

Reverse Site Visit (RSV) Report (Spring 2022)

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Overview

The Reverse Site Visit (RSV) panel met and reviewed the Virgin Islands EPSCoR Research Infrastructure Improvement (RII) Track-1 project "Ridge to Reef Processes and Interdependent Drivers of Small Island Resilience." The planned RSV at NSF headquarters was converted to a virtual format to comply with COVID-19 pandemic social distancing policies in effect at the time, yet the standard RSV agenda was maintained. The key aims of the project are to increase understanding and quantify "drivers, processes, interdependencies, and consequences of ecological change driven by natural and anthropogenic disruptions in Caribbean coastal and marine ecosystems," specifically in the U.S. Virgin Islands (USVI). The project is currently in its second year, and the team presented their accomplishments and progress to date virtually to the panel.

Research Program

Research Theme 1: Watershed Monitoring and Land Use

Strengths

The Land Use theme is very important as it relates directly to the sustainability of downstream marine resources in the USVI, which include mangroves, seagrasses, and coral reefs. The general approach is a major strength of the overall project, and upland land use research is a key to success of the downstream research themes. This research component will hire one hydrologist and one postdoc.

The proposed monitoring of sediments, associated particle-bound contaminants, dissolved nitrate and phosphate, and bacteria in stream runoff from natural, urban, and agricultural land uses is good, and despite challenges from the 2017 hurricanes and COVID-19, progress is being made.

Assessing the effects of soil conservation practices (vegetated buffer strips, contour ridge planting) in reducing sediment and nutrient runoff from different agricultural land uses is very good. This work should lead to best management practices and workforce development and could have positive effects on the health of downstream mangroves, seagrasses, and coral reefs.

Areas for Improvement

This key theme needs more integration with other project themes, especially oceanography, mangrove, seagrass, coral disease and restoration, and coral reef resilience. It is critical that this theme be conducted in a robust manner to accomplish its primary goal. One suggestion for better integration of the themes is making nutrients a major focus, as this is a common thread that links all the themes together. In particular, measuring dissolved inorganic nitrogen (DIN = ammonium + nitrate + nitrite) and soluble reactive phosphorus (SRP) from “ridge to reef” will allow quantification of DIN:SRP ratios on coastal reefs that can be used to gauge how different land uses are contributing to coral stress through nitrogen enrichment, altered stoichiometry and phosphorus limitation (elevated N:P ratios).

The watershed team is making nutrients a major focus of their work- they've already planned to do this for the upstream/freshwater side of the ridge-to-reef continuum at Salt River Bay and Fish Bay with opportunistic sampling of freshwater and stormwater. In salt water, using external lab capacity, a protocol is in place to sample water in Salt River Bay on an upstream-to-downstream spatial transect, responsively to a major rain event (i.e., within 48 hours) in order to provide a linkage in the land-based nutrient datasets produced and the observations made in deep water at the reefs. In freshwater samples, they've already acquired the capability to monitor DIN and SRP, but due to altered chemistry and additional equipment required, saltwater samples are currently sent to an external lab for analysis. In David Hensley's presentation during the RSV, he focused his comments regarding nutrients on nitrate and phosphate, which are mentioned by the review panel above, but he did not mention that he and his team will have the capability to do the DIN:SRP ratio mentioned. Although the total number of salt water nutrient samples that can be processed with external lab fees will be limited by budgetary constraints, the spatial transects established in response to selected rain events at Salt River Bay, compared to during dry season, as well as stochastically-timed transects of a similar kind performed at Fish Bay, will be instructive in establishing the nature of the link between nutrient concentrations observed on land and those in the various zones of the marine environment. Monitoring marine nutrient concentrations near shore would allow us to assess linkages between stream runoff and the marine environment, so we agree that this approach makes sense. Also, there are brackish pools around the territory, including at Fish Bay and Reef Bay, which are relict stream mouths and can discharge during heavy flow events from the upstream gut. These brackish pools are also being monitored by the team (particularly at Fish Bay) and a sampling regime is planned here in order to monitor seasonal changes in nutrient loads within this water, particularly after any confirmed discharge events (implying discharge of nutrients into the marine zone). Once our Environmental Analysis Lab (EAL) is operational, they'll be sending saltwater samples over for analysis there instead of at an external lab (the Center for Coastal Studies). Monitoring marine nutrient concentrations at regular intervals may be more feasible but may not be directly linked to streamflow unless evidence of direct discharge from streams to the marine environment can be collected (to date in the project, no such evidence has been found). The team appreciates that the review panel would like to see stronger linkages between watershed and marine systems, so they're trying to make the connections between marine concentrations and stream flow- weather permitting!

Anthropogenic nitrogen enrichment from fertilizers and sewage are well-known to increase N:P ratios in the Caribbean region, leading to higher levels of P limitation and coral stress. This will require better nutrient analytical support so that ammonium can be analyzed along with nitrate to accurately estimate DIN.

The Watershed team already developed this capacity over the last year. Given the short amount of time allocated to our research presenters during the RSV, Hensley did not mention ammonium analysis in his presentation. The main limitation has been a lack of water samples in freshwater to date in part due to drought conditions in the region, but this is already being remedied with the onset of our rainy season here in the USVI. Because of the pronounced rainy/dry seasonality of the USVI (rainy season is typically August-November), streams are typically dry for most of the year, and flow events, when observed as a result of heavy rainfall, often dissipate within hours. Developing estimates of total water flow on land as a result of these flashy rain events, as well as nutrient concentrations of such water, will be critical comparison data for marine nutrient data in order to further explain what the nature of terrestrial-marine connectivity is in the context of extended drought and ephemeral stream flows.

Ideally, samples would be analyzed in the Environmental Analytical Lab at UVI. Alternatively, these samples can be collected, filtered, frozen, and taken to the U.S. mainland for analysis in an appropriate lab. Attention must be given to the low method detection limits necessary for the nutrient analytes.

This theme could be strengthened by tissue nutrient analysis for elemental composition (C:N:P) and stable carbon and nitrogen isotopes in fresh water macrophytes in rivers and streams, as well as cnidarian symbiotic algae, Symbiodiniaceae (zooxanthellae), macroalgae, turf algae, and seagrass in coastal waters. This is relatively inexpensive and will yield considerable insight as to the type and degree of nutrient limitation on coastal reefs, as well as sources of nitrogen from the watershed (e.g., discrimination between fertilizers and sewage) that are driving eutrophication in coastal waters.

The watershed team agrees that tissue nutrient analyses for C:N:P would increase understanding. The team has limited resources – these analyses were not budgeted for but have identified two sampling periods that would likely be the most informative for generating preliminary data; late in the rainy season (November) when pools are full and plants have had time for growth and uptake, and again midway into the dry season (April) when pools have disappeared, and plants have not had water for potentially

several months- providing the best contrast for analysis. The team will begin sampling this November 2022.

Adding the hydrologist to study groundwater quality and flow is important to determine pathways for transfer of pollutants (e.g., nitrogen) from the USVI watersheds to coastal waters, especially during the current drought period. This is particularly true for developed islands that rely on septic systems or cesspits for wastewater disposal, as well as agricultural areas that use fertilizers that can infiltrate groundwaters.

We are preparing the job description for a groundwater hydrologist, especially considering the drought that has impacted our ability to study surface water since the beginning of this grant cycle. We are also becoming more aware of the lack of start-up resources for this position here at UVI, so that will require some fund-raising and planning. A study of groundwater quality and flow can be initiated under R2R (the watershed team was already planning on this), but we need to acknowledge that a full picture is not likely to come into focus within the remaining time of this current award. It's also becoming apparent that very little seems to be known about the groundwater hydrology dynamics here in the USVI. It should also be recognized that critical, and up to now missing or out of date, data and information about the complicated and poorly document surface hydrology of the USVI is being collected, as well as major capacity building for further research in this, as a result of the R2R award.

The panel suggests that the hydrologist be hired as soon as possible, prior to Year 3.

We have a draft job description for a hydrologist that will be posted in the Fall of 2022 with the plan to complete the recruiting and hiring process by the summer of 2023.

Research Theme 2: Mangrove Ecosystem Function & Recovery and Mangrove Restoration

Strengths

The Mangrove Ecosystem Function & Recovery team is studying the current and past distribution of the different mangrove species in the territory and identifying the stressors that impact their ecosystem functions. They are making good progress on measuring loss and recovery and have established a land-based nursery. They have obtained licensure to operate drones for aerial surveys and will begin the surveys after acquiring the necessary approvals. Progress is being made on determining the degree of recovery of mangrove ecosystems of the USVI following the 2017 hurricanes and droughts in earlier years.

The team has successfully cultivated all three species of mangroves. They are gathering data on growth and phenology, which will be important for future restoration efforts. They are collecting more data on phenology through their citizen science program.

The team is strongly integrated with the R2R communications, informal learning and education and workforce development (EWFD) teams. They are engaging the local community in raising awareness of the importance of mangroves in the islands. The public engagement includes K-12 students, their teachers, and local citizenry. The Mangrove Citizen Science Program is an exemplary program, with local school volunteers for the Great Mangrove Cleanup. The production of culturally relevant infographics and curricula is another example of the strong integration of this research team with EWFD programs.

There is strong leveraging of student support provided by other NSF projects, including the NSF INCLUDES SEAS Islands Alliance, NRT STRONG COASTS and S-STEM. The team is also leveraging research partnerships with US Geological Survey and the National Park Service. The team has engaged federal and local partners to conduct mangrove surveys (e.g., fishermen, ecotourism groups, St. Croix Environmental Association).

Areas for Improvement

The panel felt that there should be stronger linkages to other research themes, especially how watersheds, land use and *Sargassum* impact mangroves, and how mangroves impact seagrasses, fisheries, and reefs. Shared data on sediment transport and water levels upstream from mangroves, and water quality in groundwater wells established in mangroves, should inform the research of this team.

The strong leveraging of support provided by other funded projects makes it unclear as to what R2R is contributing to this research effort.

Under the Mangrove research theme, R2R funds have supported undergraduate and graduate student research projects, along with supplies and travel to establish long-term monitoring plots at 19 mangrove forests around the territory, and monies to support build-out and maintenance of the mangrove nursery.

It is unknown whether aerial mapping will be able to distinguish among the three mangrove species. Drones and data applications developed by this team should be applied to other research themes, especially watersheds (Theme 1). The opportunity for the drone technology and data to support vocational training and technical skills applicable to other areas could be developed but will require additional personnel and training.

That is correct. The team will not know if this technology will work for mangrove species-specific mapping because it has not been attempted in USVI coastal wetlands

settings, yet. They are excited to learn how this technology may be applied to this goal and under what circumstances it may be most successful (e.g., time of year, tree reproductive stage).

Research Theme 3: Emerging Areas of Research—Seagrass Ecology and Dynamics and Sargassum Golden Tides

Strengths

The seagrass ecology and dynamics work are early in its development but is helping to provide an enhanced understanding of the “top down” dynamics in this system. There is a good research team in place that includes graduate students. The team has identified a number of trophic interactions within this system (e.g., conch, turtles) that should improve the understanding of the processes that structure seagrass communities around the USVI. Feeding trial experiments are furthering the understanding of how higher trophic dynamics structure seagrass systems in the USVI. The addition of the Sargassum work in the future should further enhance research around seagrass dynamics.

A collaboration between Cruz-Rivera and Krueger-Hadfield (University of Alabama) is addressing genetic diversity of the Sargassum golden tides. This will help to identify what species and forms of Sargassum are contributing to the excessive biomass that is impacting the beaches and coastal ecosystems of the USVI.

The Turtle Movement emerging area group is focusing on a significant shift in submerged aquatic vegetation which has potential to link strongly to other R2R research themes. The fine-scale acoustic array has been installed and verified and the first download completed. Intellectual capital has been acquired in two graduate students, a postdoc and Dr. Ratchford. Finally, 36 tags have been deployed and bi-monthly water samples have been collected.

The Shoreline Response emerging area group characterized >10 years of data to create a spatially explicit model of wave characteristics at a scale more relevant to the USVI. They have also conducted several beach profiles and utilized aerial imagery to assess shoreline changes.

Areas for Improvement

The top-down aspect of this work is well developed but the research would benefit from the addition of “bottom up” emphases such as investigating the role of nutrient loading. The addition of nutrients should enhance the overall work around seagrass and may improve connections with other research themes within this project. The lack of facilities to carry out seagrass lab trials was highlighted within the report. It is suggested that on-campus resources (e.g., aquarium space) be provided to help facilitate research within this theme.

The Seagrass team agrees; this was the goal of the growth experiments planned, but we've been delayed – until the McLean Marine Science Center is re-opened, we do not have the facilities to start these experiments or funding to move to an off-campus location. That said, nutrient (and bacterial) sampling is being done in Brewers Bay 6 times/year. This sampling is partially supported by VI-EPSCoR.

While the outcomes of the *Halophila* work have great potential to link with other R2R programs, the work appears to be a low priority. The feeding assays should link to the herbivores of focus in the fish ecology section as well as other more significant herbivores in the area (i.e., sea urchins and herbivorous fish).

The VI-EPSCoR team clearly was not effective in communicating during the vRSV the importance of the Halophila and the coordination among our R2R researchers. The Fish Ecology team is looking at the effects of Halophila as nursery grounds for the yellowtail snapper and several parrotfish species including redbtail and stoplight parrotfish as part of a separate NOAA funded project. The Emerging Areas teams (Jobsis, Guannel, and Cruz Rivera) are coordinating with each other on Halophila distribution, use by herbivores, and role in beach dynamics, including the coastal protection work led by team led by G. Guannel through their collaboration with the University of South Alabama. As for herbivorous fish, we currently cannot do lab feeding assays with fish without our lab facilities and seawater systems being fully operational. Our sea turtle team are using the FPS acoustic array to document how the green and hawksbill turtles are utilizing Halophila as grazers. In October 2022, we will start our stingray tagging project in Brewers Bay to take advantage of the FPS array. We will examine the changes in habitat use by stingrays from a 2015 EPSCoR funded study when Halophila was much less common vs now when Halophila is the dominant seagrass species. Both local research and IACUC permits are pending approval. These permits also include the yellowtail and rainbow parrotfish as potential study species.

The seagrass survey relies on some traditional ecological survey methods (i.e., quadrats and meter tapes) to collect data. The integration of remote sensing approaches (e.g., drones, image analysis) being used in other parts of the R2R should help improve data collection and offer new perspectives on spatial dynamics that can lead to new areas of inquiry around seagrass ecology. The changing landscape configuration may provide insights that shoot density and morphometrics may not. Collaborations with the mangrove drone work would also provide opportunities for workforce development.

The Emerging Areas team led by G. Guannel are using these techniques to understand beach responses and to ID presence/absence of seagrass. The work they're doing - assessing shoreline change and shoreline characteristics, is the first step in improving our understanding of how presence/absence of seagrass drives coastal response with the use of emerging technologies such as Global Environmental & Earth Science Information System (GENESIS) in combination with the use of drones. The teams have

also been collecting Google Earth images showing the growth of Syringodium patches within the Halophila dominated seagrass meadows in Brewers Bay. Unfortunately, we cannot use drones in Brewers Bay due to its proximity to the STT airport.

The team will need to assess how the seagrass lead, Dr. Cruz-Rivera, will continue to manage the program after having taken up a new position at Morgan State University. It is unclear to the panel if they will be able to continue to lead this research while taking on new responsibilities at their new institution. Finally, this research theme has a significant reliance on external collaborators and their ability to travel to the USVI. Because of COVID-related travel restrictions, most of the collaborators could not travel to USVI, which delayed research within this theme. This may be an opportunity to assess if there are connections within the USVI or within the broader EPSCoR team that may be developed to facilitate some of the proposed research. Given the very strong connection to nutrient loading and changes in turbidity, the seagrass research component should be a major theme of the R2R. Documenting changes in plant tissue elemental stoichiometry should be a priority to connect this research theme to the land use changes theme.

Despite his move to Morgan State University, Cruz-Rivera has continued his regular lab meetings and mentoring of students at UVI and has returned over the summer to continue sampling and conduct experiments at UVI. The lack of space remains the only bottleneck to his progress. Dr. Cruz-Rivera and his students are currently sharing a lab space with Drs. R. Nemeth and R. Smith and their students. This challenge is expected to be resolved with the re-opening of our Environmental Analysis Lab by October 2022 and the McLean Marine Science Center by the end of the calendar year 2022.

It is important to keep in mind that “Emerging Areas research” includes research that was selected at the time of the R2R proposal development as areas of interest that complemented more developed research areas within the theme of “Ridge to Reef”. Basically, these areas represent research “start-ups” that are asking questions that have higher degrees of uncertainty (testing ideas, methods, and feasibility). Consequently, the teams involved in these areas are quite reliant on external collaborations that include additional subject matter expertise, facilities, specialized equipment, etc. that are not locally developed or available in the Territory.

That said, the Guannel-led team is actively training undergrads and investigating working with other non-UVI stakeholders (NGOs and volunteers) to help gather some of the needed data. At the same time, the Cruz Rivera-led team has used research findings from current and past elemental analysis from MMES graduates’ theses. This includes ongoing elemental analysis in relation to feeding on the seagrasses. Elemental analysis is not a major theme because processing these samples is expensive and the logistics of collecting at sites that had to include all four major species of seagrass has proven challenging for students who were not divers. Cruz Rivera is very interested in doing this bottom-up work, but it requires water sampling for nutrients that were not in

their budget. In spite of these limitations, the teams hope to generate some insights and data that can inform proposals and publications- which is exactly what emerging areas research is supposed to do.

The *Sargassum* golden tides are having major impacts on coastal water quality, impacting beaches as well as mangroves, seagrass and coral reef ecosystems. The *Sargassum* research could be improved by expanding its focus to include the effects of *Sargassum* influx on nutrient enrichment and microbial community shifts, which are relevant to the invasive seagrass research and coral diseases and restoration. Collaboration with researchers using satellite remote sensing of *Sargassum* could help predict *Sargassum* stranding events and also quantify *Sargassum* nutrient inputs to coastal waters of the USVI. However, there is uncertainty as to how this research will continue given that the project lead, Dr. Cruz-Rivera, is now at Morgan State.

As noted above, Dr. Cruz Rivera remains active and engaged with the R2R project and his students. Again, it is important to keep in mind that this research is an emerging area for VI-EPSCoR's current Track 1 award. Fortunately, much of the Sargassum work underway has benefited from additional funding support from a NASA-MUREP grant initially awarded to Cruz Rivera. That award has since been transferred to another emerging areas researcher (Jobsis). Two graduate students from the new 2022 cohort have already been hired under this research initiative. New Sargassum collections are also proceeding. Finally, a graduate student has been hired under EPSCoR to do the Sargassum-beach biodiversity project. This MUREP award, and the funding through VI-EPSCoR, allows Cruz Rivera to sustain his commitment to study of Sargassum at UVI. Additional funding has recently been announced – Jobsis is the PI on a two-year US Department of Interior's Office of Insular Affairs "Technical Assistance Program" (DOI OIA TAP) award to model the sargassum movement as it approaches the VI's coastal bays. There is nutrient and bacterial analysis funded in the TAP sargassum project which will supplement the work by supported by VI-EPSCoR.

There is no clear linkage of the unique intellectual capital between the two telemetry projects. The Project team provided no implicit statement on how the water quality collection in the Turtle Movement emerging area integrates into the R2R project. The shoreline response emerging theme seems outside of the R2R conceptual umbrella. While the changes in submerged aquatic vegetation may significantly impact erosion, the changes are not linked to potential drivers of land use and nutrient loading. This is an example where integration with other research teams and their use of emerging technologies (e.g., drones, remote sensing) can enhance the overall research and integration with the broader R2R research and education teams. The research projects are outlined as working in themes from the R2R but they do not integrate the drivers affecting changes at the reef from those happening on the ridge.

Despite the perceived lack of linkages articulated during the vRSV between research areas in the R2R project, there are many that can be identified. Within the Emerging Areas research, one of the major questions of the R2R project is the relationship between seagrass presence and species and shoreline/beach response which is being addressed by the Guannel-led team. They believe that this linkage is within the scope of the R2R conceptual framework because, if there's a link, the degradation of seagrass beds or change in composition of seagrass beds will have consequences on shoreline and land dynamics. For example, beach erosion may be influenced by presence/absence of seagrass, which in turn may be a consequence of drivers of land use and nutrient loading etc. The Guannel team are using a mix of technologies (noted earlier) to evaluate beach processes.

At the same time, the Cruz Rivera-led team acknowledges the challenge of linking seagrass growth to nutrient and land sources. Making such a linkage requires a combination of stoichiometry and stable isotopes work that was not identified nor budgeted for in the R2R proposal. They note the paucity of basic information on these areas precluded a more explicit integration. Little is known about the basic ecology and distribution of Halophila and Sargassum, which are both emergent environmental issues for the USVI. The emerging areas research teams expect to develop more sophisticated projects (and develop proposals based on their initial findings to secure more funding) to address these integrative issues. The NASA MUREP grant is an example of these efforts.

For the Jobsis-led team, their Post-doc, Kayla Blincow, is an obvious example of the intellectual linkage between the fish ecology team and the Jobsis' team efforts in monitoring the movement of macrofauna using acoustic arrays in areas of shifting sea grass communities. While a relatively low abundance of green turtles in Reef Bay and its non-FPS array makes Reef Bay a less rewarding location for green turtle research, the teams are still monitoring green sea turtle movement (foraging and resting) related to the seagrass type, location, density and change for the next two+ years. Water sampling/nutrient monitoring will be used to determine if fluctuations in nutrient levels correlate to changes in native and invasive seagrass beds. The fine-scale positioning system is expected to document the green turtle space use with enough precision to document changes in foraging behavior with the changes in the seagrass communities. Invertebrate tracking efforts in the seagrass beds are using tagged giant hermit crabs (Petrochirus diogenes). The teams will soon add the monitoring of stingrays' space use utilizing the FPS array once a graduate student has been recruited.

Research Theme 4: Fish Ecology

Strengths

Despite the logistical constraints of damaged facilities and COVID-19, the fish ecology group was able to make progress on three of their objectives. The team initiated a synthetic analysis focused on how resistance or recovery potential of coral reef ecosystems impact fish herbivory communities. This was accomplished through a Master of Science in Marine and Environmental Science (MMES) capstone project focused on historical fish and coral data compiled pre- and post the 2005/06 bleaching and mortality event. In addition, they were able to install 54 acoustic receivers in Reef Bay and conduct preliminary surveys to confirm the presence of two *Sparisoma rubripinne* spawning sites and tag 60 individuals. The team was able to demonstrate tagging success and illustrate fish migrations with strong spawning site fidelity. A pattern of differential foraging on turf algae along the east-west gradient was observed. The installation of the Acoustic Doppler Current Profilers (ADCP) and echo sounders at each spawning location is exciting and offers an excellent link to the oceanography working group. Progress was made on increasing the personnel capital by hiring a research technician and recruiting a graduate student.

Areas for Improvement

When displaying the telemetry data, it would be helpful to quantify how many unique individuals of the 60 tagged parrotfish remained within the array. The telemetry data would benefit from the use of some movement modeling to strengthen the perceived outcomes. The sediment tile and trap data should have a high priority for analysis to verify that a sediment gradient actually exists. Water quality parameters (e.g., nitrogen) need to be assessed along this east-west gradient as well. Nutrient monitoring should be linked to algal ecology; lower nutrient (relatively oligotrophic conditions) may promote dominance of algal turf whereas higher nutrient concentrations (relatively eutrophic conditions) promote dominance of macroalgae. Terrestrial and marine sediment trap samples should also be analyzed for dissolved nutrients to more completely characterize R2R (i.e., source-to-sink) nutrient fluxes. If present, nutrient gradients may confound impacts attributed to turbidity alone. The panel found it difficult to distinguish what are the actual accomplishments for R2R VI-EPSCoR funding from the presentation. Although many linkages were articulated in the conversation with the panel, these are not apparent in the annual report nor the presentation. Indeed, an introductory slide illustrated a source-to-sink (R2R) model, but it is unclear how this model is being implemented and operationalized across the R2R research themes. There does not appear to be one thread running through and connecting all the R2R research themes. Nutrient flow from R2R would be a natural thread that could be highlighted in all the research themes.

The Fish Ecology (FE) team had very high tagging success with total of 55 of 60 parrotfish (92%) surviving surgery and actively migrating to either the western or eastern spawning aggregation sites for at least 6 months (based on first data download in February 2022). Of the 30 fish tagged in western and eastern sides of Reef Bay, 28/30 (93%) and 27/30 (90%), were detected on their respective spawning aggregation sites with 100% spawning site fidelity.

The FE team produced animations of the telemetry data to visualize the movement of fish to and from the spawning aggregation. Visually these confirmed the movement of individuals from their respective home reef sites to the aggregations, and the lack of mixing of individuals between aggregations. Through data analysis they further confirmed that there was strong site fidelity to the respective spawning aggregations, with no crossover between the two. Modeling daily migrations to aggregations we found that fish from western sites tended to migrate earlier in the day (peak presence at aggregation in the 15:00 hour) than fish from eastern sites (peak presence at aggregation in the 16:00 hour). More fish tend to migrate to the western aggregation overall. While aggregations tended to occur daily, every individual did not visit aggregations every day. The FE team plans to continue modeling the data to address their research questions as more data is collected. Building from that data the team plans to build a more robust model of visitation frequency across individuals to look for differences between aggregations and the effects of sedimentation rates and algal composition at feeding areas.

Preliminary data from two months of sediment tile collections showed similar proportions of terrigenous (62%) and carbonate (38%) sediments among sites but significantly higher sediment loads in western Reef Bay (2.5 g/mo) where land development is prevalent, compared to eastern Reef Bay (1.0 g/mo) where no land development occurs within National Park.

Major accomplishments of the FE team include the following:

- 1. Synthetic analyses of long-term monitoring data found significant effects of major disturbance on coral reef (i.e., large-scale bleaching and disease events) on parrotfish assemblages. These findings included a shift in biomass from *Scarus* spp. (scrapers) to *Sparisoma* spp. (grazers). They also found that prior to disturbance, as grazing rates increased, it had a strong positive effect on % cover of turf algae and a strong negative relationship on % cover of macroalgae. Furthermore, grazing rates showed a very strong positive relationship to mean diversity of herbivorous parrotfishes, suggesting that increases in biodiversity, or functional redundancy, can drive ecosystem stability and coral reef resilience.*

- 2. The team also examined the effects of sedimentation rates on parrotfish assemblages. We found that *Scarus* species (scrapers) are negatively affected by even small increases in terrestrial sediment flux whereas *Sparisoma* spp. (grazers) show an initial increase in biomass at low levels of sedimentation (i.e., $<4 \text{ mg cm}^{-2} \text{ d}$) but a decrease in biomass $> 4 \text{ mg cm}^{-2} \text{ d}$.*

- 3. In summer 2021 the FE team successfully established sediment monitoring stations, a large acoustic telemetry array and tagged and released the target number ($n=60$) of parrotfish in Reef Bay. Our major assumptions that sedimentation rates, differences in algal diversity, fish feeding rates, strong spawning site fidelity and differences in spawning site visitation rates were met and thus allowed for a robust natural experimental design. Preliminary data from the first 6 months suggest interesting and significant differences among these parameters. Some of these data were presented at the 14th International Coral Reef Conference in Bremen, Germany, in July 2022. In addition to the primary*

graduate student, Jenna Cheramie, whose thesis is based on this project, four other graduate students (Stefanie Maxin, Taylor Hobbs, Gregory O'Neill, Sierrah Mueller) were recruited to assist in field and lab work related to this project.

4. Nortek acoustic Doppler current profilers with integrated echo sounders were deployed at each spawning site providing detailed information on current speed and direction and wave heights. The FE team has been working with Nortek engineers to fine-tune the novel integrated echo-sounder which is intended to measure reproductive output from each spawning aggregation site, once calibrated.

5. In April and August 2022, 60 additional parrotfish each month were captured from western and eastern Reef Bay to examine differences in diet using meta-barcoding of gut contents (in collaboration with Puerto Rican colleagues Drs. N. Schizas and C. Harmes_Tuohy) and examine differences in fecundity. We are still awaiting the results of these analyses.

Although sedimentation could also be a natural thread used to connect different research themes, nutrient analysis may be more suitable to connecting more disparate areas such as sargassum and seagrass studies.

Research Theme 5: Oceanography

Strengths

Adapting to COVID disruptions, the Oceanography research team focused on planning for oceanographic research operations in Years 2-5. The team completed an audit of existing oceanographic instrumentation and developed detailed needs assessment for additional instruments. Existing ADCPs were shipped out for repair and recalibration and four new ADCPs were acquired for deployment at the Reef Bay and coral restoration sites.

Additionally, the Oceanography research team developed simplified user manuals for various instruments to aid education and training of students and other collaborators desiring to utilize these instruments for future research endeavors. Simplified instructions include operating and maintenance protocols, and procedures for data processing and quality control. These products will educate new cohorts of researchers in R2R, reduce training time, and ensure conformity of data standards for disparate projects conducted at UVI. The Oceanography team developed the infrastructure on the Microsoft Azure cloud computing server for storage and archiving of these data. Over time, these data will be of high value and inform future research.

S. rubripinne spawning sites were surveyed and characterized by the Oceanography and Fish Ecology leads (Habtes and Nemeth, respectively). ADCPs with echo sounders capable of detecting larval organisms were deployed to Reef Bay and the coral restoration sites. A postdoc with requisite experience processing ADCP data was hired.

Dr. Doug Wilson organized a working group composed of VI EPSCoR staff and volunteers from vessel management programs within NOAA and UNOLS to determine operational costs and revenue analysis for the research vessel. The necessary costs for equipment and vessel upgrades to have an operational coastal ocean research vessel were estimated.

Areas for Improvement:

The Oceanography lead, Dr. Habtes, is on a leave-of-absence from UVI to serve as the Bureau Chief of Fisheries for the Division of Fish and Wildlife at the Virgin Islands Department of Planning and Natural Resources. This departure is an important personnel change with significant repercussions to program execution. In the context of his departure, the R2R Annual Report details that "...VI EPSCoR program and University administration will need to determine the feasibility of continuing the development of the oceanography vessel program and are waiting on a response from UVI's administration regarding administrative requirements for operating the vessel for research from other institutions, as well as a document outlining the management and decision support system for vessel operations from VI EPSCoR administration."

Given the centrality of Oceanography and its linkage to other R2R themes, it is unclear how deeply Dr. Habtes' departure may impact future research execution across the Oceanography theme.

Discontinuing the oceanography vessel program would severely limit the viability of oceanography research necessary to the R2R project.

The departure of Dr. Habtes was indeed a setback for a coastal and blue-water oceanography program. However, Dr. Habtes is now a Courtesy (aka adjunct) Faculty member at CMES and under negotiations to stay involved, particularly in the fish spawning/larval ecology work being conducted in Reef Bay. In fact, it was determined that the Derektor oceanographic vessel, purchased under the previous research infrastructure award to the USVI, was not suitable for the shallow water work in Reef Bay. The vessel was to be used for sampling offshore and to develop a regional asset for oceanographic data collection. The impact of changing the focus of this program away from a medium-sized oceanographic vessel is considered minimal. All of the work can be accomplished with the current fleet of vessels operated by the Center for Marine and Environmental Studies at UVI, and with the addition of a 35-40' faster boat that would be purchased with funds from the sale of the Derektor and CMES funds. This boat would be multi-use (light oceanography, diver support), thereby with multiple potential streams of rental revenue, and capable of reaching the entirety of Virgin Islands waters in a day from port. Furthermore, the burden of maintaining a medium-sized oceanographic research vessel that would need a dedicated captain, engineer, and annual maintenance, without a consistent individual in charge of recruiting clients (formerly to be Dr. Habtes) was considered a substantial financial risk for the program. There is not currently an individual with the expertise to do this in-house. The current plan would rent or get granted time on vessels of opportunity as needed for specific research projects.

The Oceanography theme is central to the Fish Ecology theme but is not well integrated into the other project themes. Better integration could be achieved by examining how oceanographic processes either dilute land-based sediment and nutrient runoff in coastal waters (e.g., green/turbid vs. blue water conditions) or enrich these waters via upwelling or internal tidal bores. This is important to the research on coral reef diseases and restoration by identifying oligotrophic areas where coral restoration projects could be most successful. Additional sampling for nutrients and chlorophyll as part of the Oceanography theme would also provide useful data relating to the degree of eutrophication along land-ocean gradients in coastal waters.

The oceanography research area has a large component dedicated to the integration of oceanographic models into R2R research themes. The US Caribbean Ocean Model (USCROMS) finalized by post-doctoral associate Dr. Sonaljit Mukherjee, and recently published, (Mukherjee S, Habtes S, Jobsis P (2022) Comparative analysis of the performance of the GOFS, PSY4 and AMSEAS ocean model frameworks in the Virgin Islands and Puerto Rico coastal ocean. Journal of Operational Oceanography:1-25) is central to this modelling effort. It will be used in the marine disease study (see below) and the marine resilience study. In the latter, the Connectivity Modeling System (CMS) under the direction of Dr. Daniel Holstein (LSU and UVI associate) is being integrated with USCROMS to explore connectivity matrix centrality (e.g., source/sink dynamics) on coral reef biodiversity and coral reef resilience. The integration of the USCROMS and CMS into land-based studies (e.g., flows of sediments and nutrients in nearshore environments and areas of upwelling) is an excellent suggestion. It was not included in this R2R specifically because the suite of proposed experiments was already quite large. However, it was and has always been the Team's intention to explore the dynamics of materials and their impacts on productivity across the USVI seascape and the modeling tools will be vital. We also have a large suite of extant seawater temperature (50+) and ocean current sensors (6) deployed for long term research, as well as sensors for episodic measurements that help with model validation and measurement of environmental variables such as nutrients.

The long-term plan for use of the autonomous gliders was unclear.

The Oceanography team presented the idea of using autonomous gliders to illustrate how the oceanography programs evolution has attracted the attention of outside entities and presented opportunities for additional data collection. At the time of the vRSV presentation, the team did not have dedicated gliders for research, but benefited from ad hoc deployments in the warm season by partners such as Rutgers and OCOVI (Ocean and Coastal Observing Virgin Islands) led by Doug Wilson. Since then, VI-EPSCoR has successfully engaged Wilson to assist in the development of oceanographic research products in the territory. He and Jobsis are PIs for a \$780K NSF-MRI proposal (to purchase two Slocum Gliders and start a center of excellence in collaboration with Rutgers University) that has been recommended for funding. This funding will provide significant support to the team's plans for continuous monitoring of the upper 500 - 1000 m water column off shelf. Such efforts will facilitate descriptions of the impinging Atlantic-Caribbean oceanographic conditions that affect shelf processes.

This would give the team excellent monitoring capabilities of both terrestrial and blue water dynamics that can affect neritic ecosystems.

Research Theme 6: Marine Disease and Restoration

Marine Disease

Strengths

Despite setbacks posed by the structural damages from the hurricanes and the ongoing pandemic-related supply chain issues, the research team was able to make significant progress on Year-1 goals. The PIs have recruited many undergraduate scientists to the research team. The first year yielded several publications on stony coral tissue loss disease (SCTLD). In one publication, the team harnessed data from the Territorial Coral Reef Monitoring Program (TCRMP) and citizen scientist data to document the spread of SCTLD in the first 1.5 years of its presence in the USVI. They documented disease susceptibility in different coral species (and found it was similar to other regions) and also obtained new data on disease susceptibility for data deficient species. In another publication, students re-surveyed NOAA National Coral Reef Monitoring Program (NCRMP) data in a capstone project to test how coral species composition affected SCTLD prevalence across habitats. More diverse reefs had greater losses of diversity and coral cover. Both studies were published in *Frontiers in Marine Science*.

Progress was also made on some Year 2 to 4 goals. The team obtained a collaborative NSF-RAPID grant to conduct a SCTLD transmission experiment to look at disease incidence amongst multi-species assemblages. Overall, they observed variable species responses to SCTLD. This work was also published in *Frontiers in Marine Science*. Ongoing work involves other experiments investigating genotypic diversity on disease transmission and effect of sponges on disease transmission. More disease transmission experiments are planned for summer 2022 and Year 3.

The team also started Year 3-5 work on the effects of water quality and temperature on disease prevalence and transmission of SCTLD. Water quality sampling at 15 sites around St. Thomas and St. John is ongoing. Master's theses of several students will focus on this research theme.

The PI and collaborators were awarded a \$2.5 million NSF EEID grant to use a multi-scale approach to predict disease spread in marine benthic communities. The core component of the project is modeling. The R2R modeling component of the disease theme will benefit from the NSF EEID grant.

The Marine Disease and Restoration and Fish Ecology teams intentionally overlapped field research sites. They will use the same sites in Reef Bay, Fish Bay, and Brewer's Bay where water quality sampling and sediment traps will be placed.

Areas for Improvement

It is not clearly delineated how much of the work presented is under this award, the previous EPSCoR award, or external funds leveraged from other awards.

All of the R2R research teams view the successful leveraging of VI-EPSCoR funds for infrastructure, student and personnel support as foundational for the successful expansion and sustainability of various and relevant UVI/CMES research programs. Few if any have done a better job of this than the marine disease team. External funds have been acquired that build on the focus of the R2R marine disease program and so there may appear to be significant overlap but, each project is separate but complementary. The marine disease team is focused on understanding how species susceptibility and local and regional water quality parameters influence disease transmission. While the R2R project component published information that used field data from TCRMP and then also NCRMP data in the capstone project to look at species susceptibility and diversity affecting disease transmission, the RAPID project specifically tested and published on species susceptibility from a lab-based transmission experiment. The R2R project also plans more experimental work looking at the influence of different coral reef community members (e.g., sponges, macroalgae) on disease transmission. The new EEID project plans to drill down deeper into the potential physiological mechanisms (e.g., immune responses, symbiont community) that determine species susceptibility from field sampling of corals to better define coral community susceptibility from the bottom up and how it influences disease transmission.

Year 1 work on the Coral Disease Hydrodynamic Model is behind schedule, but Dan Holstein and Ben Farmer will run real simulations in April 2022. This effort would be informed by integration with the oceanography theme.

Though this effort is behind schedule, significant progress is planned for year 3. Dr. Brandt has begun meeting regularly with Dr. Holstein, Dr. Tyler Smith, and B. Farmer to better integrate the marine disease and oceanography themes.

Restoration

Strengths

Some progress has been made on Years 2-4 work of comparing survival of outplanted coral among different species configurations (experiment in progress). The research team conducted experiments to test restoration methods. They found that freshly micro-fragmented corals had higher mortality rates than corals allowed to heal in the nursery first before being outplanted on the reef. They formed a new partnership to expand coral nurseries with the Lovango Resort and Beach Club. The group participated in education and outreach by designing signage about restoration work. They've engaged graduate and undergraduate students in outreach and maintain two websites and a social media presence.

The restoration work will be integrated with herbivory work from Dr. Nemeth and sediment data from Dr. Wilson's work. General water quality monitoring will be performed including measurements of fecal coliforms, nutrients, and total suspended solids (TSS). Dr. Brandt

predicts they will be on track to start land-based aquarium experiments in Year 3. A restoration ecologist Research Assistant Professor was hired (Dr. Robin Smith) in Fall 2021.

Areas for improvement

The restoration work is behind schedule. The restoration work depends on the completion of a building/facility to house aquaria that is still in progress.

This statement is accurate.

The restoration ecologist position is not a tenure line as stipulated in the jurisdiction specific terms and conditions.

As discussed during the vRSV, UVI does not currently offer a path toward tenure for any research faculty. We offer 1 and 2-year contracts to all our research faculty and following promotion to Associate Research Professor, longer-term contracts are typically offered. This has been acknowledged in the Jurisdictional Specific Terms Response Year 1 and 2 annual reports.

Research Theme 7: Coral Reef Resilience

Strengths

The objectives focus on generating multiple databases from long-term coral monitoring data, and related physical, water quality, and biological measures. Capitalizing on this long-term data is a huge advantage for generating projections. The databases require analyses by working groups. The panel was informed that the databases have advanced, and most are complete.

A workshop was planned, but due to COVID-19, was not feasible. The workshop, and the respective associated goals, have been shifted to Year 2 of the grant.

Areas for Improvement

The entire theme relies on the success of analyses of databases. The postdoc, who is a key person in advancing the analyses, has yet to be hired. Once this postdoc joins the team, the work will hopefully advance.

The post-doctoral position has been advertised, the search closed, and the review of applicants is underway. Excellent applicants (n=14) have applied thus far. The hope is to have the post-doc in place and working on the project by January 2023 or earlier.

For interpreting the databases, the statistical models utilized need to be selected. The team said that a modeler needs to work on this aspect via a contract. The modeler has not been identified. Therefore, progress will be impeded until both the postdoc and the modeler are on board to work on this theme. For instance, the Year-1 goal of a connectivity network model did not progress. Potentially the workshop will not be as effective without the contributions of the postdoc and modeler to the existing data analyses. This point may require delaying the workshop until the postdoc and modeler have analyzed at least a fraction of the different datasets.

Funding is in place for the coral resilience team to contract hire a statistical advisor. There are post-doctoral applicants with strong statistical and data analytical skills. Once the post-doc has been selected, the team will work with that individual to see what additional resources are needed to conduct the analyses of the coral reef resilience data. The team will not proceed with the workshop until they have a clear idea of the statistical models that will be used and the identified experts to assist in the analysis. As for the connectivity model, this has been developed and was waiting for the USCROMS to be finalized to start developing the outputs. LSU sub awardee Holstein and his pre-doctoral student have been working on integration with the Ocean's team postdoc Mukherjee and are making steady progress. Now, the team is trying to develop a more realistic bathymetric profile of the coral reef habitats near the shelf edge to incorporate in the model without causing numerical instabilities of the model simulation across a steep bathymetric gradient. LSU super-computing resources are being used to surmount this challenge and the resilience team expects to have a period of high productivity in Y3 of the R2R award.

Other Project Elements

Education and Workforce Development

Strengths:

The EWFD team excels at education professional development initiatives and creating programs to excite interest in STEM through formal and informal learning. Professional development through summer STEM Institute saw 90 teacher participants representing ca 4,000 VI students at K-12 schools. The STEM Institute provided teachers with best practices for STEM pedagogy, ecosystem resilience curricula, STEM content knowledge, STEM career knowledge, and emergent needs.

The STEM Institute developed training modules on teaching best practices for virtual, hybrid, and in-class formats in preparation for changes in how people learn during the pandemic.

Ten Mentor Teachers successfully implemented locally relevant problem-based learning projects in USVI virtual classrooms. The first cohort of teachers was paired with R2R researchers to design new curricula. These teachers are a community and continue to lead training and activities on their virtual classroom strategies and techniques.

Though Informal Learning (IL) efforts were hampered by COVID-19 restrictions, the IL team was able to adapt using virtual and hybrid program delivery methods to coordinate a variety of IL engagements across the jurisdiction. For example, 1,247 community members viewed/attended two virtual Science Saturday events hosted by the Department of Planning and Natural Resources. The events highlighted VI-EPSCoR mangrove restoration and coral disease monitoring research. Also, 54 public volunteers attended the St. Thomas Great Mangrove Cleanup, held in April of 2021. The USVI Glass Recovery Project held its first “Community Dropoff Day” in which 50 VI residents supplied glass waste to be crushed and used in the creation of sandbags.

Youth Engagement with partners such as University Bound (UB) and the Virgin Islands Marine Advisory Service (VIMAS) provided 83 7th-12th grade students STEM-based kits. Sixty-eight UB students received kits containing supplies to create their own at-home hydroponics gardens. Students participating in the Youth Ocean Explorers Summer Program received marine science-focused kits to be used throughout 2021.

Technology-based Outreach: IL is utilizing web-based tools, 3D printing/modeling technology, and virtual reality software to create place-based products and experiences to further engage target audiences. Over 200 3D models of local species have been created, to be used in STEM kits tailored for k-12 students and educators.

IL has created the “Mangrove Spy, USVI” project to document biodiversity at mangrove nursery sites through web-based citizen science platform (Zooniverse). The team is also in the early stages of creating 3 virtual reality simulations. These simulations will be used to immerse K-12 students in virtually rendered experiences that imitate VI-EPSCoR funded mangrove restoration, coral disease monitoring and fisheries research.

The EWFD group has launched a mini grant program to support education research projects.

A restoration ecology professor (non-tenure) and several research technicians and postdocs have been hired to assist with implementing projects across research themes. A hydrologist, second professor position, has been identified but not hired.

Areas for Improvement

Program evaluators noted that COVID-19 limited some efforts to promote/enhance workforce development. In particular, goal 3 of the IL program, “Promote and guide K-12 underrepresented minority students into the geosciences and broader STEM pipeline as part of the larger R2R objective to build and enhance the local STEM workforce” likely suffered during the pandemic. The evaluator reports that SCUBA certifications for 10 Youth Ocean Explorer students were supported. As COVID-19 subsides, it may be beneficial to project goals to emphasize the terminus of the STEM pipeline and develop intensive career counseling for students interested in STEM and exposure to STEM employers and employment opportunities across the jurisdiction. R2R team members expressed that UVI Provost’s Office is developing student professional development focused on non-technical competencies and R2R researcher Grimes has leveraged an

award that introduces STEM students to employment opportunities through internship-to-employment efforts. Long-term sustainability and viability of R2R initiatives with respect to increasing STEM involvement will depend critically on perceptions of employment in STEM and actual opportunities for STEM careers.

The EWFD team has developed relationships with education technology corporations to bolster teachers' preparation for technology integration into school curricula. Those partners include the following; Microsoft, Micro:bit Education Foundation, Infosys Foundation USA, TechKnowledge for Teachers, SUBSUME, Georgia Tech Constellations, Chibitronics, BirdBrain Technology, and the Computer Science Teacher Association (CSTA).

The new faculty hires have not been tenure line positions as required by the Jurisdictional Terms and Conditions. These positions are research faculty positions with initial one-year contracts with the possibility of extending to longer-term contracts. The UVI has encountered some challenges in retaining faculty/researchers in these positions as there has been some turnover.

VI-EPSCoR is not ignoring the jurisdictional terms and conditions; the issue of tenure for research faculty has been discussed multiple times over the years with UVI leadership. It will be revisited again this year. Models that are fiscally realistic for a small PUI are being explored, but examples from other institutions are extremely rare and UVI has some unique and chronic challenges as the only institution of higher learning in this EPSCoR jurisdiction. The retention issue is not a simple problem that tenure could or would resolve. Additional context is provided in the recommendations response later in this document.

The panel could not distinguish between R2R contributions to the EWFD educational programs and pre-existing efforts. For example, how R2R-specific knowledge and curricular contributions expand on existing programs.

The EWFD team has done well in integrating with other research themes and documenting this integration. The VI-ISERP PBL (place-based learning) certificate program integrates three areas of R2R research focus; Mangroves, Coral Restoration, and Agriculture, into local teacher curricula development through an extended professional learning community (PLC) of R2R researchers, teachers, and EWFD team researchers.

Seed Funding and Emerging Areas

The VI EPSCoR program has chosen to use seed funding for educational research mini-grants. This appears to be an intentional philosophical choice that is a departure from the use of EPSCoR seed funding to support new research, for example pilot projects that may lead to other funding opportunities.

Strengths

The seed funding is being used to support education research and integrate workforce development with the R2R research programs.

Areas for Improvement

The panel suggests the dollar amount of the mini grants should be related to the monetary costs to achieve the goals of the support.

The panel suggests some funding is targeted for faculty for professional development.

Noted.

Diversity and Broadening Participation

Strengths

The team has engaged in several activities aimed at increasing diversity within the R2R project as well as engagement of the broader public. Both the education and communication teams are actively engaging with the broader USVI community. The communication team has developed a web presence for the project as well as a social media strategy. This should help broaden their reach, especially with younger members of the USVI community. The education team has developed a number of education programs aimed at engaging students at the critical K-12 academic stage. These activities should help the EPSCoR project make their work more visible within the communities surrounding UVI.

Courses focused on service learning and other types of high-impact, experiential learning, are engaging many under-represented minority groups at UVI in work that has benefits to their communities. This connection between science and societal benefits should improve engagement with under-represented minority students by engaging them in research that may resonate with their cultural value structures and promote their retention and persistence.

Areas for Improvement

While participation by under-represented minority students is reflected by the K-12 and undergraduate student demographics of the USVI, the same patterns are not seen at the graduate level. There is currently one minority student within the graduate student cohort.

VI-EPSCoR is not clear on what the panel means by “minority”. If racial minority is what is meant here, the total average percent for black/African-American and Hispanic students in the MMES program from 2007 to 2022, was 14.4% and 7.7%, respectively. Currently, we have 8 minority students enrolled in the program; of the 13 most recently admitted students in the 2022 cohort, 1 is a racial minority. For another example, the 2021 cohort, the largest cohort so far with 17 students, includes 1 black/African-American, 2 Hispanic, and 1 Asian/Pacific Islander. Within this large cohort, 13 are female, 1 is non-binary, 1 is disabled, 3 are Virgin Islanders, and 2 are USVI residents (Virgin Islanders are chronically underrepresented in the STEM fields both in the Territory and on the mainland). VI-EPSCoR strives to support and matriculate under-

represented students at both the undergraduate and graduate levels. That said, the MMES program has a new director, Dr. Donna Nemeth, who began with the fall semester 2022. VI-EPSCoR leadership and EOD/IL staff have met to explore and develop recruitment strategies to increase diversity in MMES—recognizing that geosciences as a suite of disciplines are some of the least diverse nationwide.

Table of percent racial diversity in the Master’s of Marine Biology Program from 2007 to 2022 incoming student cohorts.

Year	Caucasian	Black/ African- American	Hispanic	Asian/ Pacific Islander	Indian	Total students
2007	56	44	0	0	0	9
2008	80	0	20	0	0	5
2009	75	13	0	0	13	8
2010	86	14	0	0	0	7
2011	83	8	8	0	0	12
2012	78	11	11	0	0	9
2013	75	8	8	0	8	12
2014	67	33	0	0	0	6
2015	79	14	7	0	0	14
2016	80	20	0	0	0	10
2017	67	25	8	0	0	12
2018	83	0	17	0	0	12
2019	82	9	9	0	0	11
2020	62	15	23	0	0	13
2021	76	6	12	6	0	17
2022	92	8	0	0	0	13
Avg.	76.2	14.4	7.7	0.4	1	11

Strategies to increase Virgin Islander participation in the MMES program should be developed and formalized in a plan with metrics to determine progress. The panel suggests that the team assess what are some of the internal and external barriers that may be impacting engagement of minority students at the graduate level. This may require the development of recruitment strategies that engage with the diverse cultural value structures of prospective students. The panel suggests that the team examines how they may take lessons learned from work around diversifying their graduate students to understand how they may continue to diversify the composition of research scientists and pedagogical staff and faculty in the project. This is critical for capacity-building to ensure sustainability of the project. A diverse group of scientists and mentors can also help in the engagement of students from diverse cultural backgrounds.

Year	Biology	Marine Biology	number of graduates recruited	% graduates recruited	MMES cohort size	% of MMES cohort
2017	18	5	2	40	12	17
2018	16	6	1	17	12	8
2019	15	5	1	20	11	9
2020	18	3	2	67	14	14
2021	14	1	1	100	17	6

Table above provides the number of graduates (B.A., BS.) from UVI's Biology and Marine Biology programs, number and percentage of those graduates recruited into UVI's MMES program, and the size and percentage of UVI graduates in the MMES program, over the past five years. All recruits have been Marine Biology graduates.

The MMES program at UVI also has a history of supporting students to degree completion and transitions into STEM careers. In the past five years, UVI's MMES program graduated 49 individuals: 26% who self-identify as racial and/or ethnic minorities (14% as Black or African American, 2% as Native American, 10% as Hispanic or Latinx of any race), 35% who self-identify from a racial or ethnic minority or other underrepresented group in STEM (e.g., low socio-economic backgrounds, LGBTQIA+, veterans), and 69% who self-identify as women, an underrepresented group in the geosciences. Combined, 89% of degree recipients from UVI's MMES program in the last five years, have been from underrepresented groups in the geosciences. Fourteen percent of graduates have been Virgin Islanders (data reported here do not include May 2022 graduates).

Our Youth Ocean Explorer (YOE) programs codirected by VI-EPSCoR, and Virgin Islands Marine Advisory Service (VIMAS) have had a significant impact on our recruitment of undergrad and eventually graduate students into our MMES program. Such efforts take time: perhaps 6-10 years for a YOE participant and longer for Junior YOE participants. The undergraduate stipends that VI-EPSCoR provides are aimed at speeding up this process, since undergraduate students working with VI-EPSCoR researchers will be exposed to the opportunities of graduate studies in the geosciences. That said, the R2R project is already benefiting from this "pipeline"—one of the early YOE students, Zola Roper, learned to swim and then dive as part of her YOE training, then went on as an UVI undergrad marine biology graduate, then as a MMES Graduate, then as a marine debris program intern – and now is currently the USVI Marine Debris Action Coordinator.

There should be a concerted, intentional effort to recruit and hire diverse individuals for the promised tenure-track faculty lines, including considerations of the barriers to committing to UVI such as time-limited appointments and family accommodations.

The challenges of recruitment and retention of faculty of color and other minorities are not unique to UVI but common to other HBCUs/MSIs. Salary constraints, cost of living, lack of affordable housing, poor quality of public schools and healthcare options are just a few of the challenges that face our new faculty coming to UVI. Layer in the modest start-up packages and relocation funds with the fact that Ph.Ds of color are routinely in high demand- especially in the STEM fields, and it becomes apparent as to why UVI struggles to attract and retain quality faculty of color. That said, VI-EPSCoR leadership is working to recruit two new teaching faculty of color (who were just hired in UVI's Biology

department) to identify and consider aligning their research interests as we ideate and develop the next Track 1 proposal.

Partnerships and Collaborations

Strengths

The R2R research team is composed of a transdisciplinary group of scientists and citizens from across the USVI and other states. They have engaged many federal and local partners in their research efforts, including federal and state agencies, local entities (Chamber of Commerce), national non-profit organizations, local businesses, K-12 teachers and students, university students, and the general public.

The Marine Disease and Restoration and Fish Ecology research teams have conducted careful planning to ensure overlap in research activities such as choosing the same field sites to carry out investigations.

The EWFD team has done well in integrating with other research themes and documenting this integration.

Details on the R2R project collaboration, code of conduct, leadership responsibilities, communication and conflict resolution, authorship, team expectations, data management, and fiscal responsibilities are outlined in the VI-EPSCoR Collaboration Agreement.

Areas for Improvement

The panel agreed that better integration of R2R research themes is critical. For example, choosing the same field sites and ensuring the same research methods and protocols are employed in projects within and across different themes.

The panel suggests that greater transparency is needed on how the different research groups are working together and sharing data.

The R2R Strategic Plan clearly articulates how the R2R research teams along with our Education and Workforce Development team are working together. These collaborative efforts are also captured in the R2R annual reports, updated Collaboration Agreement ([linked here](#)), and in our newly created Infographic ([linked here](#)). Both the Collaborative Agreement and Infographic have been uploaded to our viepscor.org website.

Communication and Dissemination

Strengths

The communication and dissemination team has a good set of different strategies to engage the broader public. They have created a website for R2R and have established a social media presence which has the potential to engage younger audiences and audiences outside of the USVI.

The panel found the K-12 outreach to be strong. There are outreach efforts at local institutions as well as more directed outreach to individual schools. One particular strength of their efforts is their work around introducing K-12 students to the use of technology in marine science. Beyond providing students with examples of career pathways that don't solely focus on marine biology, it can support long-term efforts towards workforce development in technology areas in the USVI. The panel suggests that the team continue to look at ways to further build out this type of engagement.

Areas for Improvement

The panel suggests expanding the visual depictions of how marine science research is conducted and should be accessible via assistive technologies. There are many depictions of work onsite from traditional marine science perspectives (e.g., boating, SCUBA, etc.). The team might consider if there are other depictions of marine science research that they can use in their external communications that promote accessibility (e.g., computer programming, robotics). This might help engage students and members of the public who may not resonate with traditional depictions of marine science. Showcasing Virgin Islanders doing marine science will help with recruiting K-12 students into STEM.

One of the ways our communications team is engaging students who may not have a natural affinity for marine science is by showcasing technology that supports research. One example is with UVI students who were introduced to robotics and computer programming within the marine science department. Through oceanography-related activities such as deploying and managing wave gliders and the computer modeling of currents and water temperatures, the CMES and VI-EPSCoR teams were able to attract students who previously had little to no exposure to marine science. These activities were recently highlighted in the new [Oceanography blog post](#) where we discussed Dr. Sonaljit Mukherjee's coastal ocean models and former UVI undergrad Kenique Liburd's work with Slocum gliders.

We also featured a "photo-essay" type post on social media to share on the exciting work being done within Brewers Bay with wave buoys which remotely upload oceanographic data. These types of images and conversations help the community understand there are many facets to what it means to be a marine scientist. We are actively working toward sharing more content related to this area.

The panel suggests that the team develop communications training for EPSCoR scientists to further improve overall public engagement across the jurisdiction.

The Communications team has hosted workshops for MMES students focused on the importance of communicating science, specifically the effectiveness of well-designed infographics. The workshops were attended by graduate students as well as interested researchers and others from UVI.

A pilot training session is planned for the fall semester 2022 to educate members of Dr. Grimes' lab as well as Communication Assistant Dan Mele on the proper way to build an InDesign document. Building on feedback from this inaugural session additional communication workshops will be offered to EPSCoR scientists.

The VICDAC website (vicoraldisease.org) was designed for Dr. Brandt's lab and turned over to Dr. Brandt and her team to manage. In the process the team is learning how to manage and edit the site. They engage the Communications team as needed for assistance and updates. Mentorship is available to anyone on the team as well as MMES students requesting guidance in creating infographics, press releases, flyers, etc.

Communication Assistant Dan Mele is being mentored in blog writing and co-authored the [Oceanography blog post](#) as an opportunity to learn the process of writing blogs from the interview process through all the revisions and final publication and promotion. Watershed and Marine Specialist Allie Durdall has been added as a contributor to the VI-EPSCoR site so she may make edits and updates to the Mangrove Ecosystem section.

The Communications team is in the process of developing a "Members Area" intended for community members (i.e., teachers and students) to access training videos and priority content. Training for researchers who wish to take advantage of the members area will be available upon request.

The panel suggests that the team consider how they can use tracking data from their website and social media presence to tailor their messaging and time of day that they are posting their stories.

The release of social media posts is strategically timed to coincide with optimum traffic. Website and social media analytics have been very helpful in this effort. In addition, analytics show which posts engender greater connection with the community. For example, a recent post on how data gathered from wave buoys provide information that helps with sea turtle research led to a community conversation on wildlife entanglement and ghost fishing. This post reached 306 individuals and had 22 engagements.

Website analytics also play an important role with regular analytical statistics providing insight into who is visiting the site and what specifically is drawing their interest. For example, the recently added page "[Mangroves 360](#)" which provides an immersive 360-degree virtual tour of USVI mangroves has received 317 viewers since its launch in late 2021. This interest in USVI mangroves is further reflected in the visits to Dr. Grimes' [mangrove page](#) (329 visitors in 2022) and the [5th Mangrove Cleanup](#) registration page (386 visitors March – April 2022). This information is helpful when creating content designed to further capture the interest of the community.

Also, in response to content engagement, we are in the process of developing "Members Areas" which will feature content tailored to specific viewers. Analytics tells us for example that marine debris is the most-searched keyword on the website. One 'members area' under development is focused on educational materials for the participants of Marine

Debris Educator Workshops. Here registrants will gain access to training videos and additional educational information. This area is under development, but we are excited to see its potential and the opportunities it creates connecting researchers with the community.

Sustainability

Strengths

The sustainability plan as described in the Strategic Plan involved the hiring of two research faculty and four postdocs to sustain research capacity at UVI. In follow-up questions, the VI EPSCoR team identified how they will sustain efforts pertaining to EWFD, partnerships and collaborations and communication and dissemination. The VI EPSCoR team will capitalize and build upon established and new partnerships to sustain the educational component moving forward. Building structures, either new or as replacement for facilities that were destroyed, will enable conducting aspects of the research during the duration of the grant and beyond.

Areas for Improvement

The VI EPSCoR team did not specifically address sustainability of the grant components, either in their annual report or in their presentation. It was only through follow up questions that the VI EPSCoR team elaborated on this aspect. When they did so, the emphasis was on the sustainability of the 'Other Project Elements.' The EFWD is indeed very important. What was unclear was how the research aspects of this grant will be sustained. From the presentation, it appeared that the continuation of the research themes will rely on subsequent potential funding from granting agencies. Beyond rebuilding and adding new buildings, it was unclear to the panel how UVI plans to sustain the research. For example, UVI has a large turnover of research faculty and has lost two key personnel. The panel suggests that the VI EPSCoR team plan how to address this issue that is a hindrance to both the execution of the grant's objectives and the sustainability of research within UVI. Furthermore, the VI EPSCoR team should address other aspects of sustainability of research, such as completion of the Environmental Analysis Lab that is important for achieving the research objectives. The VI EPSCoR team is purchasing research equipment. Sustainability of this equipment relies, in part, on maintenance contracts which should be considered to prolong the usability of the equipment beyond the warranty period and/or the duration of the grant.

Most research programs –like those that are supported by VI-EPSCoR –that experience growth over a decade or longer are the product of successful scientific research, motivated and productive faculty, and institutional support. UVI's R&D expenditures has grown from \$8.7M in 2006 to \$13.63M in 2020. For perspective, another island university and EPSCoR jurisdiction is the University of Guam. Their R&D expenditures totaled \$13.04M but with twice the student enrollment of UVI. Other HBCUs with comparable expenditure levels such as Alcorn State, Jackson State, and Tennessee State all have 2-4 times the number of students that UVI has.

Specifically, VI-EPSCoR has been building up the environmental research capacity of the university and much of the R&D development has leveraged VI-EPSCoR investments. VI-EPSCoR also established the Master's in Marine and Environmental Studies (MMES) degree program which has produced nearly 50 graduates just in the past 5 years- many of whom are contributing to VI workforce in critical STEM fields. The numerous partnerships and collaborations that our researchers are engaged in, the publication record of our researchers, and the infrastructural, staff and student support that VI-EPSCoR provides anchors a sizeable research enterprise that has grown every year since our first NSF EPSCoR Track 1 award (\$3M) back in 2004.

UVI and the Territory has also had setbacks- the devastation of the 2017 hurricanes did \$8 billion worth of damage to our territory of 100,000 people living on three islands covering 345 km². Despite the loss of major facilities, we have persisted and expect to have both the EAL and our Marine Science Center open and functioning by the end of the year. It is difficult for U.S. mainlanders to understand the delays that we've had – but it is not reflective of UVI's commitment to the research enterprise or our program. VI-EPSCoR and CMES represent 10% of UVI's staff and faculty and generate close to half of UVI's R&D expenditures on an annual basis, and the University leadership is aware and appreciative. UVI's commitment to research is exemplified by their support of positions that include the EAL manager (Packard), the CMES Boat and Facilities manager (Bryne) and the Dive Safety Officer (Prosterman). UVI's provost (McKayle) has tasked the VI-EPSCoR PD (Waddell) to draft an IDC redistribution plan that, if adopted, would expand support for the university research infrastructure.

Availability of a coastal research vessel is critical for sustaining the oceanography theme. The panel suggests the R2R project team do a cost-benefit analysis of the long-term options of maintaining their own vessel versus chartering vessels for needed work.

The CMES and R2R teams are taking advantage of newer technologies and shifting some of their oceanographic research in the direction of autonomous vehicles, including oceanographic gliders and coral-bot AUVs. Autonomous ocean observations from buoys, drones, gliders, etc. have lower overhead costs. This does not remove the need for coastal research vessels but reduces the need for a large ship with high overhead. Most of the ocean research in the territory can be conducted with the use of a fast mid-range (35-45 foot) boat.

Management, Evaluation and Assessment

Strengths

Cyberinfrastructure is managed by a Data Manager. The UVI campus network data transmission speed was upgraded to 10Gbps and the research data server was upgraded. Research data are archived on the new architecture and backed-up using MS Azure Cloud storage, providing data redundancy and disaster recovery capabilities. High-speed Internet connectivity was improved.

A form was developed for monthly reporting by R2R researchers to the EPSCoR Project Manager. Researchers receive instructions in completing the report and how to write

narrative for the R2R annual report. All data are inputted into and stored on R2R computing architecture.

Bi-weekly meetings with R2R research theme leads and staff were established. The External Advisory Board has met twice and the Governing Committee once.

The USVI Science and Technology Plan was prepared and disseminated.

Inaccurate statement. A new S&T Plan is being scoped out and an RFP for a consultant to draft a plan with the VI-EPSCoR leadership has been prepared. Work on the S&T plan will begin this Fall 2022.

The VI-EPSCoR Collaboration Agreement was completed and disseminated on the R2R project website. The Collaboration Agreement includes statement of responsibility/respect, Code of Conduct in compliance with NSF code of conduct protocol, statement of Leadership Responsibility, protocol for conflict resolution, guidance on authorships and attribution, expectations for membership/participation in R2R, data management protocols, and fiscal responsibility.

The external evaluation and assessment plan was completed for Year 1 and the first External Evaluation Report of Year 1 was delivered in Year 2.

Areas for Improvement

The Evaluation Report points out issues that need to be addressed by the PIs, including, "Nearly half of respondents cited a need for further support from R2R project leadership to facilitate outreach/engagement." In addition, 92% of the faculty indicated that they had insufficient time to pursue professional development activities, and half indicated lack of institutional support or incentives for professional development. These issues are significant as they impact faculty turnover and project viability and sustainability. When the panel asked, the research team did not articulate how the outcomes of the Faculty Baseline Survey would be addressed other than to discuss them. The panel suggested a plan for actions to remedy the issues raised in the Evaluation Report.

Recommendations from External Evaluators (TIG) and VI-EPSCoR's Response (*in italics*)

1. R2R should increase communications within the project so that participants at all levels can understand the value of their own contribution to the larger project goals. Part of this will occur naturally if COVID measures lift but the project should make strong efforts to engage across all levels to build momentum as R2R enters its mid-stage. The goal is for the project to finish strong and not be continuously recovering from COVID (and other) induced slowdowns.

Communications within and across the project components have picked up as COVID restrictions have eased- with several events such as the VI Agricultural Fair in STX this past June that facilitated researchers, our communications team and the Administration

team working together on content for public engagement. Other events, such as the preparation of the next newsletter, new MMES student orientation, UVI's Research symposium, and the Youth Ocean Explorers summer program are additional venues where individual participants can share and get recognition for their work/contribution to the R2R project.

2. R2R should position itself to be an agent of change and for building research capacity in the jurisdiction. To do this, the project needs to be a strong advocate for creating a culture of research at UVI – if VI-EPSCoR is unable to make even incremental changes at UVI, it is hard to imagine what will. The most critical of the issues identified by faculty is a policy for return of F&A to the project. This will not necessarily be a comfortable discussion, but it is a crucial conversation needed to attract the next generation of talent to UVI and to retain the current R2R participants.

As mentioned above, the PI and VI-EPSCoR Director has been tasked with developing a new University-wide policy for distributing a portion of the F&A/IDCs back to the researchers, their departments, and to the Office of Sponsored Programs to improve research management infrastructure and incentivize researchers. The University Leadership will review this policy proposal in the early Fall of 2022.

3. The Informal Learning team would benefit from mentorship/leadership of more senior personnel that could guide, direct, and encourage staff. Further, a more direct partnership/collaboration with the Education and Workforce Development team would be beneficial.

The VI-EPSCoR management team agrees and has been meeting with the IL team to discuss their needs, challenges, and opportunities. We are also turning to our outreach experts on our External Advisory Board for additional guidance and mentoring in support of the IL team. We are also reviewing our budgets to see what else we can do fiscally to support IL

4. R2R leadership should consider positioning itself to sunset Emerging Areas projects that are not making adequate progress. If such changes do not change project scope, their resources can be redirected to other R2R areas. These decisions would need to be informed by evaluations, advised by the EAB, and approved by NSF.

This will be discussed with the Co-PIs and then with EAB at our formal meeting in October 2022.

Research Capacity Improvement

Strengths

The R2R program is structured on vertical integration for capacity building. For example, young people are recruited into marine science and other STEM areas through outreach programs (e.g., the Youth Ocean Explorer Program) and introduced to the pipeline into higher education and employment in the sciences in the USVI.

The R2R group is continuing to develop capacity in local agriculture and government agencies and expanding their reach.

The R2R team has constructed an online educational platform that is also hosted by the local Department of Education. This self-paced learning platform will live far past the life of the grant if it is sustained by UVI.

Areas for Improvement

Damage from the hurricane and the ongoing pandemic has resulted in a delay in the construction of facilities and buildings necessary to grow research capacity.

The Environmental Analysis Laboratory (EAL) is scheduled to be completed during Fall 2022 and the Marine Science Center by end of 2022.

The panel suggests capacity for improved nutrient analyses is expanded at the Center for Marine and Environmental Studies Environmental Analysis Laboratory.

The EAL manager has been trained to use the nutrient analyzer at the facility. We are waiting for the reinstallation of the system in the rebuilt EAL to start offering nutrient analysis as a service for our researchers and the community. This will lower the cost of nutrient analysis for the territory and serve as another revenue source for the EAL. Currently the EAL facility is scheduled to be opened in September of 2022.

Increasing research capacity through UVI graduate training will allow the project to be self-reliant while supporting their own Virgin Islanders.

Many UVI graduates from the Master's in Marine and Environmental Science Program have continued as research technicians at UVI, the Divisions within the Department of Planning and Natural Resources (i.e., Fish and Wildlife, Coastal Zone Management, Environmental Protection), National Park Service, The Nature Conservancy, Ocean Systems Laboratory, Coral World Ocean Park, among others.

There is an ongoing issue with being able to hire faculty into tenure track lines at UVI.

Jurisdictional Impacts

Strengths

Despite disruptions to workflow and research activities due to hurricanes and COVID-19 restrictions, the R2R team is active and achieving significant impacts across the

jurisdiction with respect to the intellectual merit and broader impacts of the R2R research themes.

Watershed Monitoring & Land Use is providing information on erosion from upland areas, sediment transport by streams, and sediment supply to coastal bays and reef environments. This research theme has the potential to inform best practices for improved agricultural land management and elucidate influences of upland processes on coral reef vitality, coral reef decline, coral disease, fisheries stocks, and propagation of native versus invasive sea grass, and Sargassum golden tides.

Mangrove Ecosystem Function & Recovery impacts the coastal zone throughout USVI with implications to water quality and habitat of marine-marginal environments, fisheries stocks, storm protection and coastal erosion. Outreach to the residents of USVI through active engagement in informal learning opportunities (Great Mangrove Cleanup events) highlights the biodiversity and importance of maintaining mangrove ecosystems throughout the archipelago.

The Emerging Areas of Research—Seagrass Ecology and Dynamics and Sargassum Golden Tides highlights ongoing environmental changes consequent to global climate change, sea-level rise, warming sea-surface temperatures, and impacts of invasive species to nearshore environments due to human development, land cover and land use changes in the islands.

The Fish Ecology research theme provides insight into oceanographic processes on spawning of keystone species (*S. rubripinne*), larval dispersal, reproductive success, foraging behavior, and impacts of fish population dynamics on coral reef health and succession of macroalgal overgrowths. Coral reef health, coral diversity, and coral vitality are essential aspects of the USVI tourist economy and understanding the ecological dynamics from this fish ecology perspective informs broader coral reef management priorities.

The Oceanography research theme has developed an important high-resolution ocean model for the Puerto Rico-USVI region. This model is a valuable resource for simulating impacts of changing wave climate and surface ocean circulation processes that affect nearshore environments of the USVI. The ocean model promises to aid understanding of fisheries dynamics, dispersal and recruitment of corals, coral reef resilience versus decline, tropical cyclone and storm surge modeling, and coastal erosion, contaminant/nutrient transport, and dispersion in the coastal environment.

Marine Disease and Restoration, as well as Coral Reef Resilience research, benefit the broader USVI jurisdiction by developing understanding of causes and remedies for marine diseases impacting coral health and coral reef diversity, primary attractants of the USVI tourism economy. Research has the potential to greatly improve coral reef restoration efforts and is a highly visible opportunity for broader engagement of the tourists in promoting sustainability of tropical ocean ecosystems in USVI.

EWFD activities provide a robust spectrum of opportunities to address human dimensions of R2R research and promote research results across the jurisdiction to diverse audiences. Professional development for teachers, engaging and exciting student interest in STEM, and working to ensure opportunities for STEM careers in the USVI are critical to sustainability of the R2R endeavor.

Areas for Improvement

In general, the panel suggests the R2R teams focus on better contextualizing the systems dynamics of their research themes for themselves in order to operationalize deeper research synergies. They are uniquely positioned to articulate their systemic linkages to each other, the broader physical, biological, geological, and human environments of the USVI, and disseminate the R2R story to scientific and public audiences.

The panel encourages the research groups to use the postponed R2R writing workshop as an opportunity to explicitly highlight the linkages among the research themes.

This recommendation will be integrated into the writing workshop scheduled for 2023.

Integration of Project Elements

Strengths

The overarching concept of R2R is exciting and has great potential for a mechanistic understanding of environmental drivers of change in the coastal ecosystems of the Virgin Islands. The collaborative effort is composed of a diverse group of scientists and has several strong research programs conducting exciting work. Some research groups have explicitly planned overlap in research activities (e.g., Fish Ecology and Marine Disease).

Areas for Improvement

There is a lack of an articulated unifying theme (research thread) that runs through all elements of the R2R project. The project appears to be more of a series of researchers working in locations extending from the ridge to the reef and not as an integrated effort linking the various research themes. In the Strengths, Weaknesses, Opportunities and Threats Analysis conducted as part of the Strategic Plan, numerous responses from the various research groups identified the lack of connection to the other research groups as a perceived weakness. The lack of strong communication and collaboration among all groups result in a more fragmented presentation of the R2R outcomes. The Education and Workforce development appears to be more fully integrated both internally and with the research groups than the research groups are among themselves.

The SWOT analysis occurred early in the R2R grant cycle and the responses may have reflected the experiences of the research groups from the previous Track 1 project Mare Nostrum...Since then, the development of a new Collaboration Plan as well as better oversight by the admin team has improved the integration of the research teams. The admin team nonetheless agrees with the panel and will look to improve communication.

Jurisdiction-Specific Award Conditions

Strengths

VI EPSCoR hired a restoration ecologist, Dr. Robin Smith, in Fall 2021, addressing part of section 8.1i. The PIs have identified that the second hire will be a hydrologist.

The VI EPSCoR team presented effectively how the educational activities fit in with preparing undergraduate students for the job market or for pursuing graduate degrees (section 8.2).

The VI EPSCoR team provided a management plan and timeline in their Strategic Plan as per section 8.3. During the panel, the VI EPSCoR team explained that they have a shared document which articulates the integration of all activities.

VI EPSCoR wrote a collaboration agreement as per section 8.4 in the Jurisdiction-Specific Award Conditions. They posted this collaboration agreement on their website.

Areas for Improvement

Dr. Robin Smith was hired as a Research Assistant Professor, which is a non-tenured position even though section 8.1i stipulates that the position will be tenure-track. If the position could be converted to a tenure-track position, that would comply with the Jurisdiction-Specific Award Conditions. The same applies to the second expected hire in Year 3.

Section 8.3 states that the document providing the “clear management plan and timeline of the project” show “integration of all activities.” Although the VI EPSCoR team has an internal document in which they integrate all activities, this document was not shared with the panel.

It is not clear what the review panel is referring to. The R2R Strategic Plan is the document that details the integration of the various activities.

The collaboration agreement (addressing section 8.4) was hard to find on the website. This should be made more accessible. Although the collaboration agreement addressed some aspects, it did not discuss ‘protocols for agreements for memorandums of understanding’ nor ‘intellectual property agreements.’ These two areas should be added to the collaboration agreement.

The VI-EPSCoR Collaboration Agreement has been moved to the VI-EPSCoR website footer. In addition, the Collaboration Agreement now addresses Memorandums of Understanding/Agreements and Intellectual Property Agreements as recommended by the NSF.

Summary

Despite disruptions to workflow and research activities due to hurricanes and COVID-19 restrictions, the R2R team is active and achieving significant impacts across the

jurisdiction with respect to the intellectual merit and broader impacts of the R2R research themes.

The R2R project needs to include unifying threads, such as nutrients, across all its research themes to provide an integrated approach, product, and final outcome. The whole premise of R2R is the connectivity among the seven research themes and ecological systems. The panel suggests the R2R leadership team address how they will compensate for the loss of research capacity, in the form of key personnel, in critical research themes such as Themes 3 and 5. The research program cannot be sustained without full time key personnel.

Although the current grant builds on prior funding, in both the annual report and the RSV presentations, it was unclear what deliverables, such as scientific papers, presentations, and graduate degrees, were the result of the current grant vs. past or other research funding. Nor was it apparent what educational endeavors and collaborations could be attributed to R2R. To assess the progress on the current grant, the panel suggests identifying the tangible products and outcomes that were directly a result of the current VI EPSCoR grant.

For future reports (annual and final) and presentations, the VI EPSCoR team should separately address and provide information on all aspects of the grant. Doing so will aid in highlighting accomplishments (and potential shortcomings) in different project elements. For example, the 'Other Project Elements' such as sustainability, management, evaluation and assessment, research capacity improvement and jurisdictional impacts were not explicitly addressed. Consequently, it was difficult to ascertain how these areas were addressed and the progress in these categories.

Recommendations from NSF EPSCoR

The recommendations below are based on observations by the vRSV panel. The panelists identified many areas of strength for VI EPSCoR in their report, but they also noted some areas for improvement. NSF EPSCoR intends for these recommendations to provide a pathway for the VI EPSCoR team to address the panel's concerns and more effectively achieve its transformative vision. Responses to all three recommendations below are due to NSF EPSCoR by September 1, 2022.

Recommendation 1. The Watershed Monitoring and Land Use (Theme 1) is very important as it relates directly to the sustainability of downstream marine resources in the USVI (e.g., mangroves, seagrasses, coral reefs). However, the panel thought that this key theme was not well integrated with the other project themes, especially mangrove, seagrass, oceanography, coral disease and restoration, and coral reef resilience. Based on the panel's suggestions, the VI EPSCoR project team should determine the types of water quality analyses (e.g., nutrient analyses) that should be measured from ridge to reef to provide that unifying thread and connectivity among all R2R research themes. A

plan to address this recommendation should be submitted to the managing Program Officer (PO) by the above deadline.

It's important to begin this discussion with the Watershed team. They are tasked with identifying sediment fluxes via sediment fingerprinting and nutrient/microbial flux monitoring to characterize runoff in the two VI watersheds. One of the challenges in determining sites for the various research themes for the R2R proposal was to select sites that created as much overlap and potential integration opportunities as possible- hence the selection of Fish Bay and Salt River watersheds that offshore also included seagrass beds, specific fish populations, and coral monitoring sites. Despite best efforts, these sites were not perfectly matched up for all areas of research. Other factors included logistics (ease of access for sampling, etc.) and the varying degrees of insights/data/existing knowledge available to the researchers. The Emerging Areas teams targeting the land/sea interface are an important link between terrestrial and offshore systems but are, by circumstance, the least developed from a research and budget capacity standpoint...resulting in limitations on what can be added to their objectives and budgets. A good example is nutrient sampling in brackish and coastal saltwater sites. Beginning this fall in time for the rainy season, the teams will be coordinating an opportunistic sampling plan that builds in additional sites and utilizes data from other work (e.g., ongoing EPA Ambient Monitoring program for water quality in the Territory) that will complement the scheduled sampling.

An important limitation -exacerbated by the drought of the past two+ years- for the water sampling done to date is that the data reflects nutrient concentrations only, while estimates of nutrient flux on land will also rely on hydrological estimates of total water discharges and runoff across land uses in the watershed. Nonetheless, what the watershed team is doing is a crucial first step that can be plugged into basic models of hydrology as they are developed by the team. Despite some early supply chain challenges, the watershed team now has the equipment and supplies needed to collect and analyze water samples. The reopening of the EAL this year will reduce the time and cost of processing those samples. As noted above, the watershed team anticipates collecting freshwater samples opportunistically from outside the current study watersheds to provide as much context and data regarding typical nutrient concentrations in all forms of freshwater in the USVI. This data will be a useful and welcome addition to literature which is currently extremely limited for terrestrial systems in the Territory. In summary, the plan of the watershed team is to characterize the problematic fluxes of sediments and nutrients that move downstream in poorly understood ways to serve as input data for the activities of our R2R colleagues whose research takes place in the coastal and marine environments.

On the marine side of the nutrient sampling, the marine disease team has been collecting samples in triplicate above their 15 reef sites. This is part of their water quality sampling protocols that include measuring turbidity (total suspended solids -TSS and total dissolved solids-TDS) and measuring for dissolved nitrogen and phosphorus. Simultaneously they also collect salinity and temperature data. The data to date reveals

that nearly all the nutrient data collected at the reef sites is at or below detectable levels- not surprising given that the Caribbean waters rapidly uptake these scarce nutrients. Additionally, nutrient sampling in Brewers Bay by the emerging areas Jobsis led team is underway as well. That team has opportunities to expand the collection of nutrient and bacteria data from our Brewers Bay site but are limited by the cost of processing those samples (estimated \$150 each). There are other nutrient monitoring data from around the Territory that could be integrated into this work- specifically the EPA Ambient monitoring program that samples dozens of beaches across the three islands for water quality. Nonetheless, the R2R PIs are looking for additional funding to expand their efforts. Nutrient sampling and analysis were not part of the Mangrove team's scope of work (see R2R Strategic Plan) and we do not currently have the capacity or funding to add that to their component.

Recommendation 2. The VI EPSCoR project team should provide a sustainability plan for the research components that addresses how the team will 1) compensate for the loss of research capacity, in the form of key personnel, in critical research themes such as Themes 3 (Dr. Cruz-Rivera) and 5 (Dr. Habtes) and 2) retain faculty hires and address the “brain drain.” The sustainability plan should also include a timeline for completion of the Environmental Analysis Lab that is important for achieving the research objectives. Any proposed revisions to the specific milestones outlined in the Strategic Plan for accomplishing the objectives of the project and any budgetary adjustments should be included in the plan.

The Environmental Analysis Lab is planned to be open by the end of October 2022. The McLean Marine Science Center is expected to be completed and open by the end of the calendar year 2022. The return of these two facilities will go a long way to address the bottleneck in research capacity and space that has challenged our VI-EPSCoR research teams over the 2 years of the R2R project. The openings will also be a huge morale boost for UVI's research community and students.

As noted earlier, Cruz Rivera has adjunct UVI faculty status and is maintaining his role as researcher and advisor to UVI students. Habtes (who also has adjunct faculty status at UVI) and VI-EPSCoR are still negotiating the terms of his contract, but in the meantime, T. Smith has assumed an oversight role with the Oceanography team who are delivering support for the other R2T teams. VI-EPSCoR will finalize any proposed changes to the objectives for the Oceanography component by the end of the calendar year and submit them to NSF-EPSCoR/PO.

Regarding UVI's commitment to research sustainability relevant to VI-EPSCoR, the PI (Waddell) for the R2R project has been tasked with developing an IDC redistribution plan for the UVI leadership to consider for implementation. This draft policy plan is due to the provost in September 2022. There is solid support for a new IDC plan among the researchers and the provost, but in the larger picture, UVI has experienced a 20% decrease in enrollment over the past two years due to the impacts of the pandemic and an 18% drop in the population of the Territory (according to the 2020 US Census)- resulting in a significant university-wide budget deficit and potential staffing layoffs. In

short, it's not clear how soon an IDC redistribution plan might be implemented. It's important to note that UVI does support VI-EPSCoR and CMES' research sustainability-key positions such as the EAL manager position (Amber Packard), CMES Dive Master (Steve Prosterman) and CMES boat and facilities manager (Ian Bryne) are all supported by UVI.

The issue of tenure for researchers has been raised on multiple occasions by the R2R project PIs (and by other UVI researchers) for over 10+ years with UVI's leadership. The challenge is finding a business model or examples among other small PUIs with researchers where tenure is awarded that can be used to persuade UVI's current leadership and UVI's AAUP members. NSF sees tenure as a mechanism to improve recruitment and retention of research faculty. While it might be the case in many places and institutions on the US mainland, there are numerous factors that have greater impact in the recruiting and retention of faculty here at UVI. Modest salaries (that are rarely competitive with mainland R1 and R2 institutions) and inadequate relocation funding -all in the face of a high cost of living, lack of affordable housing, low quality of health care and public k12 education options, and a shortage of basic cultural amenities (libraries, museums, in-door music venues, fine dining options, etc.) that well-educated professionals and their families are used to enjoying- all can play a larger role than the offer of a tenure track position. The Territory has a similar challenge with medical professionals- earlier this year (2022), a VI Senate hearing revealed that the two hospitals in the Territory are operating with only 56% of the permanent nursing staff needed to meet demand. The data are even worse for our MDs. "Brain Drain" is very real across the Caribbean and the USVI are not immune to this trend. All that said, the PIs will continue looking for a tenure model that can be developed and proposed for UVI's leadership's consideration this calendar year (2022).

Recommendation 3. It was unclear to the panel what deliverables, such as scientific papers, presentations, and graduate degrees, were the result of the current grant vs. past or other research funding. In addition, the educational endeavors and collaborations attributed to R2R were also vague. Thus, to assess the progress on the current grant, the VI EPSCoR project leads should develop clear guidelines on the expectations for project reporting to the team. The team should identify the tangible products and outcomes that were a direct result of the current VI EPSCoR grant and articulate how the project outcomes are related to the R2R objectives. A list of deliverables (e.g., proposals, presentations, publications) attributable to project Years 1 and 2, should be submitted to the managing PO by the deadline noted above. Subsequent reports (annual and final) submitted to NSF should include this information.

Below is a list of deliverables for the first two years of the R2R project. This list is followed by the names of the MMES graduates who started and graduated since the beginning of the R2R project.

Ridge to Reef

Outputs and Products for Year 1

Books

Book Chapters

- Guannel, M.L., Guannel, G., Daniel, I., Copemann, N., Freeman, A., and Good, B. (2021). A course on natural disasters gets real: living the impacts of climate change in the US Virgin Islands. In E. Walsh (Ed.) Social justice in climate change education: Exploring social and ethical dimensions of environmental education. New York City, NY: Routledge. *Social justice in climate change education: Exploring social and ethical dimensions of environmental education*. Status = SUBMITTED; Acknowledgement of Federal Support = Yes; Peer Reviewed = Yes

Journals or Juried Conference Papers

View all journal publications currently available in the [NSF Public Access Repository](#) for this award.

The results in the NSF Public Access Repository will include a comprehensive listing of all journal publications recorded to date that are associated with this award.

- Guannel, M.L., Guannel, G., Daniel, I., Copemann, N., Freeman, A., and Good, B. (Accepted) July 2019. A course on natural disasters gets real: living the impacts of climate change in the US Virgin Islands. In E. Walsh (Ed.) Social justice in climate change education: Exploring social and ethical dimensions of environmental education. New York City, NY: Routledge. Status = SUBMITTED.
- Harris, L., T. Grayson, H.A. Neckles, C.T. Emrich, K.A. Lewis, K.W. Grimes, S. Williamson, C. Garza, C.R. Whitcraft, J. Beseres Pollack, D.M. Talley, B. Fertig, C.M. Palinkas, S. Park, J.M.P. Vaudrey, A.M. Fitzgerald, J. Quispe. (2021). A socioecological imperative for broadening participation in coastal and estuarine research and management. *Estuaries & Coasts*. Status = ACCEPTED.
- Cruz-Rivera, E. and D. C. Rogers. (2021). An unavoidably short history of inland aquatic animal diversity research in the US Virgin Islands. *Studies in History and Philosophy of Science*. Status = UNDER_REVIEW.
- Halliday-Isaac, A. K., J. B. Robinson, E. Cruz-Rivera, A. G. Campbell and P. C. Sikkell. (2021). Environmental correlates of prevalence of an intraerythrocytic apicomplexan infecting Caribbean damselfish. *Parasitologia*. Status = UNDER_REVIEW.
- Matley, J.K, LK Johansen*, NV Klinard, ST Eanes*, PD Jobsis. (2021). Habitat selection and 3D space use partitioning of resident juvenile hawksbill sea turtles in a small Caribbean Bay. *Marine Biology*. Status = UNDER_REVIEW.
- Ramseyer TN*, Tronholm A, Turner T, Brandt ME, Smith TB. (2021). Elevated nutrients and herbivory negatively affect Dictyota growth dynamics. *Marine Ecology Progress Series*. Status = UNDER_REVIEW.
- Ma L, Becker C, Weber, L, Sullivan C, Zgliczynski B, Sandin S, Brandt M, Smith T, Apprill A. (2021). Biogeography of reef associated microbial communities at multiple spatial scales. 2021 ASLO Meeting. Status = UNDER_REVIEW.
- Green, Stephanie J., Jordan Matley, D. Elizabeth Smith, Lad Akins, Bernard Castillo, Richard S. Nemeth, Clayton Pollock, and Kynoch Reale-Munro. (2021). Broad-scale acoustic telemetry reveals long distance movements and larger home ranges for invasive lionfish (*Pterois volitans*) on invaded coral reefs. *Marine Ecology Progress Series*. 673: 117-134. Status = PUBLISHED
- Chaves-Fonnegra A, Panassiti B, Smith TB, Brown E*, Clemens E*, Sevier M*, Brandt ME (2021). Environmental and biological drivers of white plague disease on shallow and mesophotic coral reefs. *Ecography*. Status = SUBMITTED.

- Becker CC, Apprill A, Brandt M, Miller CA (2021). Stony Coral Tissue Loss Disease biomarker bacteria identified in corals and overlying waters using a rapid field-based sequencing approach. Status = SUBMITTED.
- Meiling, S, Smith, T, Brandt, M., Muller, E (2021). Stony coral tissue loss disease (SCTLD) lesion progression slows. *Frontiers in Marine Science*. Status = ACCEPTED.
- Holstein DM, Smith, T Van Hoodonk R, Paris C. (2021). Patterns of coral metapopulation decline in a changing climate. *Conservation Letters*. Status = SUBMITTED.
- Egan KE, Viehman TS, Holstein DM, Smith, T, Poti M, Groves SH (2021). Predicting the distribution of threatened orbicellid corals in shallow and mesophotic reef ecosystems. *Marine Ecology Progress Series*. Status = SUBMITTED.
- Ali KA, Flanagan D, Brandt M, Ortiz J, Smith TB (2021). Semi-analytical inversion modelling of Chlorophyll a variability in the U.S. Virgin Islands. *PLOS ONE*. Status = SUBMITTED.
- Chiquillo, K.L., Mims, B.B., Chong, A.U, Johnson, C., Y, Fong, C.R., Habtes, S Barber, P.H., Fong, P. (2021). Herbivory as a limiting factor for seagrass proximity to fringing reefs in Moorea, French Polynesia. *Aquatic Botany* 168. Status = ACCEPTED.
- Mukherjee, S, Habtes, S., Jobsis, P. (2001). Comparative analysis of the performance of ocean model frameworks in the Virgin Islands and Puerto Rico coastal ocean. *Journal of Operational Oceanography*. Status = SUBMITTED.

Outputs and Products for Year 2

Books

Book Chapters

- Bowen, Diana (2021). Design Choices for a Growth Mindset Professional Development for Instructors in STEM Higher Education. *Mindsets Pathways to STEM Success: A compilation of tools and strategies for Higher education to boost learning in STEM Caribbean* Writer Press. St Croix. Status = SUBMITTED; Acknowledgement of Federal Support = Yes; Peer Reviewed = Yes
- Francis, G., Brown, L., Espinosa, C., Hunt, D., Powell, K., Hutcheson, L., Guannel, M.L. (2022). Abstract accepted to book under review, H. Williams, H. Huskisson, and C. Noto (Eds.), *Breaching Hierarchy: Students and Teachers Collaborating For Social Change*. *Breaching Hierarchy: Students and Teachers Collaborating For Social Change*. Status = ACCEPTED; Acknowledgement of Federal Support = Yes
- Francis, G., Brown, L., Espinosa, C., Hunt, D., Powell, K., Hutcheson, L., Guannel, M.L. (2022). Student-directed service learning in the United States Virgin Islands: Resiliencing through Disaster. *Breaching Hierarchy: Students and Teachers Collaborating For Social Change*. Status = SUBMITTED; Acknowledgement of Federal Support = Yes; Peer Reviewed = Yes
- Guannel, M.L., Guannel, G., Daniel, I., Copemann, N., Freeman, A., and Good, B. (2022). A course on natural disasters gets real: living the impacts of climate change in the US Virgin Islands. *Social justice in climate change education: Exploring social and ethical dimensions of environmental education*. Status = PUBLISHED; Acknowledgement of Federal Support = Yes; Peer Reviewed = Yes
- McSween, Verleen (2021). Effective Implementation of Informal STEM Learning Practices in the Virtual Classroom. *Mindsets Pathways to STEM Success: A compilation of tools and strategies for Higher education to boost learning in STEM*. Caribbean Writer Press. Status = SUBMITTED; Acknowledgement of Federal Support = Yes; Peer Reviewed = Yes

Journals or Juried Conference Papers

- Holstein, Daniel M. and Smith, Tyler B. and van Hooidek, Ruben and Paris, Claire B. (2022). Predicting coral metapopulation decline in a changing thermal environment. *Coral Reefs*. Status = PUBLISHED
- Brandt, Marilyn E. and Ennis, Rosmin S. and Meiling, Sonora S. and Townsend, Joseph and Cobleigh, Kathryn and Glahn, Adam and Quetel, Jason and Brandtneris, Viktor and Henderson, Leslie M. and Smith, Tyler B. (2021). The Emergence and Initial Impact of Stony Coral Tissue Loss Disease (SCTLD) in the United States Virgin Islands. *Frontiers in Marine Science*. 8. Status = PUBLISHED
- Mukherjee, Sonaljit and Habtes, Sennai and Jobsis, Paul. (2022). Comparative analysis of the performance of the GOFs, PSY4 and AMSEAS ocean model frameworks in the Virgin Islands and Puerto Rico coastal ocean. *Journal of Operational Oceanography*. 1 to 25. Status = PUBLISHED
- Heidmann, Sarah L. and Jossart, Jonathan and Kimble, Melissa and Nemeth, Richard S. (2021). Home range characteristics and diel patterns in space use of mutton snapper, *Lutjanus analis*, in St. Thomas, US Virgin Islands. *Animal Biotelemetry*. 9 (1). 10.1186/s40317-021-00237-z Status =PUBLISHED
- Pitz, Kathleen J. and Richlen, Mindy L. and Fachon, Evangeline and Smith, Tyler B. and Parsons, Michael L. and Anderson, Donald M. (2021). Development of fluorescence in situ hybridization (FISH) probes to detect and enumerate *Gambierdiscus* species. *Harmful Algae*. 101 (C) 101914. Status =PUBLISHED
- Parsons, Michael L. and Richlen, Mindy L. and Smith, Tyler B. and Solow, Andrew R. and Anderson, Donald M. (2021). Evaluation of 24-h screen deployments as a standardized platform to monitor *Gambierdiscus* populations in the Florida Keys and U.S. Virgin Islands. *Harmful Algae*. 103 (C) 101998. Status =PUBLISHED
- Meiling, Sonora S. and Muller, Erinn M. and Lasseigne, Danielle and Rossin, Ashley and Veglia, Alex J. and MacKnight, Nicholas and Dimos, Bradford and Huntley, Naomi and Correa, Adrienne M. and Smith, Tyler Burton and Holstein, Daniel M. and Mydlarz, Laura D. and Apprill, Amy and Brandt, Marilyn E. (2021). Variable Species Responses to Experimental Stony Coral Tissue Loss Disease (SCTLD) Exposure. *Frontiers in Marine Science*. 8. Status =PUBLISHED
- Meiling, Sonora and Muller, Erinn M. and Smith, Tyler B. and Brandt, Marilyn E. (2020). 3D Photogrammetry Reveals Dynamics of Stony Coral Tissue Loss Disease (SCTLD) Lesion Progression Across a Thermal Stress Event. *Frontiers in Marine Science*. 7. Status =PUBLISHED
- Olinger, LK and Chaves-Fonnegra, A and Enochs, IC and Brandt, ME. (2021). Three competitors in three dimensions: photogrammetry reveals rapid overgrowth of coral during multispecies competition with sponges and algae. *Marine Ecology Progress Series*. 657 109 to 121. Status = PUBLISHED
- Ibrahim, Ali K. and Zhuang, Hanqi and Chérubin, Laurent M. and Schärer-Umpierre, Michelle T. and Nemeth, Richard S. and Erdol, Nurgun and Ali, Ali Muhamed. (2020). Transfer learning

for efficient classification of grouper sound. *The Journal of the Acoustical Society of America*. 148 (3) EL260 to EL266. Status =PUBLISHED

- Artim, John M. and Nicholson, Matthew D. and Hendrick, Gina C. and Brandt, Marilyn and Smith, Tyler B. and Sikkell, Paul C. (2020). Abundance of a cryptic generalist parasite reflects degradation of an ecosystem. *Ecosphere*. 11 (10). Status=PUBLISHED
- Harris, L., T. Grayson, H.A. Neckles, C.T. Emrich, K.A. Lewis, K.W. Grimes, S. Williamson, C. Garza, C.R. Whitcraft, J. Beseres Pollack, D.M. Talley, B. Fertig, C.M. Palinkas, S. Park, J.M.P. Vaudrey, A.M. Fitzgerald, J. Quispe. (2021). A socioecological imperative for broadening participation in coastal and estuarine research and management. *Estuaries & Coasts*. Status = PUBLISHED.
- Cruz-Rivera, E. and D. C. Rogers. (2022). An unavoidably short history of inland aquatic animal diversity research in the US Virgin Islands. *Studies in History and Philosophy of Science*. Status = PUBLISHED.
- Halliday-Isaac, A. K., J. B. Robinson, E. Cruz-Rivera, A. G. Campbell and P. C. Sikkell. (2021). Environmental correlates of prevalence of an intraerythrocytic apicomplexan infecting Caribbean damselfish. *Parasitologia*. Status = PUBLISHED.
- Ramseyer TN*, Tronholm A, Turner T, Brandt ME, Smith TB. (2021). Elevated nutrients and herbivory negatively affect Dictyota growth dynamics. *Marine Ecology Progress Series*. Status = PUBLISHED.
- Ma L, Becker C, Weber, L, Sullivan C, Zgliczynski B, Sandin S, Brandt M, Smith T, Apprill A. (2021). Biogeography of reef associated microbial communities at multiple spatial scales. 2021 ASLO Meeting. Status = PUBLISHED.
- Chaves-Fonnegra A, Panassiti B, Smith TB, Brown E*, Clemens E*, Sevier M*, Brandt ME (2021). Environmental and biological drivers of white plague disease on shallow and mesophotic coral reefs. *Ecography*.. Status = PUBLISHED.
- Matley, JK and Jossart, J and Johansen, L and Jobsis, PD. (2020). Environmental drivers of diving behavior and space-use of juvenile endangered Caribbean hawksbill sea turtles identified using acoustic telemetry. *Marine Ecology Progress Series*. 652 157 to 171. Status =PUBLISHED
- Green, SJ and Matley, JK and Smith, DE and Castillo B, II and Akins, JL and Nemeth, RS and Pollock, C and Reale-Munroe, K. (2021). Broad-scale acoustic telemetry reveals long-distance movements and large home ranges for invasive lionfish on Atlantic coral reefs. *Marine Ecology Progress Series*. 673 117 to 134. Status=PUBLISHED
- Matley, J. K. and Johansen, L. K. and Klinard, N. V. and Eanes, S. T. and Jobsis, P. D. (2021). Habitat selection and 3D space use partitioning of resident juvenile hawksbill sea turtles in a small Caribbean Bay. *Marine Biology*. 168 (8). Status = PUBLISHED
- Duffing Romero, Mareike D. and Matley, Jordan K. and Luo, Jiangang and Ault, Jerald S. and Pittman, Simon J. and Nemeth, Richard S. (2021). Movement patterns of juvenile Atlantic tarpon (*Megalops atlanticus*) in Brewers Bay, St. Thomas, U.S. Virgin Islands. *Animal Biotelemetry*. 9 (1). Status = PUBLISHED
- Becker CC, Apprill A, Brandt M, Miller CA (2021). Stony Coral Tissue Loss Disease biomarker bacteria identified in corals and overlying waters using a rapid field-based sequencing approach. Status = PUBLISHED.
- Liefer, Justin D. and Richlen, Mindy L. and Smith, Tyler B. and DeBose, Jennifer L. and Xu, Yixiao and Anderson, Donald M. and Robertson, Alison. (2021). Asynchrony of *Gambierdiscus* spp. Abundance and Toxicity in the U.S. Virgin Islands: Implications for Monitoring and Management of Ciguatera. *Toxins*. 13 (6) 413. Status = PUBLISHED
- Holstein DM, Smith, T Van Hooideonk R, Paris C. (2021). Patterns of coral metapopulation decline in a changing climate. *Conservation Letters*. Status = PUBLISHED.

- Egan KE, Viehman TS, Holstein DM, Smith, T, Poti M, Groves SH (2021). Predicting the distribution of threatened orbicellid corals in shallow and mesophotic reef ecosystems. *Marine Ecology Progress Series*. Status = PUBLISHED.
- Stewart, HA and Janiak, DS and Wright, JL and Hunt, DAGA and Carmona Cortes, A and Powell, KT and Chapman, LJ and Altieri, AH. (2022). Epibiont community composition of red mangroves *Rhizophora mangle* are contingent on root characteristics. *Marine Ecology Progress Series*. 686 15 to 35. Status =PUBLISHED
- Chiquillo, K.L., Mims, B.B., Chong, A.U, Johnson, C., Y, Fong, C.R., Habtes, S Barber, P.H., Fong, P. (2021). Herbivory as a limiting factor for seagrass proximity to fringing reefs in Moorea, French Polynesia. *Aquatic Botany* 168. Status = PUBLISHED.
- Mukherjee, S, Habtes, S., Jobsis, P. (2001). Comparative analysis of the performance of ocean model frameworks in the Virgin Islands and Puerto Rico coastal ocean. *Journal of Operational Oceanography*. Status = PUBLISHED.
- Costa, Sophia V. and Hibberts, Stephanie J. and Olive, Danielle A. and Budd, Kayla A. and Long, Alexys E. and Meiling, Sonora S. and Miller, Madyson B. and Vaughn, Kelsey M. and Carrión, Claudia I. and Cohen, Maksym B. and Savage, Annie E. and Souza, Matthew F. and Buckley, Lorraine and Grimes, Kristin W. and Platenberg, Renata and Smith, Tyler B. and Blondeau, Jeremiah and Brandt, Marilyn E. (2021). Diversity and Disease: The Effects of Coral Diversity on Prevalence and Impacts of Stony Coral Tissue Loss Disease in Saint Thomas, U.S. Virgin Islands. *Frontiers in Marine Science*. 8. Status =PUBLISHED
- Veglia, A. J. and Beavers, K. and Van Buren, E. W. and Meiling, S. S. and Muller, E. M. and Smith, T. B. and Holstein, D. M. and Apprill, A. and Brandt, M. E. and Mydlarz, L. D. and Correa, A. M. (2022). Alphaflexivirus Genomes in Stony Coral Tissue Loss Disease- Affected, Disease-Exposed, and Disease-Unexposed Coral Colonies in the U.S. Virgin Islands. *Microbiology resource announcements*. Status =PUBLISHED
- Dimos B, Emery M, Beavers K, MacKnight N, Brandt M, Demuth J, Mydlarz L. (accepted) Adaptive Variation in Homolog Number Within Transcript Families Promotes Expression Divergence in Reef-Building Coral. *Molecular Ecology*. Status = ACCEPTED.
- Wright J.L., H.A. Stewart, I. Candanedo, E. D, Alessandro, M. Estevanez, R.J. Arajo. Coexisting mangrove-coral habitat use by juvenile reef fishes in the Caribbean. *Biotropica* (Submitted February 18, 2022, initial submission). Status = SUBMITTED.
- Heather A. Stewart, Jennifer L. Wright, Matthew Carrigan, Andrew H. Altieri, David I. Kline, Rafael J. Arajo (2021). Coexisting mangrove-coral habitats: a description of a novel canopy habitat in Bocas del Toro, Panama, global classification, and distribution. *PLOS Biology*, September 13, 2021. Status = SUBMITTED.
- Lancellotti BV, Underwood KL, Perdrial JN, Schroth AW, Roy ED, Adair CE. (2022). Complex drivers of riparian soil oxygen variability revealed sing self-organizing maps. *Biogeochemistry*. In review. Status = UNDER_REVIEW.
- Palacio-Castro A, Smith TB, Brandtneris VW, Snyder GA, van Hooideonk R, Mat JL, Manzello D, Glynn PW, Fong P, Baker AC (submitted) Increased dominance of heat-tolerant symbionts create resilient coral reefs in near-term ocean warming. *PNAS*. Status = SUBMITTED.
- Ennis RS, *Baltzer K, *Jossart J, *Sevier S, *Kisabeth J, *Forbes Jr. H, *Tennant K, *Rios M, Brandtneris V, Brandt M, Smith TB, Wilson Grimes K (submitted) Persistent water quality impairment negatively impacts red mangrove (*Rhizophora mangle*) prop root epibiont communities in a marine protected area of St. Thomas, U.S. Virgin Islands. Status = SUBMITTED.
- Ali K, *Flanagan D, Brandt ME, Ortiz J, Smith TB (in revision) Semi-analytical inversion modelling of Chlorophyll a variability in the U.S. Virgin Islands. *PLoS ONE*. Status = UNDER_REVIEW.
- Edmunds PJ, Smith TB (submitted) Spatial variation in the dynamics and synchrony of coral reefs in the US Virgin Islands. *Marine Biology*. Status = SUBMITTED.

- Henderson, LM, Jeremiah Blondeau, Marcia Taylor, Rishard S. Nemeth, Tyler B. Smith (submitted). Terrestrial and silt-clay sediment flux affect stony coral health in the nearshore US Virgin Islands. PLOS 1 (submitted 23 Mar 2022). Status = SUBMITTED.
- Huntley N, Brandt ME, Becker C, Miller C, Meiling S, Correa A, Holstein DM, Muller E, Mydlarz L, Smith TB, Apprill A (in review) Experimental transmission of Stony Coral Tissue Loss Disease results in differential microbial responses within coral mucus and tissue. ISME Communications. Status = AWAITING_PUBLICATION.
- Martin, KS, JR Evia, K Peterman, K Grimes, M Medina, M Brandt (2021). Navigating learning ecosystems; exploring students use of agency in marine and environmental sciences. Journal of Geoscience Education. Status = UNDER_REVIEW.
- McSween, Verleen (2021). Effective Implementation of Informal STEM Learning Practices in the Virtual Classroom. Mindsets Pathways to STEM Success: A compilation of tools and strategies for Higher education to boost learning in STEM. Caribbean Writer Press. Status = AWAITING_PUBLICATION.

Other Conference Presentations / Papers

- Cruz-Rivera, Edwin (2021). *A brief history of golden tides*. Loyola Marymount University. California. Status = OTHER; Acknowledgement of Federal Support = Yes
- Brandt, M, Mele, D, Carne L, Vaughan D (2021). *A comparison of micro-fragmenting propagation techniques for the endangered stony coral species, Acropora palmata*. CERF 2021 26th Biennial Conference. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Monroe-Mills, N (2022). *Big Impacts: Improving STEM Education in the Virgin Islands*. IUPUI. Indiana. Status = OTHER; Acknowledgement of Federal Support = Yes
- Cummings, Lawanda (2022). *Building a Culture of Research and Support in STEM at an HBCU*. National Science Foundation STEM for ALL Video Showcase. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- McSween, Verleen, Cummings, Lawanda (2022). *Building a Culture of Research and Support in STEM at HBCU. Developing Equity and Inclusion at the Department Level*. 2022 Massachusetts PKAL Regional Network Winter Meeting. A Virtual Meeting Hosted by Bridgewater State University. Association of American Colleges and Universities. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Cummings, L & McSween, V (2022). *Building a Culture of Research and Support in STEM at an HBCU. Developing Equity and Inclusion at the Department Level*. 2022 Capital PKAL Meeting:STEM Instructional Innovations Necessitated by COVID-19: Evolution of Processes Post Pandemic Hosted by Coppin State University. Association of American Colleges and Universities. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Brandt, Marilyn, Wilson-Grimes, Kristen, Whitcraft C, La Peyre M (2021). *Coastal Restoration: Challenges, Successes and Innovation*. CERF 2021 26th Biennial Conference. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Cummings, Lawanda, Berkeley, Resa (2022). *Culturally Relevant Community Outreach (CRCO): Fitting learning theory to informal learning spaces for science literacy*. American Educational Research Association (AERA). San Diego. Status = OTHER; Acknowledgement of Federal Support = Yes
- Francis, G (2022). *Designing Future Learning Opportunities with Students at the Center*. National Academies of Sciences, Engineering, and Medicine Virtual Seminar. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Cummings, L (2021). *Early Career Supports: Developing and Modeling Growth Mindset for STEM through Faculty Professional Development*. National Academies of Science Engineering and Medicine Virtual Town Hall, USVI. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- McSween, V (2021). *Early Career Supports: VI-ISERP: Mentoring and Research Infrastructure Support Structures for the Pre- and In-service STEM Workforce*. National Academies of

Science Engineering and Medicine Virtual Town Hall, USVI. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes

- Bestrom N, Apprill A, Trotz M, Brandt M (2022). *Evaluating the impacts of water quality on critical coral reef habitats and disease in the endangered coral species, Acropora palmata, in the northern U.S. Virgin Islands*. 15th International Coral Reef Symposium, 3-8 July, Bremen, Germany. Status = SUBMITTED; Acknowledgement of Federal Support = Yes
- Monroe-Mills, Nadia, Bowen, Diana, Cummings, Lawanda (2022). *Forging Partnerships: A crucial component to STEM workforce development in the Virgin Islands*. National Science Foundation STEM for ALL Video Showcase. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Brandt, Marilyn, Wilson-Grimes, Kristen, Durdall, Allie, Willette, D A, Vaughn, K (2021). *Impacts of shoot density and water depth on the carbon storage ability of Halophila stipulacea*. Conference of the Coastal & Estuarine Research Federation. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Brandt, Marilyn, Wilson-Grimes, Kristen, Durdall, Allie, Vaughn, K, Willette, D (2021). *Impacts of shoot density and water depth on the carbon storage ability of Halophila stipulacea*. CERF 2021 26th Biennial Conference. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Budd K, Brandt M, Sikkell P, Nemeth R (2022). *Impacts of stony coral tissue loss disease (SCTLD) on the persistence of a keystone reef fish species*. 15th International Coral Reef Symposium. Bremen, Germany. Status = SUBMITTED; Acknowledgement of Federal Support = Yes
- Dade L, Lillis A, Trotz M, Brandt M (2022). *Impacts of water quality impairment on scleractinian coral early life history stages*. 15th International Coral Reef Symposium. Bremen, Germany. Status = SUBMITTED; Acknowledgement of Federal Support = Yes
- Guannel, Michele, Diana, O., Freeman, A (2022). *Incorporation of a utility-value intervention into a place-based, culturally sustaining general education science course*. National Association for Research in Science Teaching (NARST). 2022 Annual International Conference. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Cruz-Rivera, Edwin (2021). *Intraspecific variation in palatability of the invasive species Halophila stipulacea*. ASLO Aquatic Sciences Meeting, Virtual Meeting. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Brandt, Marilyn, Meiling, Sonora, Quetel, J, Townsend, J, Williams, L (2021). *Local intervention efforts lead to species-specific reductions in stony coral tissue loss disease (SCTLD) prevalence in the United States Virgin Islands*. 74th Gulf and Caribbean Fisheries Institute Conference. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Perry, Molly (2021). *Make You Believe Everyone in Class can Change the World: Engaging First Year Undergraduates through Student-Led Project-Based Learning in STEM*. University of the Virgin Islands and National Academies of Sciences, Engineering, and Medicine Town Hall. Rethinking the STEM Pipeline: UVI Holistic Approach to Student Preparation for the STEM Workforce. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Cummings, Lawanda & Berkeley, Resa (2021). *Moving Culturally Relevant Pedagogy from the Classroom to the Community: VI-EPSCoR Outreach Education and Diversity*. Center for Culturally Responsive Evaluation and Assessment (CREA), Virtual Conference. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Stout, Jarvon, Cummings, Lawanda, McSween, Verleen, Monroe-Mills, Nadia (2021). *National Academy of Sciences Engineering and Medicine: UVI Town Hall*. National Academies of Science Engineering and Medicine Virtual Meeting, USVI. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Stewart, Heather, Wilson-Grimes, Kristen, Callwood, VerNele, Holevoet, Allison (2021). *Nursery growing conditions influence germination time and success of white mangrove*

- Laguncularia racemosa propagules*. Coastal Education and Research Foundation (CERF) 2021 annual meeting. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Hunt, D (2022). *Opportunities for the Students of 2040*. National Academies of Sciences, Engineering, and Medicine Virtual Seminar. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Stout, Jarvon (2021). *Pre-College/Community: Informal Learning to Develop STEM Identity for USVI Pre-College Populations*. National Academies of Science Engineering and Medicine Virtual Town Hall, USVI. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Monroe-Mills, Nadia (2021). *Pre-College/Community: The STEM Institute: Teacher Professional Development Program*. National Academies of Science Engineering and Medicine Virtual Town Hall, USVI. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Stewart, H (2021). *Punta Culebra 2021 Guide Training: Mangroves*. Punta Culebra Natural Center guides. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Guannel, M (2022). *Resilience leaders initiative University of the Virgin Islands*. National Academies of Sciences, Engineering, and Medicine Virtual Seminar, Designing Future Learning Opportunities with Students at the Center. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Brandt, M (2022). *SCTLD Surveillance in the U.S. Virgin Islands*. The U.S. Coral Reef Task Force Coral Disease Working Group Stony Coral Tissue Loss Disease Surveillance in the Indo-Pacific Virtual Workshop. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Bowen, Diana, Cummings, Lawanda, Monroe-Mills, Nadia (2022). *Secondary STEM Teachers Post-Hurricane Experiences and Acts of Agency in the USVI*. American Educational Research Association (AERA). San Diego. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Stewart, Heather (2021). *Shedding light on mangrove forests as a refuge for corals: The effect of shade and habitat on coral health in the Caribbean*. SEMANGLARES IV. Bogota, Columbia. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Lancellotti, Brittany, Hensley, David, Knappenberger, TJ (2022). *Soil moisture regimes under mulch covers in tropical plantain production*. Auburn Research Student Symposium. Auburn Alabama. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Gochfeld DJ, Brandt ME, Chaves Fonnegra A, Smith TB, Ennis RS, Diaz CM, Olson JB (2022). *Sponge community responses to disturbances on Caribbean reefs*. 15th International Coral Reef Symposium. Bremen, Germany. Status = SUBMITTED; Acknowledgement of Federal Support = Yes
 - Cummings, Lawanda (2021). *Student Centered Mentoring: A Case for Mentor Rich Environments*. National Academies of Science Engineering and Medicine Virtual Meeting, USVI. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Cummings, L (2022). *Student Centered Mentoring: A Case for Mentor Rich Environments*. National Academies of Science Engineering and Medicine Virtual Town Hall, USVI. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Michele Guannel, Deana Hunt (2021). *Student leadership in emergency response and recovery: from Category 5 hurricanes to COVID-19*. Virtual 2021 Massachusetts Regional Project Kaleidoscope (PKAL) Meeting, Back to Normal? STEM Education and High-Impact Practices Moving Forward. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
 - Guannel, Michele (2021). *Supporting culturally competent leaders for a changing VI: the Resilience Leaders Initiative*. University of the Virgin Islands and National Academies of Sciences, Engineering, and Medicine Town Hall. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes

- Brandt, Marilyn, Smith, Tyler, Holevoet A, Krampitz N, Bestrom N, Dade L, Cheramie J, Kelso M, McGregor A, Ayres K, del Valle T, Antoine J, Scott N, Chaparro A, Mason, R (2021). *The role of herbivory on coral reef recovery in the Caribbean*. CERF 2021 26th Biennial Conference. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Guannel, M & Freeman, A (2021). *University youth experiences and leadership: Naming and addressing layers of disaster-amplified gaps in social support structures of the United States Virgin Islands*. American Anthropological Association Hybrid 2021 Annual Meeting, Baltimore, MD, United States. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Wilson-Grimes, Kristen, Durdall, Allie, Stout, Jarvon, Holevoet, Allison, Halliday, Kayla, Hibberts, Stephanie (2021). *Why and how we built that: mangrove restoration in the U.S. Virgin Islands*. 26th Biennial Conference of the Coastal & Estuarine Research Federation. Virtual. Status = OTHER; Acknowledgement of Federal Support = Yes
- Steward, Heather (2021). *Women in Science*. Smithsonian Environmental Research Center. Maryland. Status = OTHER; Acknowledgement of Federal Support = Yes

Other Publications

- Smith T, Blondeau J, Brandt M, Brandtneris V, Ennis R, Heidmann S, Kadison E, Nemeth (2022). *Chronic and acute disease impacts as a driver of mesophotic coral degradation in the US Virgin Islands*. Abstract submitted to the 15th International Coral Reef Symposium, 3-8 July 2022, Bremen, Germany. Status = SUBMITTED; Acknowledgement of Federal Support = Yes
- Ogurcak DE, Donoso M, Duran A, Ennis RS, Gann D, Gulick A, Olivas P, Smith TB, Stoa R, Vargas J, Wachnika A, Whitman E (2021). *Natural resource condition assessment: Buck Island*. Reef National Monument. Natural Resource Report NPS/BUIS/NRR 2021/XXXX. Status = SUBMITTED; Acknowledgement of Federal Support = Yes
- Ogurcak DE, Donoso M, Duran A, Ennis RS, Frankovich T, Gann D, Olivas P, Smith TB, Stoa R, Vargas J, Wachnika A, Whitman E (2021). *Natural resource condition assessment: Salt River Bay National Historical Park and Ecological Preserve*. Natural Resource Report NPS/SARI/NRR 2021/XXXX. Status = SUBMITTED; Acknowledgement of Federal Support = Yes
- Ogurcak DE, Donoso M, Duran A, Ennis RS, Frankovich T, Gann D, Olivas P, Smith TB, Stoa R, Vargas J, Wachnika A, Whitman E (2021). *Natural resource condition assessment: Virgin Islands National Park and Virgin Islands Coral Reef National Monument*. Natural Resource Report NPS/XXXX/NRR 2021/XXXX. Status = SUBMITTED; Acknowledgement of Federal Support = Yes

PROPOSALS

#	Title	Organizers	Status	Amount Requested	Date Submitted	Funding Agency	Components
1	Providing accessible water quality testing services for cistern water with focus on bacteria, disinfection by products, and other	Amber Packard, Paul Jobsis	Submitted	\$43,000.00	2/1/2022	Water Research and Resource Institute	Watershed, Mangrove & Seagrass

	contaminants of local concern in St. Thomas, USVI						
2	RII-BEC: Securing STEM Island Pathways	Kristen Wilson-Grimes, Lawanda Cummings	Pending	\$1,000,000.00	4/22/2022	NSF	Education and Workforce Development
3	Climate change and the effects of golden tides on Caribbean coastal sustainability. Multiscale predictions for an emerging biocomplex problem	Edwin Cruz-Rivera	Awarded	\$375,000.00	7/7/2021	NASA MUREP	Watershed, Mangrove & Seagrass
4	Sargassum biomass as an animal feed ingredient for aquaculture	Edwin Cruz-Rivera	Submitted	\$298,472.00	11/2/2021	NOAA	Watershed, Mangrove & Seagrass
5	Application of Systems Thinking and Transdisciplinary Learning to Strengthen Retention and Preparation for a Resilience-Focused Workforce in the United States Virgin Islands	Michele Guannel	Pending	\$349,975.00	3/29/2022	Building Capacity in STEM Education Research, National Science Foundation	Education and Workforce Development
6	Filling in the gaps for data-poor reef fishes in the U.S. Caribbean: research on age, growth, and reproduction for	Richard Nemeth	Pending	\$37,200.00	10/1/2021	NOAA	Fish Ecology & Herbivory

	stoplight parrotfish and redtail parrotfish in anticipation of upcoming stock assessments						
7	Bringing Back the Nassau Grouper in the US Caribbean	Richard Nemeth	Pending	\$766,850.00	10/1/2021	NOAA Section 6 Endangered Species Recovery program	Fish Ecology & Herbivory
8	Filling Caribbean fish life history gaps: redtail parrotfish & hogfish	Richard Nemeth	Awarded	\$103,049.00	6/1/2021	NOAA Coral Reef Conservation Program	Fish Ecology & Herbivory
9	Build capacity for conducting fisheries life history work within USVI Territory	Richard Nemeth	Awarded	\$681,305.00	5/1/2021	NOAA Southeast Area Monitoring and Assessment Program	Fish Ecology & Herbivory
10	Investigating recovery and innovations in co-restoration of unique coral-mangrove systems in Hurricane Hole, Virgin Islands National Park and Salt River Bay	Kristen Wilson-Grimes, Marilyn Brandt	Submitted	\$380,952.00	2/19/2022	National Park Service	Disease & Restoration
11	22-2022 RID-0027	Tyler Smith	Awarded	\$1,000,000.00	8/1/2021	NASA EPSCoR	Marine Resilience
12	Application of UAV and satellite based optical sensors to	Tyler Smith, Marilyn Brandt	Submitted	\$744,453.00	2/13/2022	NASA	Marine Resilience

	help preserve the coral reefs of the US Virgin Islands						
13	USGS National Climate Adaptation Science Center Diverse Knowledge Systems Fellowship	David Hensley	Pending	\$10,000.00	3/27/2022	USGS	Watershed, Mangrove & Seagrass
14	Exploring the impacts of land cover shifts on sediment discharges in Virgin Islands marine environments using real-time remote sensing	David Hensley	Pending	\$16,000.00	2/10/2022	USVI NASA EPSCoR	Watershed, Mangrove & Seagrass
15	Large-scale CoPe: Reducing Climate Risks with Equitable Nature-based Solutions: Engaging Communities on Reef-Lined Coasts	Marilyn Brandt, Kristen Wilson-Grimes	Submitted	\$2,405,743.00	2/3/2022	NSF Coastlines and People (CoPe) program	Disease & Restoration
16	Mangrove Restoration Education & Outreach in the U.S. Virgin Islands	Allie Durdall	Submitted	\$82,348.00	2/2/2022	11th Hour Racing	Watershed, Mangrove & Seagrass
17	HAB-OA 2022: Evaluation of ocean acidification, temperature, and light on the ecophysiology and toxicity of	Tyler Smith	Submitted	\$1,491,482.00	1/10/2022	NOAA Ecology of Harmful Algal Blooms Program	Marine Resilience

	<i>Gambierdiscus silvae</i> from Ciguatera endemic regions						
18	Engaging Stakeholders using Multi-Media Approaches: Promoting Solutions for Reducing Terrestrial Sedimentation and Pollution into Coastal Environments	Richard Nemeth	Submitted	\$54,342.58	1/6/2022	WRI	Fish Ecology & Herbivory
19	Bringing Back the Nassau Grouper in the US Caribbean	Richard Nemeth	Submitted	\$766,850.00	10/1/2021	NOAA Section 6 Species Recovery program	Fish Ecology & Herbivory
20	Filling in the gaps for data-poor reef fishes in the U.S. Caribbean: research on age, growth, and reproduction for stoplight parrotfish and redband parrotfish in anticipation of upcoming stock assessments	Richard Nemeth	Submitted	\$37,200.00	8/1/2021	NOAA MARFIN program	Fish Ecology & Herbivory
21	Filling Caribbean fish life history gaps: redband parrotfish & hogfish	Richard Nemeth	Awarded	\$103,049.00	6/1/2021	OAA Coral Reef Conservation Program	Fish Ecology & Herbivory
22	Investigating Recovery and Innovations in	Marilyn Brandt	Submitted	\$373,467.00	10/1/2021	National Park Service	Disease & Restoration

	Co-Restoration of Unique Coral-Mangrove Systems in Hurricane Hole, Virgin Islands National Park and Salt River Bay, Salt River Ecological and Historic Preserve						
23	Investigating Recovery & Innovations in Co-Restoration of Unique Coral-Mangrove Systems at VICR-SARI, National Park Service, Service-wide Comprehensive Call	Kristen Wilson-Grimes, Marilyn Brandt, Allie Durdall	Submitted	\$428,000.00	12/15/2021	National Park Service	Disease & Restoration
24	Large-scale CoPe: Reducing climate risks with equitable nature-based solutions: engaging communities on reef-lined coasts	Marilyn Brandt	Submitted	\$2,405,743.00	10/27/2021	NSF CoPe	Watershed, Mangrove & Seagrass
25	Promoting Environmental Stewardship through a British and U.S. Virgin Islands Mangrove Restoration Learning Exchange and Creation of a Community of Practice	Kristen Wilson-Grimes, Allie Durdall	Awarded	\$7,000.00	9/30/2021	Community Foundation of the Virgin Islands	Watershed, Mangrove & Seagrass

26	Slowing the spread of stony coral tissue loss disease (SCTLD) in the US Virgin Islands: Treatment of diseased coral colonies in the National Park Units of St. John	Marilyn Brandt	Awarde d	\$300,00 0.00	5/1/20 21	CESU	Disease & Restoration
27	Building Capacity and Resources for Coral Reef Restoration in the National Park Units Surrounding St. John, US Virgin Islands	Marilyn Brandt	Awarde d	\$684,23 8.00	7/15/2 021	CESU	Disease & Restoration
28	Restoration for Resilience: Bringing back SCTLD Susceptible Species	Marilyn Brandt	Awarde d	\$200,00 0.00	7/1/20 21	Departm ent of Interior CRNR FY21 grants, sponsore d by DPNR	Disease & Restoration
29	A multi-scale approach to predicting infectious multi-host disease spread in marine benthic communities	Marilyn Brandt	Awarde d	\$2,499,9 26.00	6/1/20 21	NSF DEB - Ecology of Infectiou s Diseases program	Disease & Restoration
30	Slowing the spread of stony coral tissue loss disease (SCTLD) in the US Virgin Islands: Treatment of diseased coral	Marilyn Brandt	Submitt ed	\$300,00 0.00	8/1/20 22	CESU	Disease & Restoration

	colonies in the National Park Units of St. John						
31	Water Resources Research Act Program Annual Base Grants Fiscal Year 2021	Kristen Wilson-Grimes	Awarde d	\$125,000.00	6/1/2021	U.S. Department of the Interior, U.S. Geological Survey	Watershed, Mangrove & Seagrass
32	Mangrove nursery plant production at Salt River Bay Historical Park and Ecological Preserve	Kristen Wilson-Grimes	Awarde d	\$175,246.00	6/1/2021	U.S. Department of the Interior, National Park System.	Watershed, Mangrove & Seagrass
33	Territorial Coral Reef Monitoring Program: Year 20	Tyler Smith	Awarde d	\$150,000.00	7/1/2020	NOAA/DPNR	Marine Resilience
34	2021-2022 Research Facilitation Award: Dormancy, emergence, and resistance to environmental stress in an invertebrate with an opportunistic life cycle	Edwin Cruz-Rivera	Pending	\$19,387.00	3/1/2021	USVI NASA EPSCoR .	Watershed, Mangrove & Seagrass
35	National Save the Sea Turtle Foundation Agreement with the University of the Virgin Islands (MOA). August 7th, 2020. Donation of \$60,000 to the UVI Sea Turtle Research and Conservation	Paul Jobsis	Awarde d	\$60,000.00	7/1/2021	University of the Virgin Islands	Watershed, Mangrove & Seagrass

	Fund to assist Dr. Paul Jobsis sea turtle research.						
36	Comparison of organic carbon content at freshwater outflows and adjacent nearshore coastal water on St. Thomas and St. John, U.S. Virgin Islands	Amber Packard	Denied	\$49,963.00	1/7/2021	VI Water Resources Research Institute	Watershed, Mangrove & Seagrass
37	Jones Foundation	Lawanda Cummings	Awarded	\$13,000.00	5/1/2020	Community Foundation of the Virgin Islands	Education and Workforce Development
38	Science to Families (SCI2FAM) Science Learning Ecosystem: Water Both Land and Sea	Lawanda Cummings, Verleen McSween	Submitted	\$299,692.00	1/12/2021	National Science Foundation	Education and Workforce Development
39	Raising Awareness and Participation with a Social Media App: Reducing Terrestrial Sedimentation and Promoting Clear Coastal Waters	Richard Nemeth	Awarded	\$43,000.00	8/1/2020	USGS-WRRI	Fish Ecology & Herbivory
40	Understanding Species Habitat Usage and Connectivity 2021: RER 2021: Effectiveness of MPA design for fish spawning	Richard Nemeth	Submitted	\$1,961,402.00	1/15/2021	NOAA-NOS-NCCOS Regional Ecosystem Research Program	Fish Ecology & Herbivory

	aggregations in the US Caribbean						
41	Revealing Corridors of Connectivity Between Critical Fish Habitat for Enhanced MPA Performance in the US Virgin Islands	Richard Nemeth	Submitted	\$2,000,000.00	1/15/2021	NOAA-NOS-NCCOS Regional Ecosystem Research Program	Fish Ecology & Herbivory
42	Women Divers Hall of Fame Susan L. Williams Memorial Fellowship (in Coral Reef and Seagrass Restoration)	Sonora Meiling	Awarded	\$2,500.00	8/20/2021	Women Divers TM Hall of Fame	Disease & Restoration
43	Application of UAV and satellite based optical sensors to help preserve the coral reefs of the US Virgin Islands	Tyler Smith, Marilyn Brandt	Submitted	\$750,000.00	8/20/2021	USVI NASA EPSCoR	Marine Resilience
44	Testing the effect of positive species interactions on disease incidence in outplanted corals	Marilyn Brandt	Submitted	\$150,000.00	8/1/2020	Pre-proposal to National Fish and Wildlife Foundation "Coral Reef Conservation Fund 2021	Disease & Restoration

45	Expanding science-based coral and mangrove restoration to protect Virgin Islands shorelines	Marilyn Brandt, Kristen Wilson-Grimes	Awarde d	\$619,805.00	8/20/2021	Federal Emergency Management Agency, Hazard Mitigation Grant Program	Watershed, Mangrove & Seagrass
46	Deep Coral Reef Monitoring Program in the United States Virgin Island	Tyler Smith	Awarde d	\$285,329.00	8/1/2020	NOAA/CIMAS	Marine Resilience
47	Continued Coordination and Development of Research and Monitoring Activities in the United States Virgin Islands	Tyler Smith	Awarde d	\$473,024.00	8/1/2020	NOAA/CIMAS	Marine Resilience
48	Monitoring of natural and outplanted threatened Acroporid corals in the US Virgin Islands	Marilyn Brandt, Tyler Smith	Awarde d	\$747,189.00	8/1/2020	NOAA	Marine Resilience
49	Climate Change and the Effects of Golden Tides on Caribbean Coastal Sustainability Multiscale Predictions for an Emerging Biocomplex Problem	Edwin Cruz-Rivera	Submitt ed	\$749,670.00	12/18/2020	NASA (MURE P program	Watershed, Mangrove & Seagrass
50	Investigating links between fecal contamination and coral disease	Marilyn Brandt	Submitt ed	\$50,000.00	1/6/2021	Universi ty of the Virgin Islands Water	Disease & Restoration

	in the threatened species, <i>Acropora palmata</i>					Resources Research Institute Program	
51	GEO Opportunities for Leadership in Diversity	Sennai Habtes	Awarded	\$99,998.00	8/1/2020	National Science Foundation ICER	Oceanography
52	Large-Scale CoPe: Connecting Communities & Co-Innovating Nature-Based Solutions to Reduce Storm Exposure and Social Vulnerabilities	Sennai Habtes	Submitted	\$20,000,000.00	10/27/2020	NSF	Oceanography
53	Strengthen Coastal Resilience in the US Virgin Islands through Coral Reef Restoration	Kristen Wilson-Grimes, Marilyn Brandt	Awarded	\$237,455.00	8/3/2020	National Fish and Wildlife Foundation, National Coastal Resilience Fund 2020	Watershed, Mangrove & Seagrass
54	Diversity, Equity and Inclusion Capacity Building Program for Conservation Organizations	Kristen Wilson-Grimes	Submitted	\$60,000.00	8/3/2020	Doris Duke Charitable Foundation	Watershed, Mangrove & Seagrass
55	Rescue to Reef Program	Marilyn Brandt	Awarded	\$17,600.00	8/1/2020	Lovango Reef Restoration Program	Disease & Restoration
	Intervention and Mitigation of Stony Coral Tissue Loss	Marilyn Brandt	Awarded	\$16,722.00	8/1/2020	Virgin Islands Department of	Disease & Restoration

	Disease in the US Virgin Islands					Planning and Natural Resourc es	
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**MMES Students who started under the R2R Project
and have graduated (Class of 2022)**

Sophia Costa

Makayla Kelso

Alexys Long

Kristine Funk Tartaglio

Stephanie Hibberts* (*awarded posthumously)

**National Science Foundation
Financial Stewardship Business Assistance Meeting
University of the Virgin Islands
EPSCoR vRSV**

March 16, 2022
Time: 2:00 – 4:00 PM,
EDT
Zoom Meeting

Attendees:

NSF: Joe Kittle (BFA/DGA), Jannele Gosey (BFA/DGA); Rochelle Ray (BFA/DIAS); Carrie Davison (BFA/DIAS); Andrea Johnson (Cognizant NSF PO, OD/OIA); Other NSF POs (OD/OIA)

UVI: Mindy Solivan – Office of Sponsored Programs Director; Kim Waddell – Principal Investigator (OIA-1946412); Shirley Lake-King – Vice President of Administration and Finance

Subrecipient Risk Assessment:

No major issues identified in UVI's questionnaire or subsequent discussions during the vRSV. UVI explained that proposed revisions to existing policies in this area related to the need to add more clarity on roles after a restructuring of the Sponsored Program Office (SPO), who does all pre-award and continuing subrecipient risk assessments. As stated in the questionnaire, UVI uses the FDP subrecipient risk assessment tool. Before entering any subaward agreement, UVI SPO does a full subrecipient risk assessment, which includes reviewing information available in the Federal Audit Clearinghouse or other audit/financial information and validating indirect and fringe benefit rates. They stated that their subrecipients are mostly other universities, and there were no subrecipients in their current portfolio designated as high-risk. Overall, NSF staff were pleased with UVI's responses to the questionnaire, as well as the depth and breadth of knowledge of NSF policies and Federal regulations that they demonstrated throughout the vRSV.

Accounting System Changes: UVI stated there have been no major changes to the Banner Accounting system outside of software updates and that they consider the system to be working as intended. UVI also mentioned plans to implement a module for management and application of indirect costs (F&A) in the future. Given application of indirect cost rates is often the basis of audit findings under audit reports conducted by the NSF Inspector General's office, implementation of the module could be helpful in avoiding errors and overcharges to NSF and other federal awards.

Recommendations:

- 1) Update UVI subrecipient/subaward policies and procedures to include a requirement to verify and maintain documentation of subrecipients' IDC rates and allocation base prior to issuing subawards.

- 2) Ensure the UVI Banner IDC module works as intended prior to going live.
- 3) Request that the UVI Single Auditor add notes to the financial statements whenever a major change or implementation to the accounting system is performed.

Additional Notes:

The Resolution and Advanced Monitoring (RAM) Branch checked its system for the most recent advanced monitoring activity conducted for UVI and found that a desk review was performed in 2016. Since it has been six years, to ensure NSF has current data on the UVI accounting/financial systems, controls, and general management structure, a desk review has been scheduled and a letter notifying UVI of the review will be sent if it hasn't already. UVI has done nothing wrong and in fact, based on the meeting with UVI representatives on March 16, 2022, RAM believes the controls described as being in place can prevent non-compliances, if consistently applied and adhered to. RAM also reminds UVI and program that advanced monitoring activities are part of the business assistance provided to awardees by recipient to ensure stewardship over federal funds.