



Reef Renewal
Bonaire

ANNUAL REPORT 2019

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1 WELCOME – A VOLUNTEER'S PERSPECTIVE



It is difficult to comprehend that in less than one generation we, as a race, have moved from drawing on the world's resources to the wholesale destruction and pillage of our environment. Our way of life has demanded this. Many of us feel helpless facing the scale of change now required to restore environmental balance. Yet Reef Renewal Foundation Bonaire is a beacon of hope where collective actions of individuals can make a difference, before it is too late.

In the three years that I have been volunteering with this Foundation, there has been constant change and development – from increasing numbers of propagated and outplanted corals to implementing new techniques such as larval propagation and the propagation of boulder corals through to complex photo-mapping of the reefscape – all of which underlines the scale of the task facing us.

With limited resources and unlimited ambition, combined with enthusiasm, knowledge, and skill, Reef Renewal Foundation Bonaire has established a worldwide reputation and is now at the forefront of reef restoration.

All organisations rely on the efforts of their people. Through exceptional leadership, skilled and dedicated staff, and a growing cohort of volunteers, it can truly be said that Reef Renewal Foundation Bonaire is making a difference.

I am very proud to be a small part of this.

Simon Blower

Simon Blower
Reef Renewal Foundation Bonaire Volunteer





Reef Renewal
Bonaire

2 ABOUT US

OUR MISSION

Reef Renewal Foundation Bonaire protects and restores coral reefs in Bonaire by:

- Developing new and innovative ways to restore reefs that are supported by research collaborations and shared worldwide
- Training, engaging, and inspiring the community locally and internationally through volunteering, educational events, and outreach
- Demonstrating that through community efforts there is still hope for coral reefs

BOARD OF DIRECTORS



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Van der Valk
President



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Montbrun Segnini
Secretary



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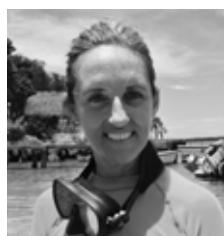


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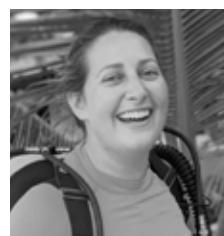
STAFF



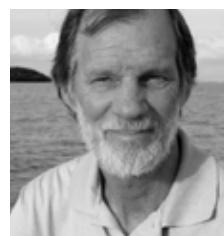
Francesca Virdis
Project Coordinator



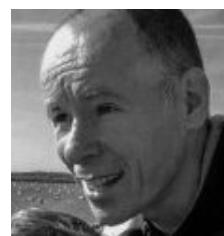
Garrett Fundakowski
*Assistant
Coordinator*



Elizabeth McWhinnie
*Reef Restoration
Technician*

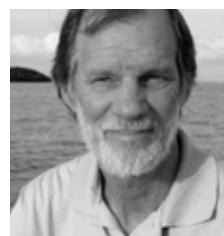


Ken Nedimeyer
Technical Advisor

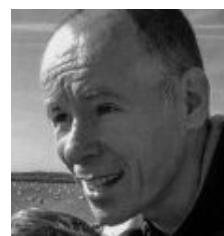


Dr. Erik Meesters
Scientific Advisor

ADVISORY COUNCIL



Ken Nedimeyer
Technical Advisor



Dr. Erik Meesters
Scientific Advisor





3 A YEAR IN REVIEW

3.1 Nursery

Since 2012, Reef Renewal Foundation Bonaire has used a coral tree nursery design to grow large numbers of endangered corals. Trees are anchored to the seafloor just offshore and float up in the water column. Corals are propagated using fragmentation and, depending on the species, hung from the branches of the trees or secured on trays. The coral fragments will stay in the nursery, growing in the water column, for several months until they reach proper size for outplanting.



Acropora palmata



Acropora cervicornis



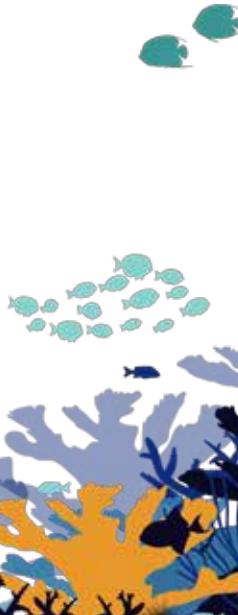
Montastraea cavernosa



Orbicella annularis



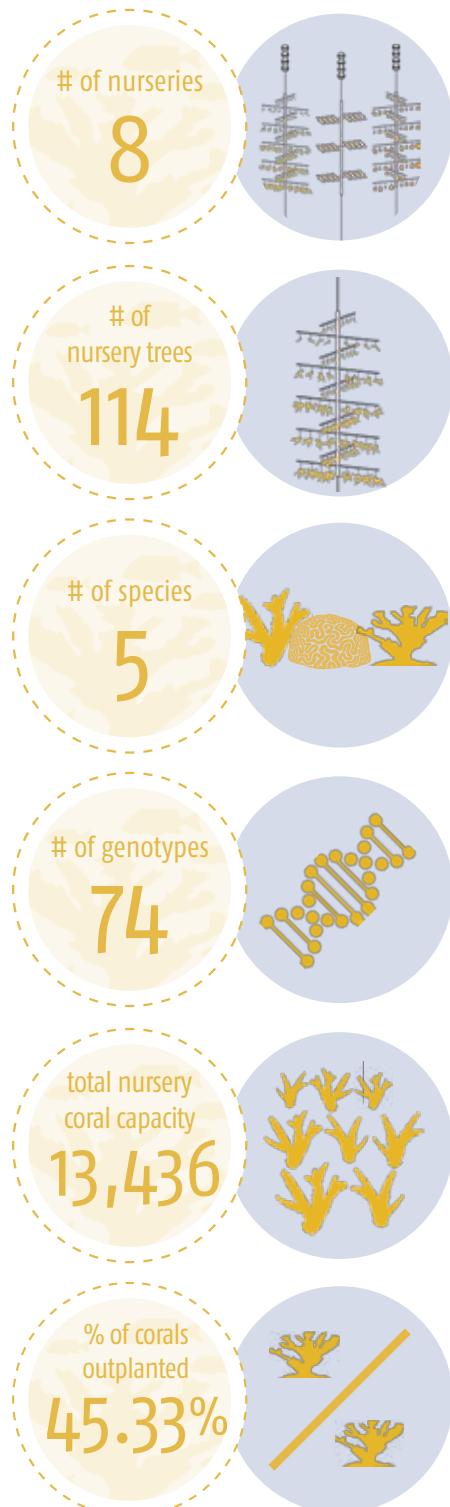
Orbicella faveolata



3.1.1 Nursery Activities and Monitoring

In 2019, Reef Renewal Foundation Bonaire managed eight nurseries. Three nurseries were primarily used for volunteer training by RRFB Dive Shop Members, and the remaining were used by RRFB for the production of corals to be outplanted to selected restoration sites.

Nurseries overview



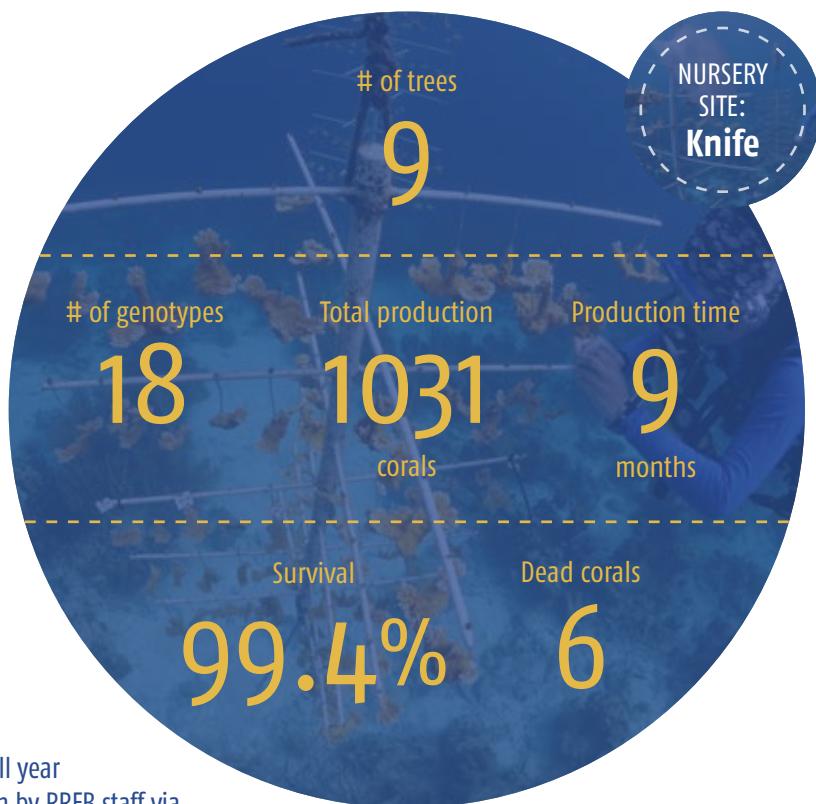
Pop-up Nurseries

Although the majority of the nursery production happened in centralized nurseries, since 2018, RRFB has been incorporating pop-up nurseries into its nursery system.

Last year RRFB removed the pop-up nursery installed at Oil Slick Leap and re-deployed the trees at Knife, a popular site on the north side of Klein Bonaire.

The new nursery will remain at Knife for at least two years, to produce approximately 2,000 elkhorn coral colonies that will be outplanted in the shallows at this site – an area where they used to thrive in the past.

The pop-up nurseries are monitored all year around for production and coral health by RRFB staff via in-water surveys. This monitoring program allows for the performance of the corals and the success of the nursery to be evaluated.



Boulder Coral Nursery

In September 2019, Reef Renewal Foundation Bonaire installed a new modified coral nursery at Buddy's Reef, fully funded by Cargill, to begin propagating boulder coral via fragmentation.

Parent colonies of three star coral species, *Montastraea cavernosa*, *Orbicella annularis*, and *Orbicella faveolata*, were collected by RRFB staff at four dive sites around Bonaire and Klein Bonaire. Each parent colony was fragmented and trimmed to remove excess skeletal material. In total, 288 broodstock corals were produced from 24 distinct parent colonies and mounted onto boulder coral trays using superglue.

Since their installation, the corals have been monitored every 6 weeks for their health and growth via in-water surveys and photo documentation, allowing the performance of the corals and success of the nursery to be tracked over time.



3.2 Outplanting

Corals are selected in the nursery to be outplanted to the reef once they are “reef-ready”. This means their age, size, and overall health, makes them better-suited for survival when exposed to predators and other stressors that exist in greater abundance outside of a nursery environment. Genetically diverse corals are then tagged, taken to a selected restoration site, and outplanted back to the reef, using various techniques.

3.2.1 Outplanting Activities

In 2019, RRFB and its Dive Shop Members outplanted at eight outplanting sites. Five sites were mainly used by RRFB Dive Shop Members for training Reef Renewal divers. At these outplant training sites, coral outplanting is done continuously, but in small batches of corals throughout the year. RRFB itself mainly focused the 2019 outplanting effort on three sites on Klein Bonaire – Knife, Carl’s Hill, and Mi Dushi – with the goal of restoring the once thriving *Acropora* coral populations that were present in the past. At these restoration sites, outplanting occurs over the course of a few large events for one to two years, at which point the monitoring activities continue and a new restoration site is chosen.

Outplanting Overview



Improving Outplanting Efficiency

Outplanting is often considered one of the bottlenecks of large-scale restoration efforts, as it requires complex logistics in addition to trained divers with suitable diving skills, dexterity, and precision. In order to increase the amount of corals outplanted per year, and thereby enable larger-scale reef restoration, the goal is to simultaneously reduce costs and time required for outplanting, without adversely affecting coral survival and the overall success of the restoration site.

In order to increase efficiency, we debuted a new outplanting technique called wedging at restoration site Mi Dushi.



In sheltered reef areas, with limited wave and surge exposure and moderately complex topographies, corals were outplanted by wedging and stabilizing colonies between dead coral and rubble, mimicking the natural positioning of wild colonies. In total, more than 2,700 staghorn corals from 17 genotypes were successfully outplanted at Mi Dushi.

The newly adopted wedging technique drastically reduced outplanting time, labor, and material costs while increasing both outplanting capacity and efficiency when compared to other outplanting techniques. Considering divers with an average level of experience, the technique resulted in a three-fold increase in the amount of corals outplanted per diver per dive, on average, increasing from 25-30 to 80-90.



3.3 Restoration Site Monitoring

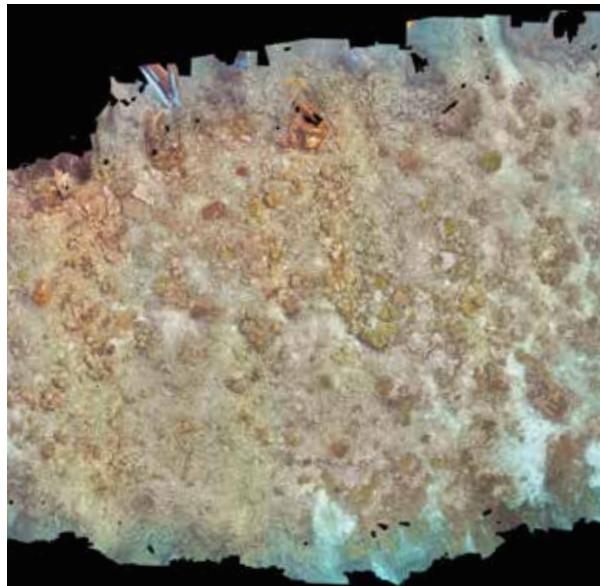
Monitoring via data collection is an important part of coral restoration and is critical to assessing the progress and success of restoration efforts. Monitoring corals throughout each step of the restoration process allows RRFB to determine where problems arise and adapt strategies to improve overall goals and success. Goals are translated into measurable objectives and associated with metrics, like coral live tissue and cover, health condition, growth, mortality and main stressors, which are then monitored and tracked over time.

3.3.1 Monitoring Activities

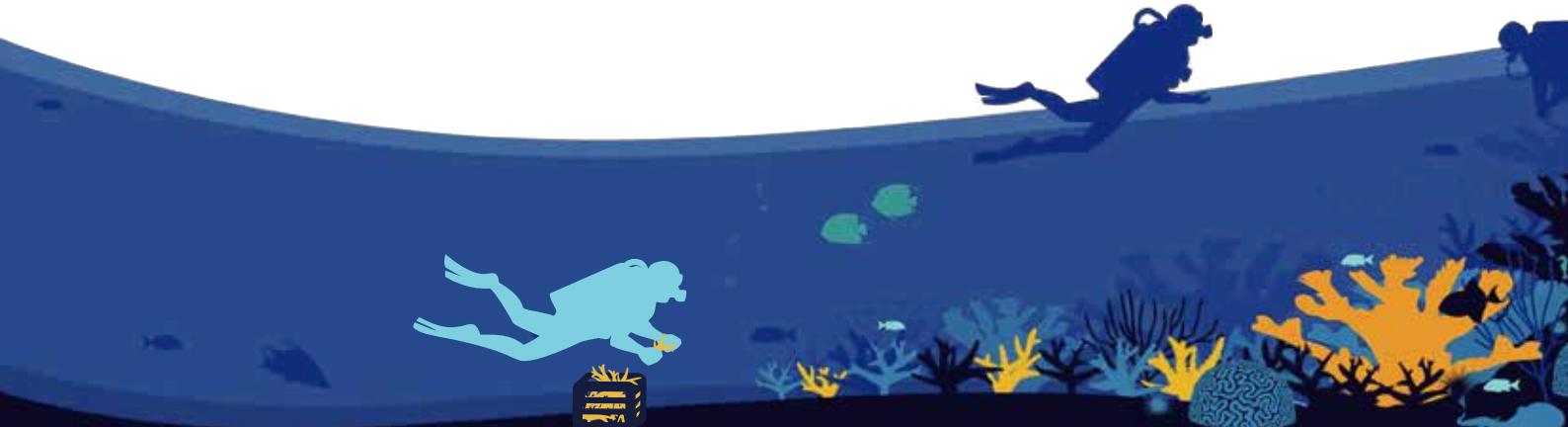
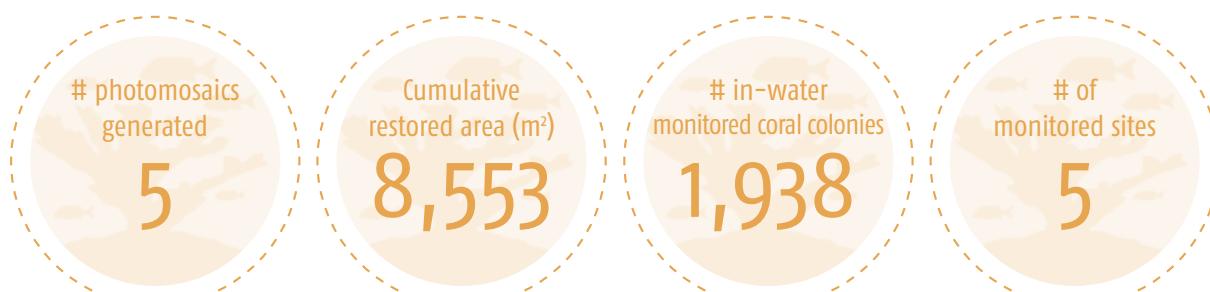
Reef Renewal Foundation Bonaire has developed a monitoring program that focuses on two different time scales, allows for meaningful data collection, and produces comparable results.

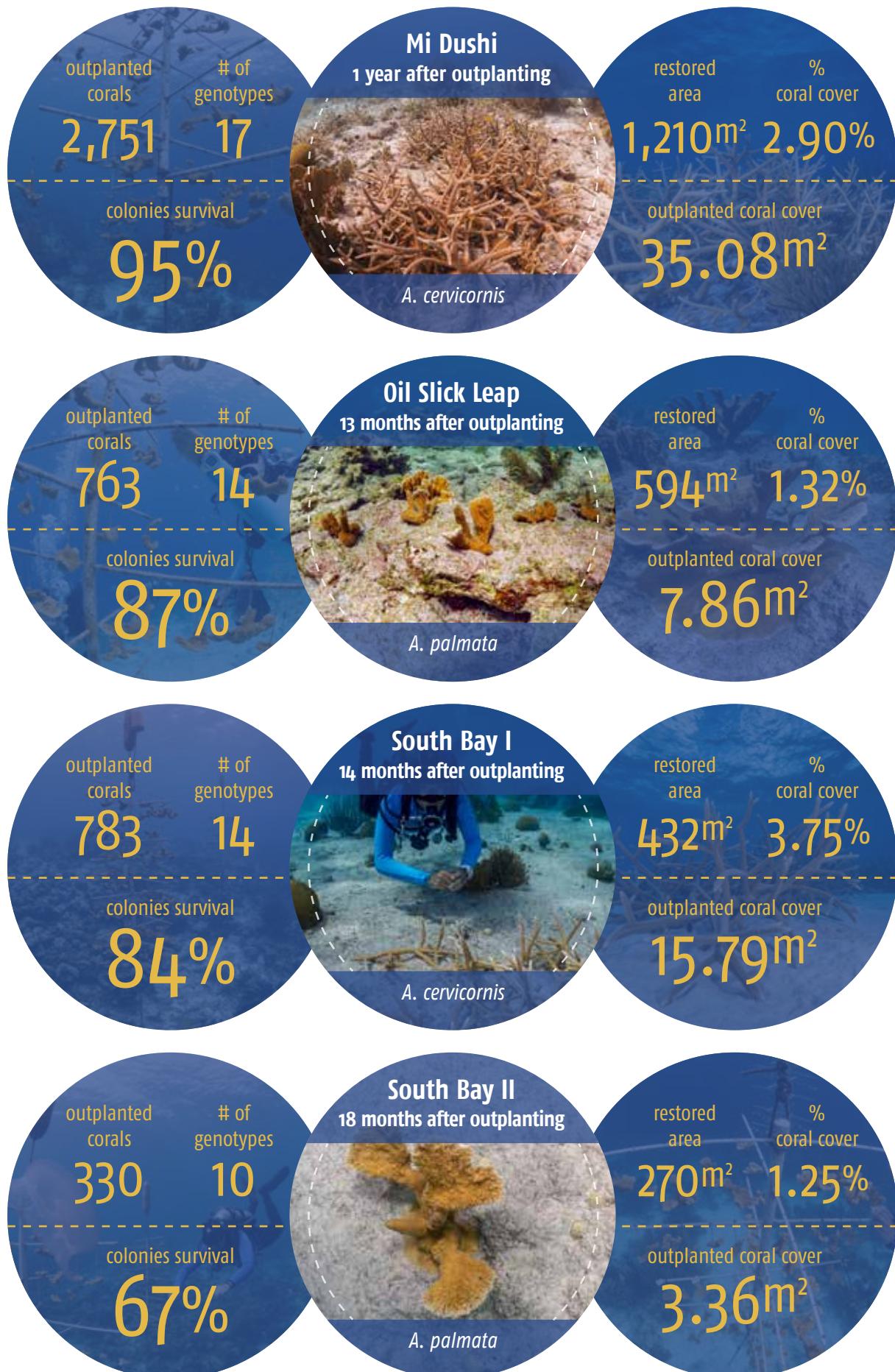
Short-term Monitoring: Completed routinely for the first 24 months, is based on underwater visual surveys and is focused on assessing individual colony performance. It aims to provide useful information for understanding the success of the outplanting strategy and technique, and comparing the performance of different coral genotypes in the short term.

Long-term Monitoring: Completed annually at each restoration site, is focused on a larger ecosystem-level scale. Spawning observations as well as photomosaic analysis of the entire reef site offers a better understanding of how outplanted colonies are growing and performing and the effects of restoration efforts on other organisms, collectively providing a comprehensive assessment of the overall project success in the long term.



Monitoring Overview





3.4 Larval Propagation Overview

The technique of larval propagation, or assisted recruitment, uses coral sexual reproduction as a restoration method. By taking advantage of corals' natural reproduction, larval propagation has the ability to produce millions of genetically unique coral offspring. The technique complements RRFB's current restoration program as it offers RRFB the potential to scale-up the number of coral outplants, to work with numerous coral species and morphologies, and to increase the genetic diversity of corals on the reef.

In 2018, RRFB entered a partnership with SECORE International to share expertise and bring the first larval propagation project to Bonaire. Using tools and protocols developed by SECORE, the method reduces labor and increases survivorship of cultured larval corals at large scales.

Larval Propagation Overview



3.4.1 Spawning Monitoring and Activities

Over the course of the year, RRFB initiated the larval propagation project. Project start-up activities included capacity building, permit acquisition, and the initial implementation of spawning monitoring, gamete collection, and fertilization trials.

April

SCORE staff came to Bonaire to perform location assessments and provide site and species-specific input for collection and outplanting.

June

RRFB staff participated in an intensive week-long training workshop hosted at CARMABI Research Station to learn larval propagation techniques from SCORE scientists.



August and September



RRFB staff and volunteers monitored for spawning of outplanted *Acropora* colonies at three restoration sites. While Jeff Davis and Buddy's Reef saw successful spawning events for the third year in a row, this year marked the first observed spawning of the outplanted staghorn corals at Tori's Reef.

September and October

Divers monitored and observed the spawning of boulder brain coral colonies (*Colpophyllia natans*) at Buddy's Reef. Spawning colonies were mapped and an estimated 2.3 million embryos were produced and released back over the reef.



3.5 Outreach and Education

Reef Renewal Foundation Bonaire acknowledges the importance of outreach and education in a successful restoration effort. RRFB actively engages the community through hands-on training, volunteer opportunities, educational programs, and outreach events in order to inspire action and create a better future for our reefs.

3.5.1 Growing Community Involvement

Diveshops & training

Dive Shop Members serve as educational ambassadors for Reef Renewal Foundation Bonaire's restoration program. By offering the Reef Renewal Diver distinctive specialty courses, local dive operators act as training centers for Reef Renewal divers. The Reef Renewal Diver specialty course is designed to offer basic coral restoration training to divers looking to become volunteers and get involved with the Foundation.



2019 Dive shop members



Buddy Dive



Gooodive



Harbour Village



Tropical Divers



Wannadive



Volunteers

Following the completion of the Reef Renewal Diver certification course at one of the participating Dive Shop Members, divers are qualified to join RRFB as a volunteer. Typically, RRFB organizes one or two volunteer dives a week, but volunteers are also able to dive independently in one of our coral nurseries. Volunteers not only help with day-to-day activities, but are also pivotal in sharing RRFB's vision with the wider community.



Events

For the 4th year in a row, on World Reef Day, RRFB organized and hosted ReeFiesta, a free outreach event aimed at bringing divers at all levels together to promote coral reef awareness and restoration. Throughout the day, over 110 divers gathered at five participating diveshops, conducted over 150 dives, outplanted 129 corals, and cleaned 63 nursery trees.



of ReeFiesta participants

110

To further engage the local community, Reef Renewal Foundation Bonaire hosted and participated in various community events to connect with local stakeholders and the general public (i.e. Bon Doet, RRFB Social Gathering, and RRFB Auction).

3.5.2 Expanding Educational Activities

Internships

RRFB's internship program is designed to actively engage individuals in the non-profit sector of marine conservation with a focus on the restoration of coral reef ecosystems. Internships provide a vast amount of experience and training through participation in coral restoration, scientific diving, and community outreach. During their 10-12 weeks with RRFB, interns become an invaluable part of the team. In addition to assisting with day-to-day activities, the 2019 interns also started an ongoing project investigating elkhorn growth rates in the nursery. RRFB was proud to host six interns during 2019.



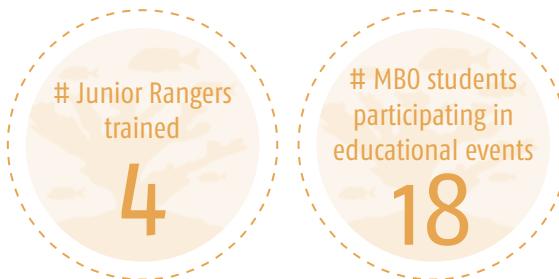
of interns

5



Local Youth Education

RRFB continues to build on its existing educational programs and is proud to work with local youth. For years, Reef Renewal training has been an established part of the STINAPA Junior Ranger program. The trained Junior Rangers volunteer at least once a month while the program is in session and many of them volunteer their time outside of the program. This year, we certified four new Reef Renewal Junior Rangers, expanding the cohort to seven active rangers.



This year also marked the continuation of RRFB's involvement with the local vocational school, MBO, to educate second-year Hospitality and Leisure students about the Foundation's efforts. Additionally, an exciting new opportunity was introduced for third-year students with a SCUBA certification to return to learn about coral nursery maintenance and participate in a nursery maintenance dive with RRFB staff.

Public Presentations

RRFB conducts weekly public educational presentations about its reef restoration work in order to educate and engage the local and international community. This year, RRFB also gave informational presentations on its restoration effort at two international conventions – the Dutch Caribbean Nature Alliance (DCNA) Biologist Conference and the biennial Global Underwater Explorers (GUE) conference.



3.6 Collaborating Internationally

RRFI

Reef Renewal Foundation Bonaire is proud to be a founding partner of Reef Renewal International (RRFI). RRFI seeks to connect coral restoration practitioners in a network where knowledge and experience are shared to help protect and restore coral reefs worldwide. Because of the experience gained and skills developed while helping others set up reef restoration programs, RRFB is able to help RRFI build a strong global network by serving as a demonstration, education, and training hub for new partners.

In this role, RRFB connected with representatives from other Dutch Caribbean islands, including research scientists and park managers, in order to develop a long-term integrated restoration plan. Additionally, RRFB hosted representatives from Cayman Islands and Mustique to provide a comprehensive overview of the restoration project on Bonaire and with training in restoration methodologies.



SECORE

Over the last year, Reef Renewal Foundation Bonaire has continued its partnership with SECORE International. RRFB is committed to sharing knowledge and tools between experts in the field of coral restoration. Through this partnership with SECORE, RRFB has been able to incorporate new tools and techniques into its restoration program, complementing the current work, while simultaneously giving RRFB the ability to scale up the restoration effort and have a greater impact on the reef. By applying the technique and integrating larval propagation into its restoration effort, RRFB will provide valuable data to SECORE in order to advance the field and improve larval propagation techniques.



Research collaboration

In 2019, Reef Renewal Foundation Bonaire collaborated with researchers from universities in the United States and the Netherlands to help investigate research questions that will inform and advance RRFB's restoration program.

Serena Hackerott, Ph.D. candidate, Florida International University, 2019–2021. *Epigenetic responses to environmental stressors in Acropora corals, and applications to coral reef conservation.*

Laura Eppinga, B.S. candidate, Van Hall Larenstein University of Applied Sciences, 2019. *Exploring the ecological & socio-economic benefits created by coral restoration for Bonaire's community.*





4 LOOKING FORWARD TO 2020

Nursery Goals

- install two new nurseries
- increase capacity of *Acropora* coral nursery system to over 15,000 corals
- propagate 4,000 boulder corals in preparation for outplanting in 2021
- test new tree design for *Acropora* corals

Outplanting Goals

- outplant 7,000 *Acropora* corals back to Bonaire's reefs
- select two new restoration sites for *Acropora* corals
- outplant 50 *Acropora* coral genotypes from the nurseries



Monitoring Goals

- monitor all restoration sites using the newly-adopted monitoring scheme, including short-term in-water surveys and long-term photomosaic
- supplement our current monitoring program with additional surveys that follow the GCRMN Caribbean Monitoring Guidelines
- develop a comprehensive database for the monitoring program to track data aligned with the Coral Restoration Consortium Monitoring Guidelines



Larval Propagation Goals

- monitor spawning of four coral species
- perform larval propagation during two spawning events of two different coral species
- perform floating pools trials to facilitate larval settlement on Seeding Units
- outplant 1,000 Seeding Units back to Bonaire's reefs

Education & Outreach Goals

- recruit a new Reef Renewal Dive Shop Member and train at least two new RRFB Instructors
- expand the internship program by hosting six new interns and explore the opportunity to engage local students in the program
- engage 100 local youth in reef education programs
- develop RRFB educational materials for students, teachers, and instructors
- increase the number of public educational events
- strengthen the volunteer program in order to increase retention and further develop restoration skills

Research Goals

- collaborate with researchers on two new ecological and/or sociological studies
- find a partner to conduct genotype tests on our nursery corals
- develop new long-term research studies to augment the internship program and provide valuable scientific research field work experience





5 FINANCIALS

Revenue

Cost price revenue

| | 2019 | 2018 |
|--------------------|---------|---------|
| | USD | USD |
| | 152,546 | 159,499 |
| Cost price revenue | 47,000 | 35,639 |
| | 105,546 | 123,860 |

Expenses

Personnel

Sales

Transportation

General

Depreciation

Financial (revenue) and expenses

| | | |
|----------------------------------|---------|--------|
| | 68,147 | 56,633 |
| Personnel | 14,839 | 8,048 |
| Sales | 1,536 | 1,736 |
| Transportation | 19,720 | 20,042 |
| General | 5,380 | 2,339 |
| Depreciation | 698 | 965 |
| Financial (revenue) and expenses | 110,320 | 89,763 |
| | (4,774) | 34,097 |

Balance Operating Statement

5.1 Donors

We could not accomplish our work without the generous support of individuals, corporations, and foundations. This list reflects 2019 donors at the \$50+ level. We are also grateful for the countless individuals who donated tools and materials to support our efforts throughout 2019. While it is impossible to list every contributor to Reef Renewal Foundation Bonaire, we thank all of our supporters for giving Bonaire's reef a helping hand.

We apologize for any errors or omissions and ask that you bring corrections to us at info@reefrenewalbonaire.org.

Reef Builders (\$1000+)

- Bon Doet
- Bonaire Vikingdivers Elin and Stein
- Club Melevsreef
- Mike & Anner Davis
- Eels on Wheels, in memory of "Bad" Bob Pappas
- Felsten Fishman Family Foundation
- Holly & Travis
- Indian Valley Scuba
- The Jackson Family
- The Family of Otto Kucera
- Michael Parker
- In memory of Patrick Poggi
- The Sherwood Family
- Robert Solomon
- Ben Thayer
- Friends & Family of Gwen Wiegerink & Herma Merx Rozendaal
- WWF-Netherlands
- Denis Zeravica

Coral Outplanters (\$500-999)

- ABC Travel NL
- Craig Beaton & Toad Abinante
- Bonaire Tours & Vacations
- Patricia Brandes
- Brave Water Foundation
- Lorenzo Cabrera-Vidales
- Jackie Christerson in memory of her husband Bill Knoepfler
- The Claux Lion Slam Club
- Han Doan
- The Dubachs
- Brian Falatko
- The Fundakowski Family
- GAI Volunteer Dive Crew
- H2O Visions Bonaire
- The Hopkins Family
- Lester Knutsen
- Maui Dreams Dive Co.
- MCB
- Brian McGrath
- Mikko & Pekkas
- The Murphy Family
- Orca Scuba
- David Peet
- Tom & Margo Peyton
- Ranum Efterskole College
- The Sarin Family
- John Shepard
- Marika Sjodin
- The Smit Family
- SPEA
- Nicholas Tang & Family
- Rob Unruh

Nursery Tree Fillers (\$100-499)

- Thorsten Albrecht (Marine Life Protectors)
- Anonymous
- In memory of Chester Berschling
- Bob & Judy
- James Brummell
- Nita Christopher
- Mark Davidson
- Joshua Dorchak
- John Easterwood
- Frank Ernst
- Kayla Fromhold
- Jacquelyn Gill
- Michael Goodman
- Saskia Italianer
- Robyn Jamison
- Billie Jaynes
- Johnson City, TN Divers
- Roderik Jones
- Johnathan Katz
- Robert Koska
- Robert Lacaillade
- Kelly McMullen
- Rebecca Morris
- Kim Oldigs
- Francis Plant
- The Polakoff Family
- Sarah Porter
- Alan Scott
- Julian Spitzner
- Carla Thomas
- Samantha Tse & DigitalOcean

Fragment Makers (\$50-99)

- Anonymous
- Edmund Bayruns
- LeeAnn Bryant
- Kassi Burns
- Jane K. Cleland
- Helen Dempsey
- Patrick & Della Edrington
- Louise Fenner
- Eric Godshalk
- in memory of Murphyn Henar
- Allan Hewett
- Jane Hirsch
- Chris Hohl
- Kathleen Eleanor Jordan
- Katherine Justice
- Courtney Kaye
- Debra Kiesel
- Honey Kirila
- Lucille Leavitt
- E. Leroy
- Maplestar Aviation
- Joke Meulenveld-de Koning
- Evan Michalski
- Martine De Mol
- Angelica Montelongo
- Doug Odom
- Lorenza Polo
- Roberto Polo
- Deborah Prickett
- Lori and Charlie Rohre
- The Sidd Family
- Joe Stanko
- Gertrud Talvik
- Olivia Westermeier





5.2 Partners

We are grateful to our partners that demonstrate their support for Reef Renewal Foundation Bonaire. Each one is an active collaborator, sharing ideas, knowledge, and techniques that advance our project and help us restore Bonaire's reefs.



Special Thanks and Credits

Our successes would not be possible without our dedicated supporters near and far. On that note, we want to thank our committed team of **volunteers** for giving their time and efforts to support Bonaire's reefs year-round—from loop making to tree cleaning, to coral outplanting, your hands make a difference.

A special thanks goes to **Buddy Dive Resort** for providing RRFB team and its volunteers with tanks, staff and boat rides every year, which allow for a countless amount of hours to be spent underwater restoring reefs.

Reef Renewal Foundation Bonaire would like to thank the generous photographers whose photographs are featured in this report: **Federico Cabello, David J. Fishman, Lorenzo Mittiga, Elisabetta Maccari, SECORE International.**

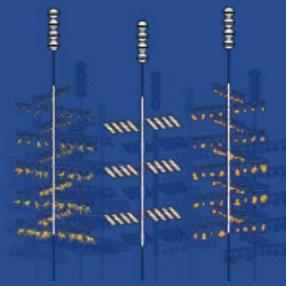




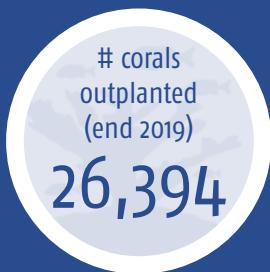
Reef Renewal
Bonaire

REEF RENEWAL BONAIRE RESTORATION IN A GLIMPSE

Nursery



Outplanting



Larval Propagation



Community Involvement

