourens (Front Desk), LITA, Richard Davelaar (Cleaning Shete Boka), Giovanni Domacassee (Ranger), Jonathan Hansen (Ranger)
Junior Rangers: Virgil Cijntje, Connie Mingeli, Haydelson Lourens

Hato Caves
Contracted to Indian Caves N.V. (Monica Vrolijk)

Nature and Environmental Education Department
Paul Stokkermans M. Sc., Head of Department
Clara Schoop, Volunteer Guide Nature Education / Coördinator
Sonaly Rijnschot-Jamanika
Ruthlyne Bernadina
Arien Liberia
Charetti Jansen
Ruthsella Statius

Advice and Consultancy Department
John de Freitas M.Sc. Head of Departmentt

Administration Department
Ethline Isenia, Head Administration Department
Shahaira Martina, Assistant Financial Administration
Larissa Hooi-Francisca, Office Manager
Rosemary Olivo Busto, Janitor
Magda Inees, Janitor
Carlos Winterdaal, Technician

Left the organization in 2014
Oswald Ricardo, Senior Ranger
Pedro Andrea, Senior Ranger
Roelly Juliana, Ranger
Shudeska Eisden, Senior Assistant Restaurant
Clifford de Lannoy, Environmental Consultant
Soraida Martis (NME Volunteer)
Mairine Djaoen (Front Desk)
Rivienca Albertoe (Restaurant en stagiaire)
Giomar Francisco (Junior Ranger)
Richandal Davelaar (Junior Ranger)
Raishelon Doran (Junior Ranger)
Sharon Beishuizen (Intern Savonet)
Sasha van Boekel (Intern Savonet)

Passed away
Sislyn Rosalia (Janitor)

Paul Stokkermans
Director

Arien Liberia
(NME)

Magda Inees
Janitor

Ethline Isenia
Head administration

Charetti Julia Jansen
Volunteer nature education guide

Sabine Berendse
Head parks department

Carlos Winterdaal
Technician

Larissa Hooi-Francisca
Office manager

Xiomara Concetion
Janitor

Valerie Chamberland
Researcher

Jurwin Rifaela
Senior ranger

Clara Schoop
Volunteer guide nature education / coördinator

Wolter Samboe
Senior Ranger (Events)

Cyrill Kooistra
Senior ranger / Deputy head parks department

John De Freitas
Head advice & consultancy

Rachel Tokaai-Redan
Assistant events and sales

Edwords Alberto
Ranger

Araceli Ersilia
Front Desk Officer

Merelyn Albertoe
Front Desk Officer

Ruthlyne Bernadina
Volunteer nature education guide

Shahaira Martina
Financial Administration assistant

Sonaly Rijnschot-Jamanika
Volunteer nature education guide

Araceli Ersilia
Frontdesk officier

Rosemary Olivo Busto
Janitor

Merelyn Albertoe
Frontdesk officer

Xiomara Concetion
Janitor

Briand Victorina
Ranger

Mark Vermeij
Head research & Deputy director

Ruthsella Statius
NME volunteer

CARMABI


CARMABI
Caribbean Research & Management of Biodiversity