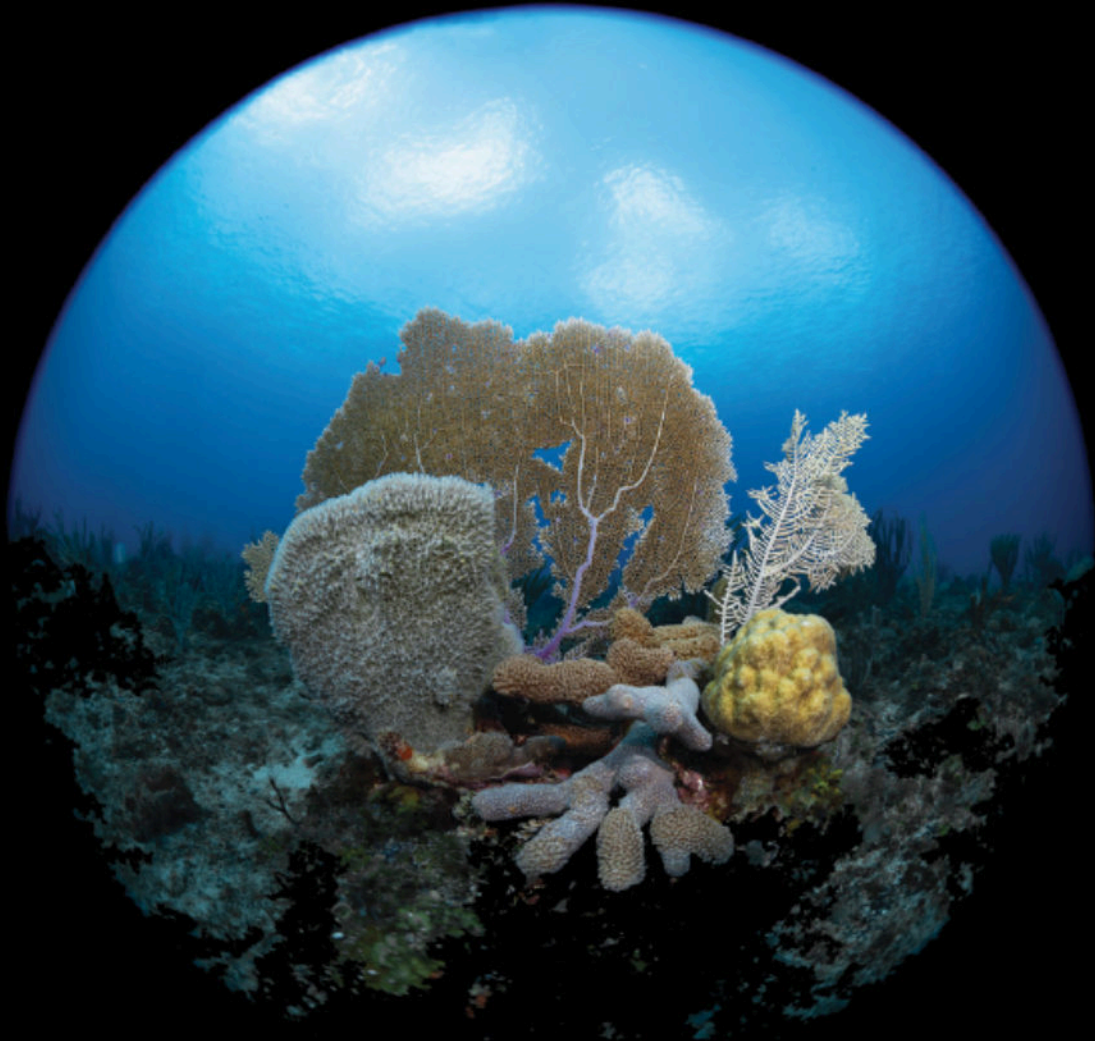


THE CORAL COMPASS



Reef Response is a coral restoration program in the U.S. Virgin Islands dedicated to improving the health and diversity of the territory's coral reefs.



2025
Volume 2

Coral Nursery & Outplanting Sites

-  In-water nurseries
-  Land-based nursery
-  Outplanting sites





Photo of Dr. Marilyn Brandt taken by Avery Coble

A letter from the Director.

There are always two sides to every story.

And so it goes with coral restoration. On one side, ReefResponse has grown—training new students and staff, adding nurseries, building new coral reproduction capacity, planting more corals, and starting new experiments. But on the flip side, we have faced some of our greatest challenges.

In 2023 and 2024, Virgin Islands reefs experienced record-high temperatures. Like most of the world's coral reefs, they suffered mass bleaching, where the majority of corals turned white due to the loss of their life-giving microalgae symbionts. Bleaching stress can be devastating for corals, and we saw many wild corals die. In an effort to rescue our in-water coral nursery stock, we evacuated corals to deeper habitats (learn more on page 27). For the corals in our land-based nursery, we invested in an additional chiller to maintain reasonable water temperatures.

The years 2023 and 2024 have been challenging for the world's coral reefs, but we have also learned so much.

We've learned that corals stressed in shallow waters can survive in the lower light conditions of deeper waters. We've learned that many of our stock corals are resistant to stressful temperatures and did not show bleaching—these corals will be prioritized for propagation. We've identified sites that performed best during the extreme heat and gained insight into how their physical characteristics contributed to coral survival. Most importantly, we've learned that by working together as a team, we can accomplish an enormous amount. All of these lessons will be applied as we move forward into an uncertain future for coral reefs.

Coral restoration has often been questioned for its value. Is what we are doing

really making a difference in the face of such extreme events and predictions of even higher temperatures in the future? As the saying goes, are we just moving chairs around on the deck of the Titanic? My answer to that question is yes—it's worth it.

Coral restoration cannot replace every coral that has been lost, but with every coral we grow and plant back on the reef, we learn more and more about them. This knowledge compounds, giving us new ideas and strategies to test. Every coral that survives and thrives - and even every coral that is lost - teaches us how to be more effective at raising and restoring them.

There is also an even more important reason for coral restoration: hope.

Hope for the students we train, who work with the corals one-on-one in our land-based nursery, that there will be a future for corals. Hope for the scientific community, that as we learn more from our experiments, we can identify the keys to coral survival. And most importantly, hope for the Virgin Islands community members with whom we share our work, that the coral reefs we love and depend on will persist.

I sincerely hope that you enjoy reading about us, our work to restore and preserve, and the lessons we are learning from the coral reefs of the U.S. Virgin Islands.



"In 2023 and 2024, Virgin Islands reefs got hotter than has ever been recorded before and like most of the rest of the world's coral reefs, they experienced mass bleaching."

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We Are Reef Responders

Reef Response is a coral restoration program located in the U.S. Virgin Islands and based at the University of the Virgin Islands. The program was created to increase coral abundance and diversity while also empowering the local community to help mitigate the effects of changing environmental conditions. Reef Response’s mission is to stimulate coral reef ecosystem health through coral restoration, promote community involvement through training, outreach and education, and ensure best practices through scientific research.



Moriah Sevier
Coral Disease Treatment Coordinator



Kayla Budd
Coral Disease Treatment Specialist

Marilyn Brandt, PhD, Program Director

A portrait of Marilyn Brandt, a woman with long reddish-brown hair, wearing a dark blue polo shirt with a circular logo on the left chest. She is smiling and looking towards the camera.

Dr. Marilyn Brandt joined the faculty of the University of the Virgin Islands in 2010. Her research focuses on understanding coral reef diseases and using insights from this work to create effective strategies for coral conservation and restoration. As the director of the Reef Response coral restoration program, she spearheads initiatives to rehabilitate reefs severely affected by disease and other climate change-related impacts. Dr. Brandt is dedicated to mentoring

and empowering a diverse new generation of scientists and restoration practitioners.

In 2023, Dr. Brandt was honored with a lifetime achievement award from the U.S. Coral Reef Task Force for “outstanding dedication to advancing scientific knowledge on coral disease and restoration in the U.S. Virgin Islands and beyond.” In 2024, Dr. Brandt was named a U.S. National Science Foundation & Every Page Foundation Ocean Decade Champion.



Samuel Gittens, Jr.
Coral Disease Treatment Specialist



Larry Dew, Ph.D.
Coral Restoration Faculty



Rachel Ionata
Coral Restoration Projects Coordinator



Brad Arrington
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Natasha Bestrom
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Jason Quetel
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Sonora Meiling
Marine Disease Specialist



Davis Strobel
Restoration Ecology Specialist



Dan Mele
Coral Restoration & Communication Specialist



Nicholas Durgadeen
Coral Restoration Specialist



Chloé Camacho
Coral Restoration Workforce Fellow



Dr. C. Anna Toline, U.S. National Park Service

Dr. C. Anna Toline is the Regional Marine Ecologist, Ocean's Program Coordinator for the Southeast Region of the U.S. National Park Service. She provides technical support to marine/coastal parks from North Carolina to the USVI and across the Gulf of Mexico.

What parks are managed by the National Park Service on St. John?

There are two National Park units on St. John, Virgin Islands National Park (VIIS) and Virgin Islands Coral Reef National Monument (VICR). Both are managed by the same staff. VIIS includes over 7,000 acres of terrestrial and shoreline habitat and over 5,500 acres of offshore underwater habitat. VICR protects an additional 12,708 acres of marine habitat.

What inspired you to partner with UVI?

The National Park Service, and particularly Virgin Islands National Park, has been working with UVI for several years. We strive to use the best available science to inform management decisions. The expertise that UVI has to offer provides our local resource managers the opportunity to obtain a variety of data that helps us understand, for example, ecosystem health, coral disease, impacts of invasive species,

water quality, climate change, restoration, and other areas of interest.

How has that partnership grown or changed over time?

Now more than ever, we rely on UVI to work with us to not only provide data, but to work on-the-ground, or in our case, in-the-water, to help conserve and restore our marine resources. The threats to coral are increasing as sea surface temperatures rise, storms are more intense, coral disease becomes more prevalent, and other threats increase or emerge.

Following the devastating 2017 hurricanes, Irma and Maria, we started to focus heavily on coral restoration. We are working extensively with Dr. Marilyn Brandt and her staff to outplant coral to mitigate for hurricane damage. They are working hard to identify new and innovative approaches to not only restore coral reefs, but to aid our understanding of how best to implement restoration at our local sites.

In 2019, Stony Coral Tissue Loss Disease (SCTLD) was identified in the USVI. This is a devastating disease that can kill coral in a matter of weeks. Dr. Brandt's group has been studying the impacts of SCTLD while treating diseased coral in the park.

UVI has also helped to search for more heat-tolerant and disease-resistant coral genotypes, stabilize our coral following vessel groundings, and aided in rescue of coral for longer-term restoration efforts.

What does this relationship mean to the people of the U.S. Virgin Islands and the National Park Service?

Our relationship with UVI is critical. The USVI is a very small place. We are fortunate to have such excellent expertise so close at hand. Coral conservation and restoration in the park and around the entire USVI is dependent upon partnerships and leveraging work as much as possible. We could not do coral restoration, disease

treatment, and research without partners like UVI.

What are some of the new projects you are working on with UVI?

We have a few projects that are just beginning. We will be working with UVI and Woods Hole Oceanographic Institution to obtain data on the underwater soundscape around the park. It has been demonstrated that the soundscape can impact coral in their very early life-stages. By recording and understanding the sound, we can begin to identify how we can manage the environment to be healthier for coral.

We are working with both Dr. Brandt and Dr. Kristin Wilson-Grimes at UVI on how to restore our unique coral-mangrove system. Corals attach to the mangrove prop-roots. It is an incredible habitat but was, unfortunately, devastated following hurricanes Irma and Maria. The system is complex and will require new techniques to determine how best to restore it.

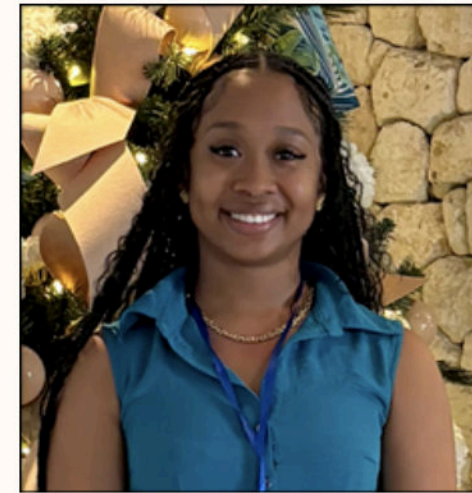
What are some non-resource management benefits of working with UVI?

I think just the great relationships with not only the professors but the staff and students. They are extremely hard-working and thoughtful, their work is excellent, and they are very conscientious about working in a protected area. We have been working closely with some of Dr. Brandt's staff, Rachel Ionata, Coral Restoration Projects Coordinator, and Moriah Sevier, Coral Disease Treatment Coordinator. Both are great to work with.

Can you share thoughts or comments on the future of coral ecosystems in the USVI and our National Parks?

Coral reefs are severely challenged. As I mentioned above, threats are increasing, and National Parks, although managed for conservation and visitor use, are still at risk to most of the same threats as corals across the USVI. But, by working with

partners like UVI, and also Coral World Ocean Reef Initiative, and The Nature Conservancy, with whom we also do coral restoration, we can identify how to address threats and increase restoration success. It's a difficult time for coral reefs, but I remain hopeful that NPS and its partners will continue to be innovative and work diligently to protect and restore this amazing habitat.



Jendahye Antoine, U.S.V.I. Department of Planning and Natural Resources

Jendahye is the Coral Reef Initiative Coordinator with the U.S.V.I. Department of Planning and Natural Resources (DPNR) and the main point of contact in that agency for coral restoration projects. She is also a recent graduate of the University of the Virgin Islands (UVI) Master of Marine and Environmental Studies Program.

Can you tell me how DPNR supports coral restoration efforts in the Virgin Islands?

Yes, of course! One of the efforts we support through funding and other resources is Dr. Brandt's *Acropora* Monitoring Project. This project evaluates the effectiveness of coral restoration by comparing natural coral populations to outplanted ones over time. It's funded by DPNR through NOAA's Coral Reef Conservation Program.

The project also focuses on stabilizing fragments of *Acropora palmata* that have been dislodged by physical disturbances, like wave action during storms. Research shows that returning these fragments to their original settlement sites significantly improves their chances of survival, so stabilization at their original location is a key part of the process.

Are there additional coral restoration programs supported by DPNR?

Yes, DPNR funds the St. Croix East End Marine Park's demonstration nursery which was created as a public outreach site and now trains volunteer divers in coral restoration techniques such as cleaning nurseries and out-planting coral fragments.

There is also the U.S.V.I. Coral Reef Initiative, which includes two key subgroups. The first is VI Restoration of Coral Squad (VI-RoCS) which coordinates restoration efforts and supports collaboration among coral practitioners to share best practices, challenges, and solutions for coral restoration. The VI-RoCS team led the creation of the USVI Coral Reef Restoration Plan. This plan serves as a strong guide for restoration efforts that are based on the territory's coral reef management needs. The plan highlights priority sites for restoration as well as provides a benchmark of stated goals and targets to track restoration progress. Many of DPNR's partners in the territory use this plan to guide their own restoration projects to support coral reef recovery.

Secondly there is the Virgin Islands Coral Disturbance Advisory Committee which coordinates response to coral disease and disturbances to support recovery of impacted reefs.

Another effort here at DPNR is our support for restoration at Butler Bay in St. Croix. Butler Bay has been identified as a priority coral restoration site, and that effort is funded by the Department of the Interior through DPNR. In collaboration

with The Nature Conservancy and Thriving Islands LLC., their team out-planted 500 *Acropora palmata* last spring and recorded spawning events this summer which was very exciting!

How has your background at UVI prepared you for this role?

My experience at UVI has been incredibly valuable. After earning my master's degree, I worked with Virgin Islands Marine Advisory Service, better known as VIMAS, focusing on community outreach and education. During my time at UVI, I also developed strong relationships with the research team. These relationships allow me to better understand their priorities and needs, creating more efficient and effective partnerships.

As the Coral Reef Initiative Coordinator, I manage federal funding to support coral reef health and resilience in the territory. My UVI connections keep me informed about ongoing fieldwork and research needs which helps me align our initiatives with current efforts.

What is your perspective on the future of coral ecosystems in the USVI?

The future of coral reefs depends on our collective investment in their resilience and health. Right now, reefs are declining due to stressors from human activities and climate change. However, with intentional and targeted intervention from all stakeholders—communities, field practitioners, and policymakers—we can rehabilitate these ecosystems and reduce the stressors they face.

While corals may not return to their historical state, we can sustain and restore populations with proper management, restoration efforts, and informed policies. This will require a long-term, collaborative effort to ensure these vital ecosystems are preserved for future generations.

Project Overview

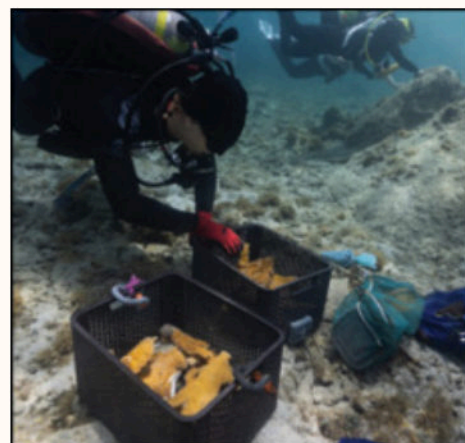
The three main tenets of Reef Response are Rescue, Research, and Restore. Cross-cutting these efforts are education, outreach, and training initiatives. The organization's operations are designed to propagate the most resilient corals from a diverse array of species and to outplant these corals at sites where they have the highest chances of survival and growth. Recently, another "R" has been added—Reproduction (see page 25). Reef Response is building new capacity to breed corals using resilient stock, aiming to enhance genetic diversity in the reefs they restore.

The knowledge gained is shared with other coral restoration practitioners at the territorial, national, and international levels. While successes are celebrated, failures are treated as opportunities for learning. Scientific methods are applied to critically evaluate the work and outcomes, ensuring that the most effective approaches are used.



Rescue

Corals known as "fragments of opportunity" are rescued—these are pieces typically broken off by storms, boat groundings, or threatened by construction projects, marine debris removal, or similar events. However, not all coral fragments are selected for restoration. The team focuses on the most resilient fragments—those that, despite experiencing disturbances, exhibit little to no signs of health impacts. These coral pieces are brought to coral nurseries, where they are further evaluated for growth and health characteristics. Once the rescued corals demonstrate stability and resilience, they are propagated using both established techniques and innovative methods.



Research

At its core, Reef Response is a research organization. While the primary goal of the organization is to restore reefs in the U.S. Virgin Islands, there is an equally important focus on understanding Virgin Islands corals and what promotes their survival and growth. Recent research projects have targeted species that are highly susceptible to stony coral tissue loss disease (SCTLD), a deadly condition that has devastated populations of pillar, brain, and star corals. Brain corals, in particular, have proven to be especially vulnerable,

making them the focus of graduate student Davis Strobel's master's thesis project (see more on page 26). The extreme marine heat waves of 2023 and 2024, which caused widespread bleaching among Virgin Islands corals (see pages 20–21), created an opportunity to identify potential evacuation sites for corals during future heat waves. Led by Marine Disease Specialist Sonora Meiling, the team tested outplanting corals at varying depths, down to 120 feet, to determine the depths at which corals survived best (see page 27).



Restore

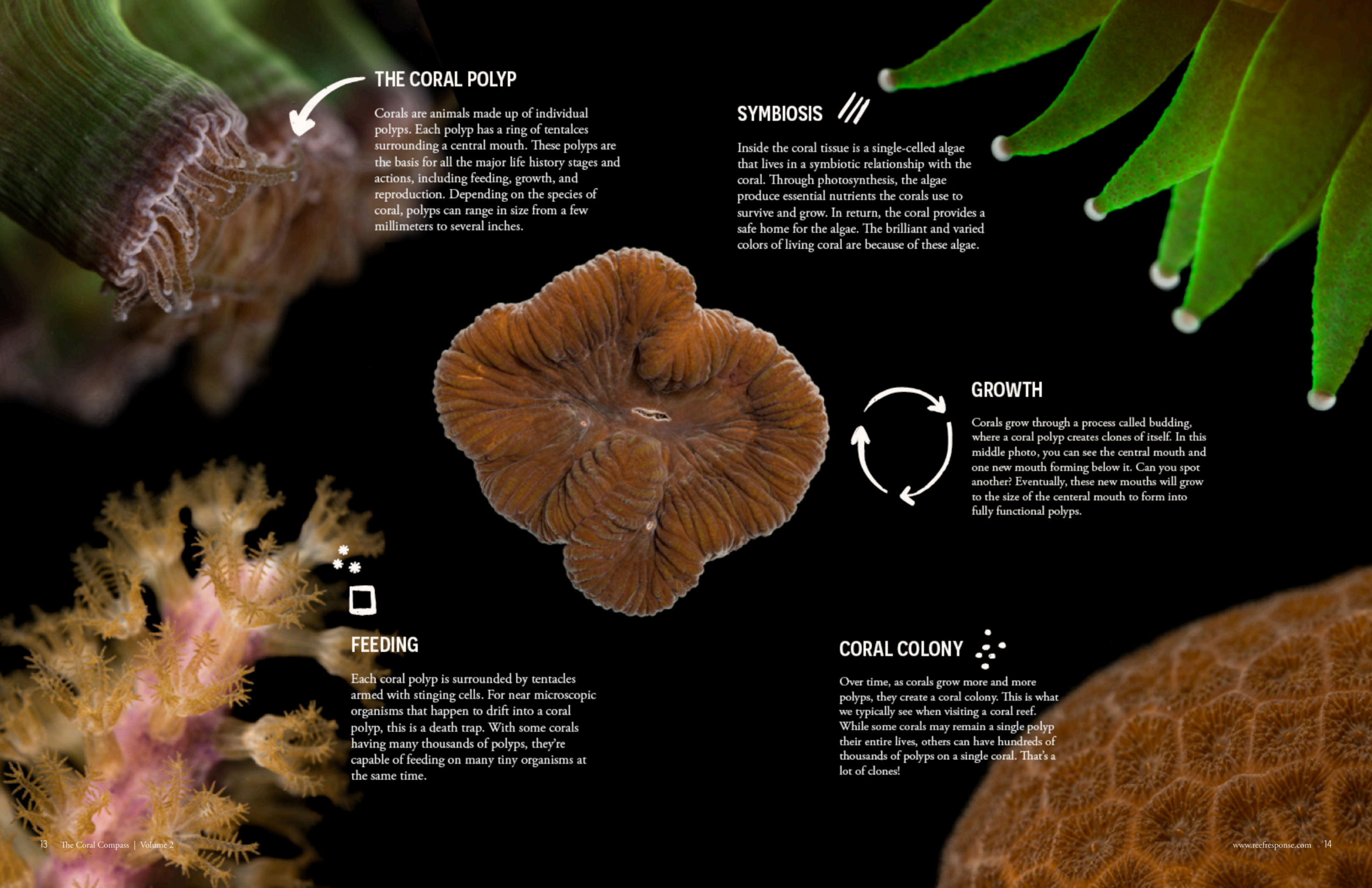
Corals are restored at sites where outplants have the highest likelihood of survival and growth to adulthood. Some of these sites include locations where partnerships have been established with the local community (e.g., Hull Bay, see page 28) or local businesses (e.g., Lovango Cay, see page 29). Other sites are priority coral restoration areas for the territory, such as Flat Cay, St. Thomas, or for the National Park Service, such as Leinster Bay, St. John.

At each outplanting location, trained divers assess the site to

identify suitable areas for coral attachment. Corals are then secured to the substrate using marine epoxy or cement. After outplanting, the corals are regularly monitored, and maintenance is performed, such as removing competing seaweeds and coral predators, until the corals grow large enough to fend for themselves and reproduce.

The goal is not to replace every lost coral on the reef but to outplant enough to catalyze the reef's natural recovery.





THE CORAL POLYP

Corals are animals made up of individual polyps. Each polyp has a ring of tentacles surrounding a central mouth. These polyps are the basis for all the major life history stages and actions, including feeding, growth, and reproduction. Depending on the species of coral, polyps can range in size from a few millimeters to several inches.

SYMBIOSIS

Inside the coral tissue is a single-celled algae that lives in a symbiotic relationship with the coral. Through photosynthesis, the algae produce essential nutrients the corals use to survive and grow. In return, the coral provides a safe home for the algae. The brilliant and varied colors of living coral are because of these algae.

GROWTH

Corals grow through a process called budding, where a coral polyp creates clones of itself. In this middle photo, you can see the central mouth and one new mouth forming below it. Can you spot another? Eventually, these new mouths will grow to the size of the central mouth to form into fully functional polyps.

FEEDING

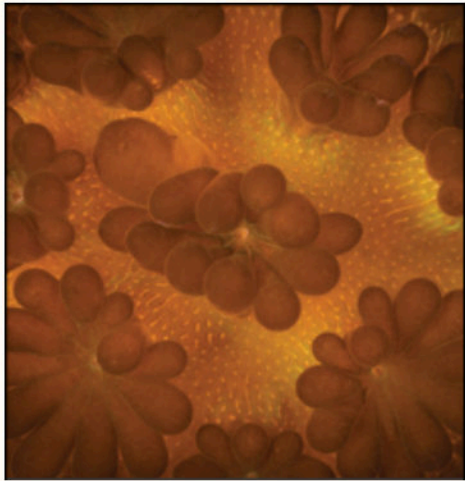
Each coral polyp is surrounded by tentacles armed with stinging cells. For near microscopic organisms that happen to drift into a coral polyp, this is a death trap. With some corals having many thousands of polyps, they're capable of feeding on many tiny organisms at the same time.

CORAL COLONY

Over time, as corals grow more and more polyps, they create a coral colony. This is what we typically see when visiting a coral reef. While some corals may remain a single polyp their entire lives, others can have hundreds of thousands of polyps on a single coral. That's a lot of clones!

Get To Know Our Corals

The Caribbean is home to over 40 species of stony corals, each playing a crucial role in its ecosystem. Among these, a select few emerge as the primary architects of a coral reef. Sadly, these key reef-building corals have experienced the most significant declines. Reef Response is dedicated to restoring a diverse array of coral species, with a particular focus on six critical species. These six are not only vital to the health and resilience of the reef but also face the highest risk of extinction.



Staghorn Coral
Acropora cervicornis

Staghorn coral quickly became the poster child for coral restoration projects when they first gained traction. As the fastest-growing coral in the Caribbean, its branches can extend up to 8 inches per year. It is also remarkably easy to propagate and boasts high survival rates in coral nurseries. In the wild, dense thickets of staghorn coral create essential habitats for fish and invertebrates, underscoring its ecological importance.

Elkhorn Coral
Acropora palmata

Closely related to staghorn coral, elkhorn coral is the species outplanted most frequently and successfully. Elkhorn is especially important for breaking up wave energy that can threaten coastlines, as they grow up to just inches below the surface. One of our newest and most accessible outplanting locations is on the east end of Hull Bay, St. Thomas. If you would like to see them yourself you can easily snorkel above them.

Boulder Star Coral
Orbicella annularis

Similar to staghorn and elkhorn corals, boulder star corals form dense clusters, but they are typically found a little deeper – 15-50 ft below the surface. Boulder star coral has a unique growth form as it naturally creates an intricate maze of hiding spots and passageways for marine creatures. From octopus, to banded coral shrimp, to cryptic blennies, there are dozens and dozens of different animals you can find within one colony of boulder star coral.



Pillar Coral
Dendrogyra cylindrus

Pillar corals are truly in a class of their own! Their unique growth form of towering pillars resemble a city skyline. They're also one of the few species of corals whose tentacles are extended day and night. Unfortunately, pillar coral populations have been severely impacted by stony coral tissue loss disease. To help preserve the genetic diversity of this species, Reef Response has established a gene bank at their land-based nursery (see page 24).

Mountainous Star Coral
Orbicella faveolata

Living up to its name, these are our underwater mountain ranges of coral. Some colonies can grow to the size of a truck and be hundreds of years old and are made up of hundreds of thousands of polyps. Their large size means they play a pivotal role in breaking up wave energy from incoming storms. Previous studies have estimated that coral reefs reduce the annual expected damages from storms by approximately 4 billion dollars.

Great Star Coral
Montastrea cavernosa

As it's common name suggests, the polyps of the great star coral are huge compared to many other species of corals. As they extend their tentacles at night, these large polyps are capable of catching much larger prey that drifts unsuspectingly into their polyps. Cleaner gobies frequently make their homes amongst the great star coral polyps, so keep an eye out for them on your next snorkel!

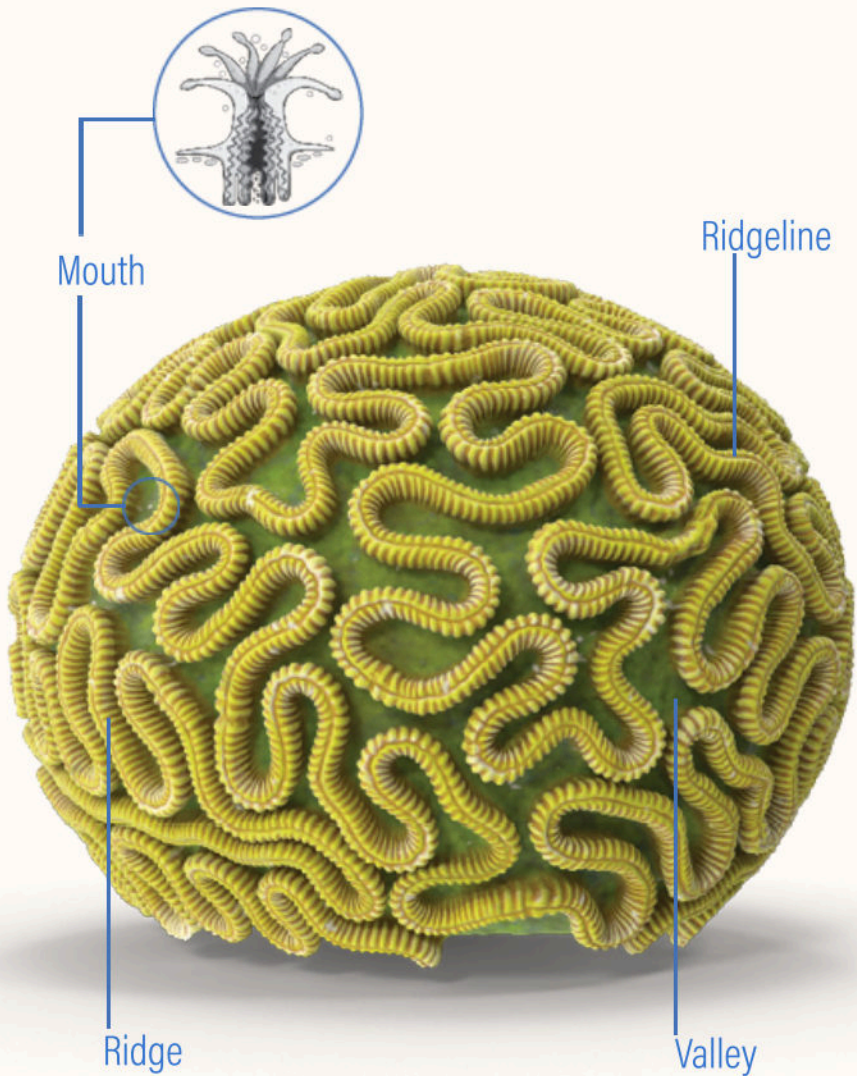
Identifying Brain Corals

To the untrained eye, many species of corals can appear nearly identical, particularly brain corals. Some of the distinct species in the Caribbean are the symmetrical brain coral (*Pseudodiploria strigosa*), knobby brain coral (*Pseudodiploria clivosa*), grooved brain coral (*Diploria labyrinthiformis*), and boulder brain coral (*Colpophyllia natans*). While these species might look alike at first glance, learning

their unique features can help you distinguish them—and impress your friends the next time you go snorkeling!

Brain coral anatomy provides useful clues for identification. The meandering ridges of brain corals create their signature patterns, while the valleys house the polyps. Polyps are the individual animals (yes, animals!) that make up a coral colony.

Decoding Brain Coral Anatomy



Boulder Brain Coral
Colpophyllia natans

The easiest way to identify a boulder brain coral is by its ridges, which resemble a zipper holding each side of the ridge together. Its ridges are also typically larger than those of other brain coral species.



Grooved Brain Coral
Diploria labyrinthiformis

This is one of the easiest brain corals to identify. Look at the ridges. If there's a groove running down the middle of the ridgeline, you've found a grooved brain coral!



Symmetrical Brain Coral
Pseudodiploria strigosa

Unlike grooved or boulder brain corals, the symmetrical brain coral ridges lack a groove or zipper-like appearance. They typically form hemispherical or sphere-like growth form.



Knobby Brain Coral
Pseudodiploria clivosa

Rather than growing upward, the knobby brain coral encrusts the surface it grows on. They're easily recognized by their distinctive knobs and irregular bulging growths.

The 2023-2024 Bleaching Events

Global temperatures reached record highs in 2023 – only to be surpassed in 2024.

The summers of 2023 and 2024 brought marine heatwaves hotter than ever before, disrupting the delicate balance between reef-building corals and their symbiotic algae. This disruption led to mass bleaching events worldwide. Coral Bleaching occurs when the symbiosis between corals and the algae (*zooxanthellae*) living in their tissues breaks down, causing the coral to expel or degrade the algae. Since *zooxanthellae* give corals their color, their loss turns coral tissue transparent, exposing the bright white skeleton underneath. Some corals contain fluorescent proteins that maintain color after bleaching, but they often appear unusually bright or glowing. Bleaching is a highly stressful state for corals, as the loss of *zooxanthellae* deprives them of the essential nutrients needed for growth.

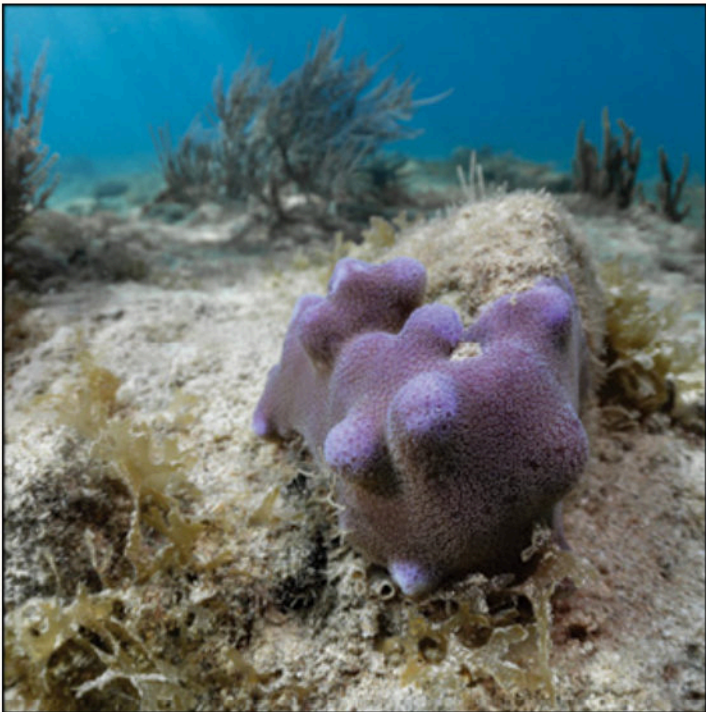
In 2023, bleaching began earlier and was more severe than ever recorded in many regions, the situation worsened, with the U.S. Virgin Islands experiencing devastating impacts.

Fortunately, government scientists predicted these heatwaves, allowing Reef Response to prepare. On land, our coral nursery was equipped with additional cooling systems to keep water temperatures stable. In the ocean, we relocated some coral

nurseries to deeper, cooler waters. We also implemented several experiments and monitoring initiatives during the 2023–2024 bleaching events to gather crucial data for future responses.

These efforts included the deep outplanting project (see page 27) and tracking coral spawning in both bleached and unbleached corals from 2023. Samples from healthy and sick corals were sent to collaborating labs to investigate biological and immune factors contributing to resilience.

As global temperatures rise, corals will continue to face bleaching thresholds more frequently. Reef Response remains committed to understanding how corals respond to these events, enabling the identification and prioritization of the most resilient species to secure the future of coral reefs.



Right: Even the oldest corals, such as this mountainous star coral (*Orbicella faveolata*), bleached in 2023. This particular coral is likely over 100 years old.

Below: Since excessive UV light worsens bleaching, it's common to see elkhorn coral (*Acropora palmata*) with bleached tops on their branches while the undersides retain their color.

Below left: As a last-ditch effort, some coral species, like this finger coral (*Porites porites*), will fluoresce. This fluorescence acts as a sun-screen, helping to protect the coral from severe bleaching.

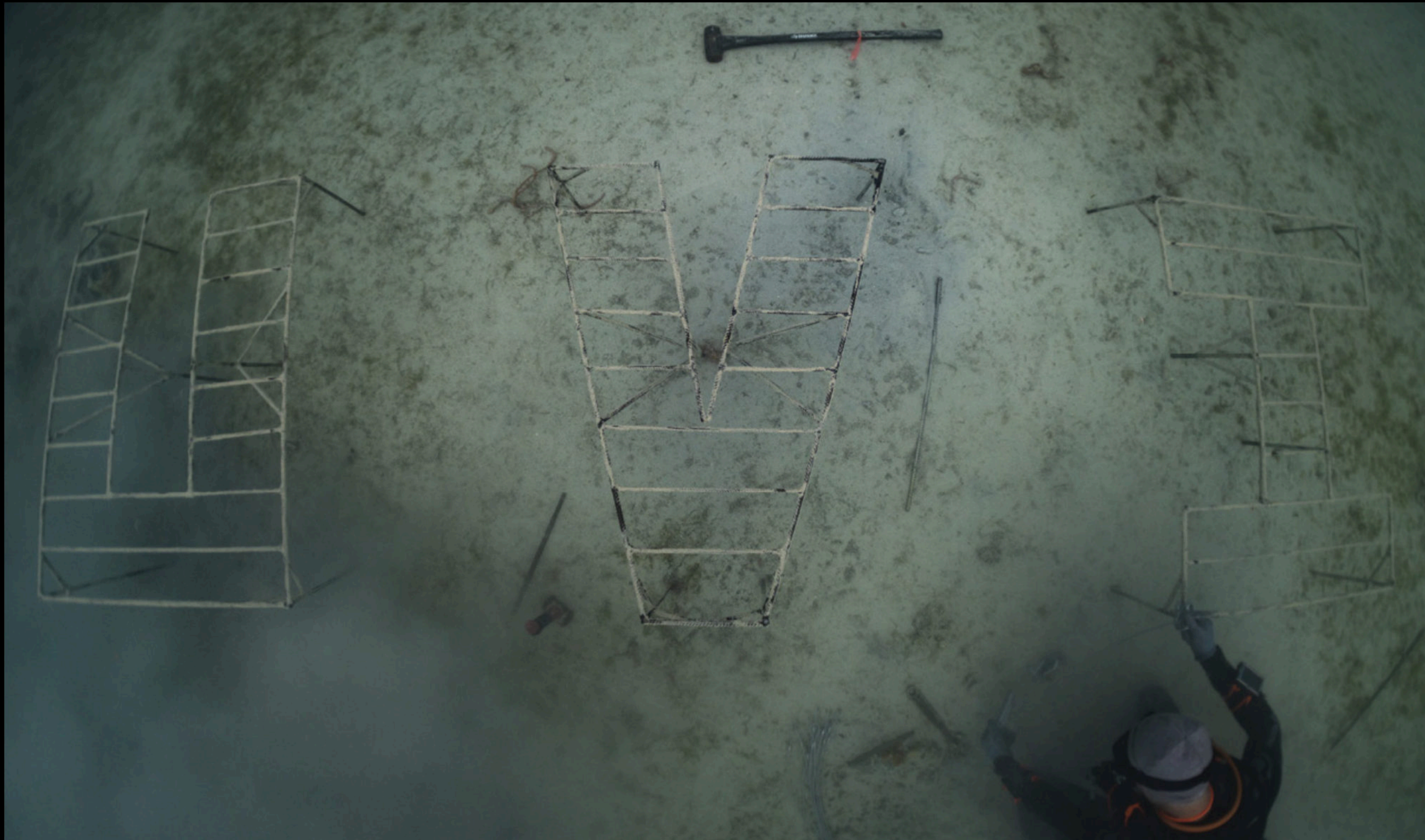


The Heat Stress Experiment

During the 2023 mass bleaching event, coral fragments exposed to heat stress before outplanting were observed to show less bleaching. This brief heat exposure may have “hardened” them, helping them endure high temperatures. Based on these findings, we designed an experiment to test whether short-term controlled heat stress in the lab increases corals’ tolerance to temperature stress after outplanting. Each experimental coral was split into two pieces: one was carefully exposed to high temperatures at the boundary of the corals’ temperature thresholds, while the other was kept at normal non-stressful temperatures. Both fragments were then outplanted and monitored during the 2024 marine heatwave.

Preliminary results show that precisely heat-stressed corals bleached less during the heatwave and even exhibited growth, while corals kept at normal temperatures bleached severely. These findings suggest that thermal stress hardening prior to outplanting may increase coral resilience to marine heatwaves, at least in the short term.

*Expanding our footprint,
building more nurseries*



Reef Response has expanded its nursery capacity, including the addition of an in-water coral nursery located directly offshore from the UVI MacLean Marine Science Center.

Like the organization's other nurseries, this one, built by Brad Arrington (below), is situated in shallow waters but is accessible without a boat. The location allows for snorkel tours to be offered to visiting school and community groups, providing new educational opportunities and hands-on training for UVI undergraduate and graduate students.



Coral Rescue

Fragments of Opportunity

Reef Response looks for “Fragments of Opportunity” to restore corals to selected reefs by salvaging naturally broken coral fragments dislodged by storms or human activity. These fragments, which would otherwise die, are collected and stabilized in land-based and underwater nurseries which provide optimal conditions for coral growth, including reduced predation and sedimentation. Reef Response prioritizes the most resilient fragments - those exhibiting the greatest growth and survival - and propagates these fragments using standardized

techniques. Once the fragments are strong enough to withstand the predation and competition pressures on the reef, we outplant them to sites where they will have the greatest chance of surviving. This approach eliminates the need for harvesting healthy corals, thereby reducing stress on existing ecosystems. In regions like the U.S. Virgin Islands, using resilient fragments of opportunity helps Reef Response restore reef resilience, enhance biodiversity, and maximize the ecological potential of otherwise lost coral resources.



This page: Reef Response technician Brad Arington collects loose fragments of elkhorn coral (*Acropora palmata*). These “Fragments of Opportunity” can be added to a nursery or secured elsewhere on the reef, giving them a second chance at survival.

Facing page, clockwise from top: 1. Reef Response technician, Nicholas Durgadeen monitors corals for spawning. 2. In Reef Response’s land-based nursery, a gene bank of the endangered pillar coral (*Dendrogyra cylindrus*) was created to help preserve the genetic material

of this species. 3. Reef Response technician, Rachel Ionata has paved the way for Reef Response’s pillar coral gene bank. 4. Reef Response technician, Davis Strobel has helped lead the construction a new coral spawning and larval rearing lab.



Next Steps: A Pillar Coral Gene Bank And New Sexual Reproduction Capacity

Reef Response is proud to announce the creation of a gene bank for the critically endangered *Dendrogyra cylindrus* coral, commonly known as pillar coral.

What is a gene bank?

Under proper permitting, Reef Response has started collecting pieces from the last existing colonies around St. Thomas and St. John. These corals are transported to aquariums at the University of the Virgin Islands, where aquarists provide daily care to keep them alive, healthy, and

growing. Reef Response is grateful for the biologists at the National Park Service on St. John who have assisted with the collection of some of these corals.

Unfortunately, due to the extreme loss of pillar corals, this species is now considered functionally extinct. Reef Response is currently building specialized aquariums designed to provide the necessary cues to encourage these corals to produce gametes and reproduce sexually under its care. Once successful reproduction oc-

curs, the organization’s coral biologists will take the necessary steps to create and nurture new pillar coral offspring.

Reef Response also plans to use these special aquariums to encourage other important reef-building coral species to reproduce under their care, generating new corals for reef restoration around St. Thomas and St. John.

Coral Research

Disease Impacts on Coral Reefs

By Davis Strobel

My thesis aimed to understand the effects of stony coral tissue loss disease (SCTLD) on coral reefs around St. Thomas and evaluate methods for restoring highly susceptible coral species. SCTLD has severely impacted coral populations, prompting us to assess coral health and test restoration techniques at five sites: Black Point, Brewers Bay, Coki Point, Magens Bay, and Perseverance Bay.

We compared two restoration methods: nursery rearing and direct transplantation of coral fragments. Nursery rearing involves growing corals in a controlled environment before planting them back on the reef, while direct transplantation places coral fragments directly onto the reef. The results were encouraging, par-

ticularly for the nursery-reared corals, with a 79% survival rate after one year compared to 60% for directly transplanted corals. This suggests that growing corals in a stable environment before reef transplantation can improve survival.

However, the 2023 mass bleaching event greatly affected survival rates, dropping the survival rate from 79% to 46% for nursery-reared corals and from 60% to 47% for directly transplanted corals. This indicates that while the initial methods were successful, external environmental factors, like bleaching events, significantly threaten coral survival.

Growth rates varied by species and location. The symmetrical brain coral showed great growth at Perseverance Bay but negative growth at Black Point and

Brewers Bay. The grooved brain coral had better survival and growth in the nursery compared to being directly transplanted into the ocean.

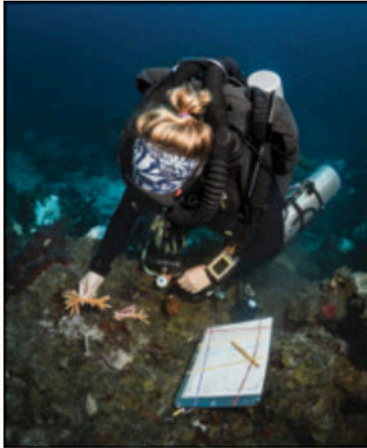
Our analyses confirmed significant differences in coral health and survival between the two methods. These findings highlight the importance of using a nursery phase before outplanting corals to ensure better survival and growth rates. In summary, nursery rearing is an effective method for restoring coral reefs affected by SCTLD, offering hope for recovering coral reefs and preserving marine biodiversity despite ongoing threats like bleaching events.

Below: Regular monitoring with photographs and measurements provides detailed insights into the growth and survival of coral outplants.



This page clockwise: 1. Outplanting coral to 120 feet underwater requires a lot of logistics and specialized training. Using closed circuit rebreathers allows divers to spend more time at depth than using conventional SCUBA gear. 2. Deep outplanting project lead, Sonora Meiling attaches a piece of staghorn coral (*Acropora cervicornis*) that had been transferred from a shallow water nursery. 3. While staghorn coral is more commonly seen in shallow reefs, it's not uncommon to find them naturally living at over 100 feet underwater.

Deep Outplanting



By Sonora Meiling

Climate change has led to rapidly increasing ocean temperatures which many marine animals struggle to cope with. In 2023, tropical reefs experienced the fourth global coral bleaching event. Record-breaking temperatures in the U.S. Virgin Islands gave the Reef Response team an early indication of what would be a stressful few months for the territory's corals. In an attempt to rescue the corals in our in-water nurseries, which our team had spent years caring for, we began moving as many staghorn

corals (*Acropora cervicornis*) to deeper reefs as possible. While we can't change the temperature of the ocean, we hoped that by relocating the corals to deeper reefs with less intense light, they would be able to withstand the stressful temperatures. Corals were moved to sites ranging from 20 feet to 125 feet deep, allowing us to find where they were the most resilient.

During the peak of the bleaching event, temperatures were the same at 15 feet as they were at 125 feet. The corals on the shallow reefs severely bleached, and many died. However, the corals on the

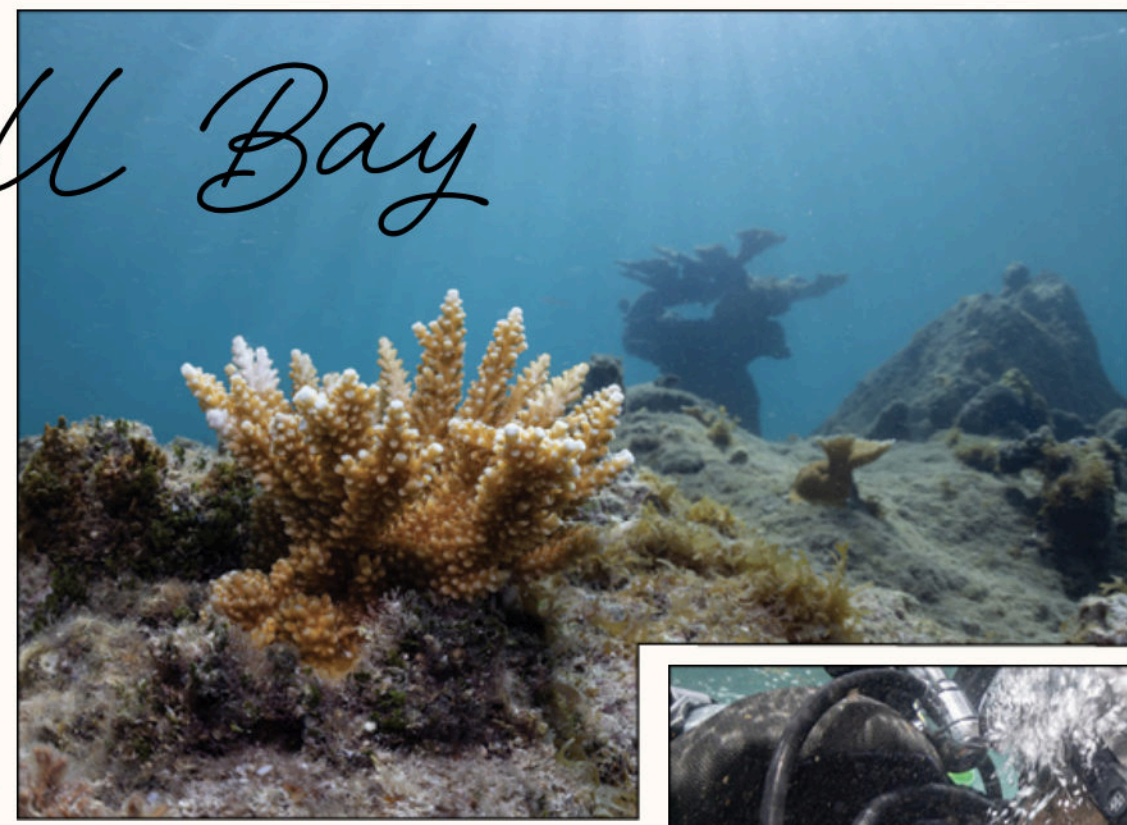
deeper reefs did not bleach, and many survived. It worked! When the corals only had to cope with one stressor (high temperature) instead of two (high temperature and high light), they were able to survive the bleaching event.

The summer of 2024 saw even hotter record-breaking ocean temperatures and another mass bleaching event was observed. Based on the results of our 2023 work, the Reef Response worked to move even more staghorn corals to deeper reefs in an effort to rescue as many of this important species as possible.

Coral Restoration

Hull Bay

Right: A young fused staghorn coral (*Acropora prolifera*) puts up its first branches after only a few months of being on the reef.



Starting in the summer of 2022, Reef Response began outplanting corals along the eastern side of Hull Bay, St. Thomas. The first corals to be outplanted at Hull Bay were removed from old, rusty, sunken ships in Krum Bay, which were scheduled for removal and disposal. Reef Response successfully relocated 188 corals from Krum Bay to Hull Bay! After weeks of monitoring the corals and observing their health and growth, Reef Response has continued to outplant corals to Hull Bay, and by the end of 2024, had outplanted close to 1,000 corals.

As these corals grow, we intend for them to contribute to reef restoration, shore-line protection, fish attraction, and serve as an enjoyable snorkel location for both

locals and tourists. Hull Bay has become a favorite restoration spot for many of the Reef Response biologists.

Not only is the Hull Bay restoration location easily accessible from shore, it holds personal significance for several team members who grew up in the area.

If you are at Hull Bay and see Reef Response biologists heading out or returning from the outplanting zone, ask them about their work!

Right: Transferred from the sunken ships in Krum Bay, this symmetrical brain coral (*Pseudodiploria strigosa*) is thriving in its new home at Hull Bay.



Below: Despite severe bleaching during the 2023 and 2024 events, most outplants recovered, showcasing resilience to warming seas.

Below right: A few months after the 2023 mass bleaching event, most of our corals had regained their color, indicating they had recovered and were healthy again.



Lovango Cay

Over the last three years, Reef Response has outplanted several species of coral off the north side of Lovango Cay, with elkhorn coral (*Acropora palmata*) being the target species. The team has observed small microfragment outplants fuse together and grow into full-sized branching colonies! Needless to say, this has been an exciting process to witness!

While this short-term success has been encouraging and shows that efforts are working, long-term survival remains the ultimate goal. In 2023 and 2024, outplants were put to the ultimate test. As sea temperatures soared to unprecedented

levels, mass coral bleaching events occurred throughout the Western Atlantic Ocean and Caribbean Sea.

At the peak of the bleaching event, several outplants bleached; however, the majority recovered as sea temperatures cooled in the winter.

The corals propagated and outplanted by Reef Response have survived previous environmental stressors, suggesting they may possess some tolerance to warming temperatures.

Student Profile



Kadejsa Tonge is a senior at the University of the Virgin Islands (UVI) working on a marine biology undergraduate degree.

Hello Kadejsa! Thank you for taking the time to meet with me. I'd like to talk about your experiences working in the Brandt Lab.

Hi, so I've been a student at UVI since I was 17 and that's when I started working in the Brandt Lab and I've been there ever since. I began with a coral internship and it was great. I recommend this internship to a lot of students because I've learned so much! Not just about coral but how to do plumbing, woodwork and even electrical work. You get a little bit of everything. What's nice is that I've been working in the Lab for so long now that I'm getting a jump start on my career. Recently, I have taken on additional responsibilities and now help manage the water tables at the land-based nursery.

I've also had so many other opportunities too like presenting my posters at conferences, doing my own research and now I get to travel with the Lab to international conferences. I was also able to do an internship in the Brandt Lab last summer

through the Emerging Caribbean Scientists program. That was great. It was hands-on learning working with corals and at the end you have to do a presentation at a research symposium and talk about your experiences. Public speaking was really hard in the beginning but I think I've gotten pretty good at it now.

What is next for you when you graduate?

I plan to apply to the Masters of Marine and Environmental Science program at UVI. That is exactly what I want. I really love this island. I'm born and raised here and it's home for me so I've never thought of permanently leaving. And, I realized I like the educational aspect of things, of explaining things and watching people light up. I see myself doing education and outreach and field work.

What has been the hardest part of working on this team?

Honestly, the hardest part was that in the beginning I didn't feel like I fit in, there is not a lot of diversity at the Marine Science Center. And, I've never traveled before and people come here from all kinds of places. I had to keep telling myself that I'm a hard worker and I belong here. After a while I realized that everyone was really warm and welcoming so I got over that and now I'm really comfortable. I'm able to teach other people what I know even if they're older than me and I've become someone others can rely on.

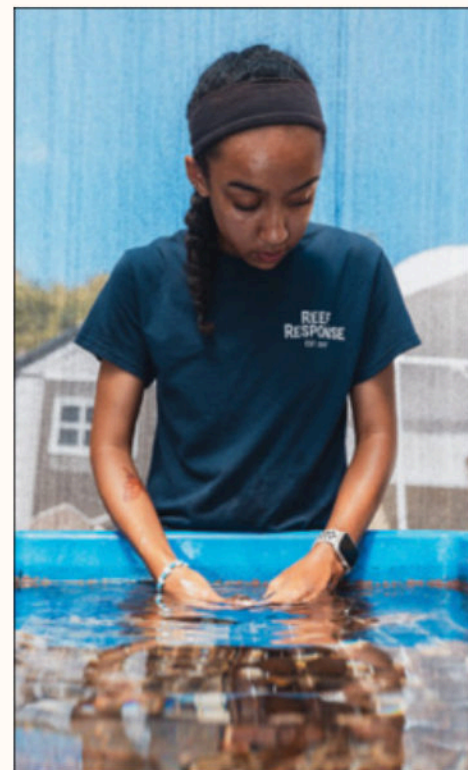
What has been the best part?

The best part is just knowing that I'm doing something to make a difference. It's a long process toward coral restoration and I like seeing the process pay off. I'm still watching corals I've taken care of grow

even a year later and they're doing pretty well. It's a really good feeling. Also, in my internship last summer we got to go to certain locations where corals were outplanted years ago have grown into big colonies. It's so rewarding to see the work you've done prosper.

Do you have any final thoughts to share?

Yes. I think marine biology is not the first degree Island people think of when they go to college. Most of the time when I explain to people that I'm doing a marine biology degree they are surprised to learn we have that here at UVI. If you like living on an island and have an interest in the water, marine biology is a great field and a great career.



Above: Kadejsa works to clean and catalogue corals in the Reef Response land-based coral nursery. This nursery is located on the St. Thomas campus of UVI, and allows for students and the public to experience reef-building corals face-to-face without getting in the ocean.



Choose reef-safe sunscreen – Use a mineral-based sunscreen whose active ingredients are zinc oxide and titanium dioxide. If you are unsure whether the sunscreen you brought in your suitcase is reef safe just avoid anything with the harmful chemicals Oxybenzone and Octinoxate. Not into mineral sunscreens? Cover up with a sun shirt, leggings, and a hat.

Take care while boating – When boating, do not drop anchor on any corals or on top of the reef. Use a depth sounder or snorkel to make sure your anchor and its chain do not hit the reef.

When diving and snorkeling – Do not touch corals or any other marine life. Make sure to be cognizant of your fins and SCUBA gear to make sure you are not kicking corals or getting equipment tangled in the reef.

Reduce your carbon footprint – Limit carbon emissions. Doing big things like investing in solar power and buying an electric vehicle really help but they aren't for everyone. Focus on the simple things like switching to using energy efficient light bulbs, having a meatless day a week, and buying food and other products locally can really make a big difference!

Support sustainable fishing – Some tasty and sustainable local options include: Lionfish, Mahi Mahi, Bonito, Mackerel, and Snapper.

Reduce pollution – Minimize fertilizer use. When washed into waterways, the nutrients from fertilizer can pollute the water and can cause harmful algae to bloom.

Refuse single-use plastic and styrofoam – Use refillable water bottles, skip the straw, and choose glass, metal, bamboo or compostable products whenever possible.

Support ocean-friendly tourism – Reach out to us by visiting our Reef Response website, social media or our local dive shop partners to get involved!

Visit our website
www.reefresponse.org
to learn more or, scan
the QR code below.





Reef Response | St. Thomas, U.S. Virgin Islands | www.reefresponse.org

Contributors: Dr. Marilyn Brandt, Elisa Bryan, Rachel Ionata, Sonora Meiling, Dan Mele & Davis Strobel.
All photography by Dan Mele except where noted.



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