RESILIENCE

ANNUAL REPORT

CORAL RESTORATION FOUNDATION™

2020

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

We have lost 50% of the world's coral reefs in the last 30 years

In the Florida Keys, coral cover is down to just two percent in places

The iconic Carysfort Reef has experienced massive declines in coral cover in the last several decades (AN)

We are actively restoring coral reefs on a massive scale

We are helping to further reef restoration science around the world

We are engaging the public in the mission and inspiring change

CRF™ has been returning nursery-raised corals to Carysfort Reef, bringing this ecosystem back to life (AN)

RESILIENCE

Resilient ecosystems are those that can respond and adjust to changing conditions, capable of reorganizing themselves after being disturbed to maintain critical functions even after a significant disruption. Resilience is a critical attribute on a dynamic planet.

For ecosystems to be resilient they need to be composed of genetically diverse, interconnected species. However, the relentless human pressure on our natural world has been increasing exponentially for so many decades, that we have outstripped the capacity of our planet's life support systems to adapt. We have removed countless species, diluted genetic diversity, and severed critical connections.

Safeguarding life on Earth now requires intervention on a massive scale. But, in an age of extreme climate change, these interventions need to restore more than just the populations of species we have lost, they need to focus on restoring these systems' capacity for resilience.

Rebuilding resilience is central to our approach at Coral Restoration Foundation™ – we are focused on restoring and reconnecting genetically diverse populations of corals, recreating acres of functional habitat that has the ability to survive in an increasingly unpredictable world.

Images thanks to Alexander Neufeld (AN), Sara Nillson (SN), Daniel Burdeno (DB), Zach Ransom (ZR), Madalen Howard (MH), Tessa Markham (TM)

CRF™ Science Program Manager, Amelia Moura, monitors boulder coral outplants at Carysfort Reef (AN)

CORAL RESTORATION FOUNDATION™

2020

March 15
CRC IN COSTA RICA
We organize and attend the CRC's biannual leadership meeting

June 2
CORAL SWAP
We facilitate the first coordinated exchange of staghorn genets

June 6
CORALPALOOZA™ DIGITAL 2020
We present the first international, online celebration of coral reefs

August 7
CORAL SPAWNING
We observe spawning firsts on our restoration sites

September 23
CARYSFORT NURSERY
We complete the expansion of the Carysfort Nursery

December 10
BOULDER DOMES
We outplant our first boulder coral dome at Carysfort Reef

CORAL RESTORATION FOUNDATION™

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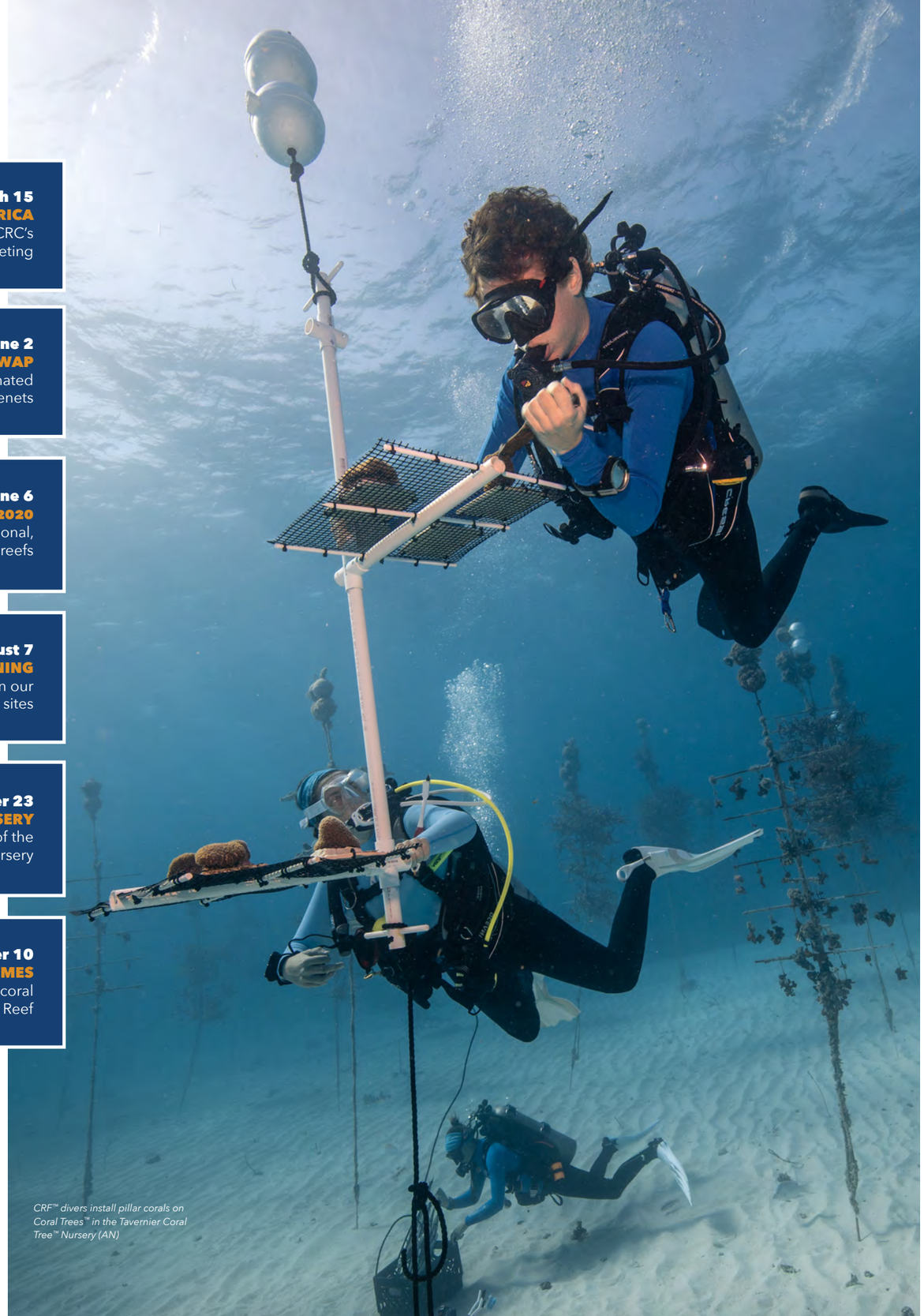


CRF™ divers install pillar corals on Coral Trees™ in the Tavernier Coral Tree™ Nursery (AN)

FROM OUR CEO

The outbreak of COVID-19 tested the resilience of almost every human system in the world; all have been stressed, some have floundered, while others have adapted and thrived. Thanks to a dynamic team and a culture of innovation, Coral Restoration Foundation™ was able to prove our capacity to adapt to changing circumstances, even those as extreme as a global pandemic.

In responding to the challenges of 2020, we were forced to develop our programs in ways that have ultimately enhanced our capacity beyond anything we could have imagined. In launching the world's first online celebration of coral reefs, Coralpalooza™ Digital, we involved more partner organizations and reached more people in more countries with our World Oceans Day event than ever before. Our virtual After School Program has also made our STEAM-based curriculum more accessible, and new online training programs for interns and volunteers are streamlining our onboarding processes and laying the foundations for expansion into new locations nationally and around the world.

Despite the impacts of COVID restrictions, our nimble restoration team was able to fulfill our 2020 outplanting obligations, following all CDC guidelines, by bringing on temporary restoration associates as we normally do during summer months.

Our successes in 2020 have been made possible only by pulling together as a team in more profound ways than at any other point in the organization's history. The pandemic has taught us that that we can't take the future for granted, and that, much like a resilient ecosystem, we must be adaptable and collaborative if we are going to survive. And, as the world slowly wakes to the harsh realities of climate change, these are lessons that will continue to guide us as we forge our path into the future.

R. Scott Winters
Coral Restoration Foundation™, Chief Executive Officer

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 practice comprised 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 September 2020, Jessica Levy, Director of Restoration Strategy at Coral Restoration Foundation™, coordinated the first CRC leadership training workshop in Costa Rica.

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

December 13-20, 2021

Ocean Reef Club®, Key Largo, Florida

*www.**reeffutures**.com*

Reef Futures 2021 brings 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 conference is presented by the Coral Restoration Consortium, and hosted by Coral Restoration Foundation™.

The first Reef Futures symposium, held in 2018, brought together over 450 participants from more than 40 countries.

REEF FUTURES VIRTUAL
Plenaries, session talks, and posters from the in-person Reef Futures Symposium in December will be digitized and presented at the Reef Futures Virtual Symposium to be held in early 2022.

All tickets sold for the Reef Futures 2021 in-person event will also include full access to the Reef Futures Virtual event.

RESTORING RESILIENCE

We are taking an active, ecosystem-wide approach to reef restoration, restoring both abundance and genetic diversity to the reefs of the Florida Keys.

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

ECOSYSTEM LEVEL IMPACT

Over the last 11 years, we have returned ***142,395 corals*** *to our restoration sites, restoring more than* ***17,600 square meters*** *of Florida's Coral Reef.*

In 2020, we put ***27,293*** *corals back into the wild:*

- *Staghorn (*Acropora cervicornis*):* ***15,833***
- *Elkhorn (*A. palmata*):* ***6,078***
- *Boulder coral (*Orbicella spp.*):* ***5,382***

CRF™ divers installing new Coral Trees™ in the Tavernier Nursery - the biggest in-situ coral nursery in the world (AN)

Staghorn corals at Carysfort Reef demonstrate why this site forms the cornerstone of the"Mission: Iconic Reefs" plan (AN)

MISSION: ICONIC REEFS

Coral Restoration Foundation™ successes over the last several years have provided a foundation for the most ambitious reef restoration plan in the world.

BUILDING ON SUCCESS

"Mission: Iconic Reefs", launched in 2018, 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.

This is the world's largest and most holistic coral restoration effort. It has been modeled, in part, on our past restoration efforts, and builds on our organization's restoration strategy and efforts to date across these sites. The two decades-long project has an estimated budget of $97 million.

WORKING TOGETHER

"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.

For the next several decades, the majority of our restoration work will be focused on the seven iconic reefs of the Florida Keys, in collaboration with the best coral restoration practitioners and marine biologists in Florida and beyond.

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. This is known as propagation.

More than a decade ago, we took clippings from wild coral colonies to begin propagating them. Now, our stock is self-sustaining.

THE WORLD FAMOUS CORAL TREES™

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

The Coral Trees™ we invented are tethered to the ocean floor and buoyed with a subsurface float.

They float in the water column and are able to move 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 nutrient- and sunlight-rich water column, the fragments of Acropora corals on our Coral Trees™ grow into colonies that are large enough to be planted onto the reef in just six to nine months.

THE BIGGEST CORAL NURSERIES IN THE WORLD

Our Tavernier Coral Tree™ Nursery is the biggest in the world. It covers an acre-and-a-half of sea floor, contains more than 500 Coral Trees™, and can produce more than 35,000 corals every year.

We have seven in-situ nurseries with a total of more than 740 Coral Trees™. We are raising more than ***44,000 "reef ready" corals*** *a year.*

We developed the Coral Tree™ now recognized as one of the best methods for growing large numbers of corals in situ (SN)

CORAL NURSERY INNOVATIONS

BOULDER CORAL TREES

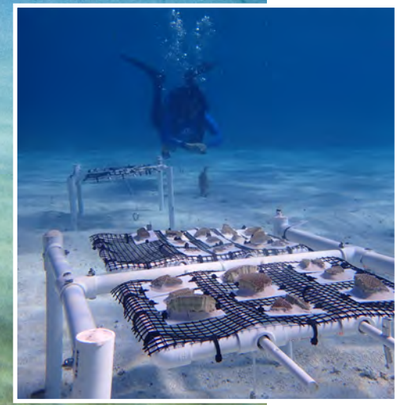
Bouldering coral species like star corals (*Orbicella spp.*), grow out onto the substrate on a single plane, and then grow upwards into massive "boulder-like" mounds.

The trees we have developed for these species hold the corals on "plugs" in a horizontal position on special trays. Each tree has six branches and can hold around 400 coral plugs. The design provides the corals with ample sun exposure and allows for easy cleaning and maintenance.

PILLAR CORAL TREES

In 2020, we began propagating pillar corals. This species grows upwards from an encrusted base into tall, cylindrical spires that can be several meters tall.

Our pillar corals are raised on Coral Trees™ that are identical to our boulder Coral Trees™. Pillar coral plugs are larger and known as "heads". The trays on these trees can be organized and oriented in numerous ways to provide the young corals with ample sunlight and space to grow.



INTERMEDIARY NURSERY

We established a new table nursery system in 2020, designed to help corals relocated from shallow water acclimatize to deeper water environments. The tables have removable trays on which the corals grow and acclimate for six months to a year.

Once the corals are stable, the corals and their trays are moved to Coral Trees™ in the Tavernier Coral Tree™ Nursery. Moving the corals while still on their trays reduces stress and improves survivorship.

RESILIENCE IN DIVERSITY

Healthy reefs rely not only on a diversity of species but also on genetic diversity within each species.

Genetic diversity results in resilience; restoring diversity is vital in mitigating risks associated with inbreeding, including genetic mutations, and the inability of coral populations to adapt to dynamic environmental conditions.

We are currently working with 415 putative coral genotypes.

Divers work to maintain the Coral Trees™ in the nursery, cleaning them of biofoul (AN)

GENETIC BANK

Our nurseries have now 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 within our nurseries.

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

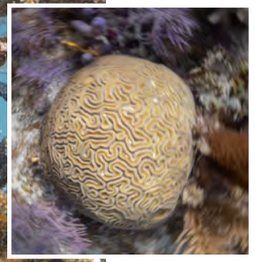
In 2020, we continued scaling up our propagation of two species of bouldering star corals: *Orbicella annularis* and *Orbicella faveolata*.

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

PILLAR CORALS

We are one of a handful of organizations that house 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 2020 we began propagating pillar corals in our nursery in the hope that we will eventually be able to start restoring populations of this species.



OTHER SPECIES

As a result of ongoing relocation work with Florida Keys Electric Cooperative, in 2020 we welcomed more species into our nursery systems. Our nurseries now contain populations of species including *Porites porites* and *Porites astreoides* (finger corals), *Oculina diffusa* (a branching coral), and *Siderastrea siderea* (a massive coral). Populations of all these species are in decline around the world.

New genotypes bred through a spawning collaboration being rehomed in the wild (AN)

REHOMING CORALS ON THE REEF

After corals in our nurseries have reached "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.

OUTPLANTING METHODS

TRADITIONAL OUTPLANTING

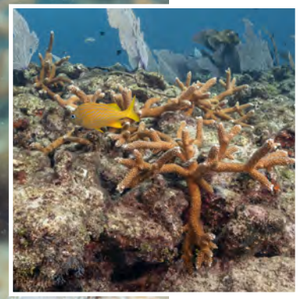
Our traditional outplanting method involves first clearing the substrate of algae with the back of a standard hammer.

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 attached with one large point of attachment. Divers waft water over the fragment to ensure that they have been well placed.

BAMBOO FRAMES

This experimental outplanting method is one of two that could allow us to return large, sexually mature corals to the reefs, restoring complex habitat more quickly.

Large staghorn colonies are attached to bamboo frames using zip ties, and the frames are then attached to the reef. The corals are held a few inches off the substrate, allowing water and nutrients to flow under and around them.



HEMP ROPE

Another promising new outplanting method involves attaching lines of eight to ten large, sexually mature staghorn corals to the reef with biodegradable hemp rope.

This is proving to deliver greater efficiency than the bamboo frames, with corals fusing quickly to the substrate.

BOULDER CORAL DOMES

In 2020, we started working with custom cast dome structures for bouldering coral outplanting. The dome structures, made of a cement mix developed for use in artificial reef structures, 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, quickly returning bouldering structures to the reef.

MAIN IMAGE: Photomosaic showing new cohort outplanting method. Each coral fragment is marked in white (AN)

BELOW: Staghorn clusters fuse quickly into healthy thickets, but growing to breach the space between them takes time (AN)

FROM CLUSTER TO COHORT

At the end of 2019, CRF™ changed the way we outplant staghorn and elkhorn corals. In 2020, this new method is dramatically increasing the area that each coral is capable of covering.

FUSION FIRST?

Before 2020, we were returning corals to the reef in clusters of 10 corals, with clusters spaced roughly a meter apart over five-by-thirty-meter transects. This outplanting strategy encourages the quick fusion of these corals into thickets. However, many of these thickets are not breaching the spaces between them fast enough to result in the large fields with 100% seafloor coverage that Acroporids are known for.

To restore this natural, wide-spread blanketing structure more quickly we adopted a new outplanting strategy in 2020.

CORAL COHORTS

Our corals are now being returned to the reef 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 ten square meters. We are outplanting dozens of genetically diverse cohorts next to each other to cover huge expanses of reef.

INCREASING COVERAGE AREA

The new process increases our "coverage per coral". In the previous method, once the individual young corals had found their neighbors and fused into thickets, we only saw minimal outward growth towards the perimeter of the thicket. In essence, the growth potential of any individual coral fragment was capped soon after fusion, limiting the total coverage capacity of a fused, mature colony.

MAXIMIZING THE FOOTPRINT

The new cohort approach, with individual outplants spaced further apart, gives each young colony more time to increase its own individual footprint before becoming part of a fused thicket.

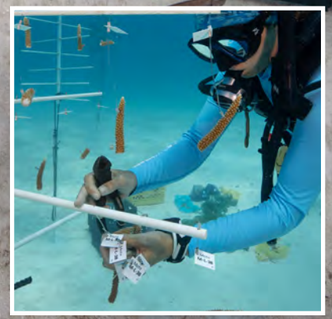
With this method, after one year on the reef we are seeing minimal fusion of individuals. This means that each coral is covering much more area on its own, before its coverage potential is capped by fusing with a neighboring colony and ceasing to grow in that direction. As a result, we are seeing dramatic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

MITIGATING DISEASE

Another advantage of this new cohort technique is that it has the potential to mitigate disease. By spacing genetically identical colonies within a cohort further apart, the risk of disease transfer from one colony to its neighbor (during or after the outplanting process) is lessened.

We are already seeing the incredible impact that this strategy is having on our restoration sites, and we will continue monitoring through 2021.

ALL IMAGES: New staghorn genotypes are tagged and homed in the gene bank at the Tavernier Coral Tree™ Nursery (AN)



SAFEGUARDING DIVERSITY

In June of 2020, Coral Restoration Foundation™ was at the epicenter of a first-of-its-kind, large-scale, coordinated "coral swap" of critically endangered staghorn coral. This exchange has helped collaborating organizations better protect, study, and restore populations of this critical animal.

On June 24th, 2020, scientists from Mote Marine Lab, Nova Southeastern University, University of Miami, and Florida Fish and Wildlife Conservation Commission (FWC) met at Coral Restoration Foundation™ headquarters to exchange 95 genotypes of critically endangered staghorn coral. Maintaining a redundancy of corals with the same genetic identity in multiple nurseries is important for preserving genetic diversity; by bringing pieces of the same colony into nurseries located throughout Florida's Coral Reef, we are insuring against loss from sporadic events like storms.

EXTINCT IN THE WILD

Many of the genotypes involved in the swap are now extinct in the wild. The fact that these colonies represent unrecoverable genetic diversity highlights the importance of an exchange of this kind to promote redundancy across restoration systems.

Supported by a grant from NOAA's Restoration Center, the exchange provides security for the future of this species, but also expands opportunities for research into coral genetics, disease and climate change resilience, and reproduction.

During the swap, CRF™ gave 27 different staghorn genotypes to each of the four collaborating organizations. In return, 66 new gentoypes of staghorn coral from the other four partners were introduced to the CRF Tavernier Coral Tree™ Nursery - the largest in the world.

RESTORING RESILIENCE

Since 2017, CRF™ has been returning at least 50 genotypes of staghorn and 50 genotypes of elkhorn to every reef site that we are working to restore. Genetic diversity is critical for ecosystem resilience; genetic diversity is the key to an ecosystem's capacity to survive episodes of stress including disease outbreaks, warming water, cold upwellings, pollution, and more.

All of the genotypes that were exchanged came from wild colonies, with a couple of these genotypes originating from colonies native to the Dry Tortugas. But a small subset of these corals has special significance for Coral Restoration Foundation™.

LOST GENETS RETURNED

During Hurricane Irma, CRF™ lost a handful of staghorn genotypes from its nursery system. Thankfully, before the storm, we shared some of these colonies with Mote Marine Laboratory, and through this swap, they have now returned to our ocean-based nursery. The return of these genotypes underscores the importance of these kinds of exchanges – by working together we can ensure that important, diverse genetic material is protected, with multiple colonies held in multiple places to safeguard against any potential disasters.

Once these colonies are large enough, a selection of them will be propagated and their clones moved into the production area, for eventual release to the reefs of the Florida Keys.

Thanks to a significant five-year investment from Ocean Reef Club®, Carysfort Reef is back on the map as a demonstration site for coral reef restoration (AN)

CARYSFORT 2020

Once known as the "Jewel of the Florida Keys", Carysfort Reef is one of the most iconic reefs in the world. But, over the last 40 years, we have pushed this natural wonder to the brink of extinction.

Now, thanks to the completion of a five-year partnership with Ocean Reef Club®, Carysfort Reef is back on the map as a model for successful reef restoration in Florida and beyond.

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, this special site 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. We called the project "Carysfort 2020".

As a result, Carysfort Reef has received more new coral outplants than any other restoration site in the Florida Keys. Carysfort Reef is now an example of what successful restoration throughout the Florida Keys should look like.

RECORD-BREAKING RESTORATION

Today, almost every staghorn and elkhorn coral you see at Carysfort Reef was introduced by CRF™. Through our game-changing partnership with Ocean Reef Club®, CRF returned more than 34,000 corals to the reef over the course of Carysfort 2020, exceeding our goal of 30,000 by the end of 2020. Our restoration efforts included both significant numbers of staghorn and elkhorn coral, as well as our first scalable outplant focus of boulder corals.

Bouldering coral species are important reef stabilizers and critical to the overall ecological health of the reef. CRF™ outplanted over 5,600 boulder coral colonies at Carysfort Reef. Following our success with the species at Carysfort, we expanded our boulder coral restoration to four additional reef sites in the Florida Keys: North Dry Rocks, Cheeca Rocks, Looe Key, and Newfound Harbor.

THE CARYSFORT CORAL TREE™ NURSERY

Carysfort Nursery is our second largest nursery and lies just inshore from Carysfort Reef. This nursery is vital for our restoration efforts in the northern Keys, providing coral stock for several restoration sites within the Carysfort Reef Complex (north, south, forereef, and backreef) and nearby reefs like Horseshoe Reef. To support our large-scale restoration goals at Carysfort, we expanded the nursery from an initial 53 Coral Trees™ to a total of 160 by 2020, with 100 of the trees dedicated to elkhorn coral as we prepare for the species' increased goals as part of "Mission: Iconic Reefs".

FIRSTS AT CARYSFORT

Carysfort Reef has served as a proving ground for a number of important reef restoration firsts:

- *Carysfort 2020 was the first restoration project to apply genetic diversity metrics.*
- *Carysfort was the first reef site to be outplanted with genetically unique coral recruits reared at the Florida Aquarium's land-based facility from coral spawn collected from CRF™ nurseries.*
- *Carysfort was the first reef site to be outplanted with CRF™ boulder corals.*
- *In 2020, Carysfort was the first site to recieve a new 3-D boulder coral dome*

INSERT: One year-old elkhorn coral outplants at Carysfort Reef in 2018 (AN)

MAIN IMAGE: The same elkhorn corals in 2020, showing impressive growth (AN)

Each tree in the nursery holds a single genotype of coral that was initially transferred to Carysfort from Tavernier, our largest offshore coral nursery. All told, the Carysfort Nursery houses over 100 genotypes across four coral species, providing the genetic diversity necessary for a resilient restoration project.

SURVIVORSHIP AT CARYSFORT

While survivorship is variable as a result of numerous factors, Carysfort Reef is a flagship site for demonstrating CRF™ outplant survival. It is one of only a handful of sites that has coral outplants more than five years old, including large, fused elkhorn colonies that mark the return of this dominant species to the reef.

After Hurricane Irma in 2017, corals along Florida's Coral Reef suffered massive losses. At Carysfort Reef, CRF outplanted corals recovered faster than they did at almost any other site in the Florida Keys.

PHOTOMOSAICS

The scope and variety of the restoration work at Carysfort has been critical in helping us to build such a robust mosaic program. It was the site of our initial mosaics of coral transects in 2018. We went on to demonstrate that our photomosaic protocol is over 95% accurate compared to in-water diver surveys. This methodology was then presented as a case study for taking the program to scale at Reef Futures 2018.

RESEARCH COLLABORATIONS

Our nurseries and restoration sites are a "living laboratory" for research on coral restoration. A number of research collaborations have taken place at Carysfort Reef over the course of Carysfort 2020:

UNIVERSITY OF ALBERTA
We established long-term monitoring areas for reef fish community surveys, covering both control (no outplanting) and active outplanting areas to see how the fish communities differ. We supported a study to test the relative influence of coral structure and living coral tissue on fish recruitment rates and community structure.

UNIVERSITY OF NORTH FLORIDA
This project investigated how outplanting success can be increased by the administration of short-term heat stress prior to outplanting. This understanding of phenotypic plasticity by genotype helps us better select corals for outplanting and techniques we could employ to promote outplanting success.

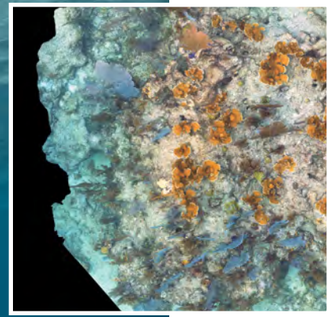
NATIONAL OCEANOGRAPHIC & ATMOSPHERIC ADMINISTRATION
This project monitored elkhorn corals at Carysfort Reef with the assistance of water temperature and current tilt meters along the outplant area to identify disease-resistant corals among nursery raised coral outplants. This information is helping us understand the effect of the specific location in which a coral cluster or individual is planted on the overall success of that outplant.

UNIVERSITY OF FLORIDA
CRF™ teams installed water quality instruments at the Carysfort Nursery to track long-term water quality trends through time. The sensors measure dissolved oxygen concentration and water temperature and represent some of the first of this kind of data to come from an offshore nursery. The sensors have been deployed for over a year and are still out collecting data. These data trends can help us tease apart changes in coral health and growth through time.

BOSTON UNIVERSITY
The primary goal of this study was to understand the value-added by restoring branching and massive corals together. Secondary goals include assessing community structure, ecological function, and ecosystem service flow of restoration efforts. This outplanting study was conducted at Carysfort, on the restoration plots where we first outplanted boulder corals.

MAIN IMAGE: Thriving staghorn coral thickets at Carysfort Reef (AN)

IMAGE BLOCK CLOCKWISE FROM TOP LEFT: Photomosaic of elkhorn corals at Carysfort; Capturing photomosaics by scooter; Young staghorn outplants attracting marine life at Carysfort; Elkhorn corals thriving at Carysfort (AN)



This has led the Florida Keys National Marine Sanctuary to allow us to use our photomosaic protocol in place of historical monitoring techniques to meet permit requirements. Currently, "Mission: Iconic Reefs" is evaluating the use of photomosaics to monitor progress throughout the initiative and has established an active working group that CRF™ participates in.

Our mapping work to date helped craft the segmentation and zonation of reef sites, allowing for coordination amongst groups supporting the work outlined in "Mission: Iconic Reefs".

INTO THE FUTURE

Ocean Reef Club's initial investment at Carysfort has helped pave the way for continued restoration focus on the iconic reef, coupled with significant additional public and private funding.

Thanks to the success of Carysfort 2020, Carysfort Reef was one of seven reefs identified through the larger management strategy of "Mission: Iconic Reefs". The decades long project has an estimated budget of $97 million, $46 million of which is dedicated to restoration work specifically at Carysfort Reef.

CRF™ will lead the continued restoration efforts at Carysfort, which call for over 110,000 new corals to be introduced to the reef over the next decade. Carysfort 2020 has been completed, but our work here has only just begun.

2020 HIGHLIGHTS

- *Despite the challenges presented by the COVID-19 pandemic, we hit all of our 2020 outplant goals.*
- *We facilitated the first exchange of* Acropora cervicornis *genets between restoration partners in South Florida.*
- *We secured a contract with the Florida Keys Electric Co-op for mitigation work to relocate corals on structures targeted for maintenance or demolition.*
- *We established a shallow-water nursery at Pickles Reef to function as a place to acclimatize rescued corals to deeper water environments.*
- *In collaboration with the CRC, we developed and deployed new structures for boulder coral outplanting.*

INTO 2021

- *We are looking ahead at an unprecedented scale of outplanting.*
- *In 2021, we're aiming to return 41,000 corals to Florida's Coral Reef, which will be the most that CRF™ has ever outplanted in one year.*
- *To achieve this ambitious goal, we will be expanding our staff and increasing our number of days on the water.*

Dive program participant from the Black Girls Dive Foundation assisting with cleaning Coral Trees™ in the Tavernier Coral Tree™ Nursery (ZR)

2020 PROGRAM 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 maintance for our working vessels, free of charge.

THE COLLEGE OF THE FLORIDA KEYS (CFK)
Our internship program with CFK enables three interns to assist in 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.

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 Sancturary provide the permits that make our work possible.

FLORIDA KEYS ELECTRIC COOPERATIVE (FKEC)
Corals we relocate from FKEC structures are contributing to diversity in our restoration programs.

GEORGIA AQUARIUM
Our long-term partnership with the Georgia Aquarium continues, highlighted by quarterly restoration trips, where Georgia Aquarium volunteers help us focus on nursery maintenance, expansion, and outplant efforts.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) & NOAA RESTORATION CENTER
NOAA RC has been pivotal in providing funding, guidance, advice, and input on decision-making.

OCEAN REEF CLUB® (ORC®)
ORC® has been a key partner in the ongoing restoration of Carysfort Reef, now one of the healthiest reef sites on Florida's Coral Reef. Ocean Reef Club® will co-host Reef Futures in 2021, as they did in 2018.

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

INFORMED EVOLUTION

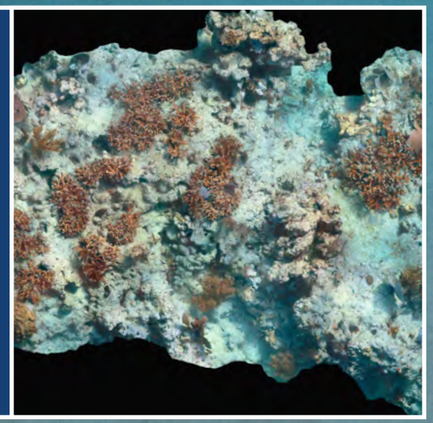
Our Science Program tracks the progress of our restoration work, ensures that we are using and developing best practices, and functions as a hub of expertise and resources for restoration practitioners around the world.

- We currently work with **415 unique coral genotypes across 11 species** to ensure that we are restoring the reefs' genetic diversity and resilience.
- We rigorously monitor our outplanted corals and reef sites, and are involved in **research into the wider ecological impact of our work.**
- This data informs our strategic development, and the **research provides a focal point for collaborations** with government agencies including NOAA, universities, NGOs, and others.
- We supply scientists from around the world with **unique resources for research** into coral reefs.

MONITORING OUR IMPACT

*In 2020, we used photomosaics to track increases in coral cover between one month and one year post-outplanting. While each species fares differently at different sites, we are seeing that, on average, our outplants increased their footprint by **143%** in the span of one year:*

- Acropora cervicornis: *outplants covered an average of **172% more area***
- Acropora palmata: *outplants covered an average of **50% more area***



Broodstock corals are "tented" to capture coral gametes used for research and restoration (AN)

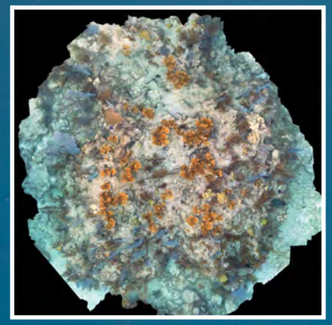
SCIENCE

PHOTOMOSAICS

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

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.

In 2020 we generated 94 mosaics which cover around 48,000 sq meters across 13 different reef sites. These mosaics capture various phases of restoration and provide data that track increases in coral cover between one month and one year post-outplanting events.



Alex Neufeld, CRF™ Photomosaics and Technology Coordinator, captures a photomosaic using a scooter (DB)

INTO 2021

- We plan to develop a process specifically for monitoring 3-dimensional growth of boulder coral outplants.
- As a part of the program's continued development, we will be experimenting with new cameras, scooters, and stitching techniques for creating even more accurate photomosaic stitches.
- We will also be coordinating with all relevant "Mission: Iconic Reefs" parties to develop consistent and appropriate monitoring procedures.

MONITORING AT SCALE

Prior to 2020, we monitored our restoration sites using a technique known as "fate-tracking". This is a time-intensive, in-water process that monitors the survivorship of individual corals. As the scale of our work has grown, this method no longer accurately represents the impact of our population-level restoration efforts.

In 2019 we conducted simultaneous fate-tracking and photomosaic monitoring to show that mosaics could produce more accurate, meaningful data. As a result, in 2020, CRF™ was officially permitted to monitor all outplanted corals via photomosaic, and we began to scale our photomosaic program significantly.

We created a new, full-time role focused on photomosaic monitoring, and developed the capacity of restoration staff to acquire photomosaic imagery on outplanting trips. But capturing the images is only the first part of the photomosaic process.

SOFTWARE DEVELOPMENT

Once the pictures have been taken, they need to be stitched together and then analyzed by painstakingly tracing the borders of the living coral tissue visible in the image. Stitching mosaics takes a huge amount of time and processing power; it took around 40 hours to stitch our largest photomosaic to date – a 5,000 sq meter rendering of North Dry Rocks.

In the fourth quarter of 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 an AI solution to trace the mosaics and measure coral coverage and growth. Such a novel technology will require substantial investment but also opens CRF™ to new revenue streams and collaborations and will allow us to help dictate the direction of a rapidly-developing area of coral conservation and reef restoration. This collaboration will continue into 2021.

UPDATED RESOURCES

The progress we made in our photomosaic program in 2020 resulted in the publication of a revised and updated Photomosaic Monitoring White Paper that is now available for download on our website.

CORAL SPAWNING

Once a year across Florida and the Caribbean, around the late-summer full moon, Acroporid corals simultaneously release gametes – bundles of eggs and sperm – into the water.

This process is called “spawning” and it is vital for the health of wild coral populations. Spawning is how corals create successive generations and new, genetically unique individuals.

UNIQUE RESOURCES

Our nurseries and restoration sites have now become invaluable resources for other organizations seeking to better understand this little-known process.

Gametes collected from our corals are helping researchers better understand coral sexual reproduction, improve monitoring methodologies, enhance the impact of spawning events, and create new coral genotypes. Corals raised from gametes collected at our facilities are thriving with organizations around the world.

THIS IMAGE: Roxane Boonstra, CRF™ Dive Training Administrator, tenting a broodstock staghorn coral for gamete collection (AN)

IMAGES LEFT: Staghorn corals releasing gamete bundles (AN & DB)

Staghorn gametes in the collection tube (AN)

SPAWNING RESEARCH

Unable to bring research teams together in 2020, we used the opportunity to send our divers to our restoration sites to gather data from our corals in the wild. These trips resulted in some incredible firsts for spawning research.

SPAWNING FIRSTS IN 2020

In 2020, NOAA divers witnessed our nursery-raised, outplanted elkhorn corals spawning in the wild for the first time. The colonies that spawned comprised two different genotypes. These colonies were introduced to the reef site in 2015, as part of a NOAA/SEFSC experiment, supported by Coral Restoration Foundation™. The team collected and successfully cross-fertilized the two elkhorn genets that spawned.

Our team also witnessed 14-month old staghorn corals propagated and outplanted by CRF™ spawning on Florida’s Coral Reef. These were the youngest CRF™ nursery-raised, outplanted staghorn corals to be observed spawning in the wild, and possibly the youngest outplanted staghorn ever to be observed spawning in the Florida Keys.

Data collected in our nurseries and on the reef showed an asynchrony of spawning between corals on the same genotype in different locations - something that we have never observed before, and presents a rich area for further study.

These firsts for coral spawning science further demonstrate how valuable the CRF™ infrastructure is to the coral research and restoration community.

UPDATES: BOLSTERING DIVERSITY

In both 2018 and 2019, we moved large broodstock corals to Keys Marine Lab, where scientists from multiple organizations observed spawning in a controlled setting and collected gametes.

In 2018, The Florida Aquarium (FLAQ) mixed these coral gametes and created over 3,000 new genotypes by crossbreeding different genets. In 2019, the FLAQ team brought 1,500 of these offspring to our Tavernier Nursery, where we raised them before introducing a number of them to the wild. These new genotypes represent a huge leap forward for genetically diverse and resilient coral populations in the Florida Keys.

In 2020, we moved the remaining FLAQ recruits into the gene bank and sent them for sequencing. This increased the diversity in our gene bank by 84 staghorn genotypes. This is a critical bet-hedging strategy as these additional, diverse corals will soon be grown out for use in future restoration efforts.

OUR RESEARCH FOCUS

1) 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.

2) OUTPLANTING METHODS

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

3) MONITORING TECHNIQUES

We are constantly looking to improve the ways we analyze outplanted corals and their impact on the ecosystem. By capitalizing on new technologies, we can show how restoration success is not only possible, but also quantifiable.

4) SUITABLE RESTORATION SITES

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

5) GENETIC RESILIENCE

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

6) COMMUNITY STRUCTURE & RESTORATION SUCCESS

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

Amelia Moura, CRF™ Science Program Manager, coordinates coral collection for spawning research with collaborators in 2019 (DB)

2020 RESEARCH COLLABORATIONS

CORAL NURSERIES

Linda Penfold
SEZARC
Investigating the "night effect" of gamete reproductive success through the cryopreservation of staghorn coral gametes. Specific project goals include: 1) Characterization of sperm morphology; 2) Optimization of cryoprotectant concentrations to increase sperm post-thaw viability; and 3) Optimization of field-friendly fertilization and cryopreservation protocols.

IMPACTS OF CORAL BLEACHING & DISEASE

Ana Palacio
University of Miami
Studying genetic trade-offs in disease resilient *Acropora cervicornis* under nutrient stress. Testing the effect of water quality on disease resistance, measuring physiology to identify trade-offs of disease resistance, and looking at transcriptomics and microbial communities. This research uses CRF™ *A. cervicornis* fragments that have been identified as "resistant" or "highly sensitive" to disease in previous studies.

Christina Kellogg
USGS
Isolating the cause of SCTLD using 10 genotypes of our nursery mountainous star coral. Answer the question of whether the pathogen causing SCTLD is bacterial or viral versus something larger (e.g., diatoms) or smaller (chemical signal), based on physical size fractionation.

Ross Cunning
Shedd Aquarium
Testing the thermal tolerance of several hundred *A. cervicornis* genotypes from throughout the Florida Keys, including over 40 from the CRF Tavernier Nursery. This technology, called CBASS, provides a rapid assessment of how individual genotypes respond to elevated water temperatures, giving us a better understanding of the unique characteristics of each coral genotype.

THIS IMAGE: Amelia Moura, CRF™ Science Program Manager, monitoring recently outplanted boulder corals (AN)

PUBLICATIONS

Our expertise and infrastructure facilitated five studies published in peer-reviewed journals in 2020:

Journal of Marine Science and Engineering
January 18, 2020
Using Scuba for In Situ Determination of Chlorophyll Distributions in Corals by Underwater Near Infrared Fluorescence Imaging
Authors: Oh T, Sermsripong J, Hicks BW.

Diversity
April 17, 2020
Coral Restoration Effectiveness: Multiregional Snapshots of the Long-Term Responses of Coral Assemblages to Restoration
Authors: Hein MY, Beeden R, Birtles A, Gardiner NM, Le Berre T, Levy J, Marshall N, Scott CM, Terry L, Willis BL.

Journal for Nature Conservation
April 18, 2020
Differential disturbance effects and phenotypic plasticity among outplanted corals at patch and fore reef sites
Authors: Lohr, K. E., Ripple, K., Patterson, J. P.

PLoS ONE
May 6, 2020
Survivorship and growth in staghorn coral (Acropora cervicornis) outplanting projects in the Florida Keys National Marine Sanctuary
Authors: Ware, M., Garfield, E.N., Nedimyer, K., Levy, J., Kaufman, L., Precht, W., et al.

Restoration Ecology
October 7, 2020
Differential survival of nursery reared Acropora cervicornis outplants along the Florida Reef Tract
Authors: van Woesik, R., Banister, R.B., Bartels, E., Gilliam, D.S., Goergen, E.A., Lustic, C., Maxwell, K., Moura, A., Muller, E.M., Schopmeyer, S., Winters, R.S. and Lirman, D.

STRONGER TOGETHER

We need to give the next generation the right tools so that they can adapt to and thrive in our changing world.

At CRF™ we provide practical, meaningful ways for everyone to learn from, and get actively involved with our mission to save and restore our coral reefs. The lessons embedded in our work provide a foundation for understanding how to ensure the future of our planet's life support systems.

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

ENGAGING THE PUBLIC

Despite COVID-19, we reached around 7,000 people through our Educational Activities in 2020, including 61 virtual events.

A young diver helps clean the Coral Trees™ as part of a private Dive Program with the Black Girls Dive Foundation (ZR)

EDUCATION

DIVE PROGRAMS

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

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 like Diveheart, a scuba club for children, adults, and veterans with disabilities.

Since 2019, more of our interns and 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.

In 2020 we had 630 people join our public recreational dive programs. We also held our first private dive program with the Black Girls Dive Foundation, and we are looking forward to welcoming them back in 2021.

VOLUNTEERING

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 alongside us.

We currently have 112 active volunteers.

Divers returning elkhorn coral fragments to the reef during a public Dive Progam (AN)

ENHANCING CAPACITY

When the COVID-19 pandemic hit, we put our recreational dive and volunteer programs on hold to keep our team and community safe. But during this hiatus, we went to work improving our volunteer program and pipeline. This was made possible by creating two new full-time positions at CRF™ – a Volunteer Coordinator and a Dive Training Administrator.

HARNESSING TECHNOLOGY

In 2020, our Volunteer Coordinator focused on increasing administratrative efficiencies in our volunteer program, incorporating a new software platform to automate and streamline our volunteer onboarding processes. This new software makes it easier for us to track volunteer progress, and makes the program more user friendly, which has resulted in a greater retention of volunteers.

TAILORED TRAINING

Our Dive Training Administrator redesigned our volunteer training pathway, providing virtual training sessions, as well as tailored, personalized coaching opportunities for volunteers with different levels of experience. 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.

These developments have dramatically enhanced our volunteer program, which has increased the capacity of volunteers, 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™; we were reminded of the critical contribution that our volunteers and dive program participants make to our mission.

CORALPALOOZA™ DIGITAL 2020

On every World Oceans Day since 2016, we have taken out an army of ocean lovers to actively restore coral reefs in Florida and around the world.

But 2020 was a little different...

As the horrifying implications of the pandemic were beginning to manifest, we were deep in planning mode for Coralpalooza™ 2020. Despite the unprecedented challenges the world was facing, our team still found a way to bring people together to celebrate our world's coral reefs and efforts to save them, staying true to the spirit of Coralpalooza™.

THE ABILITY TO PIVOT

Six weeks before Coralpalooza™ was due to take place, the CRF™ team pulled together for a dramatic pivot. Thanks to CRF's collaborative and adaptable team dynamic, we pulled off one of our most ambitious undertakings to date – Coralpalooza™ Digital 2020.

A WORLD FIRST

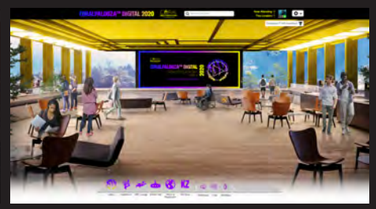
Coralpalooza™ Digital 2020 was the world's first event of its kind; an online celebration of coral reefs, packed with new and exclusive digital content. We curated films, interviews, presentations, and panel discussions, a virtual exhibit hall with booths from coral restoration and marine conservation organizations from around the world, a treasure hunt, and a Kids' Zone hosted by Captain Coral himself.

Highlights included interviews with Philippe Cousteau Jr., Wyland, and Richard Vevers, exclusive messages from the legendary Sylvia Earle, Congresswoman Debbie Murcasel-Powell, and musician Huey Lewis, and presentations from some of the world's leading coral restoration scientists and practitioners.

AN OPPORTUNITY TO REACH OUT

Coralpalooza™ Digital gave us the opportunity to reach more people with our mission than ever before; we had over 1,000 attendees join us from 67 countries, spending hours on the platform at a time. We reached the young, the old, the in-between, scientists, politicians, students, divers, animal lovers, the seafaring, and the landlocked.

Coralpalooza™ Digital 2020 was so successful that it has now become a regular feature of our famous World Oceans Day celebration.



BEHIND THE COLORS

1,100+ Attendees
67 Countries
16 Virtual booths
17 Exclusive features
230+ Pieces of content

The bright colors that marked Coralpalooza™ Digital 2020 were part of the "Glowing, Glowing, Gone" campaign. Presented by The Ocean Agency, Adobe, and Pantone, the campaign gave brands and designers around the world a dramatic visual tool kit based on the colors of "world's most beautiful death" as captured in the Netflix documentary, "Chasing Coral".

The idea was to create a tidal wave of arresting products and designs using the vibrant colors produced by some corals as they bleach and die, to force the world to confront the crisis facing our coral reefs.

We adpated our processes and programs to continue welcoming interns throughout 2020 (MH)

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.

TESTING OUR STRENGTH

The outbreak of COVID-19 in 2020 impacted our education program possibly more than any other. But the team was able to adapt and thrive, harnessing the power of technology. We learned to be more creative with our virtual learning, and turned our focus to increasing our virtual footprint.

INTERNSHIPS

We kept our internship program running through a digital learning academy. Our Spring Interns isolated in their households, and received their onboarding and department orientations online. They supported the creation of Coralpalooza™ Digital, producing video workshops based on our open-source Activity Packs, and gave Skype presentations to students around the country. We also brought on three fully remote interns from the University of Chicago.

When we were able to welcome our interns back in person, following all CDC guidelines, we structured our boats and rosters to ensure the safest possible working conditions. Our interns were eventually able to contribute to our success in reaching our 2020 outplanting goals.

From more than 250 applicants, we welcomed 37 interns to the program in 2020, filling a total of 57 positions. The majority of our interns stayed on for two or three semesters, working their way up through the tiered program which takes them from interns, to lead interns, to program interns. These young professionals are now well on their way to launching exciting careers in marine science.

VIRTUAL EDUCATIONAL EXPERIENCES

Our new virtual learning opportunities include online field trips and a virtual dive. We are also now offering our After School Club virtually, which provides access to our unique educational program to the whole country.

The developments necessitated by the challenges of 2020 have enhanced our education program immeasurably. We are now positioned to reach more people in more places than ever before.

Hands-on outplanting practice following CDC guidelines during a private Dive Program with the Black Girls Dive Foundation (TM)

2020 HIGHLIGHTS

- *Coralpalooza™ Digital reached more than 1,000 people from around the world, and has now become a standard feature of our famous World Oceans Day event.*
- *We kept our sought-after internship programming throughout the year, welcoming a total of 37 interns, with three remote interns from the University of Chicago.*
- *New virtual learning opportunities necessitated by the pandemic are allowing us to reach more minds with our mission than ever before.*
- *Our national Coral to Action Student Challenge workshop was downloaded from 16 different states, empowered 239 students to make videos about the threats facing Florida's Coral Reef , and resulted in 91 videos submitted to the competition.*
- *Our volunteer program had a 79% retention rate in 2020, despite no in-person activities.*
- *The CRF™ Dive Program recieved a 93% approval rating, with 83% of participants surveyed intending to return for another program.*
- *Our work with Club Coral through a grant from the Disney Conservation Fund resulted in the children's book, "Isabella the Decorator Crab", which will go to print in 2021.*

RESOURCES FOR TEACHERS

AFTER SCHOOL CLUBS

The Coral Restoration Foundation™ After School Club provides students with a holistic educational experience that enriches science, math, geography, language, and creative arts learning. The STEAM-focused activity sessions combine elements of project-based, team-based, and problem-based curriculum. They introduce students to oceanography and ecology, while delivering a hopeful message about our capacity to save and protect our coral reefs.

In 2020, we created virtual After School Clubs, opening up access to learners anywhere in the world.

ACTIVITY PACKS

Our open source lesson plans follow Florida State Standards and enrich the curriculum for all students from grades K through 12.

VoIP PRESENTATIONS

We offer tailored, virtual presentations for diverse classes and groups around the world.

INTO 2021

- *We will be continuing our focus on virtual learning, with more Coral Crew training videos going into production in 2021.*
- *We will be producing more virtual training and educational films and animations.*
- *We will be hosting more events in Key West and plan to open a second Exploration Center in the Lower Keys.*

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 – 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
www.coralrestoration.org/dive-programs

FREE LEARNING RESOURCES

DIGITAL CLASSROOM PRESENTATIONS

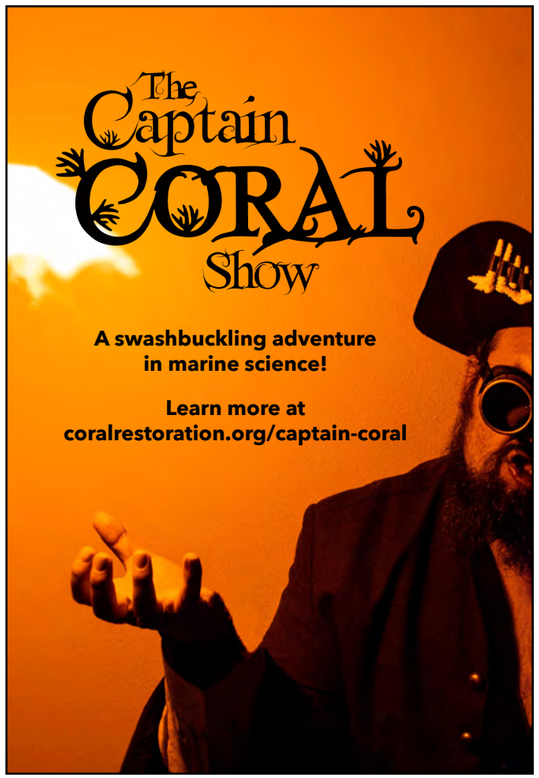
Free digital presentations bring us to your classroom, wherever you are.

Email us at: 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: www.coralrestoration.org/activity-packs



ENGAGING THE WORLD

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

We can't do this alone. We need to empower everyone to choose to make a change, and by reaching the masses with our message, we are doing just that.

In 2020, the CRF™ mission was picked up by national and international media including **PBS, The New York Times, GQ, Forbes, CNN, Esquire, Fast Company, Yahoo Finance,** and the **Miami Herald.**

Our episode of the **PBS** series, "**Spotlight On**", launched in 2020, is currently airing nationwide and will continue to do so for years to come, reaching millions of households across America every year.

CORAL RESTORATION FOUNDATION™

SOCIAL MEDIA

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

Inspiring content, world class images, and creative collaborations with corporate sponsors have propelled our social media audience into the stratosphere.

104,000+

33,000+

4,650+

10,000+

FINANCIALS

CRF™ Science Program Manager, Amelia Moura, monitors boulder coral outplants at Carysfort Reef (AN)

INCOME & EXPENSES

Coral Restoration Foundation™ is supported by individuals, corporations, private foundations, and government agencies.

The sources and allocation of our funding in 2020 are broken down as follows:

SOURCES OF INCOME

Total Income: $3,543,181

- Government **$1,438,653**
- Foundations **$736,468**
- Corporations **$315,248**
- Individuals **$969,631**
- Other **$74,181**

EXPENSES

Total Expenses: $2,423,480

- Program Expenses **$1,850,497**
- General & Admin **$357,302**
- Fundraising **$215,681**

PERCENTAGE EXPENSES BY PROGRAM

Restoration **46%**

Science **18%**

Education **36%**

MEANINGFUL GIVING

We have capacity to scale, with the ability 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.

Jacks schooling in the Tavernier Coral Tree™ Nursery - a diverse habitat in its own right (AN)

WAYS OF GIVING

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

CORPORATE SPONSORSHIPS

Support from like-minded companies 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

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 for our work today.

Give a stock gift at: 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

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 receive the same tax treatment as stocks. Donating crypto can often reduce your tax burden. Please contact your tax or financial advisor for more information.

To learn more or make a donation, visit: coralrestoration.org/crypto-donations

GIFT & ESTATE PLANNING

A gift in your will or living trust may allow you to have a greater impact on our natural world than you ever thought possible. CRF has partnered with FreeWill to provide you with new ways to support our coral reefs while making it easier to protect the people and causes you love. With our new online tool you can now write your legal will, at no personal cost, while creating a legacy gift to support our oceans. Use this free will-writing tool to get started in 20 minutes or less.

Get started at: 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

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.

Image by Alexander Neufeld

THANK YOU
2020 CONTRIBUTORS

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, 2020 and December 31, 2020.

- 4Ocean
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- The Winsor Family
- Dr. R. Scott and Janice Winters
- The Wong Family
- The Woroch/Vobach Family
- Xtinctio

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We are grateful to those who have donated goods and/or services to support our mission between January 1, 2020 and December 31, 2020.

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Forest Tek
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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.

CORALPALOOZA™ 2022

PLANT A CORAL, RESTORE A REEF

FOR WORLD OCEANS DAY
JUNE 4 & 5, 2022

Sponsorship opportunities are now available!
Contact Roxane Boonstra at roxane@coralrestoration.org

RAISE THE REEF

MARCH 19, 2022

CORAL RESTORATION FOUNDATION™
8TH ANNUAL GALA

Sponsorship opportunities are now available!
Contact Michelle Andersen at michelle@coralrestoration.org

2020 IN NUMBERS

17,600m²
Of reef restored in Florida since 2007

27,200+
Corals returned to Florida's Coral Reef in 2020

140,000+
Corals returned to the reefs of the Florida Keys since 2007

11
Reef sites received corals in 2020

630
People took part in our Recreational Dive Programs in 2020

1,100+
People attended Coralpalooza™ Digital 2020

7,000+
People reached by our Education Program in 2020

112
Active volunteers

37
Interns joined us in 2020

61
Virtual events held by our Education Program in 2020

1,000,000+
Social media reach as of August 2020

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

415
Coral genotypes safeguarded for the future

11
Coral species living in our nurseries

8
CRF™ Coral Nurseries in the Florida Keys

750+
CRF™ Coral Trees™ in the Florida Keys

48,000 m²
Of reef documented by photomosaic in 2020

143%
Average increase in area coverage across all sites and all species after one year

13
Restoration sites documented by photomosaic in 2020

94
Photomosaics of our restoration sites generated in 2020

CORAL RESTORATION FOUNDATION™

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