FROM RIDGE TO REF



A Collection of Articles Written by the 2022 DCRM Summer Interns

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BERGERS, BEACHES, AND BERMS

ANDREA ROBERTO DCRM SHORELINE MONITORING

In a 2014 article published by the Ghana Journal of Science and Technology, it was reported that the coastline area of Nkontompo was eroding at a rate of 2 meters per year. This erosion led to the eradication of approximately 117 buildings within the coastal community, as well as the diminishment of one third of its developed region (Olympio & Amos-Abanyie, 2014).

Despite being in a different ocean territory, the CNMI is in danger of the same threat. According to the Division of Coastal Resources Management (DCRM) 2018-2021 Shoreline Profile Monitoring Report, 18 of Saipan and Managaha beach transects are exhibiting signs of erosion.

As an intern under the DCRM Coastal Resources Planning Section, I conducted beach surveys and collected data the program uses to analyze risks and changes our coastal zones undergo. The data allows the program to aid coastal stakeholders in creating informed decisions. This data is also used to create a story map through ArcGis, an interactive tool that allows coastal planners to portray the physical characteristics of our shorelines for our community.

The main segments of the 2022 Shoreline Monitoring Story Map are images and "beach profiles" taken from surveys. Beach profiles are created using shoreline data (recorded using the Berger Level method) such as elevation, vegetation, weather, and tide. This data is inputted and analyzed using Microsoft Excel, and then used to curate a visual representation of a beach's shoreline. A typical beach profile portrays the following characteristics of a shoreline's anatomy: vegetation lines, wracklines, waterlines, moats/toes, drops, and berms. Beach profiles also include information about a shoreline throughout multiple years, allowing viewers to see changes and trends it went through over time.

Olympio, G. F. A., & Amos-Abanyie, S. (2014). Effects of shoreline erosion on infrastructure development along the coastal belt of Ghana: Case of nkontompo community. Journal of Science and Technology (Ghana), 33(3), 39. https://doi.org/10.4314/just.v33i3.5

EXPLORING SAIPAN'S TROPICAL FORESTS

JARREL SABLAN DFW WILDLIFE SECTION

This summer, I had the opportunity to participate in the Division of Coastal Resources Management (DCRM) Summer Internship Program under the Division of Fish and Wildlife's (DFW) Wildlife Section. The wildlife section works to conserve and manage our island's terrestrial resources through a variety of locally and federally funded projects. The majority of the federal funding comes from the Wildlife Restoration Program of the US Fish and Wildlife Service.

Throughout my internship, I assisted in various projects in the Saipan Upland Mitigation Bank (SUMBA) under the guidance of Emilie Kohler, DFW Wildlife Biologist. The SUMBA provides a species reserve (protected area) for the federally and locally listed endangered Nightingale Reed-Warblers, or gåga karisu. Development that impacts the habitat of this species elsewhere can be mitigated through the purchase of credits to protect breeding pairs of birds in the protected area. Some of the projects I was involved in were vegetation surveys, land surveys, bird surveys, camera trapping, and Nightingale Reed-Warbler surveys. However, our main focus was the vegetation surveys.

The purpose of the vegetation survey was to determine the proportion of different habitats in the SUMBA for the Nightingale Reed-Warblers.

The survey area consists of 19 transects and a total of 89 stations. The tools needed for the survey include a GPS device, meter tape, DBH tape, compass, clinometer, orange/pink flagging, batteries, markers, pencils, backup paper survey, and a first aid kit.

We collect data on vegetation structure, and complexity within 10-meter x 10-meter plots centered around the transect station oriented, so corners are pointed to the North, East, South, and West cardinal directions and flagged with orange tape. In order to identify tree and shrub species, I was supported by reading materials such as the Common Flora and Fauna of the Marianas and the Trees and Shrubs of the Mariana Islands.

We then measure every tree and shrub using diameter at breast height (DBH) tape. A DBH tape determines if a tree or shrub is a stem - if it falls under a 5cm diameter. After every tree and shrub is identified and measured, we then calculate the percent slope using a clinometer and compass for the aspect. The last step is to record vegetation strata height (canopy, shrub, and herbaceous). Data collected will be analyzed to categorize the vegetation within the SUMBA, inaugurate habitat associations, and produce population values for the sampled bird species. Overall, my experience with this internship was amazing. I've learned several things such as the ongoing wildlife conservation and management efforts. I highly recommend this internship to all nature lovers.

Vogt S. & Williams L, Common Flora and Fauna of the Marianas; 2004. Lynn R. & Rinehart A., The Trees and Shrubs of the Mariana Islands, 1992.



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To many people, including myself, the definition of "home" is the Northern Mariana Islands. Beyond our islands, we fish from and enjoy an ocean that boasts a wide variety of marine species. The CNMI coastal zone has abundant beautiful

DON'T COMPLAIN, JUST COMPLY

ROSS ARRIOLA DCRM PERMITTING & ENFORCEMENT

resources from the ridge to the reef. In an effort to protect these resources, the Division of Coastal Resources Management (DCRM) mandates that people apply for permits. These permits are intended to aid with developmental projects and minimize their effects on the environment, including reducing the influences of the environment on these projects.

As a resident of the CNMI, I have witnessed significant changes to our environment, particularly the development of new infrastructure. Through this internship, I gained an understanding of the permitting process and awareness of developmental impacts on our island.

During my first internship with DCRM in 2021, I acquired an understanding of our environment and its natural resources. From this, I was able to apply to and secure an internship opportunity with a non-governmental organization called Friends of the Marianas Trench (FOMT). Under its extension program Project HOPE (Healthy Oceans and People Empowerment), I interned as an education and outreach volunteer. Working with professional environmentalists at DCRM also enabled me to apply my experiences and knowledge to my studies at the Northern Marianas College (NMC) as I pursue a higher education in Natural Resources Management.

As a second-year intern, I was given the opportunity to assume a role in DCRM's Permitting & Enforcement section. There are three different permits issued by DCRM: A *Temporary Permit* - issued for emergency repairs before or immediately after a natural disaster; An *APC Permit* - required for all non-major developments that is located in, or may have adverse impacts to, an Area of Particular Concern; and a *Major Siting Permit* - required for all major developments, uses or activities that have the potential to significantly impact coastal resources.

As an intern, I was tasked to create a short film to inform people of the importance of proper development to lessen the impacts on our diverse environment. With the help of my mentor and the Permitting & Enforcement team, I captured many different clips of the environment and created a short film using Final Cut Pro.

PESTICIDE CONTROL, AWARENESS IS THE GOAL

Improper use of pesticide products can lead to many adverse outcomes, affecting public health and the environment from chemical contamination. Health effects range from skin irritation, allergic reactions, to more severe consequences such as cancer and lung disease. Environmental effects include contaminated water sources such as surface or groundwater through pesticide runoffs and leaching.

As an intern at the Division of Environmental Quality (DEQ) Pesticide Program, I took part in a DEQ pesticide storage inventory and market inspection. As a result, I became aware of misbranded products, which are mainly those that don't have US Environmental Protection Agency (EPA) registration numbers and English labels. EPA pesticide registration is important to ensure safe use of chemicals to prevent harm to human health and the environment. Additionally, DEQ storage and interceptions keep these products out of the CNMI because we never know if they contain deadly chemicals.

The inventory was needed for a project with EPA for proper disposal of misbranded pesticides, mostly confiscated from airports because tourists aren't aware of pesticide

MARIA CRUZ DEQ PESTICIDE PROGRAM

regulations in the CNMI. The products had to be translated to English, and I was tasked to note down active ingredients and percentages, product descriptions, quantity, and label language. This storage is important because it restricts access and secures the confiscated products. It also prevents spills and leaks, reducing exposure to the public. During the market inspection, we looked for misbranded products, shelf location within the market, and packaging conditions. Pesticides should be 10 feet away from soft packaged foods and 4 feet away from hard packaged foods. Packaging should also be in good conditions because damages can lead to leaks and contamination of other products.

From my experience, I've noticed the public lacks knowledge on proper pesticide use and storage. While this isn't uncommon, it remains a problem. According to Dugger-Webster and LePrevost, some users misunderstand, don't follow labels, and don't even



know pesticides are regulated. This brings concerns because they may not be aware of valuable information on exposure and risks, such as hazards/toxicity, signal words, precautions, preharvest intervals (PHI), personal protective equipment (PPE), etc. To address this, I created a quadfold on pesticides and food, its human health effects, and what can be done to raise awareness.

Being in the pesticides program has been insightful! I'm thankful for the opportunity to learn more about environmental issues and how they affect animals, resources, and human health.

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An ocean of abundance is what surrounds the Northern Mariana Islands. Beautiful and intricate corals make up our reefs and form the perfect homes for a diversity of wildlife to thrive. Our ocean and the life it holds is one of the most essential resources for the people, culture, and economy in the CNMI; this is why it is crucial to monitor and protect it for the interest of the present and future generations. "Monitoring methods are designed to detect trends" and "aim to determine whether the composition, structure and condition of an environment are changing over time or in response to a management intervention" (Geange et al.). This summer, I was given the opportunity to learn from DCRM's Marine Monitoring Team, whom we call the "doctors of our ocean."

The DCRM Marine Monitoring Team does a wide array of work ranging from lagoon surveys to coral restoration work. They are in charge of gathering and analyzing data on the health of all the marine ecosystems in the CNMI.

As an MMT intern, I had the chance to gain hands-on experience and learn from these professionals as I assisted them with a variety of activities. One of those activities was lagoon surveys; during this fieldwork, I helped gather data concerning seagrass, algae, and invertebrates along the transect lines on our lagoon's seafloor. Another activity I had the opportunity to be a part of was collecting and transporting a coral colony from the Smiling Cove Marina to the coral nursery.

Apart from these activities, I was assigned a project this summer to collect data regarding algal growth at the coral nursery. This project was possible by using zip ties to place

JUST BELOW THE SURFACE

KIANA CAMACHO DCRM MARINE MONITORING



cow tags on different branch levels on all six coral trees. The cow tags served as a surface area for algae to grow within a span of 3 weeks. Upon collection of the tags, I used lab equipment to determine the wet and dry weight of the algae that grew within that time frame. This project I carried out is the first round of data regarding how fast algae grows within the coral nursery; however, it will not be the last as the Marine Monitoring Team aims to continue to obtain this kind of data in the future. I am very grateful to have participated in the DCRM Summer Internship Program, as it was a great learning experience. Being a second-year intern, I can say that the experiences I had over the course of two summers have greatly sparked my interest in pursuing a career in the environmental field.

Geange, Shane, et al. *Introduction To Marine Monitoring.* 2016. Accessed 10 Aug 2022.



THE MOST IMPORTANT ELEMENT ON EARTH

JEFFREY SEO DEQ SAFE DRINKING WATER PROGRAM

How do we determine how to construct wells and maintain existing existing wells? By creating a map of all the existing wells in the CNMI using ArcGIS, we will be effectively able to analyze the geological data and determine which wells have more pure water and which have high levels of pollutants.

Throughout the course of this year's DCRM Summer Internship Program, I've had the privilege of working with Glenn Arriola and Austin Flores under the Safe Drinking Water Program at the Division of Environmental Quality, where we conducted sanitary surveys and assisted in the process of initiating a new well.

The purpose of sanitary surveys is to determine whether or not a particular well in the CNMI is being properly maintained when water is pumped from the aquifers and into the water tanks. It also helps us determine the water quality of aquifers in order to obtain information about the pollutants contained within the water. In addition, aiding other departments with the installation of new wells will provide us with information about the water toxins in a particular region. All of this will give aid in creating a geographical mapping of wells in the CNMI.

Why is it necessary to map the position of all the wells? According to the Geological Society of America, geologic maps can show how the physical environment has been impacted by human activity. Their understanding of issues important to society, such as natural hazards, climate change, economic development, sustainability, and management of soil and water resources is grounded in geologic maps.

By conducting sanitary surveys and the development of a new well, I was able to piece together how the entire process is set up and implemented. The aim of this is to demonstrate to the public that extracting water from underground is difficult work that requires particular procedures and a team effort. In addition, it is necessary to comprehend the CNMI's geography in order to determine the optimal locations for drilling wells and how to management them.

To conclude, this internship enabled me to comprehend the significance of safe drinking water and ground water management programs. The island's aquifers provide us with one of the most essential elements on earth: water. It is our responsibility to fully utilize these aquifers, as well as to strategically plan how we will pump water into our tanks in a clean and efficient manner. I am happy to be a part of this project and encourage others to pursue this field.

The Value of Geologic Mapping." The Geological Society of America,

Https://Www.geosociety.org/Documents/Gsa/Positions/pos3_ mapping.Pdf, Apr. 2022. FROM RIDGE TO REE



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THE UNSPOKEN STORY OF OUR ENDANGERED SPECIES

One takeaway from my experience this summer would be how lucky we are to have many unique and rare wildlife species on our islands that can't be found anywhere else in the world. As an intern with the Division of Fish and Wildlife, I worked on a variety of different projects relating to our island's wildlife.

I worked to install cameras at sites in order to assess the population of our endangered bird species, analyzed audio recordings using spectrograms, performed bird surveys, and conducted technical guidance assessments. I also had the opportunity to monitor sea turtles around the island, working to ensure all new turtles have been tagged and all hatchlings make their way to shore safely. More extensively, I conducted vegetation surveys to better understand what supports our endangered species out in the jungle.

The collective efforts on the different projects at DFW share the same purpose: to ensure the long-term survival and sustainability of our islands' wildlife for present and future generations.

For my project this summer, we worked on creating a plant guide specific to the Saipan Upland Mitigation Bank (SUMBA), which is our main study area for the endangered species project. The SUMBA is a conservation area that serves as critical habitat for

ALYSSA CEPEDA DFW WILDLIFE SECTION



many threatened and endangered bird species, such as the Micronesian Megapode, or sasangat, and the Nightingale Reed-Warbler, or gåga karisu. We hiked throughout the jungle in order to survey the vegetation present as it is a critical dataset when protecting our wildlife. It tells us the unspoken story of what supports our wildlife in terms of preferred habitat and available food resources (Falanruw et al., 1989).

One of the biggest challenges when performing vegetation surveys would be coming across plants that are not easy to identify. By creating a plant guide specific to the SUMBA conservation area, it will be a lot quicker to identify vegetation when out in the field collecting data. We were able to create the plant guide using our observations of the plants countless times in the field and research on existing literature and field books. We hope that the plant guide will be an easy resource for those working in the SUMBA to correctly record and identify the vegetation supporting our endangered species.

Because of this internship, I have gained a wealth of experience and knowledge regarding DFW's research, monitoring, and regulatory efforts to protect our wildlife.

Falanruw, et. al, Vegetation survey of Rota, Tinian, and Saipan, Commonwealth of the Northern Mariana Islands. Resource Bulletin. PSW-27. Berkeley, CA: US Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 11 p (1989).

ASSIGNED TO THE SHORELINE

JADEN VILLACRUSIS DCRM SHORELINE MONITORING



Our beaches provide us with more than we realize. They are places of leisure, wildlife habitat, coastal protection, subsistence, culture, and more. Our beaches are dynamic due to the influence of waves, tides, and human activity. Therefore, it's essential to monitor our shorelines so that we can see how they transform over time and it is also necessary when dealing with development and planning. Looking at each beach and monitoring their change plays a big role in making decisions and finding solutions regarding our coastlines (Cheng, 2016). This summer, I learned just how important our shorelines are. As an intern under the Shoreline Monitoring Program at the Division of Coastal Resources Management, I had the opportunity to survey Saipan's beaches and learn about its different features. In order to return to the same place to continually survey our shorelines, starting points, which we call headstakes, have been designated.

Depending on each site, headstakes can be trees or man-made structures and are usually marked with yellow paint. The coordinates of the headstakes are noted, so they can also be found through a GPS. From the headstake, a transect is aligned up to the toe. Other beach features include a vegetation line, berm, wrack line, waterline, and toe. The vegetation line is the first site of stable, natural plants. A berm is a vertical drop on the backshore, formed by wave action. A wrack line is a line of green, or natural, debris that gets washed up on shore from waves and tides. Waterline is a line that indicated the surface of the sea on land. The toe, or moat, is a point of the beach that juts out past the waterline.

There are three main roles in monitoring our shorelines: one person to hold the meter rod, one person to measure the height using a berger level, and one note-taker. During my internship, I used the Berger Level Method to survey each site. This method consists of manually reading the elevation and distance of a shoreline starting from the headstake to the toe. The Berger Level Method is a two-to-three-person job and requires several pieces of equipment: a berger level, which is a leveled telescopic instrument that measures height along the transect; a meter rod, which is a leveling instrument that helps determine the difference in height between points; a transect line; and a notebook.

Before I joined the DCRM Summer Internship Program I thought our shorelines were just something that connected our lands and sea. After my experience this summer, I am able to acknowledge the importance of our shorelines and the different services it provides. I am very grateful to have been a part of DCRM's Summer Internship and will use my experience to serve our islands.

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OUR CARBON FOOTPRINT

SUBIN CHO MARIANA ISLANDS NATURE ALLIANCE



Marine debris is a global topic and one of the fastest growing worldwide issues. It is not only unpleasant to see but also causes severe harm to our ocean ecosystems, such as entangling and possibly drowning wildlife as well as injuring our coral reefs. Scientists suggest that marine debris will remain in the depths of our ocean for hundreds to thousands of years due to its slow decomposition and types of materials used to make them. (Chiba et al., 2018) This summer, my partner Deanna and I worked for the Marianas Islands Nature Alliance (MINA) under the guidance of David Benavente, Program Manager. Our main goal for this project was to track and study the different types of marine debris that persisted in the CNMI, focusing on the Chalan Piao beach area near Hopwood Junior High School.

The materials used for this project methodology consisted of a GPS and transect lines. Deanna and I, as well as our mentor, would follow a grid-like map with a point on each corner. At every point, we input the coordinates onto the GPS while we laid out our 50m transect lines. After setting up our transect lines, we would snorkel within our grid to look for any marine debris such as historic metal, cans, plastic, etc. Using an underwater data sheet, we would log down any marine debris we found and note the time, date, size, surrounding area, and the type of debris. My partner and I were able to survey 22,500 square meters of the Chalan Piao beach site during our internship.

The importance of this project is not only to raise awareness about marine debris but to emphasize the significance of the concept of "ridge to reef." Our carbon footprints are being left to remain in the ocean for thousands of years, and we will never know how long until it's gone. The way we treat our ridges matters as it is interconnected with the overall health of our reefs and, most importantly, our ocean.

This year was the second and final year that I interned with the Division of Coastal Resources Management. I can confidently say that this opportunity and experience will definitely help me mold my skills and support me throughout my college and career goals.

Chiba, et al, Human footprint in the abyss: 30 Year records of deep-sea plastic debris. Marine Policy. (2018, April 6) Retrieved August 11, 2022, from https://www.sciencedirect.com/science/article/pii/S0308597X17305195? via%3Dihub

MAPPING THE FUTURE

MAGDALEN SANTOS OFFICE OF PLANNING & DEVELOPMENT

This year, I was given the opportunity to intern at the Office of Planning and Development (OPD), under the guidance of Manuel Camacho, as part of the 2022 DCRM Summer Internship Program. OPD served as a platform for me to learn about projects and practices here in the CNMI.

During my internship, one project I found intriguing was OPD's work with Geographical Information Systems (GIS). GIS is a system that manages, analyzes, and maps all types of data. It is best described by GIS researchers R. MacFarlane and H. Dunsford: "With increasing emphasis on efficiency ... equity ... and sustainable development ... GIS has emerged strongly as a tool to try and juggle the differing [requirements]" (2009). These "requirements" span social and built environments, and showcase what functions GIS could provide to the CNMI. For OPD, it aspires to develop GIS capacity in residents for leveraging partnerships, making planning more efficient, and building resiliency.

capacity for government employees who use GIS through the CNMI-wide GIS training plan. This summer, I assisted in gathering research to further gauge the CNMI's readiness for GIS, and what is still needed in order to understand the necessary next steps. Additionally, I was able to gain an understanding of current GIS maps in use in the CNMI and the ways they are already helping improve the CNMI's efficiency. Work to foster the necessary conditions to enhance GIS use is ongoing, and training for stakeholders on how to access and use these maps is in progress.

Increasing GIS capacity in the CNMI will cut down on unnecessarily lengthy field work, boost communications among planners, and make work more efficient for all GIS users. For instance, having local GIS experts would allow for processes and projects involving geospatial information to be more easily facilitated.

My part in this GIS project was small but exciting and educational. I gathered research and compiled information to



assist my mentor in the progression toward elevating CNMI-wide GIS capacity. Through my internship with OPD, I discovered that GIS is a powerful and valuable tool for the CNMI. I acquired new skills through my internship and gained insights into the career opportunities here in the CNMI.

Lovett, et al, (2020). GIS and Environmental Decision-Making: From Sites to Strategies and Back Again. In GIS for Environmental Decision-Making (pp. 79–99). essay, CRC Press, an imprint of the Taylor & Francis Group.

OPD is working on a plan to help build





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THE OPEN SEA: THE BLUE, THE FRESH... THE MARINE DEBRIS?

DEANA KAPILEO MARIANA ISLANDS NATURE ALLIANCE

When you think of the ocean, you might think of blue water, coral reefs, or maybe some of the amazing organisms that inhabit it. But do you know what else fills our ocean? Marine debris.

Marine debris is one of the biggest problems in our oceans and waterways, but it also happens to be one of the most solvable (Sheavly and Register, 2007). As a grantee of the National Oceanic and Atmospheric Administration's (NOAA) Marine Debris Grant, the Mariana Islands Nature Alliance (MINA) was tasked with removing 70,000 pounds of marine debris from the Saipan and Tinian lagoons, in an effort to minimize the impacts it poses on our coral reefs and coastal habitats. This summer, I had the opportunity to work on this project as a DCRM Summer Intern under MINA.

I was assigned to create various marine debris maps for multiple locations within the Saipan Lagoon in order to collect data on the types of marine debris found. I created the maps using QGIS, an open-source geographic information system. Making the maps were simple once I learned the basics of the program. First, you open a base map and locate your site. Second, trace the shape of the area you will assess. Third, lay a grid consisting of 50m x 50m squares over your chosen site.

Lastly, label your grid points. To utilize your newly



create a map, extract and upload your labeled grid points onto a GPS.

Although I was able to create the maps, they did not come without their challenges. My partner, Subin Cho, and I realized our uploaded points were in the incorrect format, preventing us from laying our grid squares to collect data.

After many attempts, we were able to correct the format. The correction allowed us to start on our

marine debris project. We made our grid squares over our chosen area and searched for marine debris in the lagoon using the uploaded points on the GPS on our new map. My partner and I are excited to get marine debris out of our lagoons!

Sheavly, S. B., & Register, K. M. (2007, November 28). Marine Debris & Plastics: Environmental concerns, sources, impacts and solutions - journal of polymers and the environment. SpringerLink. Retrieved August 11, 2022, from

https://link.springer.com/article/10.1007/s10924-007-0074-3#citeas



SHORELINE INVESTIGATION

CATHERINE CALMA DCRM SHORELINE MONITORING

Have you ever wondered why your favorite beaches seem to be sinking? Is it because Saipan is slowly sinking? Or is it due to some other factor? Well, the Division of Coastal Resources Management (DCRM) has been measuring the shorelines in the CNMI to see which areas are eroding (losing sand), accreting (gaining sand) or exhibiting stability.

This summer, I was given an amazing opportunity to intern for DCRM under the Shoreline Monitoring Program, led by Mary Fem Urena, Coastal Planner. My partners and I were assigned to monitor the western beaches of Saipan using the Berger surveying method. Once we gathered data from monitoring the beaches, we paired it to the data collected by previous interns, to see whether the beach has eroded, accreted, or stayed the same over time. This data helps us identify and track the most unstable and vulnerable areas to inform planning and management.

Since I became a Shoreline Monitoring Intern, I learned that beaches lose and gain sand, and that sand can move from one location to another. This movement of sand impacts water sports businesses and hotel operators due to the limited coastline space.

Erosion from coastal development and global beach retreat caused by effects of sea level rise as well as storm intensity may be why some beaches are observed to be eroding. (Starmer, 2009)

Overall, my time as an intern at DCRM was an insightful experience. I am more aware of the beach profile. If I revisit the same place, I would be able to compare it to my previous visit and see if it has lost or gained sand. In addition, you can help take care of the beaches by picking up trash, using reusable products, or volunteering during beach cleanups.

Starmer, John, and C. N. M. I. Saipan. "Northern Mariana Islands Needs Assessment for the Pacific Islands Ocean Observing System." Pacific Marine Resources Institute, Saipan, CNMI (2009) pmri_pacioos_2009-libre.pdf (dlwqtxtslxzle7.cloudfront.net)