U.S. Regional Caribbean Stony Coral Tissue Loss Disease Workshop
St. Croix, U.S. Virgin Islands
February 6-8, 2024
Final Report

Overview:

The 2024 U.S. Regional Caribbean Stony Coral Tissue Loss Disease (SCTLD) Workshop convened coral managers, practitioners, and researchers from the U.S. Virgin Islands (USVI), Puerto Rico, and Florida to exchange information, coordinate disease response efforts, and collaborate on projects in the U.S. Caribbean, with a focus on enhancing regional coral rescue, sharing information on coral bleaching response and monitoring, coordinating on restoration planning and implementation, and discussing strategies to expand coral disease response efforts to include other disturbances.

Planning Team Members:

- Caroline McLaughlin (Florida Sea Grant)
- Dana Wusinich-Mendez (NOAA Coral Program)
- Leslie Henderson (NOAA Coral Program)
- Dr. Aurora Justiniano-Santos (NOAA Coral Program)
- Dr. Maria Vega-Rodríguez (Puerto Rico Department of Natural & Environmental Resources)
- Dr. Dinorah Chacin (NOAA National Marine Fisheries Service)
- Ashley Pérez (Puerto Rico Department of Environment and Natural Resources)
- Kennedy Wall (Florida Sea Grant)
- Courtney Tierney (USVI Department of Planning & Natural Resources)
- Dr. Lexie Sturm (NOAA Coral Program)
- Darimar Dávila-Ortiz (Puerto Rico Department of Natural & Environmental Resources)

Objectives:

- **Coral rescue:** Identify goals and objectives for a regional coral rescue network and plan
- Identify funding strategies for a regional coral rescue coordinator
- **Thermal stress event:** Share lessons learned (where possible) from the 2023 thermal stress event, including response approaches taken, funding strategies, and monitoring methodologies
- **Restoration:** Share information about jurisdictional restoration plans and activities (including reef enhancement methods) and receive feedback from other jurisdictions
- **Disturbance management:** Better understand effective approaches to broadening management frameworks focused on SCTLD to include other disturbances
- **Research:** Share recent SCTLD research findings
- Provide a forum for information sharing and feedback via a round of lightning presentations

Meeting Agenda & Detailed Notes

Presentations

Participants

- Roxana Aslan (2024-2026 Puerto Rico NOAA Coral Fellow)
- Marilyn Brandt (University of the Virgin Islands)
- Rachel Brennan (National Park Service)
- Dinorah Chacin (NOAA National Marine Fisheries Service)
- Darimar Dávila-Ortiz (Puerto Rico Department of Natural & Environmental Resources)
- Kristen Ewen (National Park Service)
- Alex Fireman (2024-2026 USVI NOAA Coral Fellow)
- Howard Forbes Jr. (Virgin Islands Marine Advisory Service)
- Pamela Gaffin (Caribbean Oceanic Restoration and Education Foundation)
- Leslie Henderson (NOAA Coral Program)
- Edwin Hernández-Delgado (University of Puerto Rico)
- Marlon Hibbert (USVI Department of Planning & Natural Resources)
- Nilda Jiménez (Puerto Rico Department of Natural & Environmental Resources)
- Aurora Justiniano-Santos (NOAA Coral Program)
- Paco López Mújica (Arrecifes Por Ciudad)
- Maurizio Martinelli (Florida Sea Grant)
- Caroline McLaughlin (Florida Sea Grant)
- Sonora Meiling (University of the Virgin Islands)
- Tania Metz (The Nature Conservancy)
- Ashley Pérez (2022-2024 Puerto Rico NOAA Coral Fellow)
- Jason Quetel (University of the Virgin Islands)
- Fabiola Rivera-Irizarry (University of Puerto Rico)
- Hector J. Ruiz (HJR Reefscaping)
- Jordan Schneider (Ceiba Strategies)
- Samuel Suleiman (Sociedad Ambiente Marino)
- Kemit Sweeney (The Nature Conservancy)
- Courtney Tierney (USVI Department of Planning & Natural Resources)
- Laurel Thomas (National Park Service)
- Kelcie Troutman (USVI Department of Planning & Natural Resources)
- Maria Vega-Rodríguez (Puerto Rico Department of Natural & Environmental Resources)
- Kennedy Wall (Florida Sea Grant)
- Jessica Ward (The Nature Conservancy)
- Logan Williams (Coral World Ocean & Reef Initiative)
- Stacey Williams (ISER Caribe)
- Dana Wusinich-Mendez (NOAA Coral Program)

Day 1: February 6th, 2024

Jurisdictional SCTLD/Disturbance Response Updates

Florida SCTLD Response Update, *Maurizio Martinelli (Florida Sea Grant)*

- SCTLD has been a major issue for FL reefs since it emerged in 2014; considered endemic since 2021, but has waxed and waned with no consistent patterns across entire state
- FL benefits from stronger connections with the Caribbean for coral reef health and management
- Heat stress and bleaching can reduce amount/intensity of SCTLD, however disease returns after bleaching decreases
- Coral Rescue/evacuation and land-based coral propagation pipeline are two new big initiatives
- Other emerging issues: Unomia (invasive soft coral); water quality - partnership with Everglades restoration efforts; heat stress/bleaching

Image 1: Coral SCTLD treatments in Florida

Puerto Rico SCTLD Response Update, *Dr. Maria Vega-Rodriguez (Puerto Rico Department of Natural & Environmental Resources)*

- SCTLD present in Puerto Rico since 2019, significant changes in coral cover presented on SCTLD dashboard map, with an 18.5% mean percent change in stony coral cover between 2021-2022
- Intervention started in 2019, particularly in Culebra with 8812 antibiotic treatments applied, with a large increase in treatments since 2022
- Emergency response plan focuses on intervention and volunteer partnerships
- Emergency Response Coordinator- Darimar Davila hired
- Volunteer trainings and citizen science initiatives spearheaded by Ashley Perez
- Next steps : Restoration planning process through TNC, DNER, and ISER Caribe; starting to use Tracks software for data collection/ management; implementation of FEMA project

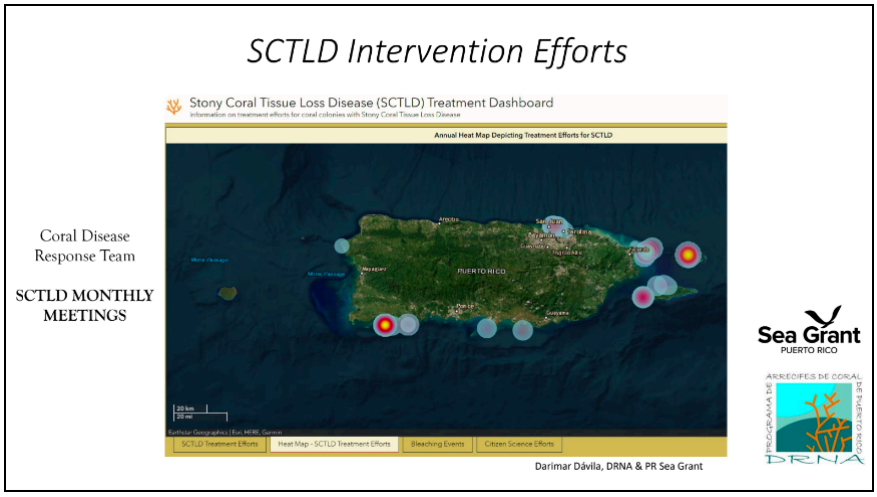

Image 2: Puerto Rico SCTLD Treatment and Bleaching Dashboard

USVI SCTLD Response Update, *Courtney Tierney (U.S. Virgin Islands Department of Planning & Natural Resources)*

- 2023 focused on intervention, rescue, and restoration
    - Intervention - expanding methods for strike teams to include SCTLD, algae removals, tags, bleaching surveys, vessel grounding
    - Rescue - updated highly susceptible species database
    - Restoration - 10 year territory plan published
    - Secured funding for Tracks software- training partners and inputting data
- SCTLD is on the rise post-bleaching event
- Next steps for 2024: action plan amendment; restructure CDAC (moving from “disease” to “disturbance” to expand capacity); Tracks software integration with all partners; develop Coral Rescue Plan (what kind of genetic diversity is here, what needs to be on land, which corals, etc); communication staff funding - no current staff for comms
- USVI SCTLD Data Report 2020-2022

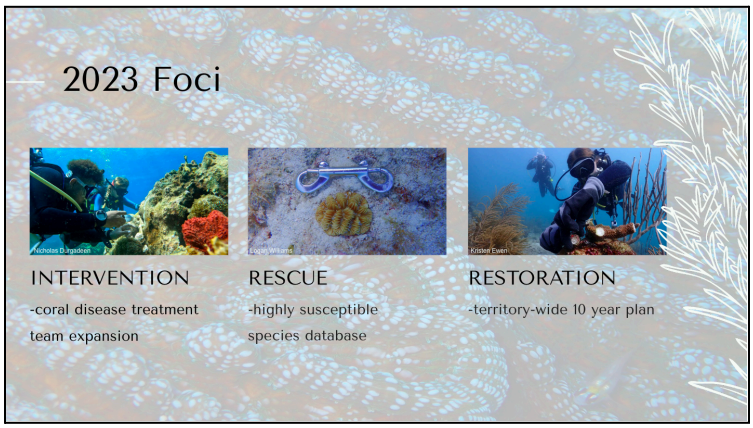

Image 3: USVI 2023 priorities for intervention, rescue and restoration

The Nature Conservancy - Estate Little Princess Facility Tour

- The Nature Conservancy staff lead an in-depth, behind-the-scenes tour of their growing Coral Innovation Hub. The tour highlighted their coral rescue operations, including water tables housing rescued endangered species, microscopy lab, and plans for their forthcoming larval-based propagation expansion.


Image 4 & 5: Estate Little Princess Facility Tour and water tables with The Nature Conservancy staff

2023 Thermal Stress Event

NOAA Coral Reef Watch, *Derek Manzello (NOAA Coral Reef Conservation Program)*

- Previously, Coral Reef Watch's Bleaching Alert Area product stopped at a Bleaching Alert Level 2, which warned of a "risk of reef-wide bleaching with mortality of heat-sensitive corals." Now, the product features a Bleaching Alert Level 3, Alert Level 4 and Alert Level 5 to account for additional heat stress risks. (Due to record breaking extreme heat/SST last year)
- 4 month outlook - potential future heat stress
- Global mass coral bleaching event occurring- we are entering the 4th global bleaching event
    - In previous El Nino years, temps were hotter in second year - predicting 2024 might be hotter than last year
- Mexico predicts between 50-93% of corals died during 2023 bleaching event

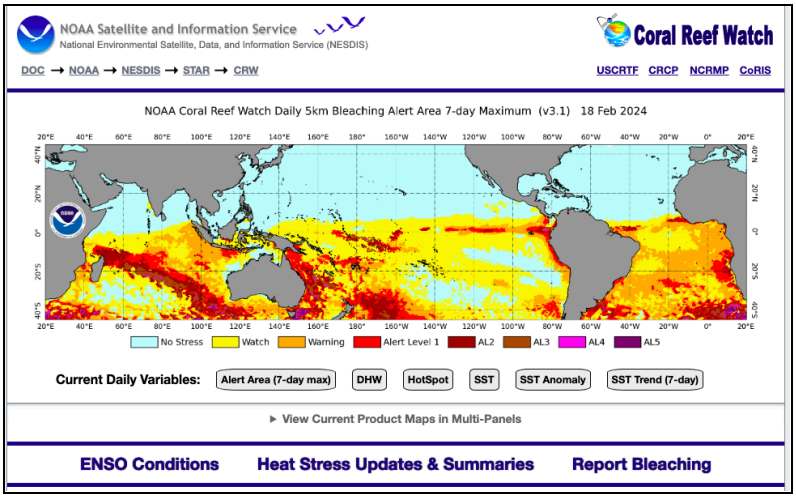

Image 6: NOAA Coral Reef Watch Bleaching Alert Dashboard

Florida Bleaching Response, *Maurizio Martinelli (Florida Sea Grant)*

- Worst bleaching event recorded
- Conditions: No wind + no cloud cover= high irradiation + high SST = Mass bleaching and mortality. In some areas - no temp stratification with depth - impacts to corals even at depth; shallow in-shore reefs most severely impacted.
- Impacts: Acroporids severely affected. Soft corals heavily impacted; Basket stars - behavior changes; Increase in snail predation. During event - uptick in BBD, subsided as temps went down; Increase in tissue loss diseases - maybe SCTLD, maybe others.
- Rescue/ intervention: Annual Disturbance Response Monitoring. 27,000 corals moved into land-based nurseries; AZA assisted with care and training. Deep water nursery established (60ft) - that worked well. Limited shading and feeding - permitting issues and too late into the event.
- For 2024 - No mass evacuation, focusing on genetic preservation rather than biomass preservation. Exploring new intervention ideas - deep water nurseries; removable shades; feeding; natural selection; increasing surface turbidity. Need to consider climate change, water quality, and other driving factors.

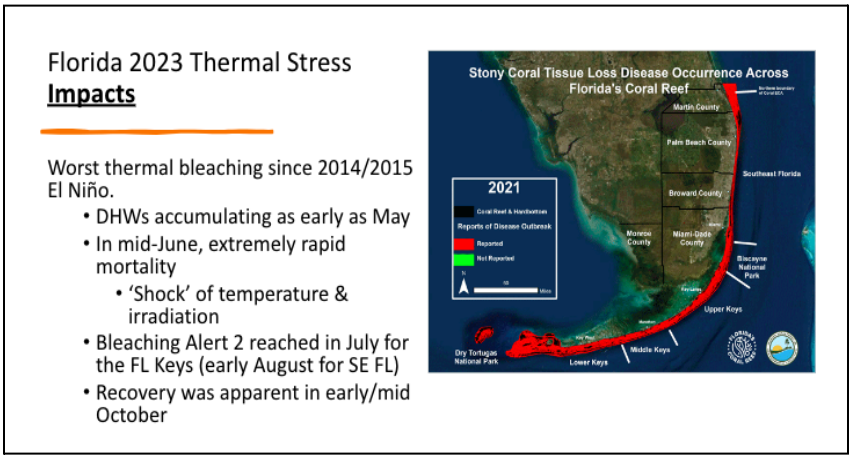

Image 7: Florida Thermal Stress Impacts

Puerto Rico Bleaching Response, *Dr. Maria Vega-Rodriguez (Puerto Rico Department of Natural & Environmental Resources)* (starts on slide 16)

- Big lesson learned - access to resources was difficult
- Eastern and SW sides of PR were most affected
- NOAA restoration center and Sea Ventures - proactive in relocating coral trees and fragments into deeper water
    - 220 colonies relocated into deeper water (50ft)
    - 42 colonies from to CIROM land-based nursery
- Experimented with shading over frames - corals under shading have survived better than the controls
- Monitoring; saw paling to mortality in a few weeks

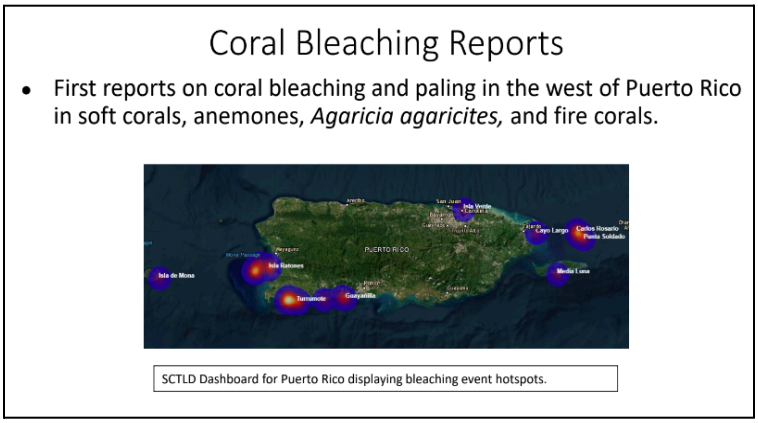

Image 8: 2023 Coral bleaching reports in Puerto Rico

USVI Bleaching Response, *Courtney Tierney (U.S. Virgin Islands Department of Planning & Natural Resources*

- Bleaching watch in July/August - very rapid onset bleaching
- Following USVI Bleaching Response Plan (developed in 2020)
- NCRMP happened in pre-bleaching season, TCRMP another bi-annual funding source and it lined up with peak of bleaching season, Acropora Monitoring Program - post bleaching data
- Mitigation and intervention: shading techniques; moving to deeper water - often requires technical diving, not much capacity for this; stopped all territorial restoration (some still in federal waters); no need for disease intervention - freed up capacity
- Needs: Stop stressors at source (runoff, pollution…); Research better intervention methods; Fund emergency response; Gene bank for resistant corals; Expand land based facilities; Build capacity (Regional Rescue Coordinator)

Image 9: Collaboration for coral bleaching and mitigation across the USVI

Innovative Responses to 2023 Thermal Stress Event - Interventions Cafe

Florida's Response - *Maurizio Martinelli*

- No formal bleaching response plan, data is compiled from monitoring and lessons learned
- Around 80% of acroporids removed from the ocean died in the evacuation process due to stress. Best practices for transportation would be helpful for practitioners (especially for places with limited land based facilities)
- Mass excavation will not be the strategy in FL moving forward - land based facilities will just be a gene bank. Mote has a gene bank - intended for everyone, not just FL - could be worth putting practitioners in contact with them to provide capacity for other jurisdictions.

The Nature Conservancy - *Jessica Ward*

- Moved corals to land based nursery
- Shading (based on methods from Australia)- overall, shading didn't work well - used repurposed frames but were too small, larger frames worked a little better. Tried to just shade APAL orchard (rows of different genets for use in outplanting later) - try to get shades high enough so the surge doesn't knock it into things, but need it to actually shade the corals
- Lesson learned: Take corals that survive (broke off pieces from survivors to put on shaded tables)
- TNC tool for mapping- Large scale/high level, across USVI and PR
- Understanding where refugia are is important for areas (like St. Croix) where land-based nurseries are limited

National Park Service - *Kristen Ewen and Rachel Brennan*

- Most work was reactive to bleaching (after what happened with Dry Tortugas)
- Joined bleaching committee - AGRRA surveys, mostly just monitoring
- Shading - established shades over cinder blocks with plexiglass on the top, very hard to move underwater. Prioritized corals; had about 50% success over corals here whereas those in FL mostly died. Trying to figure out when is the best time to remove the shade - if you wait too long, turf algae grows - damselfish will farm algae
- Plan is to work with TNC to shade nurseries better this year and revisit shading project to solidify methodology and systematize the protocols for shading

University of the Virgin Islands - *Marilyn Brandt and Jason Quetel*

- Land based nursery - added a chiller to keep water temps consistent at 86ºF
- Four in-water nurseries- outplanted some corals at different depths - deeper areas were better for some but not all genotypes. Feeding experiments - bagged corals and fed them - data is just coming in now
- Hawaii DARPA is testing lights on corals - just at dusk for ~ an hour -don't really have capacity to try that here
- Some outplants did better than wild corals in bleaching (originally came from not great conditions)

Coral World Ocean and Reef Initiative - *Logan Williams*

- Land-based facility - chillers to control water temperature
- Lots of corals come in diseased and they are treated and fed on a daily basis - fed daily starting in March and they did well
- Worried about tarps and lack of sunlight - but corals did okay
- Some small fragments did bleach but nothing substantial
- Saw more infection in October/November
- Need to have control over environmental conditions, not just temperature, oxygenation/water currents also play a big role

Sociedad Ambiente Marino- *Samuel Suleiman*

- Culebra Island, Punto del Soldado
- 2 *in situ* nurseries, 20 ft and 40 ft deep used different types of shading at both depths
- Collected temperature and light data with sensors under the shade
- Results deep 96% survival, shallow 87% survival
- Light intensity was significantly stronger in the deep water with the same shade
- Recommendation- the best thing you can do is to move the corals to deeper water to reduce irradiation

Research

SCTLD Research at the University of the Virgin Islands, *Dr. Marilyn Brandt (University of the Virgin Islands)*

- Put together a team to tackle SCTLD across multiple labs
- Rapid NSF grant for a transmission experiment- Alphaflexivirus found in SCTLD corals
- Microbial indicators in field sampled corals
- SCTLD induces dysbiosis between symbiont and coral host
- EEID NSF grant - formed PREDICT. 233 corals sampled
- Another Rapid NSF - predicting coral disease spread. Processing samples currently. Gene profile somewhere between SCTLD and white plague
- Dr. Becky Gibbel: found no difference in symbiodiniaceae in healthy vs diseased corals
- Temperature stress on SCTLD transmission - no significant effect
- Corals tagged for SCTLD treatment fate tracking
- SIR modeling of SCTLD in USVI
- Dosage and duration experiment - testing three different dosage treatments (Currently in data analysis stage)

- Mapping highly susceptible survivors and outplanting experiments. Sites where treatments are regular - lots of partial mortality, seems like treatments were at least partially successful. Nursery reared vs direct outplants - nursery seemed to do better
- Stony coral tissue loss disease: a review of emergence, impacts, etiology, diagnostics, and intervention

Demographic impact of stony coral tissue loss disease in *Pseudodiploria strigosa* populations in Puerto Rico, *Fabiola Rivera Irizarry (Sociedad Ambiente Marino and University of Puerto Rico)*

- Does SCTLD vary spatially in Puerto Rico? Evaluate presence around the island. Surveyed 32 sites in 2021, roving diver surveys
- SCTLD was lower in Culebra in 2023, but more in West- Lots of mortality in 2023
- Study: How does SCTLD impact the demography of *Pseurodiploria strigosa* populations? SCTLD decreased due to coral death. Percent survival and percent live tissue cover comparison between sites. Two Culebra sites have similar water quality and behavior of disease is very different
- Matrix Population Model - Elasticity analysis. Healthy → healthy and disease → healthy contributes the most to differences in sites
- Results: Outplanting buys us time, but without elimination of SCTLD, population will decline, eventually causing extinction
- Coral rescue - colonies detached, fragmented them in situ, and transplanted them (96% survival)

Lessons learned from mass coral bleaching impacts in Puerto Rico: 2005 and 2023, Dr. Edwin Hernandez Delgado (Sociedad Ambiente Marino)

- 2005, 2010, 2019, 2023 mass bleaching events – Magnitude of 2023 was similar to 2005
- Oceanographic conditions affect survivability; Water transparency/turbidity curbs bleaching
- 13 virtual stations for PR - close to 20 degree heating weeks in 2023
- Eastern coast of Culebra - bleaching was 87-90%, mortality was 7.5-9.6% in 2023
- Western coast of Culebra - bleaching was 76-88%, mortality was 5.6-26/8% in 2023
- Vega Baja - bleaching 16-73% , mortality 1-5.9% (confounded with SCTLD) in 2023
- Western PR, 77-99% bleaching, 13.7-41.2% mortality in 2023
- Mortality moderate but locally catastrophic (West, SW PR, Culebra)

Day 2: February 7th, 2024

Regional Collaboration on Coral Rescue

Regional Coral Rescue Network, *Dana Wusinich-Mendez (NOAA Coral Program)*

- Last year's workshop & what has happened since- *Kennedy Wall (Florida Sea Grant)*. Coral Rescue Network - two meetings since last year in May. Discussed funding opportunities and where to house position. Contact list developed - "CARE team." FSG has applied to two different opportunities for increased coordination in coral rescue. Capacity to attend meetings fizzled

Group Discussion

- **What are the goals of regional level collaboration on coral rescue?** Genetic preservation - safeguarding corals, understand genetic connectivity between PR and USVI (first step). ESA section 6 proposal - joint proposal between DNER and DPNR. ID resilient genotypes. Knowledge exchange and resource sharing. Establish best management practices.

- **What are the potential benefits?** Standardize methods. Information sharing. Increased funding. Genetic diversity. Genetic and species preservation.

- **What aspects should be regionally coordinated?** Understanding connectivity - metrics will help with permitting. Developing MOUs between jurisdictions. Emergency response and permitting- diadema, SCTLD, Section 6 (Dendro), transferring corals, EFH. Coral exchange. Funding. Data management- Using Tracks. Reduce redundancy in training and resource use.

- **What should a regional rescue network do?** Coordinating informed regional rescue. Connection/communication. Prioritization. Tracking progress. Identify funding. Coordinating permits. Coordinating data management. Coordinating gene banking. Representing the Caribbean at national level. Collaborate With BVI and other places nearby. Staff exchange to increase capacity.

Key Takeaways from Group Discussion: Coral Rescue network is still a priority. Network can/should be set up before the Coral Rescue Coordinator is onboarded. Regional Rescue Plan will be priority after the Coordinator starts. Genetic preservation is a huge priority of the Coral Rescue Network.

Next Steps:

- Coordinating the Regional Coral Rescue Network: Caroline McLaughlin and Kennedy Wall can help coordinate meeting logistics, Nilda from DNER, Courtney from DPNR, Logan CWORI. Identify another DPNR representative to be involved. Coordinate with NOAA fisheries protected resources to facilitate work with Dendro. Tyler Smith- Doing Dendro Work at UVI. Coordinate permits between territories - Maria Vega-Rodriguez, Roxana Aslan, Darimar Davila-Ortiz, Helena Antoun.
- Look into CZ for additional funds.
- Dana will speak with NSU about interest in the regional coordinating institute.

Restoration Updates

Puerto Rico Restoration Planning Update, *Tania Metz (The Nature Conservancy)*

- First core team members meeting (TNC, DNER, NOAA): Agency led, stakeholder supported. Used coral restoration guide from TNC and NOAA.
- Working through first four steps: Set goals and geographic focus, identify priority sites, identify and select interventions, develop plan: deadline July 12, 2024
- First complete draft of restoration action plan by July 19, 2024
- Final draft due to graphic designer by August 30, 2024

USVI Restoration Plan Implementation Update, *Leslie Henderson (NOAA Coral Program)*

- VI-RoCS used manager's guide and Mission Iconic Reefs Plant to develop plan
- In person workshop in 2022 to draw polygons to define reef zones (had to prioritize six out of ~30) – Estimated how much in each reef could be restored and used local knowledge
- Post workshop - refined polygons, defined cost per coral, calculated number of outplants & costs
- USVI Coral Reef Restoration Plan Final document -
- Implementation: ⅝ sites already being worked on, Long Reef was the outlier - CRF used this document to get proposal funded. Major metric for tracking is the number of outplants.
- Next steps- Mapping tool integration for all partners, coral monitoring plan, genetic management, data management (Tracks), funding, engaging partners, learning exchanges and workshops

Image 10: USVI Coral Restoration Plan

San Juan FEMA Restoration Project Overview, *Nilda Jimenez (Puerto Rico Department of Natural & Environmental Resources)*

- Goal: reduce loss of life and property from natural hazards - part of 2021 PR State Natural Hazard Mitigation Plan - goal 6
- Considering coral reefs as infrastructure - enhancement will assist in storm surge protection as natural infrastructure. Reefs dissipate wave energy by 97%, reef crests alone 86%.
- Cost benefit analysis confirmed that the cost of not doing anything was higher than the restoration efforts - might not be the case for rural areas.
- Phase 1 - studies, EHP review, outreach, final designs, permits, update BCA. Also need to create nursery and outplant schedule - but needs to be flexible to account for bleaching and other disturbance

- Water quality - don't have tools to address for the whole area. Couldn't include in funding proposal - but will have close communication with other initiatives in the area with water quality and monitoring

Florida's Restoration Approach, *Maurizio Martinelli (Florida Sea Grant)*

- Two state agencies came together to identify restoration priorities and create a document
- FL focused on ~20 species, with 5 priority species - Framework builders, species with conservation need (SCTLD-affected), species we know how to propagate
- Restoration Plan
    - Tier 1 - High-level goals. Larval connectivity drives the plan. Make sure sites are intentionally chosen
    - Tier 2 - regional goals. Mission Iconic Reefs - picked 7 sites that are both ecologically and culturally important. Try to replicate the MIR protocol in identifying sites. Start with Acroporids, but they were heavily affected this summer - reconsidering this approach
    - Tier 3 - Site Specific: Coral cover numbers for each species.
- Propagation pipeline - activities, options for transport, and options for activities
- Trying to take an ecosystem-based perspective
- Approaches: Mapping and modeling is very helpful - where are we accreting and losing reef and assess connectivity, where are larval sources and sinks are and are there remediation efforts that can make an area more habitable for larvae. Co-outplant with other organisms

Key Takeaways from Group Discussion on Restoration Planning: For PR, the key element is participation, plans have to be adaptive, MOUs need to have room for making adjustments for ecological surprises. Goals are important - ecological function vs. outreach, different goals for different sites. Narrowing geographic region is important and helpful in the long run, narrow down to specific sites where corals would be viable

Site Visit: Cane Bay Restoration Site

*Unfortunately, due to weather and unfavorable conditions we were unable to make it out in the water to dive the restoration site. It was still beautiful!

Image 11: Cane Bay Dive Site

Day 3: February 8th, 2024

Expanding Disease Response Frameworks to Include Other Disturbances

Florida's Transition to Disturbance Response, *Maurizio Martinelli (Florida Sea Grant)*

- 80 partner organizations working on SCTLD
- SCTLD is still a huge driver of coral decline -want to be more proactive about other disturbances
- Florida Reef Resilience Program - thinking more long-term and wider range of issues, facilitate recovery to a resilient, self-sustaining ecosystem. Disturbance response- Hurricanes, bleaching and disease. Ecosystem restoration- Corals, sponges, herbivores. Water quality- partnership with Everglades restoration. Climate adaptation- Resilience component and long-term thinking
- Got rid of hierarchy - use a color wheel to describe structure now to include multiple teams on each issue/approach
- Two leadership bodies - Executive Coordination team and Steering Committee, and maintain a communication venue via DAC
- Takeaways: Communication and engagement is important. Funding diversification is necessary. Reach beyond the normal network

Jurisdiction Breakout Discussions

Puerto Rico, *Dana Wusinich-Mendez (NOAA Coral Program)*

- **What has been done thus far? What is going well?**
    - Bleaching response was organized following the structure outlined in the Coral Disease response plan of SCTLD
    - Emergency Response Coordinator, Darimar Davila was hired
    - Volunteer coordination suggested through HJR Reefscaping for structured training and division of tasks, including disease treatment and general disturbance assistance. Could include training for volunteers focused on evaluating post-storm damage and reattachment techniques, particularly for reefs near the shore.
    - Nilda has been working grounding response as well as the Grounding Specialist, Sandra Schleir.
    - More access to CCEA which is the climate change committee. This committee has a structure in place.
- **Where are we struggling?**
    - Funding constraints identified as a major challenge, with suggestions for stipends to organize volunteers and standardize data collection.
    - USVI Strike Team highlighted as a successful example of intervention funded by NPS, emphasizing the importance of specialized volunteers.
- **Discussion on leveraging capacity built for SCTLD response for addressing bleaching events**
    - PR's Coral Bleaching Response Guidelines
    - Plans for emergency response include increased tank capacity in La Parguera for the upcoming bleaching emergency.
    - Funding and personnel shortages recognized as limiting factors, with transportation challenges hindering effective grounding response.
    - EREA was established to fund volunteers, but resources remain limited.
    - Need for better forecasting incorporating oceanographic dynamics and depredation concerns raised.
    - Funding opportunities such as a $1 million allocation for SCTLD highlighted as avenues to address coral reef issues.

- Emphasis on leadership meetings between jurisdictions and collaboration agreements to improve coordination and resource allocation.
- Suggestions for administrative orders and innovative funding mechanisms, such as coastal property protection schemes, proposed to address funding challenges.
- *Unomia stolonifera* addressed as huge growing concern

Image 12: Puerto Rico Team discussing plans of action

USVI, *Maurizio Martinelli (Florida Sea Grant)*

- **What has been done thus far?** Informally, VICDAC has transitioned from disease response to disturbance response. Expanded activities for strike teams - training on algae/fireworm/snail removal and different field interventions. Communications team has already broadened into coral disturbance (high level information for the public). Have NOT expanded to water quality and climate issues. Funding is an issue. Action plan is amended onto disease outbreak plan, could create a coral disturbance response plan.
- **What is going well?** Adaptability. Good protocols and file structures.
- **Where are we struggling?** Small team with limited capacity and recruitment in engaging new groups of people. Water quality and climate might not be realistic for inclusion. Maybe just include disturbance and ecosystem resilience. Database management. Community engagement/ outreach.
- **Do we know funding needs? How is this being shared?** Disease intervention funding doesn't seem likely. Possibility: apply for funding together rather than competing for the same sources. Money management becomes an issue, DPNR doesn't always spend the money given to them especially with limited personnel to manage the money.

Image 13: USVI Team talking through next steps

Key Takeaways from Discussion: Administrative capacity is a big issue- need to find alternative funding opportunities to hire more people

Lightning Presentations

Herbivore replenishment efforts and other methods of reef enhancement in the Caribbean, *Stacey Williams (ISER Caribe)*

- 2019- first land based coral nursery → 2021- enough frags to outplant
- Diadema was already in systems, outplanted corals with urchins to keep algae off of growing frags, survivorship increases when you include diadema in outplanting
- Ways to enhance herbivory- Need to take an ecosystem based approach; protection of parrotfish; redistribute healthy populations; larval rearing in labs
- Need to match up herbivores to the right kind of algae showing up on the reef
- CIROM - two centers with 3 urchin species and 1 spider crab species in nurseries. Focusing on larval rearing the lab. Also rescuing SCTLD corals - treating active infections.

Treatment Efficacies project for the SCTLD Emergency Response Strategic Plan, *Miguel Figuerola/ Maria Vega-Rodriguez (Puerto Rico Department of Natural & Environmental Resources)*

- Monitoring since 2019, ~9000 colonies treated over 9 sites, mostly SW and North PR
- Disease prevalence has been reduced, one treatment might be enough to stop lesion and mortality (this is site specific); One treatment has similar response to multiple treatments
- CNAT has slower response to treatment
- SCTLD and/or identification of it declines during bleaching events, but then comes back (potentially stronger)

UVI Deep Outplanting Project, *Sonora Meiling (University of the Virgin Islands)*

- As reaction (not long-term solution) to expected bleaching event, started moving acroporids deeper - 5 presumed genotypes down a depth gradient down to 120 ft
    - 15 ft - pretty much 100% bleaching, gradients along depth of trees (10 ft)
    - 120ft - outplanted corals did well, corals already there bleached
    - Deepest corals - stressful transfer, so had decreased survival as compared to 100ft

    - 10ft difference had a big difference on survival
- One genotype had mortality with increased depth, other four genotypes did better deeper
- Could offer temporary solution to bleaching events, these corals are now permanently at depth
- Bleaching probably due to irradiation, not a huge temperature difference between the depths

Recent Boat Groundings on St. Thomas, *Jason Quetel (University of the Virgin Islands)*

- Anchor damage - not as visual to public as groundings
- Limestone Bay - 180 ft yacht, engines went down, started to drift, dropped anchor and grounded
    - Grounding didn't do much damage, when anchor was removed major damage was done
- Brewers Bay - 80ft sail cat anchored overnight on coral
- Responding → Agency, intervention, responsibility, response
- Restoration→ Funding, leadership, monitoring, frags of opportunity
- Prevention→ No anchor buoys, moorings, industry awareness, monitoring, AIS tracking
- Navionics - updated chart to include "no anchoring" area
- Vessel Finder - has historical data

Citizen Science Efforts, *Ashley Perez (Puerto Rico NOAA Coral Fellow)*

- How to engage citizens with collaborators already doing work with SCTLD
- Ojos en el agua (eyes in the water) - Facilitate monitoring effort, ID presence of disease, serve as an alert system, enable communities to play a role in conservation
- Citizen Science protocol: Interest survey, chose a reef to visit at least once a month, collect information on a datasheet, monitoring water quality with test kits, take pictures, enter data on a digital survey, repeat monthly
- Data sheet - easy to use, lots of pictures, can change through time. Includes observations, water quality, bleaching, disease, types of coral
- Two hour virtual training
- Commitment- Be part of program for at least a year, visit reef at least once a month, submit data at max two weeks after data collection

SCTLD Dashboard, *Darimar Davila (Puerto Rico Department of Natural & Environmental Resources)*

- SCTLD dashboard created through ArcGIS dashboard
- Has an intro and description of each graph, contact info, and org logos
- Map of treatment efforts, citizen science efforts, and bleaching
- List of organizations and treatments applied
- Graphs with treatment data

Youth Ocean Explorers, *Howard Forbes (VIMAS)*

- 70% of URM youth lack swimming ability
- Junior and Youth Ocean Explorers Programs: 2-4 week long summer programs. Junior, grades 3-6 - learn to swim, how to ID fish, inverts, coral. Youth, grades 7-12 - SCUBA, coral and mangrove restoration, collecting data. Since 2016, 300 youth engaged.
- Incorporating technology - can use phones to collect data, iNat, VR with 360 degree camera
- 85 youth SCUBA certified: Every month, dive is lined up, can dive for free
- Long term investment - but it works
- Important to spend to with diverse STEM professionals

National SCTLD Efforts, *Caroline McLaughlin (Florida Sea Grant)*

- Pacific preparedness team working to engage with Aquatic Nuisance Species Task Force (ANSTF) on marine biosecurity in the Pacific
- Working with NOAA in development of National Coral Reef Resilience Strategy
- USCRTF passed a Resolution for National Action on Coral Disease Outbreak Prevention, Rescue and Recovery