FROM RIDGE TO REEF A Series of Articles Written by the **2023 DCRM Summer Interns** Issue No. 1 of 8 www.dcrm.gov.mp

The Mystery of Non-Point Source Pollution JUDE LITULUMAR

"Small actions bring big change." A phrase that I thought was so broad until entering the 2023 DCRM Summer Internship Program. As a Non-Point Source (NPS) intern under the Division of Environmental Quality's Water Quality Surveillance & Non-Point Source Branch, I learned that the things that we do to our environment can contribute to bigger issues we thought were out of our control.

NPS is an umbrella term that refers to the pollution of our waters from a non-specific source. This occurrence in the CNMI can be caused by rainfall, which fathers pollutants from a variety of sources and diffuses them into our water sources (streams, lakes, beaches, etc.). "Non-point source pollution is the major cause of impairment of US surface waters" (Science Direct). Impaired waters can harm wildlife habitats, prevent recreational use of our waters, introduce illnesses and ailments, and can also affect our food supply. Some food our communities frequently eat, like fish, can be exposed to toxic chemicals in the impaired waters, which will eventually spread to humans after consumption. NPS pollution is not easily fixable, but can be dealt with to lessen the severity of its impacts.

The main focus of my project is the storm drains around Garapan. With assistance from the Department of Public Works, we were able to monitor and replace storm drain guards at selected storm drains in the Paseo de Marianas area. These guards, established in 2021, held back sediment and debris from entering and potentially blocking the drainage. In addition, I created graphs on Microsoft Excel with data ranging back to 2011 to



measure the impacts of the newly installed storm drain guards and how effective it is when it comes to preventing debris from entering the ocean. Outreach was also a big part of my project as I presented to the local youth and developed an infographic that best informs others about NPS pollution. Since this type of pollution affects everyone, I hope that my project would spread awareness on the impacts of NPS pollution.

Through this internship, I learned that mindfulness paired with initiative is a powerful thing. Simple things like picking up after yourself or cleaning out your septic tank every five years ensure that one less source of pollution will enter our precious bodies of water. Although NPS pollution is a difficult problem to resolve, I am confident that if everyone does their part, our water will be cleaner, safer, and better.

Baker, Lawrence A, et al. "Introduction to Nonpoint Source Pollution in the United States and Prospects for Wetland Use." Ecological Engineering, 3 Mar. 2003, www.sciencedirect.com/science/article/abs/pii/092585749290023U.

Color Your Way Through the CNMI's Waters **BRIGIT TABUENA**

the Bluespine Unicornfish around the CNMI's nearshore waters! Grab your crayons and engage in some fun activities to learn more about the CNMI's coral reefs, seagrass beds, mangrove forests, initiatives to restore coastal health, and methods to save our marine environment with Bino!

National The Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management provides learning resources that are tailored to address national and regional priorities and efforts that assist in building local capacity, among others. This summer, I had the opportunity to create a fun and educational coloring book containing CNMI-specific information that will be added to our region's resource toolbox, funded by NOAA. The creation of this coloring book allows for more up-to-date materials to be distributed throughout the CNMI and across the region and nation, teaching children about 7 years old and above about the importance of the CNMI's marine ecosystems and ways to protect them.

In order to complete my project, I brainstormed fun

Nothing's more fun than an adventure with Bino activities and a story line that would attract the young audience. I also took the time to go around to other programs under the Division of Coastal Resources Management (DCRM) to compile important information and image references that should be spread to the community regarding coral reefs, marine life, and ecosystems. I worked alongside my mentor, Janice Castro, DCRM programs and NOAA members to create a coloring book that the CNMI will hopefully be proud of. In the internship, I got to experience shoreline monitoring, rain garden restoration, and beach clean-ups, all of which allowed me to visualize what to put in my coloring book. All of this was done in the DCRM office with just an iPad, Procreate, Canva, and creative input from anyone willing to contribute! You can grab a complete copy of the coloring book at the Bureau of Environmental & Coastal Quality's DCRM office to see the results for yourself!

> Providing a CNMI-focused coloring book to the world and mostly to the CNMI will educate our vouth about marine life and coastal zones and hopefully inspire them to step up and make a difference. Teaching others about our coastal



resources is important because "Recognition, understanding and appreciation of the various goods and services provided by coastal ecosystems" link to human health and sustenance (Lakshmi 1). Therefore, the more people educated, the more aware we will be, the more initiative we will take, the healthier we will be!

Lakshmi, Ahana. "Coastal ecosystem services & human wellbeing." The Indian journal of medical research vol. 153,3 (2021): 382-387. doi: 10.4103/ijmr.IJMR 695 21

FROMRIDGE A Series of Articles Written by the 2023 DCRM Summer Interns Issue No. 2 of 8 Issue No. 2 of 8

The CNMI is surrounded by an array of beautiful, vibrant coral reefs; they are a vital aspect in our islands because they provide a safe place for fish to live, protect our coastlines from damaging tides and erosion, and provide jobs and sustenance for local communities. As islanders, one of our main food sources comes from our ocean. Growing up, I liked to spear fish and wouldn't stop until I caught a fish. I didn't care if I missed and hit the coral. My mind was set on catching fish. But as I got older, I learned more about coral and its adaptability, functionality, and importance to our coastal and terrestrial areas. I grew a passion for our coral reefs and at a young age decided that I wanted to become a marine biologist.

Learning about this internship was a turning point for me. I was given the opportunity to be a part of the 2023 cohort. I can say with pride and joy that this summer I interned at the Division of Coastal Resources Management's (DCRM) Coral Restoration Program with the guidance of my mentor, Jordan Suel, Coral Restoration Technician.

My colleagues and I participated in various field days such as lagoon surveys, coral bleaching surveys, and coral restoration. A few of the projects I worked on include monitoring and gathering footage of algae

Growing Coral and A Passion FRANKLIN PANGELINAN



growth in the coral nursery, documenting and inspecting growth from coral I fragmented, and uploading photos and videos of our field work onto social media.

"Coral reef restoration is not the same as forest restoration as its success is not always guaranteed because of insufficient knowledge of coral biology" (Omori). Our coral nursery is dominantly made up of the acropora species. Although the acropora species are more susceptible to bleaching, they are fast growing coral and are more resilient than others. On one of our trips to the nursery, I was able to fragment live coral and place them on two of the coral trees. This experience was like no other. Being able to do what most people might never get the chance to do is a privilege. This internship has taught me so much and I highly recommend anyone interested in the marine sciences to apply. I'm grateful for the opportunity to learn and participate in hands-on field work and online data analysis. This internship only encourages me more to pursue my dreams of becoming a marine biologist.

Makoto Omori (2019) Coral restoration research and technical developments: what we learned so far, Marine Biology Research, 15:7, 377-409, DOI: 10.1080/17451000.2019.1662050

"Well" Calculated Measures PATRICK SANTOS, JR.



Did you know that practically all of Saipan's drinking water comes from the ground? According to the U.S. Department of Interior and U.S. Geological Survey Agency, groundwater is Saipan's "primary source of municipal water" and provides about "8-10 million gallons per day (Mgal/d) for the island's municipal water supply" (Mitchell et al., 2019). This groundwater is made accessible to Saipan residents through the use of wells that pump the water into the island's public water systems.

The Safe Drinking Water Program (SDWP) under the Bureau of Environmental & Coastal Quality's (BECQ) Division of Environmental Quality (DEQ), is responsible for the monitoring and observation of these wells. The department works closely with the government sector, private businesses, and with public water systems to ensure that the wells' operation and sanitation are maintained at a certain standard.

Throughout this internship, I had the pleasure of working with SDW Environmental Specialists Austin Flores, Glenn Arriola, Audrey Castro, and Loy Atalig, as well as my mentor, CDR Travis Spaeth, PE. As an intern, I was involved in the data collection and input of well water quality into the Direct Implementation Management Environment (DIME) database and conducted sanitary surveys.

Sanitary surveys are water system inspections that go over all system components, including wells, to determine whether its systems are maintained and operated properly. The inspection ensures system component work, water treatment is adequate, and is protected from any possible areas of contamination of the well's water quality.

Most importantly, I was tasked to use the collected information from these monitoring events into mapping the water wells and water quality using online ESRI ArcGIS. With the compiled data of the well parameters exported from the DIME database, I went through the process of sorting, cleaning, and forming formulas with the data in a Microsoft Excel spreadsheet for several iterations. Once completed, I uploaded it into ArcGIS as a mapping layer for the wells' geolocation and analyte levels.

Through the visualization of both the current and previous data displayed in ArcGIS, I set it up to present a graph of certain parameters chosen and its level trends dating as far back as the early 2000s. It also displays areas with wells that may have high concentration of certain contaminants. The results of this project will perform as a start-up for an advancement in project prioritization to take action towards minimizing and fixing the quality of water for the public water systems on the islands.

Mitchell, J.N., Presley, T.K., and Carruth, R.L., 2021, Groundwater conditions and trends, 2009–19, Saipan, Commonwealth of the Northern Mariana Islands: U.S. Geological Survey Scientific Investigations Report 2020–5129, 51 p., https://doi.org/10.3133/sir20205129.



An Ecosystem in Danger of Extinction GRACE CHOI



Coral reefs are one of the planet's oldest, diverse and most valuable ecosystems. Although they have survived the extinction of dinosaurs and the climate changes of the ice age, they are currently in danger of extinction. Living coral coverage worldwide has declined by half since the 1950s (Eddy et al., 2021). It is of vital importance that we protect and restore our coral reefs here in the CNMI.

Coral bleaching is the most obvious visual indicator of climate change in the marine environment. Corals have a mutually beneficial relationship with an algae called zooxanthellae, one cannot survive without the other. The algae lives within coral tissue and gives corals their bright colors. When there are changes in environmental conditions, such as increases in temperature, corals will

become stressed and expel the algae, causing them to bleach,

turning completely white. Corals can survive a bleaching event only if conditions quickly go back to normal.

This summer I had the opportunity to work on the development of CNMI's Coral Bleaching Response monitoring protocol, under the Division of Coastal Resources Management's (DCRM) Coral Reef Initiative. My mentor, Elly Perez, is a NOAA Coral Fellow working to establish a protocol to assess and understand how bleaching events affect coral reefs in the CNMI.

The most recent and severe bleaching event in the CNMI occurred in 2017. At the time, there was no plan in place to help guide assessments of damage and little to no public information disseminated to raise awareness of the event. CNMI's bleaching response plan will not only outline strategies for prediction, assessment, and informing the public about coral bleaching events, but will also help produce management recommendations for conserving CNMI's coral reef resources.

Throughout the summer, Elly and I went to various long-term Marine Monitoring sites in Saipan to conduct Rapid Visual Bleaching Assessment (RVA) surveys. Testing and evaluating these new survey methods are crucial in maximizing effectiveness of response actions and will help ensure the efficient use of resources.

A side project I worked on with my mentor was creating a Coral Identification Guide of the common corals in the Marianas. One of my favorite parts of the internship was being able to incorporate my hobby with work. I was able to use DCRM's camera to take photos of coral to later identify them. Some of the photos I took out in the field were used in the guide that we created for those who need help identifying corals for future surveys.

All in all, being a summer intern at DCRM has been an unforgettable experience where I have learned a plethora of things from experts while meeting new people.

Eddy, T. D., Lam, V. W. Y., Reygondeau, G., Cisneros-Montemayor, A. M., Greer, K., Palomares, M. L., Bruno, J. F., Ota, Y., & amp; Cheung, W. W. L. (2021). Global decline in capacity of coral reefs to provide ecosystem services. One Earth, 4(9), 1278–1285. https://doi.org/10.1016/j.oneear.2021.08.016

Seas to Sips: Unraveling the Mysteries Within Our Waters

In the heart of the laboratory, a collection of scientific studies plays out, driven by a passionate commitment to the environment and public health. At the Bureau of Environmental & Coastal Quality (BECQ), scientists embark on an essential mission to safeguard our shores and ensure the purity of our drinking water. Being part of a coastal community, we experience first-hand the effects of climate change. How does climate change affect our waters, you may ask? As a summer intern working under the Division of Environmental Quality's (DEQ) Environmental Surveillance Laboratory, I had the experience to witness what is truly in our waters. Now let's take a closer look!

During my time as a summer intern, I have come to understand that precision plays a crucial role within the lab. When procedures are not properly followed, results come out inaccurate. The DEQ lab is divided into two sections: the chemistry section and the microbiology section. In the chemistry section, we test conductivity, turbidity, and Nitrite levels, among others. In the microbiology section, we examine marine and drinking water for enterococcus bacteria, total coliform, and E. coli bacteria. Testing our water is important for a

FRANCINE ALBUEN



variety of reasons as it helps us to understand and monitor the quality of water sources, protects the public's safety, and ensures the availability of clean and safe water.

In an article titled, "Water Quality & Testing," it states that "even though water supplies are considered to be among the safest in the world, water contamination can still occur. There are many possible sources of contamination, including: local land use practices (fertilizers, etc.), sewage releases, and much more." This represents a call for action, encouraging readers to recognize the nature of changes in water quality and the importance in preserving both the environment and human health.

All in all, my time as a lab intern has taught me one major thing: precision is key. I've learned that even the smallest factors can have a significant impact. The worked I've done this summer has led me to one question: What can we do to change the way we treat our environment and what can we do to protect our island's beauty for future generations? As an aspiring chemist, I'm determined to create change for our community, and hopefully establish a sustainable and resilient future for our island and generations to come.

[&]quot;Importance of Water Quality and Testing." Centers for Disease Control and Prevention, 28 Oct. 2020, www.cdc.gov/healthywater/drinking/public/water_quality.html. Accessed 14 Aug. 2023.

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Bringing More Life to Our Coastlines JESSE ATALIG

FROM RIDGE TO REEF

Before the summer started, I was looking forward to becoming a potential intern for the Division of Coastal Resources Management (DCRM) Summer Internship Program. As time went on, I got accepted and discovered that this internship was not what I expected it to be.

I was placed in DCRM's Coral Reef Initiative (CRI) Watershed Management branch with the guidance of my mentor, Zachary Williams, Watershed Coordinator. The main project for this internship was to build a mangrove nursery and bring three extirpated (locally extinct) mangrove species back to Saipan, while making a safe habitat for mangroves to grow. The mangroves returning to Saipan are *Rhizophora Apiculata* (tall-stilt mangrove), *Rhizophora mucronata* (loop-root mangrove), and *Lumnitzera Littorea* (black mangrove). This was exciting because these species of mangrove have been extirpated from Saipan for 1,500 years. There was a lot of hard work put into this project and I learned so much along the way about mangroves and their importance in the CNMI.

Mangroves are unique species of trees adapted to saltwater, and are found in coastal environments throughout the tropical world—including Saipan.

Commonly seen mangroves on Saipan are the *Bruguiera Gymnorrhiza* (oriental mangrove) and *Pemphis Acidula*

(small-leaf mangrove). They hold great importance in our ecosystem by providing habitats for a multitude of species and protecting our coastlines from erosion. Research has shown that mangroves can provide shoreline protection through their complex roots and branches, reducing 66% of wave energy across 100-meters of forest width (Mclvor *et al.* 2012). By doing so, our mangrove forests preserve our beach communities, like Tanapag Village.

With aid from the National Park Service and Kupu Program interns at American Memorial Park, we were able to set up a nursery located along the coastline within the park. The nursery was built with t-posts, PVC pipe, shade cloth, and other materials with an area of 60 by 30 feet. It was set up with the idea of being easily dismantled in case of a typhoon. At least 500 propagules of each of the mangrove species will be planted in the nursery, with extirpated species being imported from Guam.

The internship opened my eyes to how mangroves aid by protecting us and the environment. We have come a long way in this project. From building the nursery to getting the propagules, this journey made me realize I'm contributing to something bigger than



myself. The nursery will help increase the population and diversity of mangroves on Saipan, bringing more life to our coastlines and mudflats.

McIvor, A.L., Möller, I., Spencer, T. and Spalding. M. (2012) Reduction of wind and swell waves by mangroves. Natural Coastal Protection Series: Report 1. Cambridge Coastal Research Unit Working Paper 40. Published by The Nature Conservancy and Wetlands International. 27 pages. ISSN 20507941.

Gaining Knowledge to Sustain Our Endangered Wildlife ANIKA SNYDER



Many people, including myself, often forget how integral biodiversity is within the CNMI. The CNMI holds many endemic species that can be found nowhere else in the world and each of these species holds essential ecological and cultural value. While working as a Division of Coastal Resources Management (DCRM) intern with the Division of Fish and Wildlife (DFW), I had the opportunity to learn more about the unique and beautiful plants and animals found in the CNMI and work directly toward their conservation.

This summer, I worked on multiple projects aimed at the conservation and maintenance of our wildlife populations. I helped conduct public outreach and nest inventories to aid in conserving Green Sea Turtles (Haggan Bedi) and Hawksbill Sea Turtles (Haggan Karai). From there, I transitioned to surveying Saipan's bird populations. I aided in an ongoing project monitoring our population of endangered Nightingale Reed-Warblers (gå'ga' karisu) as well as aiding in monitoring the general bird populations on Saipan using visual and audio surveys. Finally, I worked with the fisheries data, where we surveyed and interviewed fishermen to gain more knowledge on the CNMI's fish stocks.

A large part of my project was centered around

creating a banner informing the public of the endangered and threatened species within the CNMI. A lot of work within the Wildlife sector of DFW is invested in conserving the populations of our endangered endemic species. However, much of this work goes unnoticed by larger public because the knowledge of our threatened species is not readily available. Our banner was made to bring public awareness to the important species currently at risk of extinction to engage the public in everyday conservation. The CNMI relies on all endemic species to complete valuable ecosystem services that benefit both the overall environmental health of the islands and the people living within them. To sustain and grow our endangered species, everyone needs to invest and engage in their conservation, and knowing which species are threatened is the first step.

This internship has allowed me further to understand the importance of conservation, specifically within the CNMI. The knowledge, experience, and passion I have gained this summer will follow me throuhgout my life and help guide me toward a career in conservation.

Katili, A. S., & RAHMAT, A. (2020). Biodiversity literacy in science education for biodiversity conservation. International Journal of Innovations in Engineering Research and Technology, 7(05), 31-35.



Protehi l Machålek Na Lina'la BRANDEE HUNTER

The Commonwealth of the Northern Mariana Islands (CNMI) is not just an archipelago of beautiful islands and pristine beaches; it is a home to the endangered plants and wildlife that play an integral role in both the cultural heritage and delicate ecosystem of our islands. Many of these endangered species are not only extremely significant to our land but also to our identity and sustainability. This summer I had the opportunity to be a part of the Division of Coastal Resources Management (DCRM) Summer Internship Program as an intern at the Division of Fish and Wildlife (DFW) and was able to connect to the endangered species that have been woven into stories, traditions, and ceremonies for generations, embodying the spirit of resilience and harmony with nature that is at the heart of the CNMI.

I was given the opportunity to work on a variety of projects, beginning with monitoring Green Sea and Hawksbill Turtles around Saipan, assisting in outreach to spread awareness, and eventually helping hatchlings to shore. I also assisted in breeding bird surveys, where we calculated the population of birds in several areas, specifically focusing on the endangered Nightingale Reed-Warbler. I then assisted in inshore and offshore fishing surveys, as well as the Saipan International Fishing Tournament, where I collected data on local fish and how they contribute to the health and balance of the ecosystem here in the CNMI. I also helped conduct vegetation surveys, where



I learned the importance of our unique limestone forests and how they play a crucial role in how our endangered species are protected by the rich biodiversity of the habitat, contributing to the conservation of these vulnerable plants and animals.

After gaining knowledge on the importance of endangered wildlife to our natural heritage, I worked on creating a banner that displays all endangered and threatened species here in the CNMI. Through this project, I am helping to educate the community on the conservation of our wildlife in order to protect the unique biodiversity and the role of these species in our local ecosystem.

Overall, protecting our endangered wildlife in the CNMI is not just a matter of conservation; it's an investment in our environment, economy, culture, and well-being. Our particular plant and animal species must be protected and not conflict with our society's cultural heritage, as we continue to face the challenges of modernization and environmental change (Terborgh 1976). By safeguarding our wildlife, we can ensure a sustainable future for its natural resources and our communities.

John Terborgh ,Island Biogeography and Conservation: Strategy and Limitations.Science193,1029-1030(1976). DOI:10.1126/science.193.4257.1029

TacTacTasi tyrik basa

Buenas yan hafa adai! This summer I had the opportunity to intern under the Division of Coastal Resources Management's (DCRM) Marine Monitoring Team (MMT), under the guidance of my mentor, Rodney Camacho, Lead Biologist. The scope of my summer project is to inform the public about the different species that live in our lagoons, and the many ways in which we can keep our reefs safe. There are many negative impacts that people have on the reef including littering, oil and chemical spills, debris from road construction, and overfishing, among others.

A popular fish that locals tend to eat and enjoy is parrot fish, or palaksi. What most people don't know, however, is that parrot fish play a significant role in our coral reef ecosystem. They are a main contributor to cleaning our reefs by eating excess algae, which helps the corals stay bright and healthy.

Throughout the summer I conducted reef and seagrass surveys in our lagoon in order to collect data on the number of species within our marine ecosystem. The collected data is used to determine what we can do to improve resource management strategies. The data is also used as a way to determine whether or not the water quality is sustainable for the species that reside in this ecosystem.

The tools used to complete these surveys are data sheets, a plastic



clipboard, a pencil, mask, snorkel, transect about the different species of marine life in lines, quadrats, and diving fins. about the different species of marine life in our waters. The reef helps protect our

The work that we do in the MMT program is important because we can use the data that we've collected to help preserve and protect our reefs for future generations. This data also keeps the public informed about the different species of marine life in our waters. The reef helps protect our island and keeps it beautiful, so we should put in the same efforts to help protect it, too. We should all work together to make the world a better and cleaner place and keep it that way for generations to come.



The CNMI's Voice in Federal Decision-Making where ALEXANDER TUDELA websi

"To preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone" – that is the goal of the Coastal Zone Management Act (CZMA) of 1972.

The CZMA is administered by the National Oceanic and Atmospheric Administration (NOAA) and contains a particular provision that gives the CNMI a chance to speak up against certain proposed federal action(s) that will likely impact our coastal use or resources; this provision is called *federal consistency* and can be found under Section 307 of the CZMA. Federal consistency requires that certain federal actions that take place within or outside of the coastal zone that have reasonably foreseeable effects on any coastal use or resource, be consistent with the enforceable policies of the CNMI's coastal management program (CMP). The CNMI CMP is administered by the Division of Coastal Resources Management (DCRM) under the Bureau of Environmental & Coastal Quality (BECQ).

As a summer intern under DCRM's federal consistency program, I worked under the guidance of my mentor, Arthur (Art) Charfaurus, Coastal Resources Planner III, whom I have learned so much from. I was tasked to update



and redesign DCRM's Federal Consistency Procedures Guide and ensure that the document is 508 compliant. The purpose is to establish accessibility of the document and include updates from NOAA. The guide is mainly for federal agencies and those conducting federally funded activities or needing to acquire a federal license/permit. It is an online pdf posted on the DCRM website to be publicly available to anyone interested in learning more about federal consistency. I primarily used Canva to accomplish all design elements of the guide, google sheets to organize the CNMI's enforceable policies and accessed an online color contrast tester and multiple pdf's to guide me in establishing 508 compliance.

Overall, redesigning and updating DCRM's federal consistency guide is essential in ensuring federal agencies are equipped with the necessary information to be consistent with the CNMI's enforceable policies. Federal consistency gives the CNMI a voice or a say in projects conducted and/or funded by federal agencies within/outside our coastal zone that can have reasonably foreseeable effects to our coastal resources. Traditionally, federal policy permitted federal agencies to conduct their activities haphazardly, not considering the use of a state's land or water resources (Brewer, W. C., 1976). It wasn't until the enactment of the CZMA and its federal consistency provision that a pretty radical change was made in traditional federal policy.

Brewer, W. C. (1976). Federal consistency and state expectations. Coastal Zone Management Journal, 2(4), 315–325. <u>https://doi.org/10.1080/08920757609361720</u>



Managing the Dynamic Nature of Coastal Areas MADISON SABLAN

As an intern at the Division of Coastal Resources Management (DCRM) under the Shoreline Monitoring Program, I've learned so much throughout the summer. With the guidance of my mentor, Mary Fem Urena, I learned how to monitor our beaches in Saipan using survey-grade tools such as the berger method and total station. Ashton et. al (2007) stated, "recently, big improvements in technology have improved the capabilities to investigate processes and sedimentary deposits in the coastal zone, allowing us to address some of the problems involved in shoreline change." Our shorelines naturally change throughout time. However, with storms that drive high wave energy onto our shores, it raises a big concern for beach loss. That is why we use the berger level as a great method to measure our shorelines. To use this technique, we must first locate the headstake and then place a transect line from the headstake to the bottom of the beach toe. We then set up the tripod, making sure it is secured and calibrated. The elevation difference using the telescope is then determined using a rod. After gathering the data, we enter it into Microsoft Excel and generate a beach profile, which provides a clear depiction of the changes occurring in our shorelines and how they alter over time.

An unhealthy shoreline is one that has been degraded, polluted, or has lost biodiversity. Because of human activities—such as improper waste disposal, urban development, or industrial pollution—it may have eroding or contaminated soil, diminished vegetation, poor water quality, and limited aquatic life. It can result in an increase of erosion and the amount of bad nutrients that can enter the water. However, a healthy one prevents soil erosion, reduces impacts of flooding, helps maintain clear water, and much more. A healthy shoreline has the ability to recover and stabilize. Before starting this internship, I was clueless on the importance of our shorelines. Now I see why shoreline monitoring is crucial for understanding and managing the dynamic nature of coastal areas. Shoreline monitoring helps address erosion, assess hazards, adapt to climate change, protect ecosystems, manage resources, and guide policy development, ultimately contributing to the sustainable and resilient management of coastal environments.

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The Bridge Between Land and Sea SAMANTHA LISKE-CLARK

Shorelines are the point of connection between our community and the coral reef ecosystem that is so essential to our economy and way of life. This summer, I had the opportunity to study our beaches under the Division of Coastal Resources Management's (DCRM) Shoreline Monitoring Program. One of our project goals for this summer was to investigate erosion on Mañagaha.

Despite the protection of the barrier reef, Mañagaha's shoreline has been changing shape for several decades. In 1996, WWII debris on the east and southeast of Mañagaha was removed, as it posed safety concerns to visitors. Since then, Mañagaha's east and southeast shorelines have experienced significant erosion (losing sand), while the sand dune on the north shore has been steadily accreting (gaining sand). As of 2007, Fletcher et al. stated that Mañagaha "may still be in the process of stabilizing since the disruption of 1996". Whether the shoreline is stabilizing or not, such changes can negatively impact those relying on Mañagaha. The pristine beaches that visitors use for recreation are quite literally washed away, harming the livelihoods of those working on Mañagaha. Moreover, the erosion of the south eastern shoreline has damaged the nesting habitat of wedge-tailed shearwaters (Ardenna



pacifica). Mañagaha is the only nesting site for shearwaters in the CNMI.

With so many depending on them, DCRM's Shoreline Monitoring Team was eager to assess these critical shorelines. I assisted in conducting island-wide land surveys. We measured the elevation along eight transect lines that run perpendicular to the waterline. This allows us to generate cross-sectional models of the shoreline at each of the eight sites. That is to say, we can visualize the shape of the shoreline and see where it is gently sloping and where it is steep. When we compare present-day cross-sections to those collected in years past, we can observe changes to the shape of the shoreline and determine whether erosion has occurred.

Our preliminary results suggest that the southeast shore of Mañagaha continues to erode, and the northern sand dune continues to grow. The information we collected will inform future efforts to preserve the natural beauty of Mañagaha, from the foreshore's white carbonate sand to the backshore's stabilizing forests. This internship has allowed me to see first-hand how diligent monitoring is essential to well-informed management decisions that conserve our shorelines for future generations.

Fletcher, C.H., Barbee, M., Dyer, M., Genz, A., Vitousek, S., 2007. Mañagaha Island Shoreline Stability Assessment, Report to the Coastal Resources Management Office, Commonwealth of the Northern Mariana Islands, Saipan, 90 p.

Leaving A Digital Footprint for Future Generations REMEDIO DELA CRUZ

When you think of education and outreach, you think of school presentations or translating scientific data into a more simplified version. However, it is much more than that. Education and outreach creates an impact on everyone. It is not only our responsibility as residents of the CNMI to take care of our environment, but it is also the responsibility of our visitors from across the world. Our actions affect our environment and spreading that awareness to everyone is what distinguishes education and outreach.

This summer, I was blessed to be able to capture the beauty of our natural resources and gain knowledge of the different conservation projects happening in the CNMI. The 2023 Summer Internship Program hosted by the Division of Coastal Resources Management (DCRM) has allowed me to use my creative thinking skills as an intern under DCRM's Coastal Zone Communications section. My summer project was to design and create outreach materials such as an educational coloring and activity book with a ridge-to-reef concept, stickers, and various social media posts showcasing the multitude of projects and efforts being done by DCRM, to help our community understand the importance of preserving our island's natural resources and environment.

"Human-mediated environmental changes have resulted in appropriate concern for the conservation of ecological systems and have led to the development of many ecological monitoring programs worldwide" (Nichols,



Williams, 2006). Our influence created a massive surge of diverse programs throughout the world. Examples include the Marine Monitoring Program and the Shoreline Monitoring Program under DCRM. I had the opportunity to work closely with the interns in these programs to highlight their work through social media, where the community is able to gain insight into the heavy-duty fieldwork being done by DCRM staff. In this day and age, social media is an essential outlet to get your message across and to leave positive digital footprints for future generations.

Nichols, J. D., & Williams, B. K. (2006). Monitoring for conservation. Trends in ecology & evolution, 21(12), 668-673.

FROM RIDGE

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Helping Our Island Flourish TAMISHA SABLAN

As the granddaughter of a marine biologist, I come from a family who taught me the importance and beauty of our environment from a young age. It always made me set on working in the environmental field. Once I heard about the Division of Coastal Resources Management's (DCRM) Summer Internship Program, I jumped straight on the opportunity. I was hoping it would give me a better insight into the environmental field and it did just that and more. This summer, I had the opportunity to intern under DCRM's Shoreline Monitoring Program. In addition to conducting shoreline monitoring, I was given the chance to see the coral nursery, learn more about mangroves, see the laboratory in full action, and many more great experiences.

As a shoreline intern, I saw firsthand how our beautiful island is slowly losing its shoreline due to erosion, climate change, and human activity. My mentor, Mary Fem Urena, my fellow shoreline interns, Madison Sablan and Samantha Liske-Clark, and myself have been making our way from the



south to the north beaches of Saipan, and even Mañagaha, measuring the shoreline change. It wasn't always easy. Many factors came into play such as the weather, transportation, participation, etc., but in the end, we managed. We used two types of measuring equipment while conducting shoreline monitoring. The first one is called the Berger level. "The Berger levels are the... the transit-level. This instrument is a combination instrument. The telescope turns not only sideways, but also up and down. This valuable feature enables you to determine if a wall is perfectly plumb, to run straight lines, and to measure vertical angles." (Berger-Engineering Supply). The second one is called the Total Station Method. It "measures angles and distances electronically and processes trigonometrically to give us, at a minimum, position coordinates in space" (leica-geosystems.com). AFter we measured all our headstakes at each beach, we would enter the collected data into a spreadsheet, then plotted them into a graph. The graph will show which areas are either losing or gaining sand.

Shoreline erosion is critical and should be widely known in our islands. Being a DCRM intern has opened my eyes to many environmental issues. I hope my article reaches the general population and intrigues them to learn more and enter the environmental field so we can help our islands flourish together.