



CORAL  
RESTORATION  
FOUNDATION™

2021  
ANNUAL  
REPORT

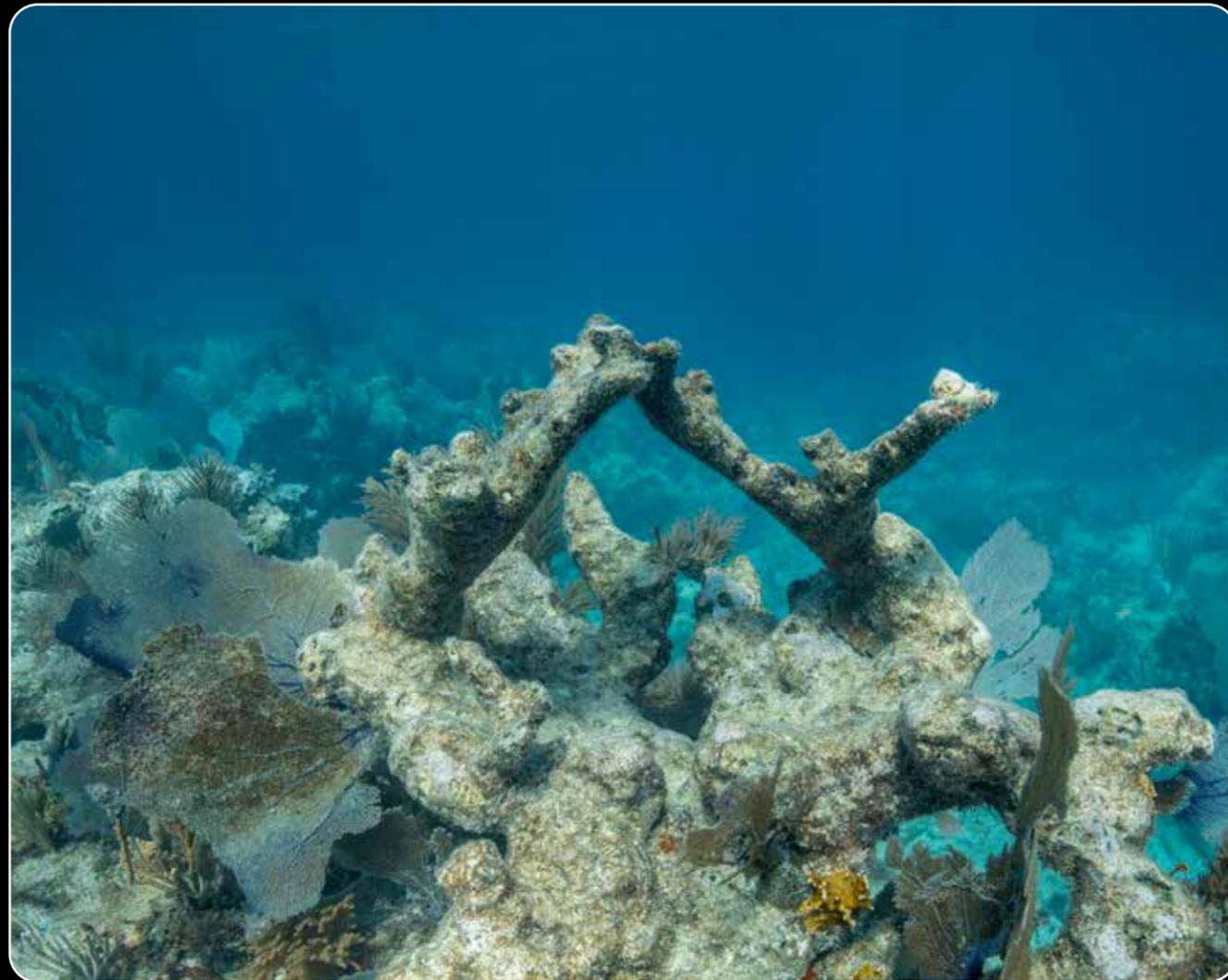
COMMUNITY

**We have lost more than 50% of the world's coral reefs in the last 30 years alone.**

**On Florida's Coral Reef, coral cover is down to just two percent in most places.**

**Without action, we could lose all shallow-water coral reefs by 2100.**

*Algae-covered skeletons are all that remain of the fields of elkhorn corals that once dominated this seascape (AN)*



*Healthy elkhorn corals used to blanket the sea floor off Florida's coast. CRF™ is working to bring them back (AN)*



**We are actively restoring coral reefs on a massive scale.**

**We are helping to further coral reef restoration science around the world.**

**We are engaging the public in the mission and inspiring change.**

**CORAL RESTORATION FOUNDATION™**

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Coral reefs attract and support myriad species. Here, silversides school around some young elkhorn outplants (AN)

# COMMUNITY

**Life on Earth is comprised of interconnected communities of species. These communities all rely on a unifying foundation that holds the collective together. For coral reef ecosystems, some of the most diverse biological communities on the planet, stony corals constitute this foundation, providing habitats for myriad other species.**

The coral reefs we are working to restore are fundamental to the way of life for everyone in the Florida Keys, and so a sense of community pervades every aspect of our work at Coral Restoration Foundation™.

By returning populations of genetically diverse, stony corals to the wild, we are safeguarding a critical fishery, the local tourism industry, and maintaining a vital natural barrier that protects our infrastructure during storm events.

As our programs evolve, we are also providing tools, solutions, and resources for national and international communities of expertise. And, as we take our reef restoration work to scale, we can see the beginning of a “restoration economy” that will provide sustainable employment opportunities for local people.

This work is about so much more than saving an ecosystem; it is about saving countless species, including our own.

Images thanks to: Alexander Neufeld (AN), Madalen Howard (MH), Ginger Monteleone, and Jack Fishman/Project Aware

## RESTORATION page 8

We are actively restoring coral reefs on a large scale. Our innovative methods are cost-effective and scalable.

## SCIENCE page 24

Our approach is guided by rigorous scientific research into coral reproduction, growth, and survivorship.

## EDUCATION page 46

We work with schools, the public, and other NGOs to generate engagement around marine conservation.

## FINANCIALS page 64

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# 2021

## February

### NEW GENE BANK

We complete the build of our second genetic ark with NSU

## April

### AFTER SCHOOL CLUB

We launch our first virtual After School Program

## May

### BOY SCOUTS SUMMER

First event at SeaBase with the Boy Scouts of America

## June

### CORALPALOOZA™

Our World Oceans Day event held online and in-person

## July

### \$2 MILLION GRANT

UWCK grants CRF™ nearly \$2M to continue work at Carysfort

## July

### CORAL REGISTRY

We launch the collaborative Coral Sample Registry

## September

### GIRL SCOUT BADGES

We launch our new badge program at Girl Fest

## October

### MOSAIC FOR NASA

We finish mapping Aquarius by photomosaic

## December

### REEF FUTURES VIRTUAL

CRF™ presents the CRC Symposium online

*A massive star coral provides refuge for a grunt. Corals of this size are now uncommon in Florida (AN)*

## FROM OUR CEO

**Over the last few years, Coral Restoration Foundation™ has experienced incredible success. But, as our programs have gone from strength to strength, the most rewarding aspect of this growth is the way in which our organization is increasingly able to support a much wider community.**

When we developed the Coral Tree™ in 2010, our goal was to share this simple technology freely with the wider world. We had the same intention when we published our restoration and monitoring techniques on our website, as freely available white papers that are continually updated as we improve our methods. But it was in 2021 that we were finally able to provide truly game-changing assistance to the coral reef research and restoration community.

With the launch of the Coral Sample Registry, we can offer a solution to some of the fundamental data-sharing issues that have hampered international coral research and restoration efforts until now. And, this year, as we make progress towards the development of artificial intelligence solutions for photomosaic stitching and analysis, we can envision a near-term future where this tool will radically accelerate coral reef monitoring efforts for practitioners, managers, and researchers around the world. The sophistication of our photomosaic program is even supporting NASA as they train astronauts for lunar exploration in the coming years.

Our expertise now provides critical leadership for *Mission: Iconic Reefs Working Groups*, helping drive this unprecedented effort towards success. And our infrastructure continues to serve as a resource for researchers studying coral reef ecology, thermal tolerance, restoration techniques, coral spawning, and much more. We were able to help the Coral Restoration Consortium to bring the Reef Futures symposium online in response to a resurgence of the coronavirus pandemic, giving an international audience of around 1,000 participants free access to the platform that we use to host Coralpalooza™ Digital.

This kind of community support has always been the driver of our ambitions at Coral Restoration Foundation™. Because we know that the reefs we are restoring lie at the heart of our local community here in the Keys.

And so, as we work towards bringing this ecosystem back to life, we are also working towards furthering the field of reef restoration around the world *and* preserving the way of life for the people that live here alongside us.

**R. Scott Winters**  
Chief Executive Officer

## BOARD OF DIRECTORS

### **R. Scott Winters, CEO**

Coral Restoration Foundation™

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Retired Sr. Vice President and Sr. Corp Counsel Xerox Corp

### **Patti Kirk Gross, Vice Chairman**

PADI Dive Instructor

### **David Wing, Treasurer**

Retired Chief Accounting Officer United Airlines

### **James Boilini, Director**

Owner Boilini Eye Care and Doc's Diner

### **Stephen Frink, Director**

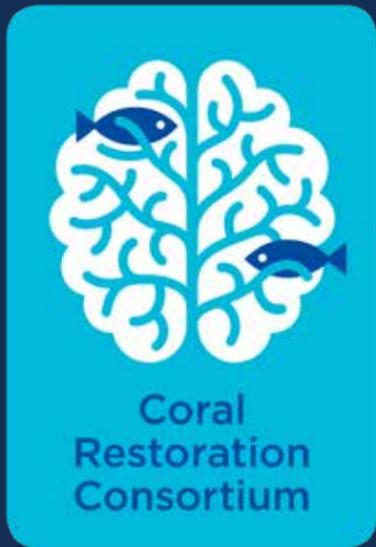
Stephen Frink Photographic; Publisher *Alert Diver*

### **Charles Lynch Jr., Director**

Principal & Advisor, Bernstein Private Wealth Management

### **Sascha Simon, Director**

Founder, President, and Chief Science Officer Sfara



To address the urgent crisis facing our coral reefs, it is imperative that we work together, simultaneously, at multiple scales.

To accomplish this, CRF™ co-founded the the Coral Restoration Consortium in 2017.

The Coral Restoration Consortium (CRC) is a community of scientists, managers, coral restoration practitioners, and educators dedicated to enabling coral reef ecosystems to survive the 21st century and beyond.

The CRC serves as a coordinating body that disseminates best practices, identifies and addresses key research gaps, fosters collaboration and technology transfer among participants, and facilitates scientific and practical ingenuity.

#### A BODY OF ACTION

The Coral Restoration Consortium is driven by action and results. We believe that through innovation, open access to data and education, and a collaborative, coordinated approach, we can provide goal setting and supporting resources to restore coral reefs in an ecologically meaningful manner to help ensure their sustainability for future generations.

In December 2021, Coral Restoration Foundation™ presented Reef Futures Virtual 2021 for the CRC, hosting the symposium online for the first time.

The CRC currently has over 1,800 members around the world, all working towards the goal of ensuring that coral reefs will continue to be a feature of life on Earth.

#### EXECUTIVE TEAM

**R. Scott Winters (Co-Chair)**  
Coral Restoration Foundation™

**Tom Moore (Co-Chair)**  
NOAA Restoration Center

**Tali Vardi (Executive Coordinator)**  
ECS for NOAA Fisheries Office of Science and Technology

**Michelle Loewe (Coordinator)**  
ERT for NOAA Restoration Center

**Jessica Levy (Coordinator)**  
Coral Restoration Foundation™

**Petra MacGowan**  
Reef Resilience Network

**Ian McLeod**  
James Cook University

#### WORKING GROUP CHAIRS

**Restoration Genetics**  
**Iliana Baums**  
Penn State University

**Larval Propagation**  
**Valerie Chamberland**  
SECORE International

**Field-based Propagation**  
**David Suggett**  
University of Technology-Sydney

**Management**  
**Liz Shaver**  
Reef Resilience Network

**Restoration Monitoring**  
**Shay Viehman**  
NOAA NCCOS

**Land-based Propagation**  
**Chelsea Wolke**  
Hawaii Division of Aquatic Resources



#### STEERING COMMITTEE

**David Gulko**  
Hawaii Department of Aquatic Resources

**Ilsa Kuffner**  
U.S. Geological Survey

**Les Kaufman**  
Boston University

**Phanor Montoya-Maya**  
Corales de Paz

**Joe Pollock**  
The Nature Conservancy

**Sandrine Pivard**  
UN Environment – Caribbean Environment Programme

**Buki Rinkevich**  
National Institute of Oceanography

**Anastazia Banaszak**  
The National Autonomous University of Mexico

#### REGIONAL GROUP CHAIRS

**Australia**  
**Nathan Cook**  
Reef Ecologic

**Latin America**  
**Samuel Suleiman**  
Sociedad Ambiente Marina

**Eastern Tropical Pacific**  
**Tatiana Villalobos**  
Raising Coral Costa Rica



#### REEF FUTURES VIRTUAL 2021

In 2021, CRF™ hosted Reef Futures Virtual, bringing the conference online in response to a resurgence of the coronavirus pandemic.

More than 1,060 people from nearly 100 countries registered for the event. Over two days, three auditoriums went “live” at times suitable for three different time zones, giving everyone around the world the most engaging experience possible. Presenters were online during their presentations for questions, connecting with the international audience in a previously unimaginable way.

#### REEF FUTURES 2022

Reef Futures will be held in-person once again in 2022. The symposium will bring together coral restoration practitioners, researchers, students, and resource managers from around the world to share the latest techniques, technologies, and science to dramatically scale-up the impact and reach of coral reef restoration. The first Reef Futures symposium, held in 2018, brought together over 450 participants from more than 40 countries.



# REBUILDING HABITATS

We manage one of the biggest coral restoration efforts in the world, taking an ecosystem-wide approach and restoring both abundance and genetic diversity to Florida's reefs.

- We grow and return **genetically diverse, critically endangered** corals to restore reef sites to a healthy state.
- Our **program partners** include government agencies, non-profits, academic institutions, and private enterprises.
- Our outplanted corals are **spawning**, kick-starting the reefs' natural processes of recovery.
- We are a **resource for other organizations** around the world seeking to implement reef restoration programs.



*Staghorn coral outplants thriving in the wild at North Dry Rocks (AN)*

# RAISING CORAL

## CORAL PROPAGATION

To grow large numbers of corals, we take advantage of the way in which corals naturally reproduce asexually through fragmentation. When a coral breaks, the separate pieces will grow into new, genetically identical colonies.

More than a decade ago, we took clippings from wild coral colonies to begin propagating them. Today, our nurseries are self-sustaining.

## THE WORLD-FAMOUS CORAL TREES™

After years of R&D, the Coral Tree™ was born at CRF™. This simple, cost-effective technology is now used by groups around the world.

Coral Trees™ are tethered to the ocean floor and buoyed with a subsurface float. They are suspended in the water column and move freely with wave surges and currents. This helps prevent damage to the tree structures and corals by absorbing the wave energy.

Coral fragments are hung from the branches of the trees using monofilament line. Suspended in the sunlit and nutrient-rich water column, Acroporid fragments grow into “reef ready” colonies in just six to nine months.

We clean the trees regularly so that the corals do not have to compete with any other organisms for space or food.



**Our in-situ (ocean-based) coral nurseries are the largest in the world**

Our Tavernier Coral Tree™ Nursery covers  
**1.5 acres** of sea floor, and contains  
**500+** Coral Trees™

CRF™ has multiple Coral Tree™ Nurseries with a total of  
**740+** Coral Trees™

We can produce  
**45,000+** reef-ready corals every year

*LEFT: The CRF™ Tavernier Coral Tree™ Nursery has become a habitat in its own right, home to more species than can be found in the surrounding habitats (AN)*

*BELOW: CRF™ has worked to develop different Coral Tree™ structures to accommodate the needs of different species (AN)*

## CORAL TREE™ INNOVATIONS

Over the years, we have adapted our Coral Tree™ design to accommodate the specific morphological needs of different coral species.

Boulder corals and pillar corals are raised on Coral Trees™ with upward facing trays. Boulder corals are held in place with “plugs”, while pillar corals sit on the trees’ trays on larger “heads”.

Positioning the corals in a stable, horizontal orientation allows them to grow upwards towards the sunlight from a secure base, as they do on the reef.



Restoring a coral reef ecosystem effectively means returning genetic diversity to the wild

Our nurseries are home to **1,305** different genotypes across **20** coral species

EXPANDING THE COMMUNITY OF CORAL NURSERIES

Healthy reefs rely on a diversity of species as well as genetic diversity within each species. Diversity creates resilience and reduces inbreeding and mutations.

Our nurseries have become a vital repository of genetic diversity for corals whose populations are in a spiral of decline - our genetic ark comprises the world's largest living genetic "bank" of corals. Some of these genotypes have now been lost in the wild and can only be found in our nurseries.

In 2021, we teamed up with Nova Southeastern University (NSU) to establish a second in-situ genetic bank in Broward County. We installed 19 Coral Trees™, alongside the current NSU offshore nursery, which are now home to 180 unique genotypes of staghorn and elkhorn coral.

This nursery constitutes a second genetic ark for staghorn and elkhorn coral, a vital redundancy in an area prone to hurricanes. If the CRF™ Tavernier Coral Tree Nursery were impacted by a major storm, these coral genotypes would be preserved.

This new nursery also allows CRF™ to support expanding restoration efforts, as well as the local restoration community; these corals will contribute to the restoration of local reefs in Broward County, and the nursery itself now provides NSU researchers and students with increasing opportunities for field studies and learning experiences.

The CRF™ Tavernier Coral Tree™ Nursery is the largest in-situ coral nursery in the world (AN)



CORALS IN OUR NURSERIES



ACROPORIDS

The majority of our nursery stock consists of the branching corals *Acropora cervicornis* and *Acropora palmata*.

These were once the dominant reef-building species in the Caribbean. Their populations have declined by around 98% in the last 40 years. Both are listed as "Threatened" under the U.S. Endangered Species Act, and as "Critically Endangered" on the IUCN Red List of Endangered Species, one step away from "Extinct in the Wild".



BOULDER CORALS

In 2021, we continued scaling up our propagation and restoration program for two species of bouldering star corals: *Orbicella annularis* and *Orbicella faveolata*.

Bouldering species like star corals are important reef stabilizers. Within the past 20 years, *Orbicella annularis* has seen a greater than 50% decrease in its population and is now listed as "Endangered" on the IUCN Red List.



PILLAR CORALS

We are one of a handful of organizations that cares for living colonies of pillar coral, *Dendrogyra cylindrus*.

We currently care for 20 pillar coral genotypes in the Tavernier Nursery. This species is now functionally extinct in the wild in Florida.

In 2021, we proved that our pillar coral propagation techniques are capable of supporting a large-scale restoration program for this species.



OTHER SPECIES

As a result of ongoing relocation work with Florida Keys Electric Cooperative, in 2021 we welcomed more species into our nursery systems. We now care for colonies of: *Montastrea cavernosa*, *Occulina diffusa*, *Porites astreoides*, *Porites porites*, *Siderastrea siderea*, *Siderastrea radians*, *Millepora complanata*, *Dichocoenia stokesii*, *Favia fragum*, *Manicinia areolata*, *Pseudodiploria strigosa*, *Solenastrea bournoni*, *Solenastrea hyades*, *Isophyllia sinuosa*, and *Colpophyllia natans*.

# RESTORING REEFS

After corals in our nurseries have reached a “reef ready” size, they are moved from the Coral Trees™ and taken to a carefully selected site.

We keep a record of which genotypes have been rehomed on each site.

We are continuously developing new outplanting methods for different species, while also working to restore ecosystem functionality more quickly.

Since 2007, we have returned **174,264** corals to the reefs of the Florida Keys, restoring an area of over **25,000m<sup>2</sup>**

## ACROPORID OUTPLANTING

Our method for outplanting Acroporid corals involves first clearing the substrate of algae with the back of a masonry hammer.

Corals are then fixed to the substrate with a two-part marine epoxy. Staghorn corals are affixed with three points of attachment. Elkhorn corals are secured with one large point of attachment. Divers waft water over the fragments to ensure that they are securely attached.

## BOULDER CORAL DOMES

To quickly return bouldering corals to the reef, we use custom cast dome structures. The dome structures are made of a cement mix developed for use in artificial reef structures, and contain attachment slots for coral plugs.

The domes are 6” or 11” in diameter and can hold 35 or 75 individual boulder coral plugs. The corals grow over their plugs, fusing together and colonizing the dome with living tissue.



A one-year old cohort of elkhorn outplants begins to blanket the substrate at Pickles Reef (AN)

## MAXIMIZING COVERAGE

Acroporid corals are known for blanketing the seafloor in huge swaths of 100-percent coverage. To restore these natural blanketing formations, we rehome corals on the reef by arranging them in “cohorts” of 50 to 70 coral fragments with each fragment placed around 30 centimeters from its neighbor.

In this way, each cohort is capable of growing to provide 100% coral coverage over an area of up to 10 square meters. We outplant dozens of genetically diverse cohorts next to each other to cover huge expanses of reef.

This process maximizes our “coverage per coral”, giving each young colony plenty of time to increase its own individual footprint before becoming part of a fused thicket.

With this method, after one year on the reef we see minimal fusion of individuals. This means that each coral is covering much more area on its own, before its coverage potential is capped by fusing with a neighboring colony and ceasing to grow in that direction.

We developed this outplanting strategy at the end of 2019 and in early 2020. In 2021 we have begun to see dramatic increases in area coverage in a relatively short time.

In 2021 we returned **35,011** corals to the wild:

**22,185**  
Staghorn corals

**7,922**  
Elkhorn corals

**4,904**  
Boulder corals

## NORTH DRY ROCKS: THE LITTLE REEF THAT COULD

Since Coral Restoration Foundation™ began returning corals to North Dry Rocks in 2014, we have rehomed nearly 10,000 staghorn, elkhorn, and bouldering corals on this small Key Largo reef. Many of the corals from our earliest restoration efforts continue to grow – and even spawn – on the reef today. Even though the site is relatively small, continued, consistent, and concentrated outplanting events have made North Dry Rocks one of our most successful restoration sites. This little reef is a testament to the potential that large-scale coral restoration has to bring degraded reefs back to life.

In the time that CRF™ has been active at North Dry Rocks, the reef has been the site of several focused waves of Acroporid restoration efforts. In 2014, we outplanted some of our first elkhorn corals with Drs. Margaret Miller and Dana Williams as part of an effort to compare growth rates and survivorship of different genotypes. Today, these elkhorn corals average 68 centimeters in diameter, with 15 individuals from this wave larger than one meter across. To our knowledge, these corals constitute the largest outplanted elkhorn corals in the Florida Keys. In March 2018, Coral Restoration Foundation™ rehomed over 1,000 elkhorn corals to a reef spur on the northern end of North Dry Rocks. After just three years, the average colony has grown from 11 centimeters in diameter to now nearly 50 centimeters in diameter and elkhorn coral coverage on the spur has gone from 0% to 9%. Then, in 2019, we returned

over 1,500 staghorn corals to the backside of the reef. In 2021, just two years after being introduced to the wild, these corals spawned, and, in just the last year alone, coral coverage has increased by 26%.

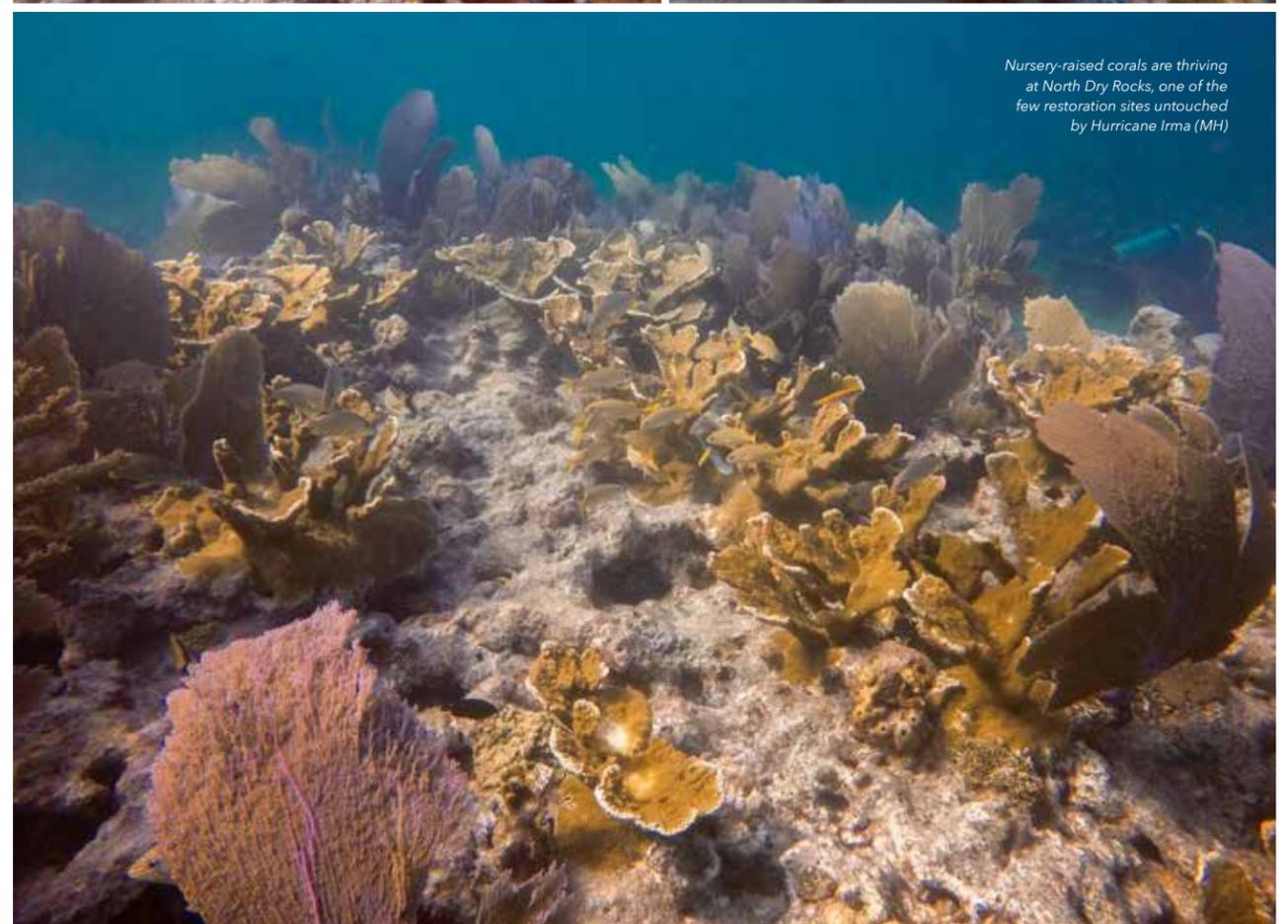
When Hurricane Irma made landfall on Cudjoe Key in

2017, many of the reefs in the Florida Keys suffered devastating losses of coral cover. However, for reasons that are still somewhat unknown, North Dry Rocks escaped relatively unscathed. Both elkhorn and staghorn outplants from 2014 and 2015 survived the storm and have continued growing well ever since. North Dry Rocks has the largest population of extant pre-Irma outplants, and so is one of only a handful of sites with nursery-raised corals from nearly every year since 2014. The relative success of North Dry Rocks following the storm prompted CRF™ to expand our efforts at this site in 2018 and 2019.

Aside from what our eyes tell us every time we visit North Dry Rocks, CRF™ can quantify the results of our restoration efforts through our photomosaic program. In fact, North Dry Rocks was the site of our first reef-scale photomosaic, which was captured and stitched in 2021. The mosaic covers nearly all of the site's 15,000 square meters and constitutes the first of what will soon be many reef-scale photomosaics that we will create in the coming years, as part of an effort to expand our restoration monitoring and assess our impact over longer timeframes.

Our work at North Dry Rocks shows us that coral restoration has the potential to help us return coral populations on Florida's Coral Reef to historic levels, even in the face of ongoing degradation. But it is important to remember that these are fragile ecosystems still facing extraordinary threats. Our success at North Dry Rocks is an example of the potential of reef restoration rather than its certainty. Unless we work to reduce our carbon emissions and remove local stressors and impacts, coral restoration efforts will not be successful in the long term. But we do know that by outplanting huge numbers of diverse corals across sites spanning multiple ecological habitats we can give ourselves a fighting chance at more North Dry Rocks success stories on Florida's Coral Reef.

“ This little reef is a testament to the potential that large-scale coral restoration has to bring degraded reefs back to life.



Nursery-raised corals are thriving at North Dry Rocks, one of the few restoration sites untouched by Hurricane Irma (MH)

WORKING  
TOGETHER  
FOR IMPACT  
AT SCALE  
THROUGH  
MISSION:  
ICONIC  
REEFS

In 2018, Coral Restoration Foundation™ provided a basis for the most ambitious reef restoration plan in the world, *Mission: Iconic Reefs*. This is an unprecedented, multi-agency effort with the goal of restoring seven iconic reefs throughout the Florida Keys to near-historic coral cover. These sites will become refugia of biodiversity that will help to seed the rest of Florida's Coral Reef with life.

*Mission: Iconic Reefs* unites the work of NOAA, CRF™, MOTE, the Florida Keys National Marine Sanctuary, TNC, University of Miami, DEP, the Florida Aquarium, Reef Renewal, FWC, and University of Florida under one collective phased plan to restore corals and lost herbivores to Florida's Coral Reef.

This is the world's largest and most holistic coral restoration plan and has been partly modeled on Coral Restoration Foundation™ successes of the past few years, building on our restoration strategy and efforts to date across the target sites. The two decades-long project has an estimated budget of \$97 million.

For the next several decades, most of our restoration work will be focused on the seven iconic reefs of the Florida Keys targeted by this plan, and carried out in collaboration with the best coral restoration practitioners and marine biologists in Florida and beyond.

“ *Most of our restoration work will be carried out in collaboration with the best coral restoration practitioners and marine biologists in Florida and beyond.* ”

FAR RIGHT: Carysfort Reef is one of the Florida Keys National Marine Sanctuary's iconic reef sites and a focal point of the *Mission: Iconic Reefs* plan (AN)

RIGHT: Recreational Dive programs give everyone the opportunity to contribute to the restoration of these seven iconic reefs (AN)



## CARYSFORT CONTINUES WITH A NEW \$2M GRANT FROM UWCK

In July 2021, Coral Restoration Foundation™ was awarded a grant of just under \$2 million by United Way of Collier and the Keys (UWCK) to expand our work at Carysfort Reef over the next five years. But this work is about much more than just reef restoration – it's about building socio-economic resiliency in our communities that rely on coral reefs.

This competitive grant is part of UWCK's "Revitalizing the Florida Keys through Reef Restoration and Beyond" initiative, with support from the United Arab Emirates. UWCK's goal is to revitalize the coral reefs - a lifeblood of the Florida Keys economy - while supporting sustainability through education. In line with these priorities, our work under this grant will prioritize on-the-reef restoration progress towards *Mission:*

*“This work is about much more than just reef restoration. It's about building socio-economic resiliency in our communities that rely on coral reefs.”*

*Iconic Reefs*, financial impacts to Monroe County families living paycheck to paycheck, volunteerism, and engagement with students studying marine science.

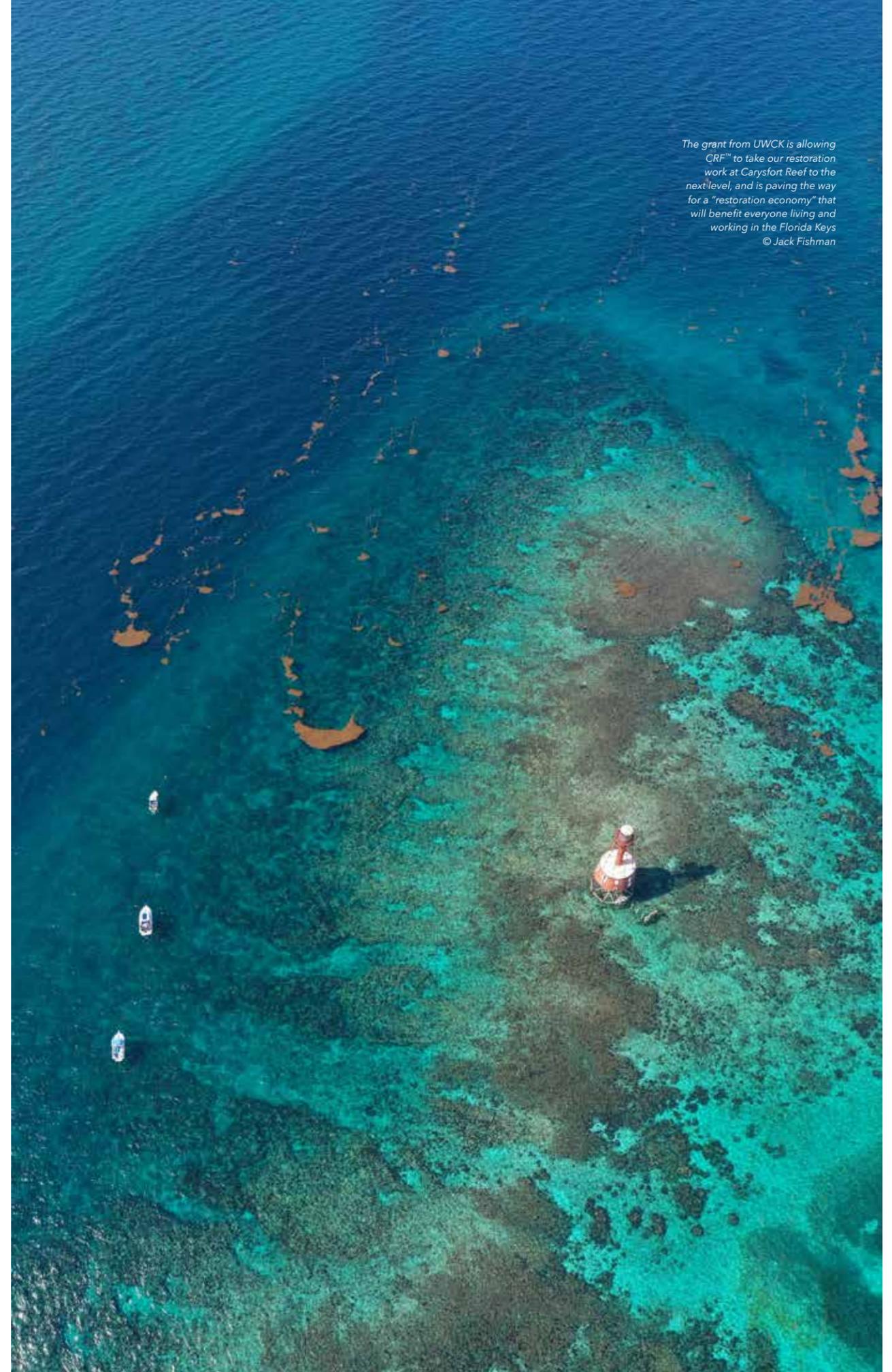
This funding was the first significant investment in restoration work on sites covered by the *Mission:*

*Iconic Reefs* plan. Coral Restoration Foundation™ will secure a one-to-one match of the awarded funds, culminating in almost \$4 million for our efforts at this iconic reef site.

Carysfort Reef, the first coral reef to grace the cover of National Geographic Magazine, is one of the most famous coral reefs in the world. But, in the last 40 years, Carysfort has experienced massive ecosystem degradation, along with the rest of Florida's Coral Reef. In 2015, Coral Restoration Foundation™ entered a five-year partnership with Ocean Reef Club® to re-populate the reef with 30,000 corals and bring this ecosystem back to life. But by 2020, we had rehomed more than 34,000 corals at Carysfort. This new investment by UWCK and the UAE is a testament to our achievements of the last few years, especially the success of this work at Carysfort Reef.

Work on coral restoration at this scale now has the capacity to improve livelihoods and diversify the local economy. Carysfort Reef is becoming much more than iconic reef site – its recovery will be a catalyst for creating sustainable community resilience in the Florida Keys.

The grant from UWCK is allowing CRF™ to take our restoration work at Carysfort Reef to the next level, and is paving the way for a "restoration economy" that will benefit everyone living and working in the Florida Keys  
© Jack Fishman



# 2021 RESTORATION PARTNERS

## CARIBEE BOAT SALES & MARINA

Invaluable support for our infrastructure has been provided by the team at Caribee. They helped facilitate the purchase of new engines in 2019, and regularly provide routine maintenance for our working vessels, free of charge.

## THE COLLEGE OF THE FLORIDA KEYS (CFK)

CFK enables three interns to assist with our Key West nursery and restoration operations, which include guiding divers, outreach events, and monitoring efforts.

## CORAL RESTORATION CONSORTIUM (CRC)

Through our leadership role in the CRC, we have been helping to facilitate information exchanges and build on the opportunities presented by this community of collaboration.

## FLORIDA KEYS ELECTRIC COOPERATIVE (FKEC)

Corals we relocate from FKEC structures are contributing to diversity in our restoration programs.

## THE FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION & THE FLORIDA KEYS NATIONAL MARINE SANCTUARY

The Florida Fish and Wildlife Conservation Commission and the Florida Keys National Marine Sanctuary provide the permits that make our work possible.

## FLORIDA KEYS NATIONAL MARINE SANCTUARY FOUNDATION

The Foundation administers a collaborative grant that supports our restoration work and expansion at Eastern Dry Rocks.

## MISSION: ICONIC REEFS

As we work towards the *Mission: Iconic Reefs* plan we will be collaborating with NOAA, The Nature Conservancy, SECORE, University of Florida, University of Miami, Nova Southeastern University, and Mote Marine Laboratory, among others.

## NATIONAL FISH AND WILDLIFE FOUNDATION

NFWF supports our restoration work at four reef sites as well as the development of our pillar coral propagation methods.

## NOAA & NOAA RESTORATION CENTER

NOAA RC has been pivotal in providing funding, guidance, advice, and input on decision-making.

## UNITED WAY OF COLLIER AND THE KEYS (UWCK)

UWCK is supporting our ongoing restoration efforts at Carysfort Reef with a grant of just under two million dollars.

## US ARMY CORPS OF ENGINEERS

The US Army Corps of Engineers provides the permits for our in-situ coral nurseries.

## CRF™ RESTORATION SITES FLORIDA KEYS



Carysfort Reef from the air is instantly recognizable, one of the most iconic reef sites in the Florida Keys, if not the world  
© Ginger Monteleone



# RESEARCH & RESOURCES

**Our science program tracks the progress of our restoration work, supports the development and use of best practices, and provides a vital knowledge base resource for restoration practitioners around the world.**

- We rigorously monitor our restoration reef sites, applying proven methodologies and the latest technology to track our impact.
- We develop publicly available techniques and generate data that can be used by other groups around the world.
- We are involved in research into the wider ecological impact of our work, collaborating with scientists around clearly defined areas of investigation.
- We provide the research and restoration communities with unique and invaluable resources including field-based infrastructure, corals, gametes, genetic data, and cutting-edge tools.
- Our data informs our strategic development, and our research provides a focal point for collaborations with government agencies including NOAA, universities, NGOs, and others.

*Acropora cervicornis sample on its way to be genetically sequenced (AN)*

# PHOTOMOSAICS

We monitor the progress of our restoration work using photomosaics.

Photomosaics are huge, composite images of reef sites created by stitching together thousands of smaller images. The high-resolution image that is produced allows us to measure increases in coral coverage with an incredible degree of accuracy.

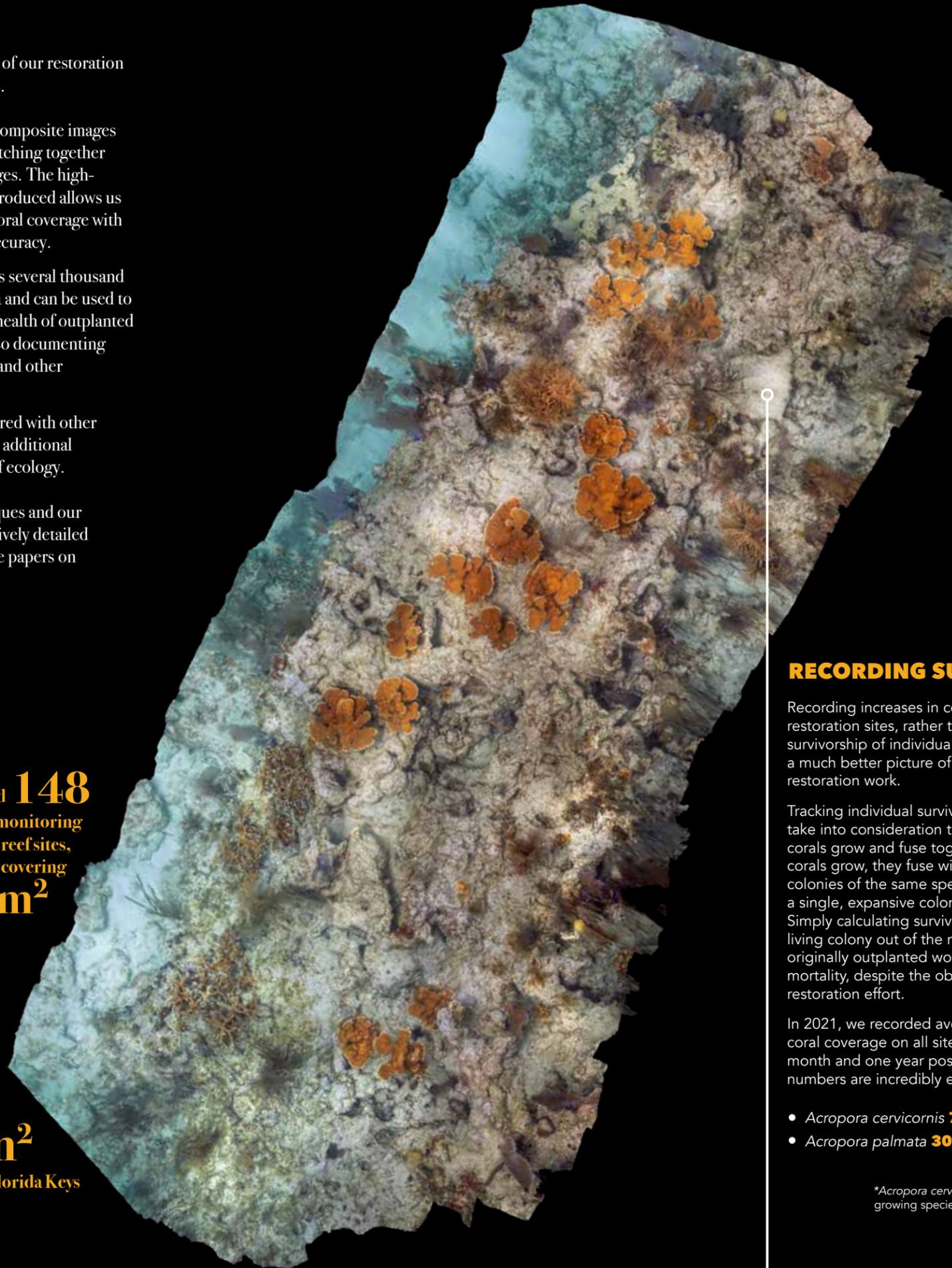
These mosaics encompass several thousand square meters of reef area and can be used to compare the growth and health of outplanted corals over time, while also documenting changes to the reefscape and other underwater habitats.

These mosaics can be shared with other groups looking to answer additional questions about coral reef ecology.

Our photomosaic techniques and our methods are comprehensively detailed in regularly updated white papers on our website.

In 2021, we generated **148** restoration site monitoring mosaics, for **12** reef sites, covering **61,000m<sup>2</sup>**

Our monitoring program shows that we have restored around **25,000m<sup>2</sup>** of reef in the Florida Keys



Section of a photomosaic of North Dry Rocks, showing both staghorn and elkhorn outplants (AN)

## RECORDING SUCCESS

Recording increases in coral coverage on restoration sites, rather than tracking the survivorship of individual corals, is giving us a much better picture of the impact of our restoration work.

Tracking individual survivorship doesn't take into consideration the way in which corals grow and fuse together. As healthy corals grow, they fuse with neighboring colonies of the same species, forming a single, expansive colony - a "thicket". Simply calculating survivorship as one living colony out of the many that were originally outplanted would imply massive mortality, despite the obvious success of the restoration effort.

In 2021, we recorded average increases in coral coverage on all sites between one month and one year post outplanting. The numbers are incredibly encouraging:

- *Acropora cervicornis* **72% increase**
- *Acropora palmata* **30% increase\***

\**Acropora cervicornis* (staghorn) is a faster growing species than *A. palmata* (elkhorn)

## ARTIFICIAL INTELLIGENCE: THE FUTURE OF PHOTOMOSAICS

Until 2021, stitching and analyzing photomosaics were painstaking processes, requiring huge amounts of computing power and hundreds of hours of work.

In 2020, we began working with a New York-based software development firm – Applied Visions, Inc. – on a cloud-based stitching solution and the development of a machine learning program to trace the mosaics and measure coral coverage and growth: *CeruleanAI*.

And we made exciting progress with *CeruleanAI* in 2021 – we can now upload image sets to the cloud, tag them with relevant information and then automatically activate a virtual machine that stitches the images into a mosaic, which can then be viewed online or downloaded.

Work will continue on *CeruleanAI* through 2022. We are now developing the artificial intelligence system that will analyze the stitched mosaics, generate metrics on coral coverage and diameter, and that will continually improve by way of a human adjudication portal; the CRF™ team will be able to "grade" the AI's analysis on a case by case basis, and augment identifications of corals from within the online system.

Additional work will focus on building an intuitive user interface, where mosaics are sorted and categorized by real-world location and where reports and site-by-site comparisons can be quickly generated from the pipeline's stitching and analysis metrics.

“ We will eventually offer the pipeline's services to external partners, supporting coral reef monitoring efforts around the world.

Once completed, we will eventually be able to offer the pipeline's services to external partners, supporting the acceleration and scaling up of coral reef monitoring efforts around the world.

# FROM THE REEFS TO THE MOON: MAPPING SEASCAPES FOR NASA

In 2021, CRF™ was approached by NASA to create a photomosaic of the FIU-managed underwater habitat, Aquarius, and the surrounding “Carpenter Basin” area. NASA uses Aquarius to train astronauts for missions to the Moon and the International Space Station. Having a detailed, three-dimensional map of the site would provide an analog for the map that astronauts will be using when they navigate the lunar surface on foot in the coming years.

To capture the mosaic, CRF™ dive teams completed eight days of diving across September and October 2021. The area ranges from 35 feet deep at the top of the Aquarius structure to 95 feet deep at the edge of the spur and groove reef formations. Typically, CRF™ photomosaics are captured in five to 15 feet of water. These deeper dives required extensive planning, the use of nitrox dive equipment, and two independent two-person teams, each equipped with a DPV, or underwater scooter.

The team captured over 60,000 images which were then stitched together over the course of two months. This generated a single mosaic for NASA and FIU that covers almost 35,000 square meters of reef, with a resolution that allows visualization of minute details on the site, down to the bolts holding the Aquarius habitat together.

This is the largest photomosaic CRF™ has ever captured, and demonstrates the ways in which we can use our techniques and expertise to support partners from extraordinarily diverse fields.

“ This demonstrates the ways in which we can use our techniques and expertise to support partners from extraordinarily diverse fields.

FAR TOP RIGHT: Science Program Manager Amelia Moura swims past the Aquarius Habitat capturing images for the photomosaic (AN)

FAR BOTTOM RIGHT: Astronauts installing a CRF™ Coral Tree™ during NEEMO 23 in 2019 © NASA

NEAR RIGHT: The CRF™ mosaic allows the Aquarius Habitat and Flask Farm to be viewed in great detail and in 3D (AN)



The photomosaic of the FIU-managed Aquarius Habitat and the surrounding Carpenter Basin allows landmarks to be viewed in extraordinary detail and in 3D. The mosaic provides an analog for maps that astronauts will be using when they explore the surface of the moon on foot (AN)

To create this photomosaic of the Aquarius Habitat & Carpenter Basin for NASA, our team captured more than **61,000** images over **8** dive days

The final photomosaic covers an area of over **34,700 m<sup>2</sup>** in one image file of more than **45 GB** with a resolution of **1.32 mm/pixel**



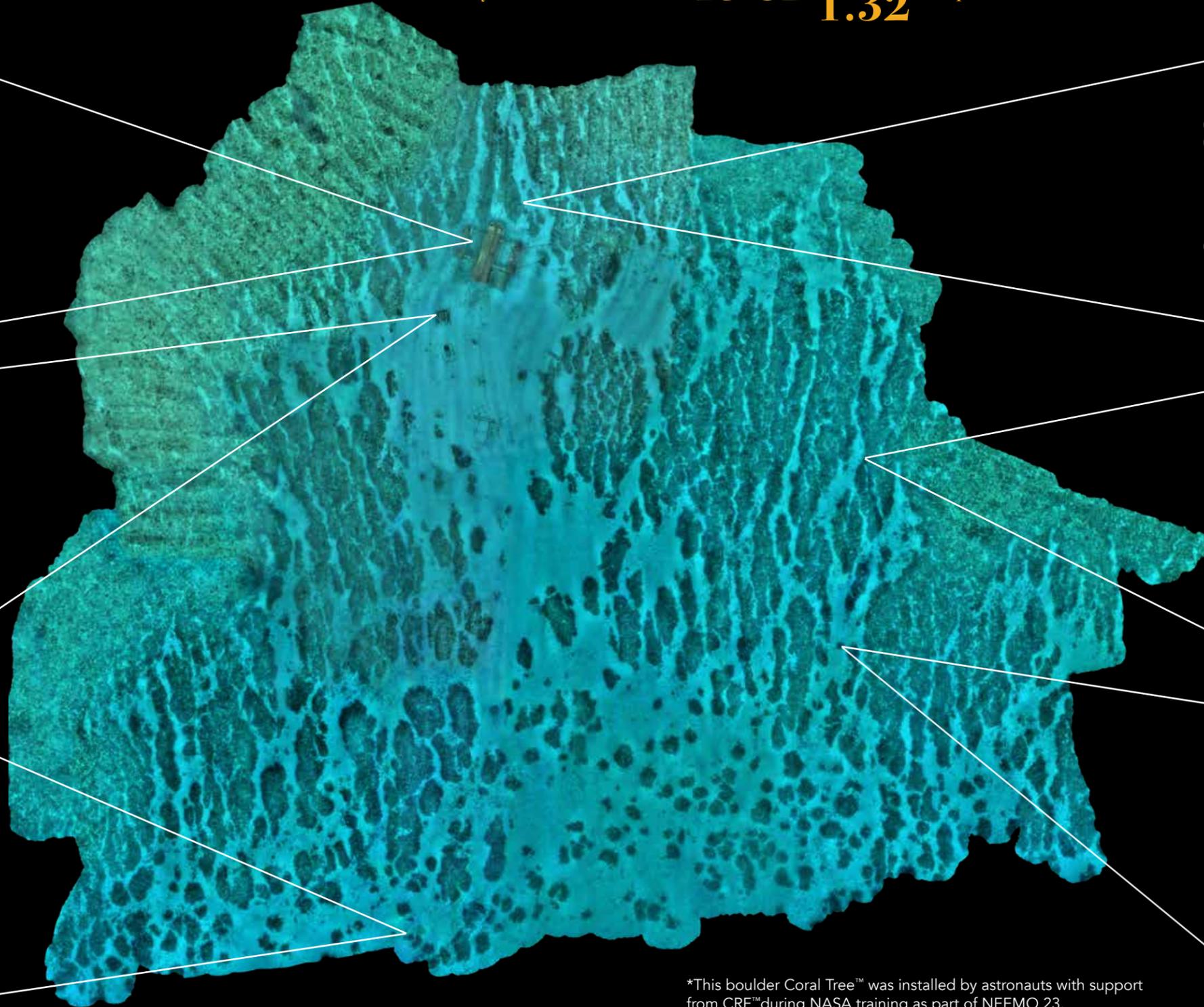
AQUARIUS HABITAT



FLASK FARM



CORAL GROWTH PLATFORM



\*BOULDER CORAL TREE™



FIFTH LEG MOORING



PAVILION BASE

\*This Boulder Coral Tree™ was installed by astronauts with support from CRF™ during NASA training as part of NEEMO 23.



“Our infrastructure, corals, and the data we have available provide a unique resource for researchers from around the world looking to study this extraordinary event.”

# CORAL SPAWNING

Every year across Florida and the Caribbean, around the late-summer full moon, Acroporid corals simultaneously release gametes in bundles of eggs and sperm into the water. This process is called spawning and it is vital for the health of wild coral populations.

Ten years ago, in a historic first, corals we had returned to the “Wellwood Site” on Molasses Reef became the world’s first outplanted corals documented to spawn. Since then, we have recorded spawning at multiple restoration sites – strong evidence that our methods are working. Upscaling restoration means ensuring that spawning corals can seed the reefs with new genetic strains and expand the geographic distributions of these critically endangered species. Spawning is an energy intensive activity and so seeing this sexual reproduction indicates that our corals are happy and healthy, both in the wild and under our care.

The broodstock corals in our nursery also spawn every year. By carefully monitoring our corals, we determine gamete maturity, which allows us to predict when spawning will occur. As a result, our infrastructure, corals, and the data we have available – including comprehensive genetic information – provide a unique resource for researchers from around the world looking to study this extraordinary event.

Corals raised from gametes collected at our facilities are living with organizations around the world, helping a whole community of researchers better understand coral sexual reproduction to improve monitoring, to enhance the impact of spawning events, and to create new coral genotypes. Coral sperm and eggs from our nurseries have also been cryopreserved, securing a future for unique genetic strains of these disappearing animals.

In 2021, the combination of a split spawning event and poor weather hampered our monitoring efforts, but the sexual recruits of spawning collaborations from past years are still thriving in our nursery and on the reefs.



## 2017

Spawning was observed in our Tavernier Coral Tree™ Nursery as well as on two restoration sites.

We also welcomed scientists from South East Zoo Alliance for Reproduction and Conservation (SEZARC), Florida Aquarium, Nova Southeastern University, Georgia Aquarium, Columbus Zoo, SeaWorld, and Mote Marine Lab, who used our corals and infrastructure to help further their research. SEZARC collected and cryopreserved gametes from a number of genotypes.



## 2018

We moved broodstock corals of several different genotypes to holding tanks at Keys Marine Lab (KML) due to bad weather. Scientists from Florida Aquarium, Georgia Aquarium, SEZARC, Mote Marine Lab, SeaWorld, Nova Southeastern University, University of Florida, and Horniman Museum and Gardens visited us in Key Largo to collect gametes from these corals.

These gametes were cross-fertilized and settled out, enabling Florida Aquarium (FLAQ) to breed over 3,000 *Acropora cervicornis* larvae comprising thousands of new genotypes.



## 2019

CRF™ divers, assisted by Georgia Aquarium, transferred broodstock corals of 12 staghorn and seven elkhorn genotypes to holding tanks at KML. Once again, gametes from our corals were cross-fertilized and cryopreserved by a research team led by the Florida Aquarium that included University of Florida/Florida Institute of Oceanography, Georgia Aquarium, College of Charleston, Nova Southeastern University, NOAA, SeaWorld, and SEZARC.

In the field, CRF™ worked with Nova to observe pillar coral spawning, collect gametes, and cross-fertilize pillar coral eggs and sperm to boost genetic diversity of this threatened species.

Over 1,500 of the new genotypes created by FLAQ from the 2018 spawning event came back to CRF™, spending time in the nursery before being rehomed on the reefs in a huge boon to the genetic diversity of Florida’s wild coral populations.



## 2020

*A. palmata* and *A. cervicornis* outplanted by CRF™ were observed spawning at North Dry Rocks. This is the first time nursery-raised *A. palmata* have been observed spawning in the wild. At just 14 months post-outplanting, these *A. cervicornis* were also the youngest nursery-raised corals observed spawning on the reef.

Spawning was also observed in the Tavernier Coral Tree™ Nursery for seven nights in a row. Gametes from these corals were collected by SEZARC, who were able to cryopreserve nine new genotypes.

CRF™ assisted NOAA and University of Miami with spawning observations for grooved brain coral, and the species was seen spawning in the ocean for the first time in Florida.

## LINKING DATA SETS: THE CORAL SAMPLE REGISTRY

In July, CRF™ launched a game-changing tool for the coral restoration community. The novel Coral Sample Registry enables the integration of coral restoration and research data sets, solving several critical issues for restoration managers, practitioners, and researchers.

In the last decade, the field of coral reef restoration has generated a huge amount of data around corals used in reef restoration and research. This information includes the sources of coral samples, their genetic information, and the performance of these different species and genotypes in research and restoration practices. While each individual data set is important, collectively they can provide far deeper insights and better guide coral restoration efforts. But, until now, these data sets have been siloed, giving managers, practitioners, and researchers limited ability to cross-mine this information.

The CRF™ Coral Sample Registry now offers a way for agencies to contribute to and access the full picture of corals being used in reef restoration and research.

“CRF™ offers a way for agencies to contribute to and access the full picture of corals being used in reef restoration and research.”

The Registry is designed to be suitable for all coral species in all geographic regions. It can be used for tracking both sexual and asexual harvests, and establishes a link between collection information for any subsequent sample and

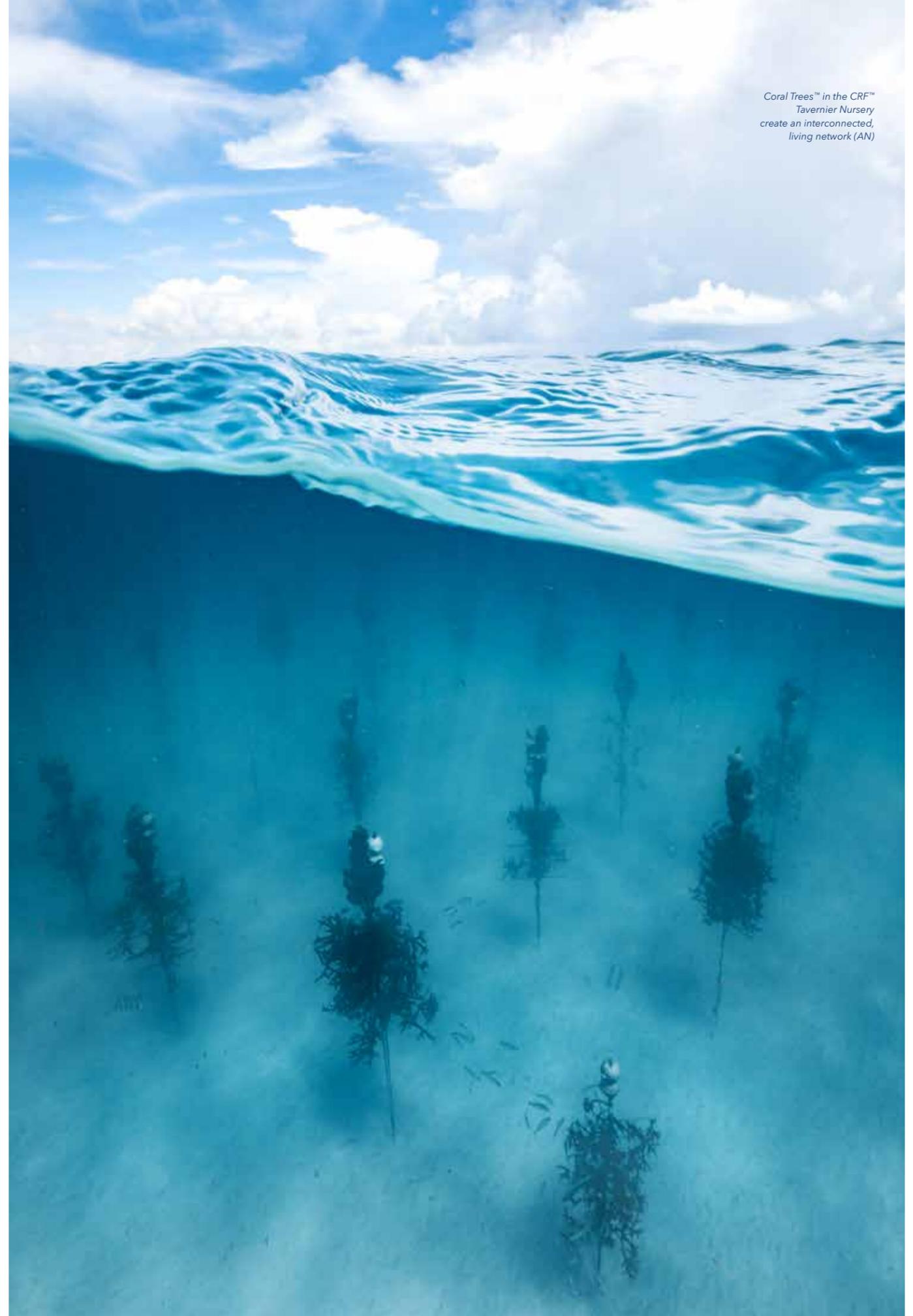
all phenotypic data collected. The Registry solves several problems: it avoids naming confusion within and between stakeholder groups and it removes the burden of sorting through reported information, making it easier to understand which groups are working with which species and genotypes.

The Coral Sample Registry assigns a unique “accession number” to each sample, corresponding to a specific collection event of coral tissue, whether for research, archiving, or restoration purposes. It essentially unlocks information related to that sample across any and all data structures that include the accession number field.

The Coral Sample Registry was developed by Coral Restoration Foundation™ in collaboration with the NOAA Coral Reef Conservation Program, the Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, SECORE International, and the NOAA National Marine Fisheries Service. A peer-reviewed paper describing the registry and its utility was published in the journal *Frontiers in Marine Science* in July 2021.

In 2022, we will continue to promote the adoption of the Registry within the global coral research and restoration community, with the goal that it will be adopted by researchers, restoration practitioners, and managers, saving all of us time and resources at this critical juncture for our planet’s coral reefs.

Coral Trees™ in the CRF™  
Tavernier Nursery  
create an interconnected,  
living network (AN)





Science Program Manager  
Amelia Moura leads our pillar  
coral propagation efforts (AN)

## SAVING UNICORNS: PRODUCING PILLAR CORALS

Known as the “unicorns” of the coral world because of their shape as well as their rarity, pillar corals were once one of the iconic species found on Florida’s Coral Reef. However, in the last 40 years pillar coral populations have steadily succumbed to human pressure, along with many other species. And, since it first emerged in 2014, the deadly Stony Coral Tissue Loss Disease (SCTLD) has now caused the local extinction of wild pillar corals in Florida. But, in 2021, we made great strides in pillar coral propagation, helping to pave the way for the restoration of this species in Florida by 2040.

In 2016 and 2017, as part of the multi-agency Pillar Coral Rescue Project, the Coral Restoration Foundation™ team collected fragments from 10 of the last remaining wild pillar coral colonies in the Florida Keys National Marine Sanctuary, bringing these young rescues into our Coral Tree™ Nursery where they have since been thriving under our expert care.

In 2019, we facilitated a pioneering transfer of pillar corals from a land-based aquarium system to an open-ocean nursery with the relocation of 81 pillar coral colonies from Mote Marine Laboratory. With the success of this move, in 2020, Florida Aquarium also moved nine more pillar corals to CRF™. And, in 2021, we successfully propagated these colonies, bringing the total number of genetically diverse pillar corals in our nursery to 238, more than doubling our captive population and providing promise for the large-scale propagation and restoration of this species.

“ CRF™ can now contribute proven, in-situ propagation techniques that can be applied by others to scale up pillar coral restoration efforts.

Pillar corals have been named a key species in the *Mission: Iconic Reefs* phased restoration plan. This plan, spearheaded by NOAA, calls for the return of over 4,000 pillar corals to the Florida Keys National Marine Sanctuary by 2040, as part of an unprecedented, collaborative ecosystem-wide restoration strategy.

CRF™ can now contribute proven, in-situ pillar coral propagation techniques that can be applied by others to scale up restoration efforts. And we are not only learning how to propagate these corals, we are also learning how best to treat them if they become infected with SCTLD and how fast they grow on different substrates. We are ready to take the information we’ve gleaned over the past two years and apply it to an active, upscaled restoration program. We can finally feel hopeful about the future of this little animal.

## TRACKING GENETIC DIVERSITY IN FLORIDA'S ELKHORN CORALS

In 2021, with support from NOAA, CRF™ funded and coordinated a massive effort to genetically sequence all of Florida's elkhorn coral population. Unlocking the full picture of the genetic variation and relatedness across all corals used in restoration efforts allows agencies to better craft plans that maximize genetic diversity in restoration.

NOAA and CRF™ arranged for the sequencing of 480 individual elkhorn coral samples from across restoration groups in Florida, using the single nucleotide polymorphism technique, or SNP. CRF™ alone supplied 105 of these samples, including some sexual recruits created from the 2017 spawning event, reared at the Florida Aquarium, and returned to the Tavernier Nursery in 2019.

Recently, CRF™ undertook a similar effort to sequence all the staghorn corals in our nursery, and with this new data, we will have successfully sequenced all the staghorn and elkhorn corals that we care for.

While CRF™ has participated in other sequencing efforts in the past, this one is different – by coordinating the effort and offering the same technique to all of our peer restoration organizations, we will be able to accurately compare the data to understand the relatedness of corals used in Florida restoration efforts and the genetic diversity that remains in this region.

These types of coordinated data gathering programs are essential as we work towards scaling up restoration efforts locally, and provide essential insights that allow us to better support and inform the world's coral restoration community.

“ These types of coordinated data gathering programs are essential as we work towards scaling up restoration efforts.

FAR RIGHT: CRF™ Restoration Associate Ellen Hudson hands coral samples up to Science Program Manager Amelia Moura (AN)

RIGHT: Science Program Manager Amelia Moura prepares coral samples for genetic sequencing (AN)



Science Program Manager  
Amelia Moura visits young  
boulder coral outplants to  
assess their health and  
growth rates (AN)

# OUR RESEARCH FOCUS



## CORAL NURSERIES

The coral propagation data we collect in our nurseries helps us increase the number of nursery-raised corals that can be successfully rehomed on the reef.



## OUTPLANTING METHODS

We are currently experimenting with new outplanting techniques that will help move the overabundance of corals we are cultivating into the wild.



## MONITORING TECHNIQUES

We are constantly looking to improve the ways we analyze nursery-raised corals and their wider impact on the ecosystem.



## RESTORATION SITES

Ongoing research at CRF™ seeks to better understand why some sites exhibit a higher survival rate for outplanted corals than others.



## GENETIC RESILIENCE

Our research tracks how different coral genotypes (and their associated microbes and symbionts) survive and grow, and how different outplanting techniques correlate with success.



## COMMUNITY STRUCTURE

By monitoring our outplanting sites, CRF™ is demonstrating how ecology impacts coral restoration; we show how other organisms and reef conditions can affect the health of rehomed corals.

# 2021 RESEARCH COLLABORATIONS

We are in the unique position of being able to provide scientists with corals from our nurseries, as well as limited field support, for experimental work that is aligned with our research priorities.

## IMPACTS OF DISEASE & BLEACHING

**Dr. Steven Vollmer**  
**Northeastern University**

Dr. Vollmer's research aims to study how CRF's staghorn genotypes react when exposed to disease. This work, combined with past sequencing work conducted by Dr. Vollmer on these same genotypes, will help to develop a better understanding of the stress faced by different coral genotypes when presented with the same disease.

**Megan Kennedy**  
**Nova Southeastern University**

Ms. Kennedy is conducting research on the presence of UV-filters in seawater and in the tissues of staghorn corals, and the potential impacts those filters have on coral fecundity. This is the first time tests for UV-filters on coral reefs will be completed in mainland USA, and the first time UV-filters have ever been used to study staghorn coral fecundity.

## GENETIC RESILIENCE

**Dr. Ross Cunning**  
**Shedd Aquarium**

Dr. Cunning is building on research performed in October 2020 by re-testing genotypes across multiple restoration program nurseries for thermal tolerance using the CBASS methodology. This rapid assessment has shown that genotypes display a wide range of tolerance to rapid and acute heat stress, and this research may now provide context for how those genotypes adjust seasonally and over the years.

**Kelsey Johnson-Sapp**  
**University of Miami**

Ms. Johnson-Sapp is also investigating the differences in thermal tolerance across genotypes, in particular how thermal tolerance changes for genotypes involved in the 2020 staghorn swap between restoration practitioners. These data, gathered using CBASS methodology, will be used to further understand if and how genotype thermal tolerance changes across genotypes that are moved between nurseries.

*Nursery-raised elkhorn corals growing incredibly well in the wild, demonstrating that restoration efforts are increasing coral cover on Florida's Coral Reef (AN)*



## CORAL NURSERIES

**Taylor Gill**

**University of Miami**

Ms. Gill is investigating how coral fragments survive and grow across various nursery programs following a large-scale coral swap between five restoration practitioners in Florida. Growth data is being collected to assess the differences in growth and performance of "local" and "foreign" genotypes in each nursery program to help understand how corals adjust when moved between nursery locations.

## ECOLOGY

**Archit Parnami and Rick Hudson**

**University of North Carolina – Charlotte**

Mr. Parnami is leading a group of students in a computer vision course to develop techniques in image processing methods and machine learning. Using a subset of mosaic imagery from Florida restoration sites, students are gaining hands-on experience applying the techniques they're learning to real-world coral restoration datasets.

## OUTPLANTING METHODS

**Joseph Henry**

**University of Miami**

Mr. Henry is studying the effect that grow-out time in a nursery has on sexually propagated corals once outplanted to the reef. Two hundred fragments created via sexual reproduction between genotypes in the Tavernier Nursery in 2017 and 2018 were outplanted to Carysfort Reef and will be monitored through time to better understand the influence that a long nursery period has on outplant success.

## OUTPLANTING METHODS & IMPACTS OF DISEASE & BLEACHING

**Dr. John Hunt**

**Florida Fish and Wildlife Conservation Commission**

This multi-agency collaborative outplanting study is designed to investigate restoration feasibility in response to Stony Coral Tissue Loss Disease. Developed by the Restoration Trials Team, this project involved outplanting three species of SCTL D-susceptible species across the entire Florida Reef Tract to determine the incidence rates of disease and assess how restoration activities impacted neighboring wild communities of SCTL D-susceptible species.



Restoration Program Manager, Dan Burdeno heads into the Tavernier Coral Tree™ Nursery to harvest corals to rehome on the reef (AN)

Our expertise and infrastructure supported

**6** studies published in peer-reviewed journals in 2021

# PUBLICATIONS

## **Journal of Marine Science and Engineering**

**January 18, 2021**

Using scuba for in situ determination of chlorophyll distributions in corals by underwater near infrared fluorescence imaging

*Thomas Oh, Jittiwat Sermsripong, Barry W. Hicks*

## **Zoo Biology**

**February 6, 2021**

Growth, calcification, and photobiology of the threatened coral *Acropora cervicornis* in natural versus artificial light

*Sebastian Slagel, Kathryn Lohr, Keri O'Neil, Joshua T. Patterson*

## **Coral Reefs**

**July 14, 2021**

Strategies for integrating sexually propagated corals into Caribbean reef restoration: experimental results and considerations

*Joseph A. Henry, Keri L. O'Neil, Aaron R. Pilnick, Joshua T. Patterson*

## **Frontiers in Marine Science**

**July 16, 2021**

Integrating coral restoration data with a novel coral sample registry

*Amelia Moura, Brian Beck, Renee Duffey, Lucas McEachron, Margaret Miller, Jennifer Moore, Alison Moulding, R. Scott Winters*

## **Restoration Ecology**

**September 20, 2021**

Six priorities to advance the science and practice of coral reef restoration worldwide

*Tali Vardi, Whitney C. Hoot, Jessica Levy, Elizabeth Shaver, R. Scott Winters, Anastazia T. Banaszak, Iliana B. Baums, Valérie F. Chamberland, Nathan Cook, David Gulko, Margaux Y. Hein, Les Kaufman, Michelle Loewe, Petra Lundgren, Caitlin Lustic, Petra MacGowan, Mikhail V. Matz, Miles McGonigle, Ian McLeod, Jennifer Moore, Tom Moore, Sandrine Pivard, F. Joseph Pollock, Baruch Rinkevich, David J. Suggett, Samuel Suleiman, T. Shay Viehman, Tatiana Villalobos, Virginia M. Weis, Chelsea Wolke, Phanor H. Montoya-Maya*

## **Restoration Ecology**

**October 20, 2021**

Census of heat tolerance among Florida's threatened staghorn corals finds resilient individuals throughout existing nursery populations

*Ross Cunning, Katherine E. Parker, Kelsey Johnson-Sapp, Richard F. Karp, Alexandra D. Wen, Olivia M. Williamson, Erich Bartels, Martine D'Alessandro, David S. Gilliam, Grace Hanson, Jessica Levy, Diego Lirman, Kerry Maxwell, Wyatt C. Million, Alison L. Moulding, Amelia Moura, Erinn M. Muller, Ken Nedimyer, Brian Rickenbeil, Ruben van Hoodonk, Craig Dahlgren, Carly Kenkel, John E. Parkinson, and Andrew C. Baker*



# EMPOWERING EVERYONE

Our goal is to educate, entertain, and empower. We seek to engage the wider community in the mission to restore our coral reefs and to inspire the world to become stewards of our planet's life support systems.

At CRF™, we provide practical, meaningful ways for everyone to learn from and get actively involved with our mission to bring our coral reefs back from the brink of extinction.

- Our publicly available **educational materials complement state standards**, and can be easily incorporated into lesson plans.
- **Presentations** at our Exploration Center, or remotely online, can be tailored for any group.
- **Internships** provide university-level students with **vocational training and experience**. Our interns go on to launch exciting careers in marine science and related fields.
- **Recreational Dive Programs** let all ocean lovers make a difference, while enjoying fun days out on the water working alongside our team.
- **Volunteers** from the local community contribute to our daily work, both on and off the water.

*A CRF™ intern brings a crate of staghorn corals to the boat for transportation to their new home in the wild (AN)*

EDUCATION

# EDUCATION & OUTREACH

In the face of massive ecosystem degradation, the coming generations have unique and complex challenges ahead. At Coral Restoration Foundation™, we are giving them the tools they need to learn how to thrive in the world we are handing them.

We have built a practical, future-focused path of engagement with science and ecosystem restoration. Our STEAM-based learning resources unite the fields of science, technology, engineering, and mathematics with the arts, and introduce learners of all levels to complex problem solving, science, and interdisciplinary studies.

## PRESENTATIONS

We offer tailored presentations for diverse classes and groups. We hold in-person sessions in schools and we beam our young educators to classrooms around the world.

## WORKSHOPS

Our 66 STEAM-focused “Learning Labs” follow state standards and enrich the curriculum for all students from grades K through 12. We can deliver these workshops in person and remotely.

## ACTIVITY PACKS

Our publicly available lesson plans, derived from our workshops, follow Florida state standards and can be integrated into any classroom from grades K through 12.

## CAPTAIN CORAL

Demonstrating the power of edu-tainment at its best, the Captain Coral Show is a swashbuckling performance and an explosive journey into marine science. It has become a hit with audiences of all ages.

## AFTER SCHOOL CLUBS

Our After School Club provides students with a holistic educational experience. Activity sessions combine elements of project-based, team-based, and problem-based curriculum. We introduce students to oceanography and ecology, while delivering a hopeful message about our capacity to save our coral reefs.

CRF™ interns engage young minds with traveling hands-on experiments (MH)



Children in the local community discover what it's like to fragment and hang corals on a Coral Tree™ at the Ocean Reef Club® Eco Fair (MH)



We worked with  
**7,451**  
students in  
2021, with  
**54**  
virtual sessions  
and **118**  
Covid-safe  
in-person  
events

## 2021 EDUCATION PROGRAM HIGHLIGHTS

### JANUARY

Virtual learning is in full swing, with our interns giving presentations to classes across the country, including to some of their former high schools and universities.

### FEBRUARY

The Ocean Reef Club® Eco-Fair gives CRF™ the opportunity to gather with conservation organizations from all over South Florida to highlight local environmental issues.

### MARCH

We give a virtual presentation on coral restoration and reef ecology to thousands of youth climate activists at The Miami Youth Climate Summit.

### APRIL

We launch our first virtual after-school program, spanning five weeks and providing students from across the country access to hands-on, at-home coral edu-tainment lessons.

### MAY

Our collaboration with the Boy Scouts of America is unveiled with our first ever two-day dive program on location at Florida SeaBase.

### JUNE

Coralpalooza™ Digital reaches more than 1,400 people from 80 countries with messages from restoration practitioners, scientists, and a music video featuring an original coral restoration rap by Blake Rules!

### JULY

CRF™ hosts a three-day learning extravaganza for the Young Presidents Organization at Ocean Reef Club®. Future leaders spent their time with our team learning about threats to our oceans and ways to combat them.

### AUGUST

CRF™ swaps SCUBA tanks for shovels, joining local conservation organizations on historic Pigeon Key to plant 1,000 mangroves around the island.

### SEPTEMBER

The Girl Scouts' annual Girl Fest hosts 1,200 girl scouts and their families in Miami, Florida. Our education team packed two of their favorite hands-on edu-tainment activities – Coral Slime and Sibilating Scleractinia – for the girls stopping by the booth, introducing them to the new badge opportunities for troops of all levels.

### OCTOBER

The Make-a-Wish Foundation brings one of their young recipients to our Exploration Center for a day of coral reef magic.

### NOVEMBER

Our virtual education initiatives are still a popular option for schools to connect with our team from anywhere. Students from Colorado State University learn about restoration from our team, which led to semester-long projects for their Ecological Restoration Case Studies course.

### DECEMBER

CRF™ launches our new Girl Scout Badge series and hosts the Girl Scouts of Tropical South Florida at our Exploration Center to begin the projects needed to earn their coral restoration badge.

“ More than 1,100 members of America’s scouting community were involved in the program. Collectively, they helped return over 600 corals to the reef.”



## REEF-SAVING SUMMERS FOR BOY SCOUTS OF AMERICA

SeaBase is a unique scouting program that offers sailing, scuba diving, fishing and rustic camping activities on an undeveloped barrier island in the Florida Keys for older Boy Scouts, Varsity Scouts, Venturers, Sea Scouts, and their leaders. SeaBase programs are designed to achieve the aims of the Boy Scouts of America to build character, to foster citizenship, and to develop physical, mental, and emotional fitness.

In 2021, we launched an official relationship with SeaBase and Boy Scouts of America, offering an in-depth summer program that gives the scouts an opportunity to take an active role in the mission to save and restore our coral reefs. From May through August, we held 25 educational sessions at SeaBase,

which included presentations, hands-on workshops, and dive programs. We also trained SeaBase staff up to Coral Crew to help oversee coral nursery maintenance and outplanting events. More than 1,100 members of America’s scouting community were involved in the program. Collectively, they helped return over 600 corals to Alligator Reef.

The collaboration with SeaBase was so successful that we have now created a dedicated CRF™ SeaBase Lead Internship position for the summer semester, during which one of our Lead Interns will spend at least three days a week running educational programs with the Scouts.



## NEW CORAL BADGES FOR GIRL SCOUTS OF TROPICAL FLORIDA

We first started working with the Girl Scouts in 2018. We took their troops out on the water where the girls could experience our mission first hand.

In 2021, we formalized our relationship with the Girl Scouts, with the creation of 24 badge pathways across five grade levels for Girl Scouts of Tropical Florida. We kicked off the partnership at Girl Fest in September, where we introduced the girls to our work and their new badge activities.

We held our first badge event in November, during which 12 Brownies worked through four hands-on education workshops to earn their first coral restoration badge. Then, in December, we ran our first badge event for ten members of the Girl Scouts of Tropical Florida Juniors Troop. They worked through five STEAM-based activities, earning their first coral restoration badges.

We are excited to continue hosting badge events through 2022, bringing more girls through the program and inspiring them to engage with marine science and conservation.

*FAR LEFT: CRF™ Intern Lindsey Smith holds an outplanting practice session with the Boy Scouts (MH)*

*LEFT: Girl Scouts of Tropical Florida work towards their first coral badge (MH)*

New CRF™ interns head out for a day of in-water training (MH)

Our internship program is highly competitive – in 2021 we had

**512** applications for just **67** internship positions

We welcomed **41** individuals to our internship program in 2021

Interns were responsible for returning **17,831** corals to Florida's reefs in 2021

## WORLD-CLASS INTERNSHIPS

We are helping to nurture tomorrow's leading marine scientists. We offer vocational training to university-level interns, providing them with a structured learning environment and the opportunity to contribute on a professional level to a world-class non-profit. Interns can expect to be challenged, mentored, and inspired, working with a dynamic team that is dedicated to helping them find their focus.

Our intern training program includes a Scientific Diver accreditation and the opportunity for interns to become members of the world-famous Explorers Club.

### REMOTE TRAINING PAVES THE WAY FOR REACHING THE WORLD

Our intern community lies at the heart of Coral Restoration Foundation™, and so we made every effort to keep this essential program running throughout the coronavirus pandemic. By the beginning of 2021 we were well adapted to the new normal, comfortably harnessing the power of technology to continue bringing new interns into the fold.

With each new semester, we continued to hold the first two weeks of intern training online. These sessions were recorded for the interns to review in their own time, and interns were made aware that the CRF™ staff were always available to answer their questions and provide remote support for their self-directed projects.

By having the opening few weeks take place completely remotely, all incoming interns were able to comply with CDC recommendations and self-isolate for two weeks before joining the rest of the team in person.

Adaptations to our intern training necessitated by the pandemic helped us revise and improve our volunteer program. The lessons we learned and the processes we have built over the past year now present exciting opportunities for the expansion of our work nationally and globally.



CRF™ Volunteer Coordinator JD Reinbott works with a new volunteer helping them learn how to return corals to the wild (AN)

# VOLUNTEER PROGRAM

Coral Restoration Foundation™ volunteers work alongside our staff and interns, all year-round, on land and on the water, to further the mission of restoring coral reefs.

The local dive community has been increasingly supportive of our volunteer training, helping our volunteers gain the certifications they need to work with our team.



## VOLUNTEERS RETURN TO A REVAMPED PROGRAM IN 2021

Our volunteers returned in 2021, after a year-long hiatus imposed by the coronavirus pandemic. But we were more than ready to welcome them back with a new-and-improved pipeline for onboarding and training.

We rolled out our new onboarding, scheduling, and management system, Samaritan, which had been in development through 2020. Samaritan streamlines and automates sign-up opportunities, documentation, reminders, and activity logs. It allows us to run detailed reports and track a variety of metrics for internal usage and grant reporting, to schedule our volunteers more efficiently, and ensure that our volunteers are

receiving comprehensive training before they join our restoration team. In early 2021, we began processing new volunteer applications through Samaritan and introducing our existing volunteers to the platform.

In March, we were able to re-start active volunteer training, applying covid-safe strategies that we had developed for intern training during the latter part of 2020, including Zoom-based education sessions, socially distanced classroom sessions, and sanitation protocols. Volunteer training sessions are now conducted from charter vessels, taking the pressure off the teams on our work boats, and giving volunteer divers plenty of time to develop their skills.

This new volunteer training pathway, with virtual training sessions, as well as tailored, personalized coaching opportunities for volunteers with different levels of experience have dramatically enhanced our volunteer program, increasing the capacity of volunteers and maximizing output whilst simultaneously allowing them to diversify their skill set.

The absence of our volunteer team was felt throughout the organization, both in terms of the work itself, and the atmosphere at Coral Restoration Foundation™. It was wonderful to be able to welcome volunteers back to our revamped program in 2021.

In 2021, we worked with **207** volunteers, who reintroduced **680 +** corals to the reefs of the Florida Keys

Our dive and snorkel programs give everyone the chance to immerse themselves in a world of hope for coral reefs.

## DIVE & SNORKEL PROGRAMS

In 2021, we welcomed **950+** recreational divers and snorkelers to **85** public dive programs and **55** private dive programs

These dive program participants returned **2,400+** corals to the reefs of the Florida Keys

We also ran **11** PADI Coral Restoration Distinctive Specialty courses, certifying **50+** divers in coral restoration techniques

Year-round public programs, set by local dive operators, have made it incredibly easy for recreational scuba divers and snorkelers to experience a restoration adventure.

We also tailor private programs for groups from all over the country, including specialized programs for organizations and clubs that work with children, adults, and veterans with disabilities.

Our interns and select long-term volunteers have been trained to guide Coral Restoration Adventures, as “Coral Crew”. Their leadership enriches our Dive Programs immensely, giving the public a chance to engage with some of the world’s most promising young marine scientists.

### 2021 RECREATIONAL DIVE PROGRAM HIGHLIGHTS

#### MARCH

We run our first private dive program with The Sabot Foundation, a nonprofit focused on supporting combat veterans making the transition to civilian life.

#### APRIL

We work with Rainbow Reef Dive Center to add a restoration-themed program to their Earth Day activities, in addition to the regular monthly programs we run together.

#### JUNE

Living Planet Aquarium volunteer divers join us for a dive program that runs over several days and features a mix of returning divers and new participants. They go to work in the nursery and on the reef, returning 345 corals to Florida’s Coral Reef in a single day.

#### JUNE

West Coast Connection offers life-changing summer experiences for teenagers. They join us for a three-day educational and snorkel program. This is our first blended program that combines significant education time with a snorkel day.

#### JUNE & JULY

We welcome Diving With a Purpose (DWP) back to CRF™ with two private dive programs in the summer. DWP is a nonprofit dedicated to the conservation and protection of submerged heritage resources. Their Youth Diving with a Purpose augments their marine archaeology focus with an added coral restoration component.

#### JULY & AUGUST

Road Less Traveled participants spend a total of four days with CRF™ carrying out restoration work alongside our team.

#### AUGUST

Therapeutic SCUBA, through Camp Open Seas, a nonprofit supporting adaptive divers, join us for a day of coral restoration education.

Divers bring staghorn corals out of the Tavernier Coral Tree™ Nursery during a private CRF™ Dive Program (AN)

Director of Restoration Strategy  
Jessica Levy checks out an  
elkhorn outplant during a dive  
for Coralpalooza™ 2021 (ZR)



# CORALPALOOZA™ 2021



Every year since 2015, for World Oceans Day, CRF™ has hosted Coralpalooza™ – a day of large-scale, active reef restoration in the Florida Keys with coordinated ocean conservation activities around the world.

Moving the event online in 2020 proved to be a massive success and we brought back Coralpalooza™ Digital for a second year in 2021. This year, we also brought back the original Coralpalooza™ Dive Day, engaging our local community in this world-famous day of reef restoration.

## CORALPALOOZA™ DIVE DAY

By June, we were ready to implement covid-safe logistics to bring back our in-person World Oceans Day event, re-branded as Coralpalooza™ Dive Day, which sold out just 36 hours after registration opened. The Dive Shop, Horizon Divers, Silent World, Rainbow Reef, Keys Divers, John Pennekamp Coral Reef State Park, Florida Keys Dive Center, SeaBase, Isla Bella, and SNUBA Key West all stepped up and donated boats to the event. We held orientations over Zoom and provided hands-on training in the open air at the operators' docks.

Although the weather on the day of our in-person event did not allow us to outplant any corals, participants were still treated to a productive experience. Divers cleaned Coral Trees™ in three different nurseries and visited nearby restoration sites to see the full potential of our critical restoration work.

**1,490+** Registrations

**80** Countries

**17** Virtual booths

**300+** Pieces of content

## CORALPALOOZA™ DIGITAL

Once again, our wildly creative and fully interactive digital platform brought together an international community of scientists, conservationists, and ocean enthusiasts for a day-long virtual celebration in honor of World Oceans Day.

This free event celebrated a mission of hope for coral reefs. Visitors immersed themselves in a digital underwater world where they were treated to never-before-seen footage, interviews and presentations from some of the leading figures in marine conservation, hands-on activities for kids, a treasure hunt, and content-rich virtual booths where they held live chats with local, national, and international experts.

In the Kids Zone, Captain Coral presented a three-part video series exploring the ocean depths. We also debuted a pre-press exclusive of our new children's book *Isabella the Decorator Crab*.

The age of digital connection and collaboration has opened new opportunities, allowing CRF™ to reach an ever-expanding global community of support for coral reef restoration. We can now connect experts with everyday enthusiasts and curious minds at the click of a button, giving ocean stewards everywhere access to our mission and a world of solutions that they can be a part of.





Image by Zach Ransom



## FREE LEARNING RESOURCES

### DIGITAL CLASSROOM PRESENTATIONS

Free digital presentations bring us to your classroom, wherever you are.

Email us at: [education@coralrestoration.org](mailto:education@coralrestoration.org)

### ACTIVITY PACKS: GO-TO LESSON PLANS

Anyone can download our STEAM-focused Activity Packs that follow CPalm and Florida state standards for grades K-12.

Go to: [coralrestoration.org/activity-packs](https://coralrestoration.org/activity-packs)

## DIVE WITH US!

AN UNFORGETTABLE EXPERIENCE

Join the CRF™ team out on the water for a day of diving unlike any other.

We run public dive programs all year-round and you can sign up at the click of a button!

We also tailor private programs for groups.

We even offer PADI Coral Restoration Certifications!

FOR MORE INFORMATION, VISIT [coralrestoration.org/dive-programs](https://coralrestoration.org/dive-programs)

**The Captain CORAL Show**

A swashbuckling adventure in marine science!

Learn more at [coralrestoration.org/captain-coral](https://coralrestoration.org/captain-coral)

## CORAL RESTORATION FOUNDATION™ SOCIAL MEDIA

We reach more than **1,400,000 people** every month with our messaging on social media alone!

Inspiring content, world-class images, and creative collaborations with corporate sponsors have resulted in the extraordinary organic growth of our social media audience.

**120,000+**

**35,000+**

**10,000+**

**5,400+**

**10,000+**



Influencer Kelly Flanagan takes in the wonder of the CRF™ Tavernier Nursery during a private dive program (AN)

## ENGAGING THE WORLD

Millions of people around the world are using our mission of hope as inspiration for making positive change for our planet.

In 2021, the CRF™ mission was picked up by national and international media including **PBS, The Washington Post, CBS, USA Today, Yahoo, Oceanographic Magazine** and **National Geographic**.

# WAYS OF GIVING

*Would you like to help us preserve the legacy of our reefs? Our work is made possible by committed, mutually-beneficial relationships with visionary, practical, and passionate people.*

## MEANINGFUL GIVING

*We have the capacity to scale, able to absorb significant funding and put it to work, producing tangible results backed by scientific research.*

## CAUSE-RELATED COLLABORATIONS

*Credibility is critical. Our sponsors and donors can rely on our reputation to position themselves publicly as genuine ocean advocates.*

*To discuss how your philanthropic goals can make a difference for our coral reefs, please contact our Development Department by phone at (305) 453-7030, or send an email to [donors@coralrestoration.org](mailto:donors@coralrestoration.org).*

*Influencer Kelly Flanagan joins CRF™ on a dive program and helps share the CRF™ mission with a new audience (AN)*

FINANCIALS

## CORPORATE SPONSORSHIPS

It is consistent support from like-minded companies that gives CRF™ the ability to provide security for the future of our coral reefs. CRF™ is a non-profit partner of 1% for the Planet. Join us in making a difference for a threatened ecosystem.

*To learn more, visit: [coralrestoration.org/corporate-sponsorships](https://coralrestoration.org/corporate-sponsorships)*

## GIFTS OF STOCK

If you have appreciated assets, you can restore our reefs with a stock donation. Avoid paying capital gains tax and join our most tax-savvy donors by using our new, online tool to transfer your stocks to CRF™, so that you can make a powerful impact on our work today.

*Give a stock gift at: [FreeWill.com/Stocks/CRF](https://FreeWill.com/Stocks/CRF)*

## HONORARY & MEMORIAL GIFTS

Commemorate someone special while making a meaningful impact for the reefs we all depend on. CRF™ welcomes such gifts as they help support our work to restore coral reefs and create a legacy of hope for healthy, thriving reef systems around the world.

*To make a donation that will have an immediate impact, visit: [coralrestoration.org/donate](https://coralrestoration.org/donate)*

## DONATING CRYPTOCURRENCY

There's nothing cryptic about the benefits of saving coral reefs. Investing in the future of our oceans is easier than ever by donating your cryptocurrency to CRF™. The IRS classifies cryptocurrencies as property, so cryptocurrency donations to 501(c)(3) charities can often reduce your tax burden.

*To learn more or make a donation, visit: [coralrestoration.org/crypto-donations](https://coralrestoration.org/crypto-donations)*

## GIFT & ESTATE PLANNING

A gift in your will or living trust allows you to have an incredible impact on our natural world. We have partnered with FreeWill to provide you with simple tools to protect the people and causes you love. You can now write your legal will in less than 20 minutes, at no personal cost, while creating a legacy gift to support our oceans.

*Get started at: [FreeWill.com/CRF](https://FreeWill.com/CRF)*

## DONOR-ADVISED FUNDS

Donor-advised funds are one of the fastest growing charitable giving vehicles in the United States today because they are easy, flexible, and tax-smart. CRF™ routinely receives gifts from our supporters through their DAFs established at Fidelity Charitable, Schwab Charitable, and other sponsoring organizations. Ready to direct a grant to save our reefs?

*Get started at: [coralrestoration.org/donor-advised-funds](https://coralrestoration.org/donor-advised-funds)*



Young elkhorn corals growing in the Tavernier Coral Tree™ Nursery before being rehomed on the reef (AN)

## 2021 CONTRIBUTORS

### THANK YOU

Our goals are ambitious, but thanks to the generous support of individuals, corporations, and foundations we are achieving our vision – to inspire hope and restore our reefs to healthy, thriving ecosystems.

Although space does not permit the listing of every donation, each contribution makes a crucial difference for our reefs.

Thank you to the following supporters who have made gifts of \$500 or more between January 1, 2021 and December 31, 2021.

- A + L Jewelry
- Kurt Allebach
- Aloha Redland
- Amazon Smile
- Andrew R. and Janet F. Miller Foundation
- Anonymous (143)
- Aquarium at the Boardwalk
- Corwin and Virginia Atwood
- Kelly Baker and Whitney Ellerman
- Baker's Cay Resort, Key Largo
- Jacob Balthazor
- Bank of America Charitable Gift Fund
- Andrea Barbon
- Barrett Family Fund at New Hampshire Charitable
- The Batchelor Foundation
- Dr. Sally E. Bauer
- Don and Marta Baum
- Chloe and Jay Beatty
- Benevity
- The Betsy and Clarke Moody Fund
- Alexander Blocker in memory of Ken Dewey
- James J. and Mary L. Boilini
- Amy Bourne
- Karen Brasch
- Nicole and William Bridges
- The Buchanan Family Foundation
- Ronald Bunnell and Scott Coulter
- Buoy Up Styles
- Caldwell and Ellen Kendrick Memorial Fund
- David and Sherri Campbell
- Tom and Michelle Canick
- Kim Carpenter
- Brian Caster
- Cause Photography
- Cd Holdings Oregon
- Michele Chan
- The Charles Hazlehurst Moura Family Foundation
- CHUM - Houston's SCUBA Club
- Cirque Colors
- Clarendon Partners
- Clif Bar Family Foundation
- Keith and Cheri Cohen
- Jill Cohen, MD and Justina Cotter
- Community Foundation of the Florida Keys
- Coral Ethical Wine - an Entrecanales Domecq e Hijos brand
- The Crickenberger Vance Family Foundation
- CryptoClimates
- Daniels Family Foundation
- Nick Davies
- DC Construction Associates, Inc. in memory of Allen "Ross" Hall
- Lesley-Jane Dixon
- Robert Donnelly Jr.
- Mr. and Mrs. James Drinkwater
- EcoBee, Inc.
- The Edward and Gale McBride Foundation Inc.
- Jenny and Matt Elkins Werber of the Werber Family Foundation
- Endowment
- Anne Estevez and Joaquin Luaces
- Facebook
- Felsten Fishman Family Foundation
- FGP Foundation
- Fidelity Charitable Gift Fund
- The Fikes Family
- Firth-Link Family Foundation
- The Florida Aquarium
- Fluval, a division of Rolf C. Hagen Inc.
- Fowler Revocable Living Trust
- Fox Family Fund
- Franklin Philanthropic Foundation
- Justin and Katharine Furby
- The Garden Group at Ocean Reef
- George and Marlisa Garrett
- German American Police Association of Chicago
- Kristin and Cory Gilchrist
- Michael and Suzanne Gilson
- The Giving Block
- Golden Age Spirits Caribbean Rum
- Goldman Sachs Philanthropy Fund
- John and Denise Gordon
- Stephanie Graeler
- Steve Greenwell
- Fritz Grimm
- David and Patti Gross
- Laura and Fred Hartner
- Helen and Ritter Shumway Foundation
- Henshel Foundation
- Hollomon Price Foundation
- HollyJolly Foundation
- Kathryn Boeckman Howd
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- Pascale Huntsinger and Simon Pyatkin
- JBL
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- Emily Joffrin
- The John A. and Elizabeth F. Taylor Charitable Foundation Inc.
- Karlson Family Foundation
- Ronald J. Kemperle
- Morgan Kessler
- Andy and Cathy Knudsen
- Linda and Lester Knutsen
- Kreitzberg Family Foundation
- Gabriel and Angela Kwentus
- La Storia Productions
- Lary Foundation
- Andrew Lasken and Caitlin Lamb
- Glenn and Susan Latham
- Kyle Lauderdale
- Sam and Kate Lawrence
- Leaf Shave
- Karl and Lynn Legatski in honor of Stella Baker
- Anne Lovett and Steve Woodsum
- The Lubrizol Foundation
- Meghan and Ken Lutschg
- Charles Lynch Jr
- Paul D. MacDougal
- Poonam, Ted, Setara, and Nikhil Manasa
- Dandelion Mané
- Samar Manjeshwar
- Karen McKinley
- The Meeker Rom Family Foundation
- Mary and Barry Menne
- Metro Mermaids Stake Pool TAILS
- Terrell and Benjie Mills
- Monroe County Tourist Development Council
- Monroe County via RESTORE funding from the U.S. Department of Treasury in partnership with The Nature Conservancy, Mote Marine Laboratory, and Fish and Wildlife Research Institute
- Douglas Morrison
- The Mortenson family
- Austin Myatt
- MyCHELLE Dermaceuticals
- National Park Trust and USDA Forest Service
- The Negley Flinn Charitable Foundation
- Andrea Aleff Nelson
- Network for Good
- New Chapter, Inc.
- The New York Community Trust
- Newport Aquarium Retail Staff
- Nexions
- NOAA's Office for Habitat Conservation
- Kevin M. Nuccitelli
- Ocean Pointe Suites Key Largo
- Ocean Reef Club
- Ocean Reef Community Foundation
- Ocean Reef Conservation Association
- One Earth Collective (directed by Young Filmmaker Contest winner)
- Michael and Patricia Pape
- Paul M. Angell Family Foundation
- PayPal Giving Fund
- James Peppler in honor of Ethan Glassworks
- Petco Animal Supplies
- Mark and April Pierce
- Laura Pollak and Jeff Petrinitz
- Ponyo Impact
- David Puyanich
- Max Puyanich
- Rainbow Fund at the Rochester Area Community Foundation
- Jack and Beverly Randall
- Ransom Everglades School
- ReefBreeders.com
- The Reynolds Family
- The Richard Laurence Parish Foundation
- The Riviera Towel Company
- Rochester Area Community Foundation
- Royce Family Fund
- Crista Ryan
- Saie
- Sand Cloud
- Schwab Charitable Foundation
- Seder Family Foundation
- The Shumway Fund of the Ocean Reef Community Foundation
- The Silver Foundation
- Sascha and Anka Simon
- Skiff Dogs
- Dr. Susanne Skyrms
- Dave Smith
- Snappers Key Largo
- Adam and Molly Spector
- David Splitt and Laurene McKillop

- Senator and Mrs. Paul Steinberg
- Stephen Frink Photographic, Inc.
- The Stephenson Pope Babcock Foundation
- The Stevens Family Foundation
- SucculentScribbles
- Tara and Brian Swibel
- Michael and Janice Talbert
- Aditya Tammana
- Adam and Danielle Theurer
- Stephen Tillinghast
- Tom Thumb Food Stores, Inc.
- Total Sprinkler and Lighting
- Tradewinds Experience Inc.
- Chris Tresslar
- Triad Foundation
- T. Rowe Price Charitable
- Jeff and Joleen Turner
- Undersea Wear
- United Jewish Foundation
- United Way of Collier and the Keys, Inc.
- Rob Unruh
- Vanguard Charitable
- Ron Van Oeveren
- Veza Sur Brewing Co.
- Virginia Wellington Cabot Foundation
- Vohra Wound Physicians
- Jos Vromans
- Walder-Christensen Charitable Fund
- Philip and Betsey Walker
- Wallace Research Foundation
- Preston Wanless
- The Rev. Jeanne L. Warner
- B. Scott Washburn
- Waterbox Aquariums®
- Kimberly Watkins
- Marcus and Anne Wedner
- Kaily and Adam Westbrook
- Daniel Westervelt
- Glenn White
- The Wilson Family
- The Wing Arts and Humanities Fund
- David and Donna Wing
- Dr. R. Scott and Janice Winters
- The Wong Family
- Suzanne Wootten
- Woroch/Vobach Family
- Xtinctio
- Yardi Systems Inc.
- YourCause
- YPO Florida
- Natasha and Dirk Ziff

## IN KIND & SERVICE DONATIONS

We are grateful to those who have donated goods and/or services to support our mission between January 1, 2021 and December 31, 2021.

Ace Hardware  
 Caribee Boats Sales and Marina  
 Dawson Marine Services LLC  
 Dive Isla Bella  
 Dive Rite  
 Divers Direct  
 The Dive Shop  
 Fourth Element  
 Henderson Aquatics  
 Horizon Divers  
 Huish Outdoors, Inc.  
 Innovative Scuba Concepts  
 John Pennekamp Dive Shop  
 Keys Diver  
 National Safe Boating Council  
 Oceans Wonders  
 Pilot House Marina & Restaurant  
 Rainbow Reef Dive Center  
 The Riviera Towel Company  
 Safe Harbor Angler House  
 SeaBase  
 Sfara Inc.  
 Silent World Dive Center  
 SNUBA Key West  
 Steer Films  
 Tinsley Advertising

*We strive for accuracy and are appreciative of the generosity of our many supporters. Please accept our sincere apology for any omissions or errors and feel free to bring corrections to the attention of our Development Department by sending an email to [donors@coralrestoration.org](mailto:donors@coralrestoration.org).*

Snapper schooling around a staghorn Coral Tree™ (AN)

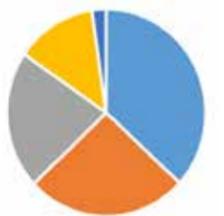
# INCOME & EXPENSES

Coral Restoration Foundation™ is supported by individuals, corporations, private foundations, and government agencies. The sources and allocation of our funding in 2021 are broken down as follows:

## SOURCES OF INCOME

**Total Income: \$5,984,875**

- Government **\$2,203,634**
- Foundations **\$1,565,311**
- Corporations **\$1,291,967**
- Individuals **\$786,136**
- Other **\$137,827**



## EXPENSES

**Total Expenses: \$3,168,751**

- Program Expenses **\$2,537,035**
- General & Admin **\$394,542**
- Fundraising **\$237,174**



## PERCENTAGE EXPENSES BY PROGRAM

- Restoration **54%**
- Science **17%**
- Education **29%**

# CORALPALOOZA™ 2023



FOR WORLD OCEANS DAY  
JUNE 3, 2023

**Sponsorship opportunities are now available!**  
Contact Roxane Boonstra at [roxane@coralrestoration.org](mailto:roxane@coralrestoration.org)

## RAISE THE REEF 2023



CORAL RESTORATION FOUNDATION™  
9TH ANNUAL GALA

Sponsorship opportunities are now available.  
Contact Michelle Andersen at [michelle@coralrestoration.org](mailto:michelle@coralrestoration.org)

**25,000+m<sup>2</sup>**  
Of reef restored in Florida since 2012

**35,000+**  
Corals returned to Florida's Coral Reef in 2021

**170,000+**  
Corals returned to the reefs of the Florida Keys since 2007

**11**  
Reef sites received corals in 2021

**1.5 ACRES**

Of seafloor covered by our Tavernier Coral Tree™ Nursery, the largest in the world

**1,300+**  
Coral genotypes safeguarded for the future

**20**  
Coral species living in our nurseries

**8**

CRF™ Coral Nurseries in the Florida Keys

**720+**  
CRF™ Coral Trees™ in the Florida Keys

**950**

People took part in our Dive Programs in 2021

**1,490+**

People attended Coralpalooza™ Digital 2021

**7,450+**

Students reached by our Education Program in 2021

**208**

Active volunteers

**41**

Interns joined us in 2021

**172**

Outreach events held by our Education Program in 2021

**1,400,000+**

Social media reach as of January 2022

**61,000m<sup>2</sup>**

Of reef documented by photomosaic in 2021

**148**

Photomosaics of our restoration sites generated in 2021

**12 51%**

Coral reefs documented by photomosaic in 2021

Average increase in coral coverage across all sites and all species after one year

**2021**  
IN NUMBERS

**CORAL RESTORATION FOUNDATION™**



As seen on FOX, CBS, ABC, BBC, NBC, PBS, Animal Planet, Forbes, The Guardian, NBC Nightly News, The History Channel, CNN, National Geographic, Miami Herald, NowThis, Yahoo Finance, The LA Times, Oceanographic Magazine, USA Today, The New York Times, and The Washington Post.



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