



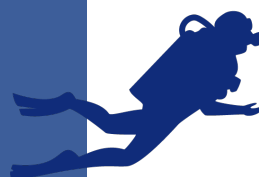
Reef Renewal
Bonaire

2021 ANNUAL REPORT

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Photo by Lorenzo Mittiga



1 WELCOME — A MESSAGE FROM THE PRESIDENT OF THE BOARD OF DIRECTORS



As I compose this message in 2022, reflecting on Reef Renewal Bonaire's accomplishments during 2021, and during its first ten years of operation – I find it impossible not to be captivated by the impact that RRFB's work has had on the shores of Bonaire and Klein Bonaire. For the diver and snorkeler, this work is now easy to see – acres of restored Staghorn corals, stands of majestic Elkhorns thriving and spawning, and providing habitat for a teeming biodiversity of reef life.

If you have been lucky enough to tour the Jeff Davis Memorial dive site, just a few yards off Bonaire's northern coast, you get a sense of what years of hard work and actively managed, successful restoration work can achieve on Bonaire.

When RRFB started, these accomplishments were the dream of our Board of Directors, and specifically of our founding President, Martien Van der Valk. As I assume the role of President in 2022 from Martien, I want to take this opportunity to thank him for his hard work, his broad vision, his get-things-done attitude, and for his ability to assemble the diverse team that has executed on behalf of Bonaire's coral reefs for the past decade. From the beginning, Martien insisted that this vision could not succeed if it was the initiative of a single dive operation or resort. Rather, the whole of Bonaire needed to embrace the restoration vision for RRFB to succeed. Today, RRFB boasts more than 9 dive operators and resort partners who work together on the mission of protecting, restoring, and giving the reefs of Bonaire a helping hand. Together with the Bonaire government, hundreds of volunteer divers and donors, the Bonaire Tourism Board, STINAPA, DCNA, WWF, and other key island partners, the work of RRFB can truly be categorized as a whole, island-wide initiative.

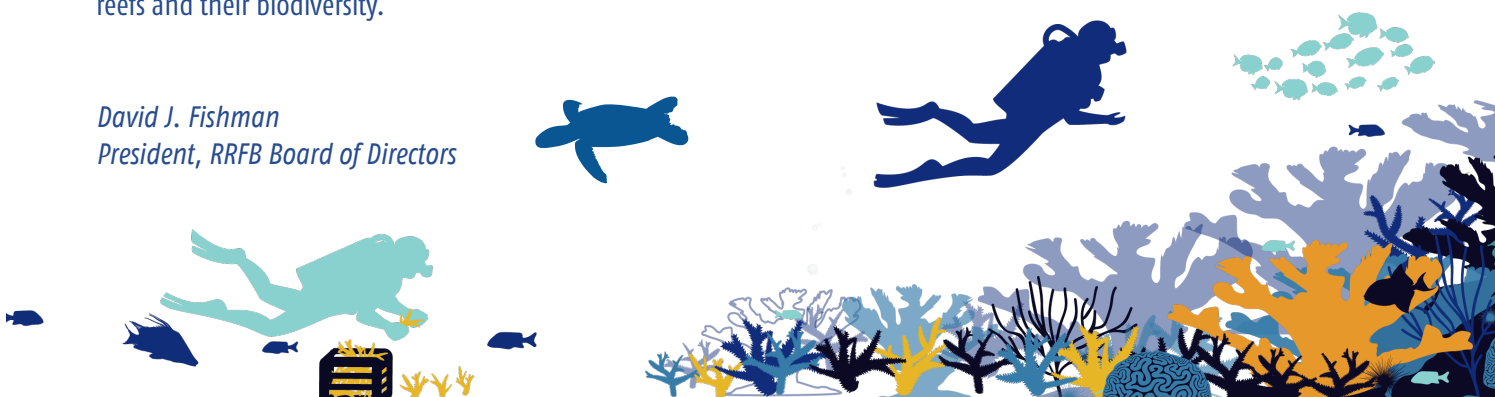
Martien helped define RRFB's "Secret Sauce" – focus on practical goals that are informed by science but made successful and sustainable by a powerful engine of cooperation between local businesses, government, NGOs, volunteers, and the dive community. As we move forward into 2022 and our next decade, we are setting some very ambitious goals, but we will be guided by Martien's recipe and his standards as we move forward.

Our second secret – in this case, our Secret Weapon – is our Chief Operating Officer, Francesca Viridis. From day one of RRFB, she has been making RRFB's ambitious vision a reality. She has tirelessly led RRFB's efforts, pushing it forward in the water, in the lab, and with the scientific community.

You will see the impressive results of Francesca's and her team's work in this report on our activities in 2021 – but know that RRFB is just getting started. Yes, we will grow more and get more corals in the water but are also looking to significantly scale our outplanting efforts, to push restoration science with new partnerships and new techniques (including building Bonaire's first full-featured coral Wet Lab), and to continue the push to make Bonaire the global Center of Excellence for coral reef restoration.

Thank you to all our partners, donors, and volunteers. As a team, we will continue to execute for Bonaire's coral reefs and their biodiversity.

David J. Fishman
President, RRFB Board of Directors





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

OUR VISION

The vision of Reef Renewal Foundation Bonaire is a world:

- Where knowledge and experience can be shared
- Where reefs are protected and restored
- Where reef degradation is halted
- Where ocean awareness is promoted

BOARD OF DIRECTORS



David J. Fishman
President



Augusto A. Montbrun
Secretary



Paulus P. Coolen
Treasurer



Martinus W.A. Van der Valk
Director



Christine M. Wall
Director

STAFF



Francesca Virdis
Chief Operating Officer



Sanne Tuijten
Assistant Coordinator



Ernst Noyons
Reef Restoration Technician



Nina Le Trocquer
Reef Restoration Technician



Ken Nedimeyer
Technical Advisor



Dr. Erik Meesters
Scientific Advisor

ADVISORY COUNCIL





3 WHERE ARE WE NOW?



NURSERIES

Coral capacity

A. Knife	900
B. Buddy's Reef	5,243
C. Something Special	500
D. Harbour Village	1,000
E. Eden Beach	500
F. Joanna Sunchi	5,700
G. Calabas Reef	1,100
H. Bachelor's Beach	300
I. Punt Vierkant	1,000

TOTAL 16,243

OUTPLANTING SITES	# outplanted corals	
	<i>Acropora cervicornis</i>	<i>Acropora palmata</i>
1. Jeff Davis	3,021	n/a
2. Oil Slick Leap	n/a	816
3. Buddy's Reef	7,852	2,334
4. Harbour Village	1,238	201
5. Eden Beach	123	641
6. Something Special	467	393
7. Knife	n/a	1,959
8. Mi Dushi I	5,183	n/a
9. Mi Dushi II	1,451	n/a
10. Yellowman	3,186	n/a
11. Carl's Hill	n/a	1,850
12. South Bay	1,288	330
13. Playa Lechi	1,250	n/a
14. Calabas Reef	375	400
15. Bachelor's Beach	155	50
16. Punt Vierkant	905	n/a
17. Salt Pier	1,250	n/a
18. Tori's Reef	2,986	n/a
19. Pink Beach	1,250	n/a
TOTAL	31,980	8,974

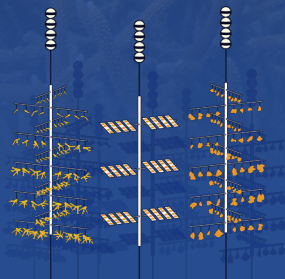




4

REEF RENEWAL BONAIRE RESTORATION IN A GLIMPSE

Nursery



Outplanting



Larval Propagation



Community Involvement

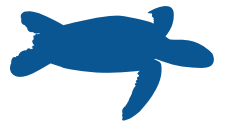
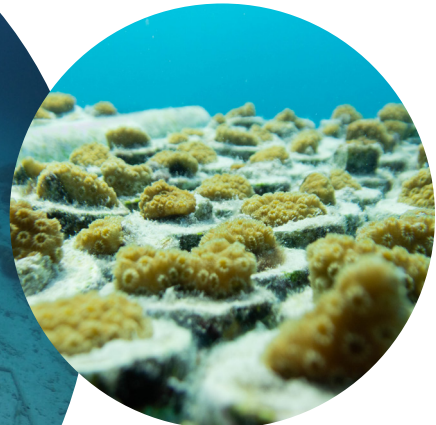




5 A YEAR IN REVIEW

5.1 Coral Fragmentation

Since 2012, RRFB has used the propagation by fragmentation technique in combination with the coral nursery tree design to grow endangered coral species. This method is based on the asexual reproduction of corals and allows RRFB to harness the natural process of fragmentation to propagate large numbers of corals. Depending on the species' morphology, fragments are either hung from the branches of the trees or secured on trays. The coral fragments stay in the nursery for several months until they reach the proper size for outplanting. Depending upon the species of coral and the environmental conditions of the reef, a variety of outplanting methods are used.



5.1.1 Nursery Propagation and Monitoring

In 2021, RRFB managed 10 nurseries. Four nurseries, which accounted for 82% of the total nursery coral capacity, were used by RRFB to produce corals to be outplanted to targeted reef sites. The remaining nurseries were primarily used by RRFB Dive Shop Members for educational purposes and volunteer training.

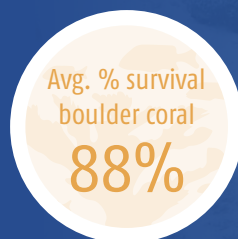
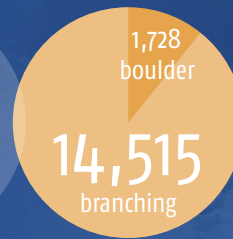
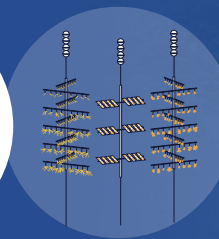
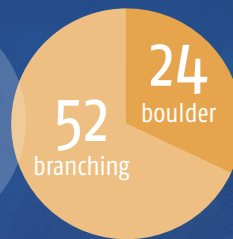
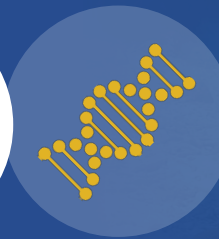
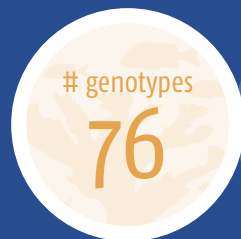
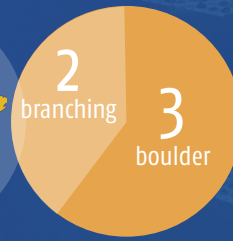
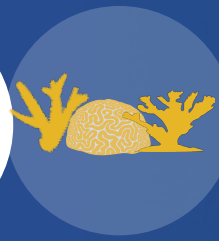
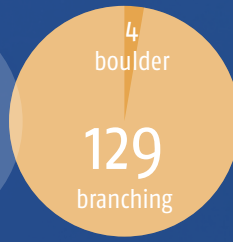
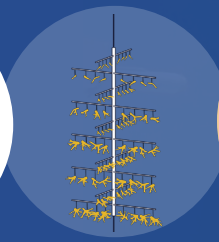
As a first for RRFB, in 2021 boulder coral broodstock fragments were further propagated to prepare for outplanting. Larger broodstock fragments were cut into small fragments of 1–5 polyps and glued onto cement plugs. The 1,368 “micro” fragments will stay in the nursery to heal and grow before their outplanting in 2022.

Reef Renewal-managed nurseries are actively monitored year-round via in-water surveys to gather production, health, and overall nursery performance data. In 2021, volunteer Cathleen Whillock developed a comprehensive database to help streamline the monitoring system. This database can create reports and real-time updates on the status of the nurseries, facilitating planning and increasing working efficiency.



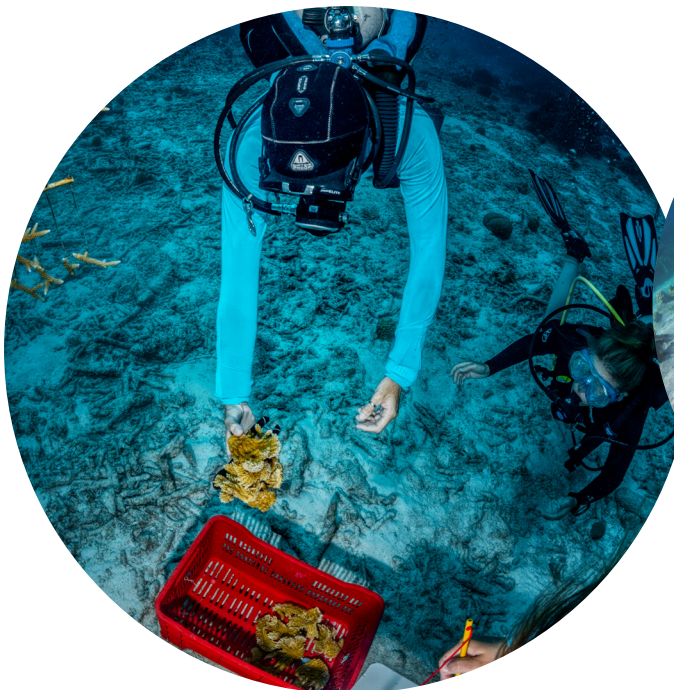
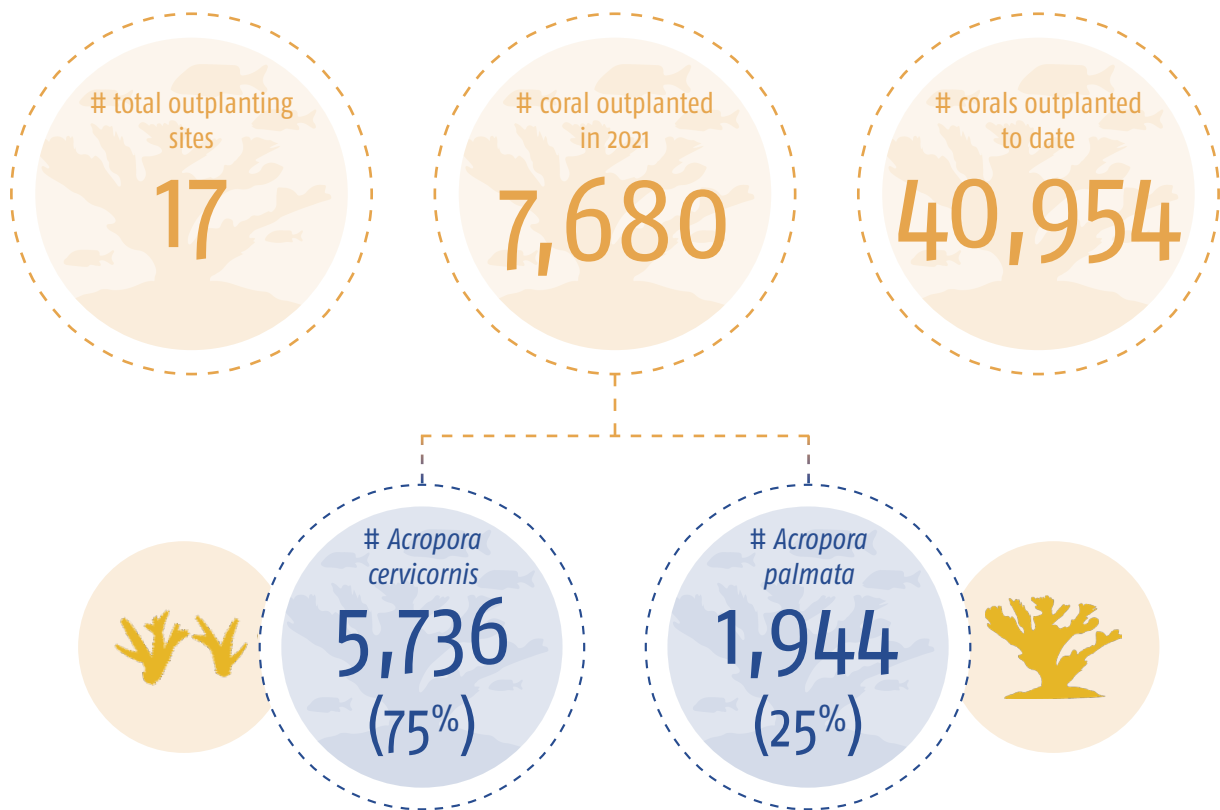


Nurseries Overview



5.1.2 Outplanting and Monitoring

At training sites, outplanting is done frequently, but in small batches by RRFB dive shop members mainly for training or educational purposes. At the other sites, a large number of corals are outplanted by RRFB staff with a few efforts throughout one to two years.





Reef Renewal
Bonaire

Monitoring via data collection is an important aspect of the project and critical to assessing restoration efforts' progress and success. The first year after outplanting Reef Renewal monitors restoration sites via in-water surveys. By visually assessing stressors and the health of individual coral colonies, Reef Renewal can better understand what the challenges might be in the shorter term. In the long-term, photogrammetry is used to understand more holistically how a restoration site changes over time.

photomosaics
generated

5

cumulative
restored area (m²)

7,890

in-water
monitored coral colonies

4,588

monitored
sites

4



Monitoring the Outplanting Sites



Site: **Yellowman**
Species: *Acropora cervicornis***
Last outplanting: 2021

outplanted
corals

1,344

colonies survival
(6 months)

97%

coral cover*

7%

restored area

468m²



Site: **Knife**
Species: *Acropora palmata*
Last outplanting: 2020

outplanted
corals

1,029

avg. size of
restored corals

88cm²

coral cover*

1%

restored area

323m²





Site: **Mi Dushi**
Species: *Acropora cervicornis***
Last outplanting: 2020

outplanted
corals

5,831

coral cover*

9%

restored area

992m²



Site: **Punt Vierkant**
Species: *Acropora cervicornis***
Last outplanting: 2021

outplanted
corals

906

coral cover*

3%

restored area

483m²

*Coral cover of targeted species only

**avg. size of restored corals is not available for *Acropora cervicornis* as the coral colonies fuse.



5.2 Larval Propagation

By taking advantage of corals' natural sexual reproduction, larval propagation can produce millions of genetically unique coral offspring. During mass spawning events, gametes are collected using nets and taken back to a lab to be assisted in fertilization. The resulting embryos are kept in the lab and floating pools, called Coral Rearing In-situ Basins (CRIBs), to complete their development into larvae. Using CRIBs allows RRFB to contain swimming coral larvae until they settle onto specially designed ceramic substrates, called Seeding Units, which are later outplanted back onto the reef.

5.2.1 Coral Spawning Monitoring

Coral spawning monitoring is a crucial tool for restoration efforts. The observations help RRFB narrow spawning prediction windows and, therefore, assign resources more efficiently during gamete collection, the first step of the larval propagation process. Furthermore, witnessing outplanted corals spawning is a critical benchmark because it is an unquestionable sign of coral health and restoration success. Thanks to participating volunteers, the monitoring was extended across multiple months and sites, which allowed RRFB to record extensive spawning observations of several coral species along the west coast of Bonaire.

spawning species
observed

10

nights
monitored

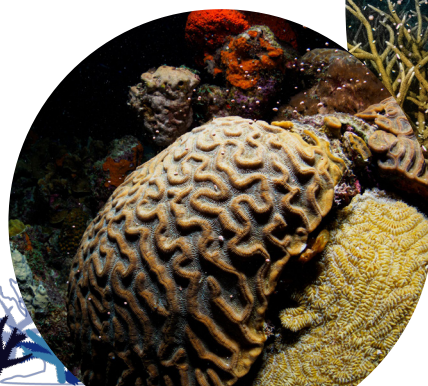
9

area
monitored (m²)

5,600

coral species
monitored vs
spawning

10/8



5.2.2 Larval Propagation Activities

In 2021, RRFB received a grant provided by the IUCN through the BEST 2.0+ Program funded by the European Commission, to further support the 18-month project “Larval propagation: an innovative technique to scale-up Bonaire’s reef restoration program” in partnership with SECORE International. The funding through BEST2.0+ will allow RRFB to build capacity and increase the knowledge necessary to scale up the core coral restoration activities, based on fragmentation, and extend them to other damaged reef areas and coral species.

RRFB focused the 2021 larval propagation activities on the grooved brain coral (*Diploria labyrinthiformis*), staghorn coral (*Acropora cervicornis*), and the boulder brain coral (*Colpophyllia natans*). To help scale up RRFB’s efforts, more training for dive shop members staff was done on coral ID and netting techniques. For the first time, RRFB outplanted 469 Seeding Units with settlers of *Diploria labyrinthiformis* at Buddies Reef.

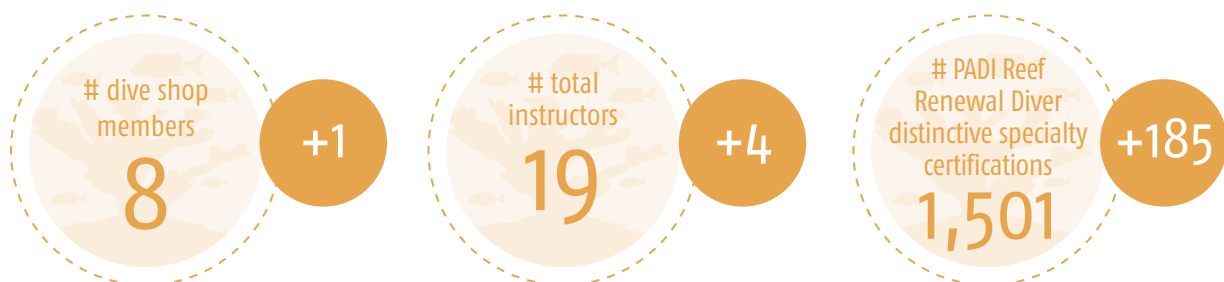


5.3 Outreach & Education

RRFB is turning the tide of reef degradation by taking collective community action and by educating the public about reef science and restoration. Through interactive in-person and virtual events, RRFB reaches local and international audiences of all ages, fostering a movement of reef stewardship among devoted and budding conservationists.

5.3.1 Dive Shop Members

Dive shop members are an essential part of RRFB's outreach program. When teaching courses and raising awareness, they are the public's first point of contact and are responsible for training volunteers and connecting them with the foundation. In 2021, RRFB is proud to add Toucan Diving to the member network.



Buddy Dive



Beyond The Corals



Harbour Village



Tropical Divers



VIP diving



Divi Dive Bonaire



Wannadive



Toucan Diving



5.3.2 Educational Events

Educating the public about reef restoration is the first step toward protecting reefs. Through virtual events, RRFB has been able to reach more than 300 participants directly, and hundreds more through recorded videos of these presentations. Spreading the word and talking to people all over the world enables the foundation to reach a wide audience, ranging from locals & visitors to students from international universities and visiting dive groups or organizations.



RRFB also has been active by hosting in-person presentations for enthusiastic dive groups from all over the world, who are interested in learning more about coral restoration work. This resulted in giving presentations and demonstrations to more than 10 visiting groups. For the 9th time, RRFB has participated in Bon Doet, which is an island-wide volunteering movement where locals and visitors have the chance to try their hand at coral nursery maintenance.

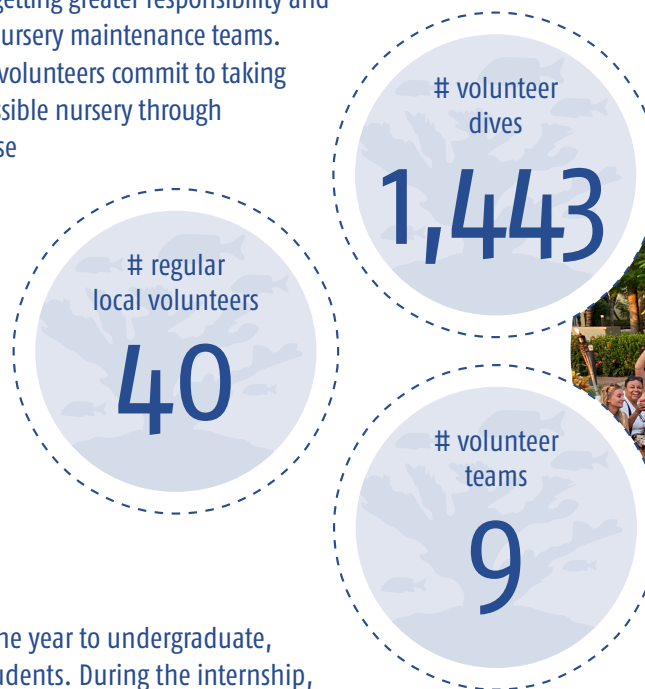
Through youth-focused events, RRFB can inspire even the youngest future reef protectors to care for this vital ecosystem. In July, RRFB continued its Junior Ranger program: certifying five of them as Reef Renewal divers. For the MBO, RRFB gave a special presentation and snorkel tour for 20 young adults. RRFB also hosted virtual events for groups of kids from the KSC group and Blue Endeavors.



5.3.3 Volunteer Program

In 2021 RRFB has seen the return of many friendly and familiar faces, who were able to return to Bonaire after the COVID-pandemic regulations loosened up. The volunteer boat trips, organized multiple times a week, remain extremely popular and are almost always filled to maximum capacity with enthusiastic volunteers. In 2021, the volunteers did more than 1,400 Reef Renewal dives. Without them, and their vigorous diving, the foundation wouldn't be able to maintain the number of nursery trees that are around the island.

Residents and long-term visitors are getting greater responsibility and more training, forming shore diving nursery maintenance teams. Through the nursery team approach, volunteers commit to taking care of an RRFB-assigned shore-accessible nursery through 2-4 dedicated dives each month. These teams report back information regarding coral health and the state of the nursery trees to RRFB HQ. The work done by these volunteers is pivotal to maintaining nurseries across Bonaire while freeing up resources to focus more on other activities like outplanting.



5.3.4 Internship Program

RRFB offers internships throughout the year to undergraduate, graduate, and recently graduated students. During the internship, they develop the skill set of the next generation of restoration practitioners by providing them with hands-on training in reef restoration practices, as well as experience working with an NGO. After most of the travel restrictions of COVID were lifted through 2021, RRFB was able to host another 6 interns, coming from all different parts of the world.



5.4 Collaborations in Scientific Research



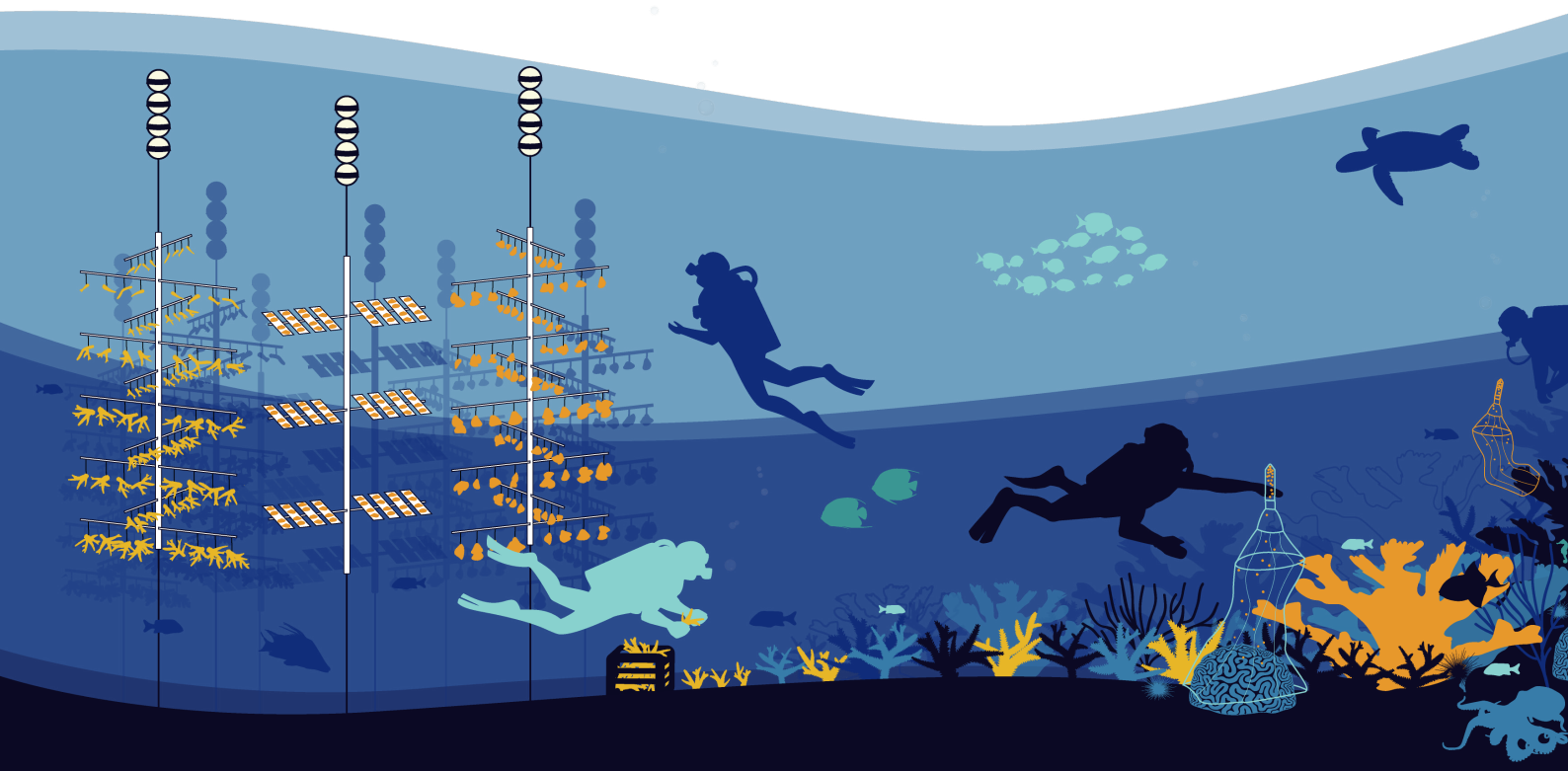
Epigenetic responses to environmental stressors in *Acropora* corals, and applications to coral reef conservation

Project Leader(s): Serena Hackerott and Dr. Jose Eirin-Lopez, Florida International University (FIU) Environmental Epigenetics Lab.

Student: Serena Hackerott, PhD student FIU (USA).

Period: Summer 2019 – Summer 2022

Project description: This two-part study investigates the role of acquired epigenetic modifications in helping two important Caribbean reef-building coral species, *Acropora cervicornis* and *A. palmata*, cope with stressors associated with global change. During the proposed project, in collaboration with RRFB, corals have been sampled monthly and site-specific environmental conditions have been monitored to 1) characterize the effects of seasonality and site-specific environmental conditions on coral epigenetic modifications and their connection with coral health; and 2) to evaluate the role of epigenetic modifications in mediating the “nursery-effect”, or measuring the effect of the environmental conditions where a coral is raised on its ability to tolerate subsequent exposure to stress.





Care and Coral Restoration in the Caribbean

Project Leader(s): Sarah Fischel and Dr. Sam Randalls Geography department at University College London (UCL).

Student: Sarah Fischel, PhD student UCL (UK).

Period: 2019–2023

Project description: This study explores how we, as individuals and as a society, can care more about the other species that share our planet, focusing on coral reefs, one of the most threatened ecosystems globally. This study investigates where coral fits into the spectrum ranging from charisma, love and care on one hand, to distance, indifference or fear on the other. The aim is to find out how people view and interact with coral and the resulting impacts this has on coral conservation.



Ecological assessment of coral diseases and symbioses at Bonaire, Dutch Caribbean

Project Leader(s): Università degli studi di Milano-Bicocca (Italy) & MaRHE Center (Maldives)– Simone Montano

Student(s): Andrea Magrini, Giorgia Ferrari and Camilla Rinaldi

Period: 16 May – 15 December, 2021

Project description: Coral diseases represent a serious threat to reef ecosystems. In recent decades, outbreaks of emerging diseases have become more frequent, possibly due to global ocean warming and human activities, contributing substantially to the speed-up of coral loss and reef decline. By contrast, the coral associated fauna have been recently proved to reduce the susceptibility to disease for their host coral. Although coral diseases and coral reef symbioses are well reported in the Caribbean, little scattered information has been documented on the Bonaire's coral reefs. In particular little information is present regarding the hydroids associated with the coral reef fauna, such as sponges, bryozoans and octocorals and their positive effects on the health of the hosts. The aims of this study is to assess the spatial distribution, host range, and prevalence of coral diseases and symbioses and exploring the possible differences between outplanted and non-outplanted sites.





6 LOOKING FORWARD: OUR GOALS FOR 2022

Nursery

- install 1 new nursery
- increase coral nursery capacity at least 5%
- install at least 20 new trees to expand and refurbish the current nursery

Outplanting

- outplant 7,000 *Acropora* corals and 1,000+ boulder coral fragments to the reef
- target 1 additional restoration site for *Acropora palmata*
- increase outplanted *Acropora palmata* to over 25% of total outplanted corals
- extend long-term monitoring to 60% of restoration sites

Larval propagation

- monitor spawning of 4 coral species
- perform collection, fertilization, and rearing of 3 coral species
- deploy the larva rearing pool (CRIBs) three times
- outplant 1,500+ Seeding Units back to the reef

Outreach & Education

- support 1,000+ volunteer dives
- have 1 new dive shops join the dive shop partnership
- involve at least 15 local youth through the educational program
- engage with at least 300 participants through virtual and in-person events

Research

- collaborate with 1 additional research group
- conduct genetic analysis on the coral genotype stock





7 FINANCIALS

REVENUE

Cost price revenue

GROSS PROFIT

EXPENSES

Personnel

Social security

Sales

Housing

General

Depreciation

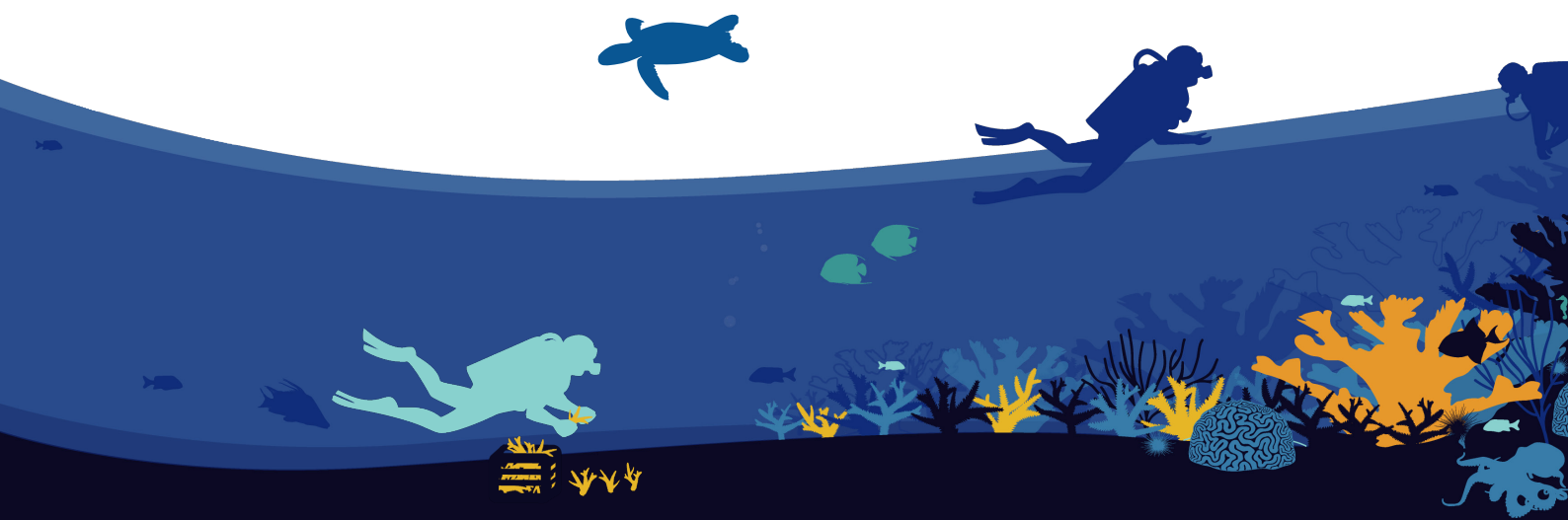
TOTAL EXPENSES

OPERATING RESULT

Financial (revenue) and expenses

BALANCE OPERATING STATEMENT

2021	2020
USD	USD
199,627	117,776
(37,716)	(16,594)
161,911	101,182
73,408	65,141
9,568	8,528
5,660	4,005
16,214	16,244
18,454	17,440
8,599	10,399
131,903	121,757
30,008	(20,575)
(317)	(1,217)
29,691	(21,792)



8 DONORS

RRFB's work would not be possible without the benevolent support of individuals, corporations, and foundations. RRFB is grateful to all the thoughtful individuals who donated tools and materials to support the efforts throughout 2021. While it is impossible to list every contributor to Reef Renewal Foundation Bonaire, RRFB thanks all the supporters for giving Bonaire's reef a helping hand.

RRFB apologizes for any errors or omissions, if there is a need for corrections, please email info@reefrenewalbonaire.org.

Reef Builders (\$1000+)

- Andrew and Diedre Agustin
- Anonymous (2)
- Aquanautics LLC
- Barrett and Peggy Walker
- Blue Water Divers 2021
- Brandi and Trampas Allen
- Colleen Kelly
- Connie Stiklestad
- Craig Beaton and Toad Abinante
- Drs. Marjorie A. Hoy and James B. Hoy
- Eels on Wheels
- Felsten Fishman Family Foundation
- Jeff Levinton and Joan Miyazaki
- Jess Early and the Bender Family
- Judith Lewis
- Kevin Alvarado
- Kids Sea Camp
- Lester Knutsen
- MB Bedrijfskunding Marketings Advies Leerdam
- Megan and John Seiler
- Mike and Anner Davis
- Patricia Roman
- Rob Unruh
- Robert Struijk
- Sara and David Trockman
- Thayer/McGivern Family
- The John Akin and Mary Stevens Charitable Fund
- The Kandrac Family
- The Novis Family
- Thomas Peyton
- Victor P.M. van der Hulst

Coral Outplanters (\$500-999)

- Alain de Brouwer
- Allyson Marquering – Peterson
- Anonymous (5)
- Bouwzorg Fryslân
- Brave Water Foundation
- Breezeway Bubbles Scuba
- Brian and Heather Healy
- Caley Satterfield
- Carla Laidlaw
- Cindy Hewitt and Fritz Hayes
- David Minge
- Delco and Friends
- Dolph Heck
- Family Katz
- Family Slooff
- Garrick and Margaret Cataldo
- In honor of Steven L. Barker
- Indian Valley Scuba
- Joseph Sanfilippo
- Justin Castagnacci
- Mahoney Family
- Marika Sjödin
- Martin van der Straaten
- Meagan Mitchell
- Milena Opacic
- Nancy and Tim Brandon
- Rex King
- The Coral Project
- The Dubachs
- The Illinois Institute of Diving
- The Jackson Family
- The Jones Family
- The Kirchiro Stone-Stillwell Family
- The Yurek Family

Nursery Tree Fillers (\$100-499)

- Aaron Craft
- Alan Scott
- Alex Winch
- Anonymous (9)
- Bobbie Howard
- Brian McGrath
- Cathleen and David Whillock
- Christopher Taylor
- Dr. Edward Moss
- Drew Knight
- Elias Thayer
- Elisabeth Frank
- Eric Taxer
- Ernest Pellegrino II
- Eve Bohlin
- Frank Ernst
- Gale Berkowitz
- Gerard van der Made
- In memory of Peter Deshotels
- Isaac Winter
- Jack Edelstein
- Jackie Christerson
- Jacquelyn Gill
- Jane Cleland
- Jason Wallace
- Jim John Marks
- Joe Hansen
- John Adamson
- John Easterwood
- Karen Banta
- Lee Ann Hires
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- Lydia and Sam Stoler
- Margaret Cataldo
- Mary Boyer
- Matt Scheuer
- Michael Haremski
- Mike and Kathi Feibus
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- Nicholas and Susan Tang and Family
- Nicholas Johnson
- Pat Coffey
- Richard and Kathryn Osten
- Robert Scott Harrington
- Robert Solomon
- Ruth Winters
- Sarah Porter and Jonathan Grund
- Tim and Linda Taylor
- Valerie Lynch
- Wiebe Barkey

Fragment Makers (\$50-99)

- Allison Josephson
- Amber Reed
- Anonymous (13)
- Brianna Martin
- Carolyn Zinko
- Christophe Langlois
- Colleen Murphy
- Connie Schulte
- Constance Stirling-Engman
- Daniel Scheel
- Danielle Zacher
- DarlenePeni Gensler
- Evelien Bohte
- Hans Mitsch
- In honor of Cherne
- Ione Perhay
- Jared Cosper
- Jeffrey Berschling
- Jen Orkfritz
- Jenny Berschling
- Joshua Dorchak
- Julie Moylan
- Karen Laudon
- Laura Moyer
- Lisa Monge
- Margo Ganon
- Mihai-Andrei Gurau
- Patrick Edrington
- Ria Heitkönig
- Richard Lowery
- Simon Blower
- Steffi Koch
- Susannah Turner
- Suzan van de Kerk
- Thomas Makowski
- Thorsten Albrecht
- Vicky Weisz and Alan Tomkins

8.1 Partners

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Special Thanks and Credits

Our success would not be possible without our dedicated supporters near and far. On that note, RRFB wants to thank our committed team of volunteers for giving their time and effort 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 the RRFB team and its volunteers with tanks, staff, and boat rides every year, allowing for countless hours to be spent underwater restoring reefs.

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