# 2025 - 2035

## Commonwealth of the Northern Mariana Islands

# State Wildlife Action Plan

Revised Draft for Public and Internal Government Review



CNMI Division of Fish and Wildlife
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# EXECUTIVE SUMMARY

Fish and wildlife in the Commonwealth of the Northern Mariana Islands (CNMI) are resources belonging to the people who reside here. Our islands are home to a remarkable array of wildlife specific to the Marianas, including species found nowhere else on Earth. Our lands provide vital habitats for unique terrestrial plants and animals, while our waters boast some of the most pristine and vibrant marine ecosystems in the United States and Pacific Islands region. This abundance of fish and wildlife makes the CNMI a truly special place, inspiring our commitment to conserving these invaluable resources for the benefit of current and future generations.

Conservation in the CNMI  is challenging, given the limited capacity and financial resources available for taking action to conserve our species across the entire island chain. In addition, we face challenging conservation factors, including current and potential future impacts of globalization and our changing environmental conditions in the Anthropocene. Specifically, invasive species, habitat instability, and land use change continue to threaten our natural resources. Successful management of our resources will only happen with careful consideration of the values that we aim to prioritize and a vision for what "success" means. This 2025 Wildlife Action Plan addresses the conservation values expressed by the people of the CNMI and gives a clear pathway to achieve success. The Wildlife Action Plan is a foundational element for implementing conservation within the CNMI.

This is the third iteration of the CNMI SWAP. Ten years have passed since we last revised the State Wildlife Action Plan (SWAP) in 2015, which built off the foundation laid in 2005.  We reviewed the 2015 SWAP and implementation outcomes at the beginning of our revision process to see what lessons we could learn.

The first version of the CNMI SWAP from 2005 was an ambitious plan that laid out lofty goals and objectives. While some of these goals were accomplished, several were left unaddressed because they were  beyond the capacity of the CNMI at the time. The second edition finalized in 2015 set more achievable and realistic goals. Although we didn't accomplish all of the objectives in the 2015 plan, we were able to complete an impressive amount of tasks in the 10 year period before 2025. In this plan, we aim to strike a balance between realistic goals and, as one of our public meeting attendees suggested, "shoot for the moon and land among the stars".

The 2025 plan will broaden the scope of our 2015 objectives and set specific goals for conservation of our Species of Greatest Conservation Need (SGCN) and their essential habitat.

We will also expand our list of SGCNs to include plants for the first time in our SWAP history. Plants have been excluded from previous editions simply because the federal funding sources set aside for SWAP initiatives do not support plant-specific research or conservation actions (unless the plant supports an animal SGCN). However, if federal funding for plant conservation becomes available, the CNMI should be prepared to take advantage of these resources to conserve our SGCN plants and inclusion of these species into the SWAP provides a way forward to do so. The SWAP is also recognized as an essential planning document by other agencies that may provide funding opportunities for plant conservation. In addition to expanding our list of SGCN, we have fortified our SWAP with smart conservation objectives and goals that take into consideration projected future environmental conditions for the CNMI. Though changing the trajectory of future conditions may prove difficult, smart planning will help identify near-term actions that will prepare resource managers and our fish, wildlife, and plant populations for a changing environment. Maps are incorporated throughout the document to provide context to the spatial extent and scope of conservation priorities and opportunities.

This version of the Wildlife Action Plan is closely tied to other essential planning documents for the CNMI including but not limited to: the Comprehensive Sustainable Development Plan (CSPD, OPD. 2021), DCRM watershed management plans (DCRM 2012, 2015, 2020), and CNMI Coral Reef Management Priorities (BECQ 2019). The Wildlife Action Plan should be a document where agencies, program managers, NGOs, researchers, and community members can locate information on our SGCN and the priority conservation actions for conserving them and their habitats.

In Chapter 1, we describe some of the accomplishments from the 2015 Plan, the guiding principles for the 2025 Plan revision and update, and major changes from the 2015 Plan.

Chapter 2 provides an overview of our 14 islands. This chapter describes the geographic, political, and demographic context within which we conduct our conservation actions.

In Chapter 3, we describe the process and criteria used for selection of “Species of Greatest Conservation Need”, and the list resulting from that process.

Chapters 4 and 5 describe the terrestrial and marine habitats, respectively, that are important to SGCN.

Chapter 6 summarizes the threats that are impacting, or are expected to impact SGCN within the next ten years.

Chapters 7 and 8 form the core of the 2025 Plan as they identify the specific objectives and actions that are planned over the next ten years. Chapter 7 summarizes ecosystem-based goals and strategies, i.e. those that will benefit most or all SGCN, and provides an introduction to the species-specific objectives and actions that are described in Chapter 8.

Chapter 8 contains a profile of each SGCN, including:

- species-specific ten-year objectives for all SGCN and, for some, additional longer-term objectives
- federal and state Threatened and Endangered listing designation, and International Union for the Conservation of Nature (IUCN) Red List designation
- brief descriptions of known distribution, abundance, and preferred habitat
- priority actions required to meet the ten-year objectives, and other possible supporting actions
- research and monitoring needs

The Wildlife Action Plan is not an agency document. Instead, it reflects broad input from people across our islands, as successful implementation of the Plan will require collaborative efforts to achieve success. Chapter 9 describes the process we used to gather input from the public, government agencies, and other stakeholders.

Chapter 10 lays out our vision for implementation over the next ten years.

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# Preface

The CNMI Division of Fish and Wildlife (DFW) has received over $1,000,000 in funding from the federal State and Tribal Wildlife Grants program (SWG) administered by the U.S. Fish and Wildlife Service (USFWS) over the last 10 years. Funding from SWG is valuable because it supports conservation efforts for species (non-game species) for which there is currently no other congressionally apportioned funding source available. This is important because it provides CNMI the opportunity to institute conservation measures before native species are considered candidates for federal protection under the Endangered Species Act (16 U.S.C. 1531-1544). An example of successful SWG projects includes island-wide assessments for the presence of *Emoia slevini* on Saipan and Rota.

As a condition of receiving SWG funds, the U.S. Congress requires that all States commit to reviewing and, if necessary, revising their Wildlife Action Plan every 10 years. The last CNMI Wildlife Action Plan was completed in 2005. This document represents the revised and updated Wildlife Action Plan that is required for the CNMI to maintain eligibility for SWG funds.



# Road Map to Eight Required Elements

Additionally, the U.S. Congress indicated that the USFWS should institute guidelines to maintain consistency across states. USFWS therefore stipulates eight required elements that must be included in the Wildlife Action Plan and process, and that each State provides a “road map” to describe where in the document these elements are addressed. The CNMI “road map” is provided here:

| | | |
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| Element 1 - the distribution and abundance of species of wildlife, including low and declining populations as each State fish and wildlife agency deemed appropriate, that are indicative of the diversity and health of wildlife of the State; (In subsequent discussions, these species were referred to as Species of Greatest Conservation Need or SGCN.) | | |
| Where addressed | Chapter 3 | This section provides a comprehensive list of the SGCN |
| | Chapter 8 | This section provides detailed profiles for each SGCN or assemblage of SGCNs |
| Element 2 - the location and relative condition of key habitats and community types | | |

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| essential to the conservation of each State’s SGCN | | |
| Where addressed | Chapter 2 | This section provides an overview of the Mariana Islands, including conservation areas |
| | Chapter 4 | This section describes the terrestrial habitats and their relative condition for the CNMI and for each island. |
| | Chapter 5 | This section describes the marine habitats and their relative condition for the CNMI and for each island. |
| Element 3 - the problems which may adversely affect SGCN or their habitats, and priority research and surveys needed to identify factors which may assist in the restoration and improved conservation of SGCN and their habitats | | |
| Where addressed | Chapter 6 | This section details threats to the various habitats and SGCNs for both Marine and Terrestrial ecosystems |
| | Chapter 7 | This section details priority strategies, actions, and objectives for addressing threats to SGCN and their habitats. |
| Element 4 - the actions necessary to conserve SGCN and their habitats, and establishes priorities for implementing such conservation actions | | |
| Where addressed | Chapter 7 | This section details priority strategies, actions, and objectives for addressing threats to SGCN and their habitats. |
| | Chapter 10 | This section details the monitoring and implementation for the SWAP. |
| Element 5 - the provisions for periodic monitoring of SGCN and their habitats, for monitoring the effectiveness of conservation actions, and for adapting conservation actions as appropriate to respond to new information or changing conditions | | |
| Where addressed | Chapter 7 | This section details monitoring needs for SGCN and their habitats |

| Element 6 - each State’s provisions to review its Strategy at intervals not to exceed ten years | | |
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| Where addressed | Chapter 10 | This section details the monitoring and implementation of the SWAP, including making minor and major revisions on appropriate timelines |
| Element 7 - each State’s provisions for coordination during the development, implementation, review, and revision of its Strategy with Federal, State, and local agencies and Indian Tribes that manage significant areas of land or water within the State, or administer programs that significantly affect the conservation of species or their habitats | | |
| Where addressed | Chapter 9 | This section details the participation and stakeholder engagement for the development of this plan. |
| Element 8 - Each State’s provisions to provide the necessary public participation in the development, revision, and implementation of the Plan | | |
| Where addressed | Chapter 9 | This section details the participation and stakeholder engagement for the development of this plan. |
| | Chapter 10 | This section details the monitoring and implementation of the SWAP, including making minor and major revisions on appropriate timelines |

## Abbreviations

| | |
|---|---|
| ACE | Army Corps of Engineers |
| ACA | Allen Coral Atlas |
| BECQ | CNMI Bureau of Environmental and Coastal Quality |
| Bioscore | Biological vulnerability to extinction score |
| BTS | Brown Tree Snake |
| CAP | Conservation Action Plan |
| CCAP | Coastal Change Analysis Program |
| CNMI | Commonwealth of the Northern Mariana Islands |

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|---|---|
| COTS | Crown of thorns Seastar |
| CRB | Coconut Rhinoceros Beetle |
| CRED | Coral Reef Ecosystem Division |
| CREES | Cooperative Research, Extension, and Education Center (NMC) |
| CSDP | Comprehensive Sustainable Development Plan |
| CUC | Commonwealth Utilities Corporation |
| DAWR | Guam Division of Aquatic and Wildlife Resources |
| DCRM | CNMI Division of Coastal Resource Management |
| DFW | CNMI Division of Fish and Wildlife |
| DEQ | CNMI Division of Environmental Quality |
| DLNR | CNMI Department of Lands and Natural Resources |
| DoD | U.S. Department of Defense |
| DoN | U.S. Department of the Navy |
| EEZ | Exclusive Economic Zone |
| ESA | Endangered Species Act |
| FDM | Farallon de Medinilla (Noos) |
| GIS | Geographic Information Systems |
| IUCN | International Union for Conservation of Nature and Natural Resources |
| JRM | Joint Region Marianas |
| LWCF | Land and Water Conservation Fund (Act) |
| Ma | Million years ago |
| MARAMP | Mariana Archipelago Reef Assessment and Monitoring Program |
| MAC | Mariana Avifauna Conservation (Plan) |
| MES | Micronesian Environmental Services |
| MINA | Micronesia Islands Nature Alliance |
| MLA | Military Lease Area |
| MMT | Marine Monitoring Team |
| MPA | Marine Protected Area |
| MTMNM | Mariana Trench Marine National Monument |
| MVA | Marianas Visitors Authority |
| NAVFAC | Naval Facilities Engineering Systems Command |
| NCCOS | National Centers for Coastal Ocean Science |
| NRCS | Natural Resources Conservation Services |
| NI | Northern Islands |
| NMC | Northern Mariana College |
| NOAA | National Oceanic and Atmospheric Administration |
| NPS | National Park Service |
| SCORP | Statewide Comprehensive Outdoor Recreation Plan |

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|---|---|
| SGCN | Species of Greatest Conservation Need |
| SGIN | Species of Greatest Information Need |
| TNC | The Nature Conservancy |
| TOAD | Towed Optical Assessment Device |
| US | United States (of America) |
| USDA | United States Department of Agriculture |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| WAP | Wildlife Action Plan |
| WPRFM | Western Pacific Regional Fishery Management |
| WWII | World War II (Two) |

# 1 Introduction

The lands of the Commonwealth of the Northern Mariana Islands (CNMI) are home to an extraordinary diversity of wildlife, including many species found nowhere else on Earth. Our surrounding waters contain some of the most pristine and biologically rich marine ecosystems in the United States. The CNMI is a unique and remarkable place, endowed with fish and wildlife resources of immense ecological, cultural, and economic value.

These natural resources not only support vibrant ecosystems but also enrich the lives of our residents and visitors through recreation, cultural connection, and natural beauty. They provide essential ecosystem services—such as clean air and water, coastal protection, and climate regulation—and form the backbone of local industries such as tourism, fishing, and subsistence livelihoods. Preserving our natural resources is not only a matter of environmental stewardship but also critical to the well-being and prosperity of our communities.

Yet, conservation today is increasingly complex, challenged by the growing impacts of invasive species and other threats that have arisen in the Anthropocene. Lasting success requires thoughtful deliberation about the values that guide our decisions and a shared vision of what we aim to achieve.

The 2025 Wildlife Action Plan embodies the conservation priorities and values of the people of the CNMI. It offers a clear, strategic roadmap to safeguard our natural heritage, ensuring that these resources continue to sustain our ecosystems, support our economy, and inspire future generations.

In 2005, we completed our first-ever Wildlife Action Plan (then called the Comprehensive Wildlife Conservation Strategy), which outlined conservation priorities for the Commonwealth of the Northern Mariana Islands (CNMI) for the ten-year period 2005-2015 (Berger et al. 2005). The Plan was revised in 2015, CNMI State Wildlife Action Plan 2015-2025 (Liske-Clark). We began reviewing the 2015 SWAP in 2024 to prepare for the major revisions process due at the end of 2025. We assessed our accomplishments and missed opportunities and reevaluated our priorities to produce an updated Plan.

The Wildlife Action Plan belongs to CNMI residents across all islands and reflects broad community input. The CNMI Division of Fish and Wildlife is the “keeper” of the Plan, overseeing

Plan development and implementation. Starting in 2024, DFW reviewed the 2015 Plan and proposed a series of core revisions that will keep the Plan relevant and effective in meeting our islands' conservation needs over the next ten years and beyond.

## Guiding Principles

The following interdependent principles were central in the Plan's development and will guide implementation through the next ten-year life of this Plan. While not everyone shares all of these values or may define them differently, we can agree that they are important to the people of the CNMI and are the crux of this Plan.

**1. Maintain fish and wildlife populations in sufficient abundance and distribution to meet the needs and values of the people of the CNMI, over the next ten years and beyond.** These needs and values include ensuring the sustainable harvest of fish and game resources and providing sustainable ecotourism and recreational opportunities for both residents and visitors. Resource managers need to work toward meeting downlisting criteria for federally threatened and endangered species while preventing new listings. Additionally, the plan emphasizes conservation-smart development (identified by our partner agencies) and perpetuating traditional cultural practices while promoting the importance of sustainable resource use, protecting and conserving biodiversity, and preventing extinctions, particularly of our endemic species.

**2. Protect and manage habitats to meet the needs of fish and wildlife populations.** All of our species depend on habitats to meet their needs for food, shelter, and breeding areas. We cannot meet our goals for fish and wildlife populations without providing habitat of sufficient quantity and quality.

**3. Cultivate conservation commitment to ensure we have the necessary political, social, technical, and financial support to meet our population and habitat goals across all islands.** We need the support of political and community leaders, resource users, conservation agencies and organizations, and the public to meet our population and habitat goals over the next ten years and beyond.

## 1.1 Progress Report 2015-2025

A major factor in the effectiveness of the State Wildlife Action Plan (SWAP) is its implementation. We evaluated the execution of the 2015 SWAP by examining progress made over the past ten years. The authors of the 2015 SWAP crafted a relatively conservative and attainable plan, outlining goals, objectives, actions, and strategies designed for a ten-year timeframe. Although we did not achieve all our proposed goals, we accomplished significant conservation work and wildlife management as outlined in the 2015 SWAP. Setting realistic goals is a sensible strategy for implementing a wildlife action plan. However, since this plan can be utilized to secure funding for underfunded species conservation initiatives, broadening the SWAP's scope may create new opportunities for effective conservation efforts in the CNMI. Therefore, we will adopt a more expansive approach in this revised version of the CNMI SWAP.

The 2015 Plan listed over 35 actions needed to benefit priority species and their habitats (CNMI Wildlife Action Plan Chapter 7, Liske-Clark 2015). In addition to outlining conservation actions, the 2015 SWAP also outlined 34 ecosystem-based conservation strategies, 32 priority monitoring needs, and 3 main research goals. Of 37 actions detailed in the SWAP, 24 were fully implemented, are in progress, or were partially completed. All our wildlife monitoring priorities were conducted. None of the three main research needs detailed in the 2015 SWAP were adequately addressed.

### 1.1.1 Conservation Achievements 2015-2025

**Coral Reef Restoration and Marine Conservation**

Two Coral Nurseries Established in Saipan:
Since the publication of the 2015 State Wildlife Action Plan (SWAP), two coral nurseries have been established in Saipan, providing essential support for coral reef restoration efforts in the Saipan Lagoon. These nurseries propagate, grow, and outplant Species of Greatest Conservation Need (SGCN) corals across various lagoon sites, helping determine optimal conditions and techniques for coral rehabilitation in the CNMI.

New Conservation Laws Enacted:
Significant conservation legislation has been passed over the past decade, including:

- The Coral Reef Protection Act of 2017 (PL 20-79)
- The Bioprospecting Law of 2022 (PL 22-19)
- 23 Newly ESA Listed Mariana Island Species (USFWS 2015)
- Official designation of coral reefs as critical natural infrastructure (2024)
- Enhanced monitoring and regulation of commercial fish markets to protect fishery resources

Marine Species Monitoring:
Ongoing monitoring programs in the Saipan Lagoon track the presence and distribution of key marine species. These efforts help identify priority areas for protection and ensure sustainable use of marine resources.

Monitoring Marine SGCN Species:
Projects initiated to determine the presence, distribution, and abundance of various SGCN species, including:

- Halu'u (Grey reef shark, *Carcharhinus amblyrhynchos*)
- Tanguisson (Napoleon wrasse, *Cheilinus undulatus*)
- Laggua (Steephead parrotfish, *Chlorurus microrhinos*)
- Many popular food fish (hangon, mafuti', hiyok)
- Åcho' tåsi (Corals, multiple species)
- Langosta (Spiny lobsters, *Panulirus* spp)
- Marine snails
- Lå'on (Collector urchins, *Tripneustes gratilla*)
- Pulpo (Day octopus, *Octopus cyanea*)
- Mangrove crabs (*Cardisoma carnifex*)
- Pectinate Venus clams

### Terrestrial Wildlife Management and Monitoring

Targeted Research on Endangered Species:
Research initiatives have addressed critical gaps in our understanding of the life history, population status, and distribution patterns of several endangered species, including:

- Chichirikan Tinian (Tinian Monarch, *Monarcha tatatsukasae*)
- Ga'ga' karisu (Saipan Reed Warbler, *Acrocephalus hiwae*)
- Pulattat (Mariana Common Moorhen, *Gallinula chloropus guami*)
- Akale'ha tree snails (humped tree snails)
- *Perochirus ateles* (Mariana gecko)
- Dulalas Luta (Rota blue damselfly, *Ischnura luta*)
- Nosa' Luta (Rota white-eye, *Zosterops rotensis* )
- Trongkun guafi (*Serianthes nelsonii*) and fadang (*Cycas micronesica*)

Åga Captive Rear and Release Program:
A major success story is the establishment of the åga (Mariana Crow, *Corvus kubari*) rear and release program on Rota. In collaboration with the University of Washington and San Diego Zoo Global, over 80 critically endangered åga have been reared and released across 6 cohorts. This

project also exemplifies the 2015 SWAP's strategy of increasing education and on-the-job training for CNMI residents. Several wildlife technicians from Rota have been trained and employed through this program, including a field crew leader who has remained with the team for over five years. Community engagement efforts have improved local attitudes toward åga conservation, fostering a more positive outlook than has been seen in the past two decades. This program highlights how local participation in conservation builds bridges and restores community ownership over the protection of endangered species.

SGCN Bird Translocations:
In partnership with Pacific Bird Conservation, DFW successfully translocated several SGCN forest birds to the Northern Islands in an effort to create redundant populations. Redundant populations will provide some insurance for our bird species in the event of an accidental brown tree snake invasion (BTS, *Boiga irregular*) on Saipan or Tinian. Five species of forest birds were translocated, including nosa (Bridled White-eye), totot (Mariana Fruit Dove, *Ptilinopus roseicapilla*), na'abak (Rufous fantail, *Rhipidura versicolor saipanensis*), Chichirikan Tinian (Tinian Monarch, *Monarcha tatatsukasae*), and canario (Golden White-eye, *Cleptornis marchei*), moving populations to Guguan, Sarigan, and Alamagan Islands. The development of post-translocation monitoring methods is ongoing to ensure we can assess the success and stability of these populations and the rest of the translocated populations under the Mariana Avifauna Conservation (MAC) Plan.

### Education and Workforce Development:

A key achievement over the past decade has been to increase education and training opportunities for local residents in conservation fields. These efforts have ensured a steady and skilled workforce committed to conservation initiatives within the CNMI. Programs like the åga recovery project, MINA Green Rangers, DCRM Summer Internship, and NOAA's Coral Reef Fellow programs have demonstrated the importance of investing in local talent, with multiple participants receiving long-term employment, education, and leadership roles in conservation within the CNMI.

These achievements highlight the CNMI's progress in implementing conservation strategies outlined in the 2015 SWAP, despite challenges. Through innovative programs, legal protections, and community engagement, the CNMI has taken meaningful steps toward safeguarding its natural heritage for future generations.

### 1.1.2 Areas of Improvement

While we celebrate our conservation successes over the past ten years, we also need to address challenges and disappointments. A major theme of our shortcomings is our ability to design, fund, and implement effective biosecurity measures for the CNMI. We saw the introduction and proliferation of several invasive species in the past ten years, notably the coconut rhinoceros beetle (CRB, *Oryctes rhinoceros,* Figure 1) became established on Rota in 2015 and has since spread across the island despite quarantine and control efforts. Invasive species that are here, such as the scarlet gourd and other noxious  vines, continue to spread unchecked across our landscapes. As the US military increases its focus on the Pacific region and seeks to expand its training and infrastructure in the Mariana Islands, particularly on Tinian, the need for biosecurity has become a primary concern for all wildlife conservation efforts, including marine environments. Currently, various invasive species affect some islands but not others (for example, the coconut rhinoceros beetle is found on Rota but not on any of the islands North of Rota). To prevent the spread of these invasive species across all islands and to manage them locally, it is essential to establish inter-island biosecurity, along with enhancing biosecurity measures at our major points of entry into the CNMI.

Figure 1. Adult coconut rhinoceros beetle in a trap at an infested site on Rota (Rota DLNR 2017).

Northern Island's (NI) biological monitoring and management goals continue to be challenging to achieve for many reasons. In the last ten years, the primary obstacles to carrying out successful Northern Island conservation expeditions include a lack of reliable, safe, affordable, and US Coast Guard-certified vessels to transport crew members and narrow weather-dependent timeframes to complete intensive surveys on the islands. DFW has adapted to this challenge by developing autonomous survey methods to limit the number of team members needed for NI expeditions; however, we still need reliable vessels to transport personnel and supplies to collect and deploy automated units.

The global COVID-19 pandemic caused significant delays for several projects. Progress on some initiatives came to a standstill as research institutions, global shipping, and local and national government agencies shifted their focus to preventing the spread of the virus and providing aid to those affected. The CNMI continues to feel the effects of the prolonged economic downturn spawned by the pandemic, with the tourism sector still struggling to recover to pre-pandemic conditions.

Over the past decade, CNMI has seen dramatic shifts in economic conditions.  The economy faced challenges before the pandemic, such as austerity measures and the lingering impacts of Super Typhoon Yutu, which devastated infrastructure across Saipan and Tinian in 2018. Federal stimulus programs during the COVID-19 period (2020-2022) provided crucial economic relief through individual financial assistance payments, business support, and expanded government programs. However, the post-pandemic economy has now reverted to pre-pandemic conditions, marked by economic hardship. Reinstated austerity measures, including mandatory reductions in work hours and corresponding pay cuts for all government employees under CNMI Public Law 23-26, have further strained the economy. As a result, the CNMI Division of Fish and Wildlife, along with other government agencies, has struggled to keep up with standard industry pay grades and has experienced significant staff losses. These economic fluctuations have also impacted the implementation of the 2015 State Wildlife Action Plan (SWAP). Some programs received funding and staffing support, allowing them to make progress, while others struggled to fill key positions and secure necessary supplies. As capacity within the CNMI shifts, so too does the progress of conservation efforts.

## 1.2. Major Changes and Additions

The goals from the 2015 Plan are sound and remain relevant today. The 2015 Plan provides a foundation to build on as we continue to improve upon our Plan in this and future iterations. We have made several major changes and additions to this 2025 Plan.

**Adaptive Management Framework**

The 2015 Plan provided a simple overview of the plasticity of environmental conditions in the CNMI and the potential effects of environmental hazards on our SGCN and their habitats. In the 2025 Plan, we have conducted a preliminary resiliency assessment  for each of our SGCN, which are designed to assess the adaptability of species and the risk of exposure to change in environmental conditions. These assessments have provided insight into how our ecosystems might change in the face of an altered climate. From these assessments, we have developed adaptive conservation and management goals and objectives for our SGCN.

**Landscape-Scale Conservation**

The 2025 Plan will adopt a landscape-scale conservation approach that recognizes that many of our SGCNs exist in habitats that span multiple political and jurisdiction boundaries. We will directly address shared conservation needs between Guam and the CNMI which will fortify regional conservation efforts for the American Territories.

**Inclusion of Plants as SGCNs**

The 2025 Plan will include plants for the first time in CNMI SWAP history. Several SGCN plants were identified through community and stakeholder engagement, including endemic and culturally significant medicinal plants. The CNMI has several rare and endangered plants that could benefit from SGCN designation.

**Species of Greatest Information Need**

Many of our SGCNs in the 2025 WAP were included simply because we do not know enough about them to assess their conservation status. These species are designated SGIN.

**Freshwater Habitats**

The 2015 Plan highlighted freshwater habitats but only listed one freshwater-dependent species as an SGCN. In the revised plan, we further detail the unique freshwater habitats in our islands, have included several more known freshwater species as SGCN or SGIN, and have developed specific goals for conserving these essential freshwater and wetland habitats.

**Cross-Reference Plans**

The 2025 Plan will cross-reference other major natural resource management and development plans for the CNMI to ensure cohesive planning across jurisdictions in the CNMI.

# 2 Our Islands

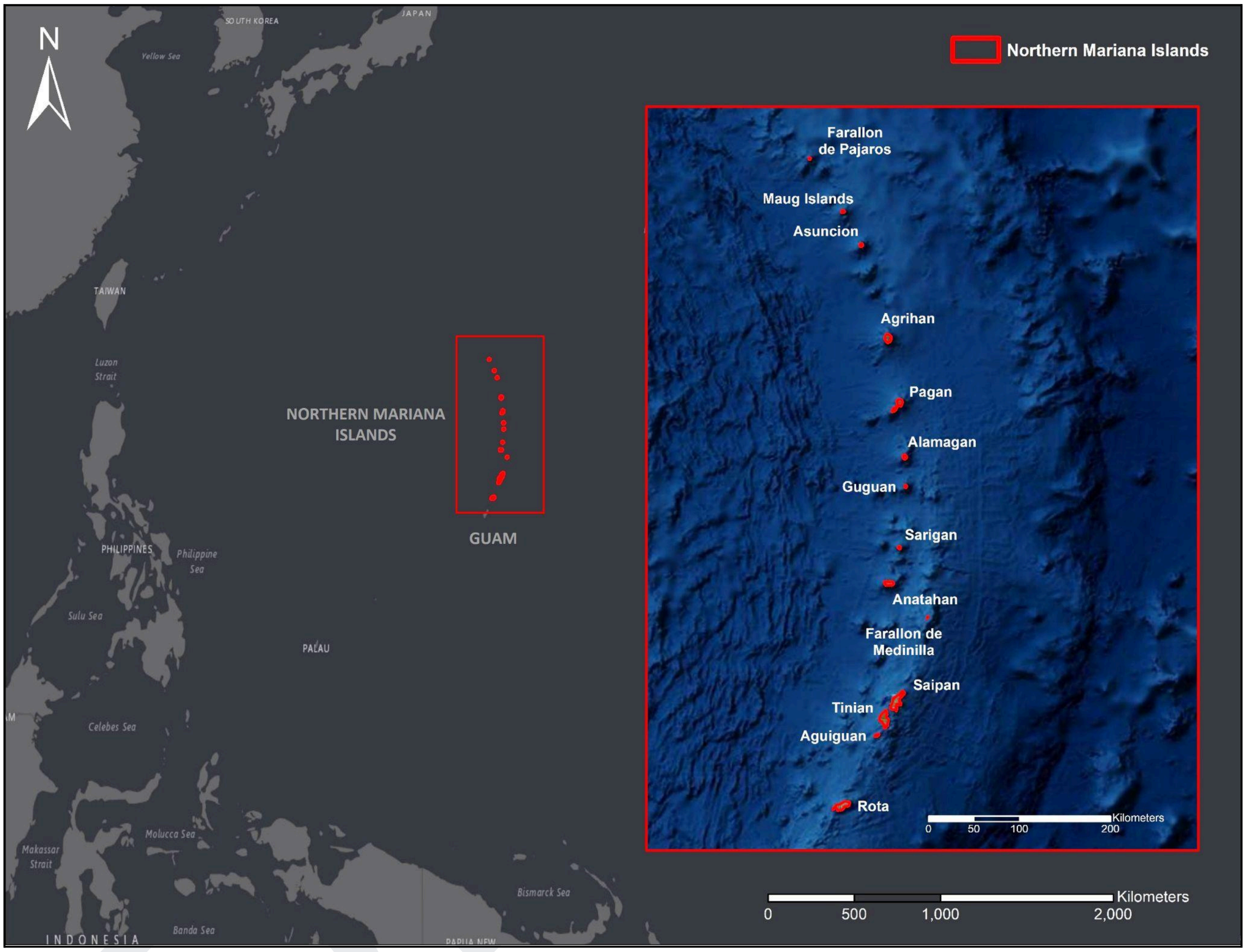



Figure 2. Map of the Commonwealth of the Northern Mariana Island archipelago.

## 2.1 Introduction

The Mariana Archipelago comprises 15 islands and numerous offshore banks and reefs that span a distance of 890 km in the western North Pacific Ocean, from 14˚ to 20˚ N, along 145˚ E longitude (Figure 2).

The southernmost island, Guam, and its associated offshore banks and reefs are under the jurisdiction of the U.S. Territory of Guam. The remaining fourteen islands fall under the jurisdiction of the Commonwealth of the Northern Mariana Islands. The CNMI also has jurisdiction over offshore banks and reefs and most submerged lands extending to 4.8 km from the coasts. These fourteen islands became the Commonwealth of the Northern Mariana Islands (CNMI) in 1976 through the Covenant to Establish a Commonwealth of the Northern Mariana Islands in Political Union with the United States of America (“the Covenant”). This Wildlife Action Plan pertains to the CNMI, but will have an integrated approach to accomplish landscape-scale and population-level conservation goals for both the CNMI and the Guam Plans.

The islands of the Mariana Archipelago range in size from <1 $km^2$(Noos/Farallon de Medinilla) to 544 $km^2$ (Guam). The largest island in the CNMI is Saipan, with a total land area of 119 $km^2$. In contrast, the combined land area for the ten islands north of Saipan (Noos to Uracas) is only about 160 $km^2$(Table 1).

**Table 1.** Area, elevation, and population of CNMI islands. Source for area and elevation, Brainard et al. 2012, except Noos, Camp et al. 2015. Source for human population figures for Rota, Tinian, and Saipan 2020 U.S. Census Bureau; Northern Island populations are estimates.

| Island | Land Area ($km^2$) | % of Total Area | Maximum Elevation (m) | 2020 Population | % of Total Population |
|---|---|---|---|---|---|
| Rota | 85.13 | 18.0 | 496 | 1,893 | 3.99 |
| Aguiguan | 7.01 | 1.5 | 57 | Uninhabited | |
| Tinian | 101.22 | 21.4 | 187 | 2,044 | 4.31 |
| Saipan | 118.98 | 25.2 | 474 | 43,385 | 91.7 |
| Noos (FDM) | 0.74 | 0.2 | 25 | Uninhabited | |
| Anatahan | 33.91 | 7.2 | 788 | Uninhabited | |
| Sarigan | 4.47 | 0.9 | 538 | Uninhabited | |
| Guguan | 4.24 | 0.9 | 287 | Uninhabited | |
| Alamagan | 12.96 | 2.7 | 744 | <10 | <.02 |
| Pagan | 47.75 | 10.1 | 570 | <20 | <.04 |
| Agrihan | 44.05 | 9.3 | 965 | <10 | <.02 |
| Asuncion | 7.86 | 1.7 | 857 | Uninhabited | |
| Maug | 2.14 | 0.5 | 227 | Uninhabited | |
| Uracas (FDP) | 2.25 | 0.5 | 360 | Uninhabited | |
| **TOTAL** | **472.71** | | | **~47,329** | |

## 2.2 Geology

Geologically, the archipelago is the southern extension of the 2,800 km-long Izu-Bonin-Mariana arc system, which extends from near Tokyo, Japan, southward beyond the island of Guam. The islands represent the summits of volcanic mountains that emerged from the subsidence of the Pacific plate under the Philippine plate.

The Mariana Archipelago can be divided into two geologic groups: the older southern islands, which were formed 15-30 million years ago (Ma), which include Guam, Rota, Aguiguan, Tinian, Saipan, and Noos (FDM), and the younger (0-5 Ma) northern islands, which include Anatahan, Sarigan, Guguan, Alamagan, Pagan, Agrihan, Asuncion, Maug, and Uracas (also called Farallon de Pajaros). The six southern islands are part of the frontal arc, or fore-arc, of the Mariana arc-trench system. Although they are volcanic in origin, the islands have rifted eastward from the active arc system and are mostly covered by uplifted, layered limestone surfaces (Figure 3). The northern nine islands remain part of the active Mariana Arc. All of the northern islands, which span from Anatahan to Uracas, are stratovolcanoes comprised of hardened lava, tephra, and volcanic ash, and are characterized by steeply sloping topography, both above and below the ocean's surface (Brainard et al. 2012). Periodic, explosive volcanic eruptions occur on the islands, with the most recent major eruptions occurring at Uracas in 1967, Pagan in 2021, and Anatahan from 2003-2008 (Global Volcanism Program 2024).

The West Mariana Ridge, which is a remnant volcanic island arc, forms a series of seamounts approximately 145-170 km to the west of, and parallel to, the archipelago (Figure 3). Estimated to have formed between 17 and 8 Ma, the West Mariana Ridge is younger than the southern part of the Mariana Arc that rifted eastward but older than the northern portion. Some of the seamounts found along the West Mariana Ridge rise to within 10 m of the ocean surface, and, owing to their remote location away from human stressors, high coral cover reef ecosystems can be found at those seamounts.

The Marianas Trench, a 2,550 km-long seafloor feature formed at the subduction zone of the Pacific and Mariana plates, runs ~130-210 km to the east of, and parallel to, the archipelago (Figure 3). The Marianas Trench hosts Challenger Deep, which at 36,069 ft is the deepest known location in the world's oceans, located southwest of Guam.

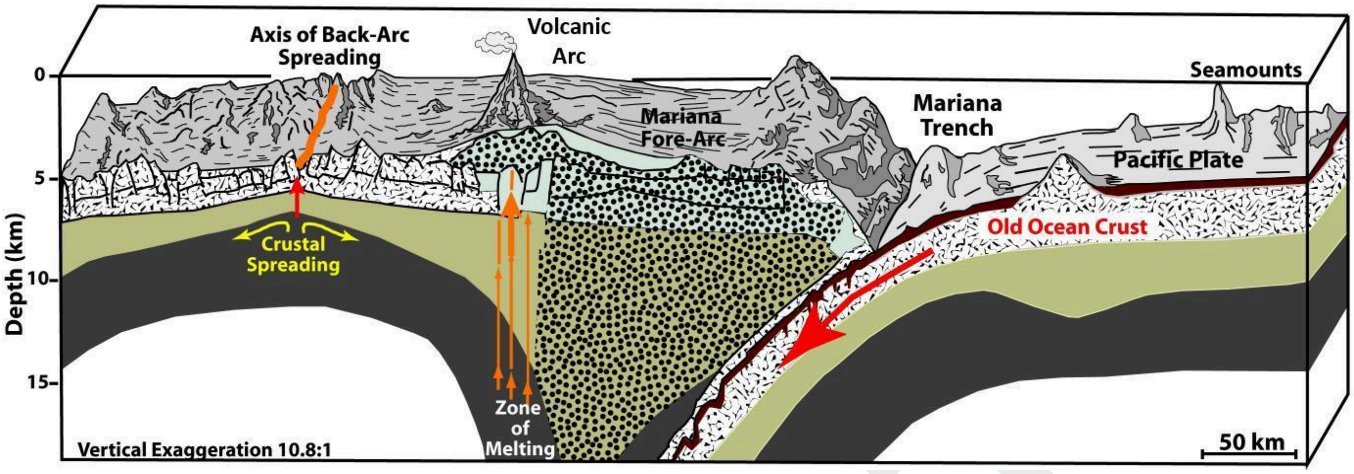



Figure 3. Cross-section of the Mariana subduction zone, showing the relationship between the Trench, Forearc, Volcanic Arc, and Back-Arc. Image is adapted from Hussong and Fryer, 1981.

## 2.3 Climate

The climate of the CNMI is hot and humid year-round, with a mean annual temperature of 28.9°C (84°F) and mean annual rainfall of 213 cm (84 in) (Pacific RISA 2025). The wet season generally occurs between July and November, and the drier season between December and June. During the dry season, brisk east and northeast trade winds dominate the western Pacific Ocean (Eldredge 1983), while slower east and southeast trade winds occur during the summer months. The islands of the CNMI lie within an El Niño Southern Oscillation (ENSO) core region in the western North Pacific, with drought-like conditions in years following El Niño events (Brainard et al. 2012). The probability of tropical cyclone formation increases during El Niño years, while the mean sea level drops during El Niño years and rises above normal during La Niña periods (Brainard et al. 2012). The North Equatorial Current, which flows from east to west in the tropical Pacific Ocean, is the primary ocean current that influences the archipelago (Starmer et al. 2008).

The western North Pacific is the most active tropical cyclone basin in the world. The CNMI lies within the colloquially termed “Typhoon Alley”. Tropical storms frequently affect the CNMI, with an average of three tropical cyclones passing within 300 NM of Saipan each year since 1970 (Lander 2004). Category 3 (sustained winds of 111 - 129 mph) and stronger typhoons can be quite destructive, affecting both terrestrial and marine habitats and species.

## 2.4 Population

The population of the CNMI from the 2020 Census was 47,329, a 12% decrease from the 2010 population of 53,883 (U.S. Census Bureau 2020b) (Table 1). However, the 2020 census numbers might be skewed due to the COVID-19 pandemic which limited contact and participation in the census. The vast majority, approximately 43,385, or 90% of the total population of the CNMI, reside on Saipan, while 2,044 (4%) reside on Tinian, and 1,893 (4%) on Rota. While small permanent and seasonal communities occur on some Northern Islands, volcanic activity has caused the evacuation of most residents. Currently, a few families intermittently reside on Pagan, Alamagan, and Agrihan. Resettlement remains a goal for some of the roughly 50 evacuated families who have residency in the Northern Islands.

## 2.5 Protected Lands and Waters

"Protected lands and waters" are those areas legally designated by the federal or CNMI government primarily for the conservation of natural resources. Conservation Areas, Marine Protected Areas, and National Monuments are examples of protected lands or waters. Generally, protected lands and waters are secured from habitat conversion due to development and have associated regulations regarding hunting, fishing, and other uses of the area. These regulations vary among protected areas, as each area has a distinct history and purpose for protection.

The Commonwealth of the Northern Mariana Islands has designated approximately 26% of the exclusive economic zone as either state or federally protected marine areas and 10% of the total land mass as terrestrial protected areas. These conservation areas have been established through various legal means: the CNMI Constitution, CNMI public laws and local laws, by agreement between government agencies, and by regulation. Conservation lands comprise 22% of Rota, 4% of Tinian, and 9% of Saipan. The entire islands of Guguan, Asuncion, Maug, and Uracas are constitutionally protected. Hunting and collecting plants on Sarigan is prohibited unless permissions are obtained by the Department of Land and Natural Resources. Visitation and hunting permits must be obtained from the Mayor of Tinian and Tinian DLNR prior to landing on Aguiguan, though the island is not a conservation area.

The CNMI government has designated protected waters around Rota and Saipan. While the total area is small relative to the vast protected waters of the Marianas Trench Marine National Monument, these areas provide critical protection to ensure sustainable use of highly visited areas and to provide protected source populations for species that can be harvested outside the protected waters.

Wetlands in the CNMI fall under the jurisdiction of the U.S. Army Corps of Engineers (ACE) which determines which wetlands are regulated under the Clean Water Act (33 U.S.C. §1251 et seq. (1972)). Riparian habitats also fall under the jurisdiction of the U.S. ACE by way of the Clean

Water Act and the Rivers and Harbors Act of 1899.

### 2.5.1 Marianas Trench Marine National Monument

In 2009, U.S. President George W. Bush established the Marianas Trench Marine National Monument (Figure 4), which covers approximately 246,608 square kilometers of waters and submerged lands in the Mariana Islands. The Monument is comprised of the Islands Unit, which includes the submerged lands and waters surrounding the three northernmost Mariana Islands (Uracas, Maug, and Asuncion); the Volcanic Unit, which includes the submerged lands within one NM of 21 designated volcanic sites; and the Trench Unit, which includes the submerged lands extending from the northern limit of the Exclusive Economic Zone (EEZ) of the United States in the CNMI to the southern limit of the EEZ of the United States in the Territory of Guam; no waters are included in the Volcanic or Trench units. The Monument was placed within the National Wildlife Refuge System, with management falling under the jurisdiction of the U.S. Fish and Wildlife Service. The Secretary of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), has management responsibility for fishery activities within the waters of the Islands Unit. The CNMI government maintains jurisdiction of the area landward of mean low tide on Uracas, Maug, and Asuncion.

**Current Management and Management Needs for the Mariana Trench Marine National Monument**

Representatives from USFWS, NOAA, and the CNMI developed a management plan to satisfy the directives of the Monument Proclamation 8335. A management plan for the Mariana Trench Marine National Monument (MTMNM) was completed in June 2024. Six overarching goals were identified in the MTMNM Management Plan:

1. Conserve and protect the marine ecosystems around the islands of Farallon de Pajaros, Maug, and Asuncion; 21 of the Mariana Ridge undersea volcanoes and thermal vents (as identified in the Proclamation); and the geologic features and life forms in the Mariana Trench.
2. Provide for traditional access to the Monument by the indigenous people of CNMI and Guam for culturally significant, subsistence, and religious uses.
3. Develop education, interpretation, and outreach programs to enhance the understanding and appreciation of Monument resources and efforts to conserve them.
4. Assess and promote scientific exploration and research opportunities, and adopt measures to ensure that the Monument’s ecosystems, marine resources, and other objects of scientific interest are not degraded.
5. Assess and provide opportunities for tourism, recreation, and economic ventures that are compatible with the Monument’s ecosystem, marine resources, and other objects of scientific interest.

6. Contribute to the recovery and protection of all native species with special consideration for threatened and endangered species and species of management concern.

A full version of the MTMNM Management Plan can be found at the following link: https://www.fisheries.noaa.gov/resource/document/mariana-trench-marine-national-monument-management-plan

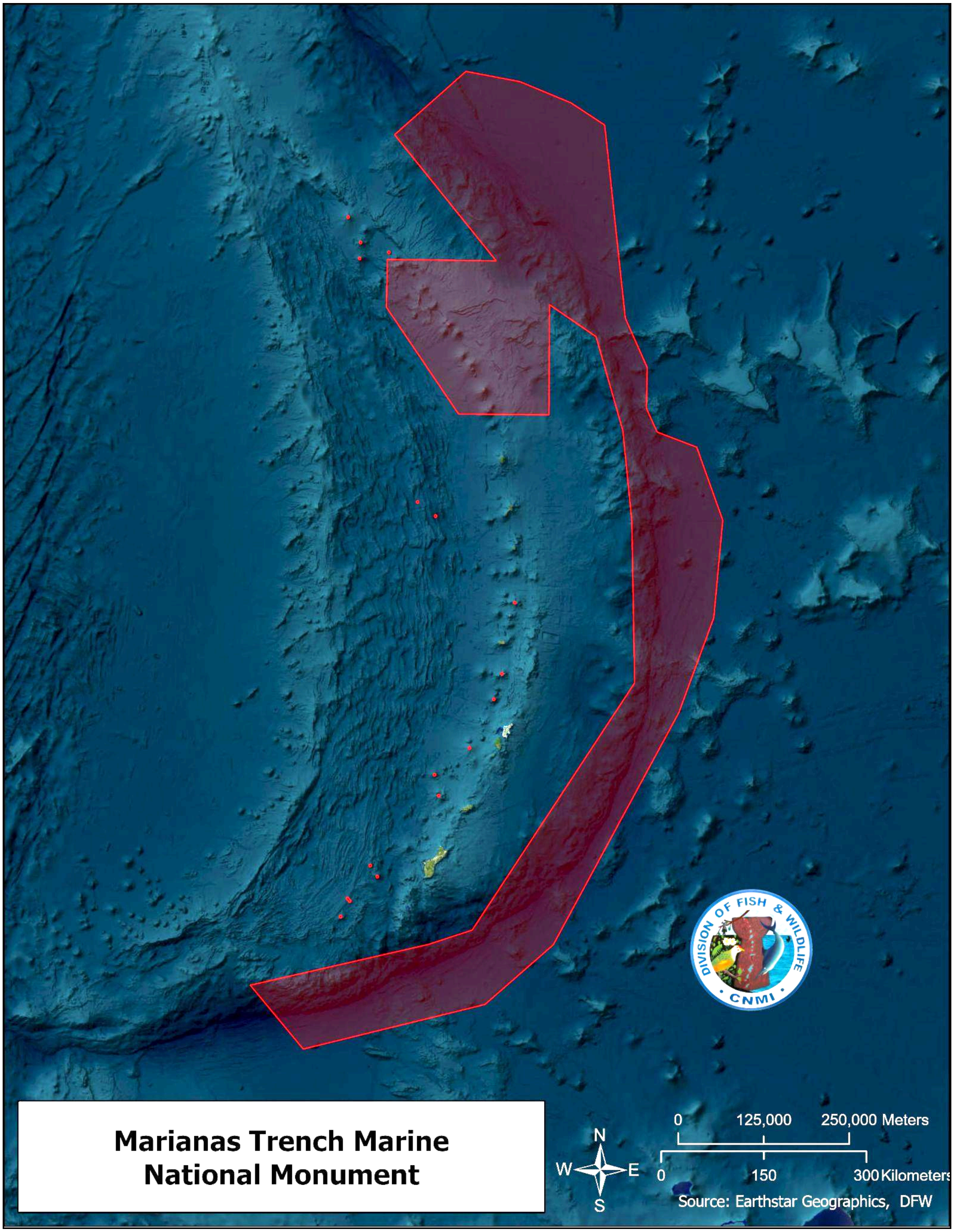


Figure 4. Marianas Trench Marine National Monument unit area and refuge are marked in red.

## 2.5.2 Sabana Conservation Area

This area encompasses the top plateau of Mt Sabana on the island of Rota (Figure 5) and consists of a mixture of small agricultural lots and unique native vegetation (Figure 6). The primary purpose of the Sabana Conservation area is to protect the watershed on the south side of the mountain that drains into the Talakhaya area which is the sole source of fresh water for the island residents. The freshwater that flows from the springs along the south side of Mount Sabana also provides essential habitat to many SGCN species including plants, freshwater species, and nearshore marine species. The Sabana Conservation Area is an important area that harbors some of the last natural individuals of the endangered *Osmoxylon mariannense*, many of the SGCN orchids and birds, and is an important foraging area for fanihi.

**Current Management and Management Needs of the Sabana Conservation Area** - Municipal Rota DLNR Forestry and DFW Endangered Plants Program manages experimental agroforestry plots, endangered plant out-planting, native plant propagation plots, and a large-scale forest restoration project within the conservation area. The CNMI DFW monitors forest bird populations, ayuyu populations, and fanihi colonies in the conservation area. We recommend developing a comprehensive management plan for the Sabana Conservation Area.

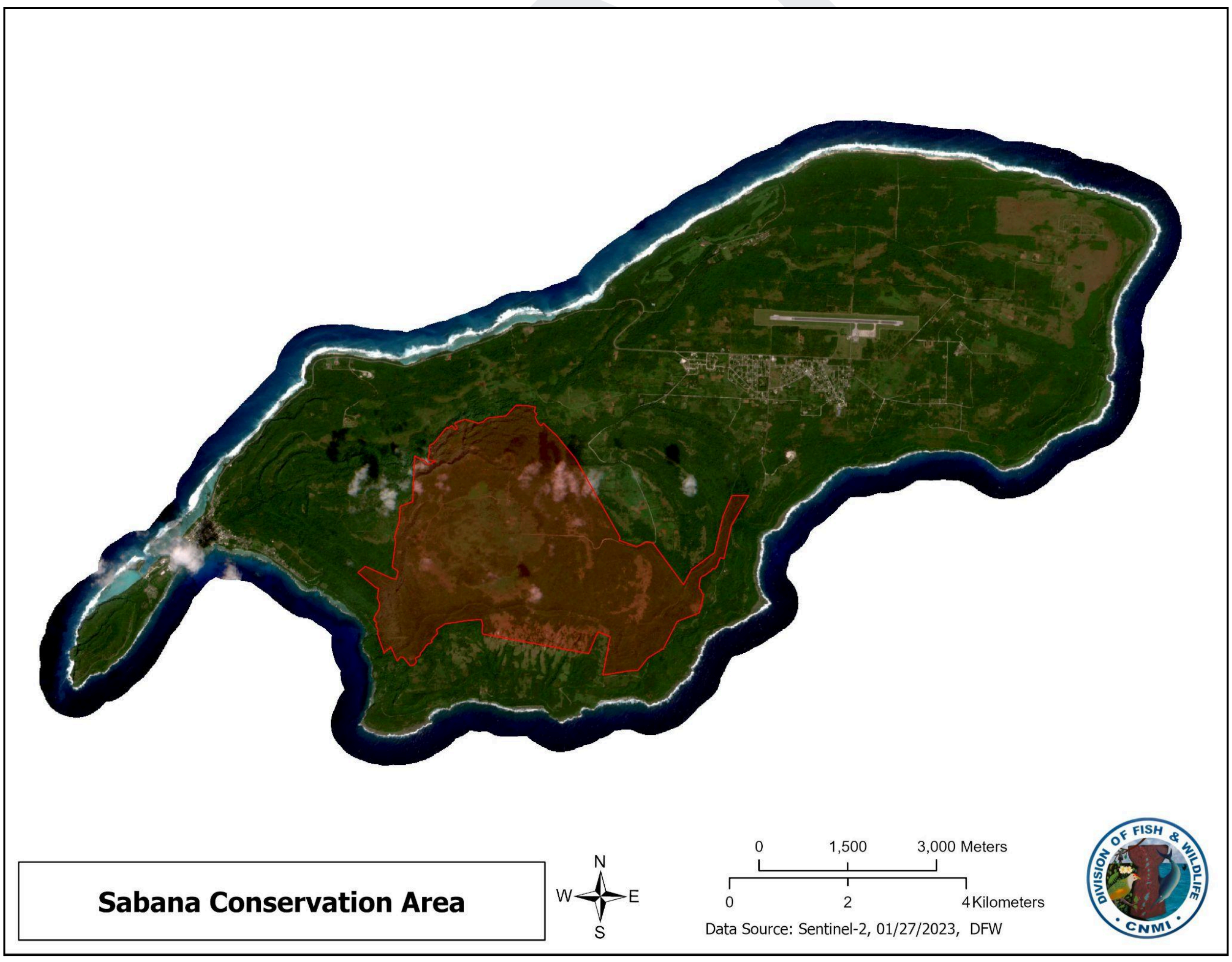


Figure 5. Map of the Sabana Conservation Area boundary on Rota island.

Figure 6. Typical limestone forest in the Sabana Conservation Area includes many epiphytes and mosses, tall mature trees, and sparse understory due to ungulate browsing. (Wiitala, 2021)

### 2.5.3 I Chenchon Bird Sanctuary (I Chenchon Park Wildlife Conservation Area)

This area (Figure 7) was established by Rota local law 9-1 for the conservation of wildlife and forest vegetation for the benefit of current residents and future generations and the tourist industry. This unique area consists of multi-terraced coastal forest cliff lines and rocky coral reef shoreline area which is home to thousands of nesting seabirds - one of the largest seabird nesting colonies in the CNMI.

**Current Management of the I Chenchon Bird Sanctuary** - Researchers monitor SGCN populations within the conservation area including åga nest monitoring, forest bird research, seabird colony monitoring, and fanihi colony monitoring. We recommend developing a comprehensive management plan for the I Chenchon Bird Sanctuary.

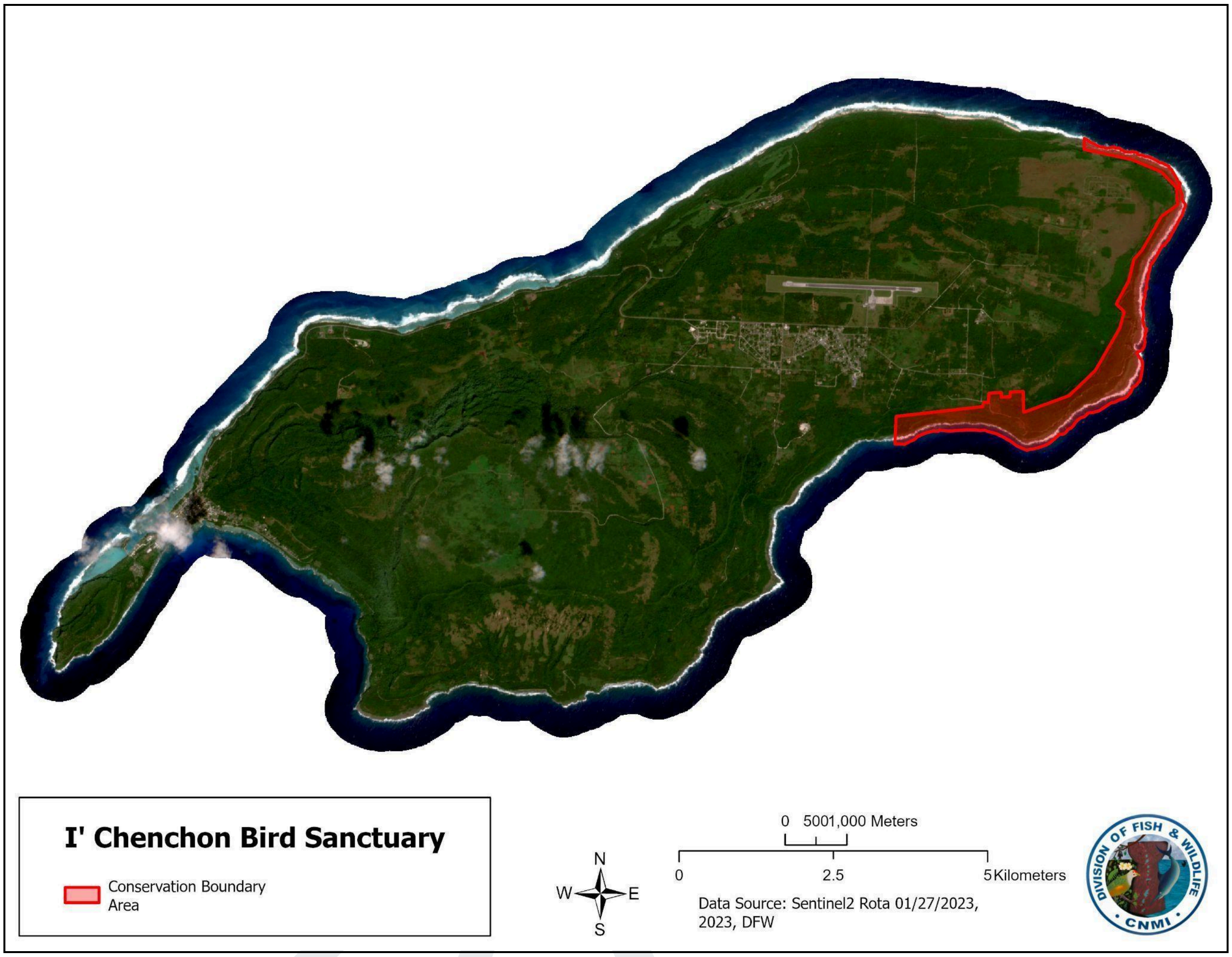



Figure 7. Map of the I Chenchon Bird Sanctuary boundary on Rota island.

## 2.5.4 Liyo' Conservation Area (Wedding Cake Mountain)

This area (Figure 8) was created by Rota local law title 10 Division 1:section 1821 to conserve the wildlife and forest vegetation that exists on and around Mount Taipingot. Forest birds, seabirds, and fanihi reside within the conservation area. The Liyo' conservation area is a semi-popular tourist site for hiking and scuba diving. The Rota Hole, or Rota Grotto, is situated along the northern tip of the peninsula and can be accessed via boat or an inland trail that starts in Tweksberry Park.

**Current Management of the Liyo' Conservation Area** - Tweksberry Park is a municipal park along the northern isthmus of the peninsula and is ground zero for the Coconut Rhinoceros Beetle infestation which was first detected in 2015. A quarantine area was established around the park and activities are limited to allow for local managers to treat the area for the highly invasive pest. At the base of the mountain at the far western edge of Tweksberry Park is a fence with a locked gate to keep unauthorized activity at a minimum within the conservation area. The CNMI DFW conducts forest bird and fanihi monitoring in the conservation area. There is no formal management plan for the Liyo' Conservation Area. We recommend developing a comprehensive management plan for the Liyo' Conservation Area.

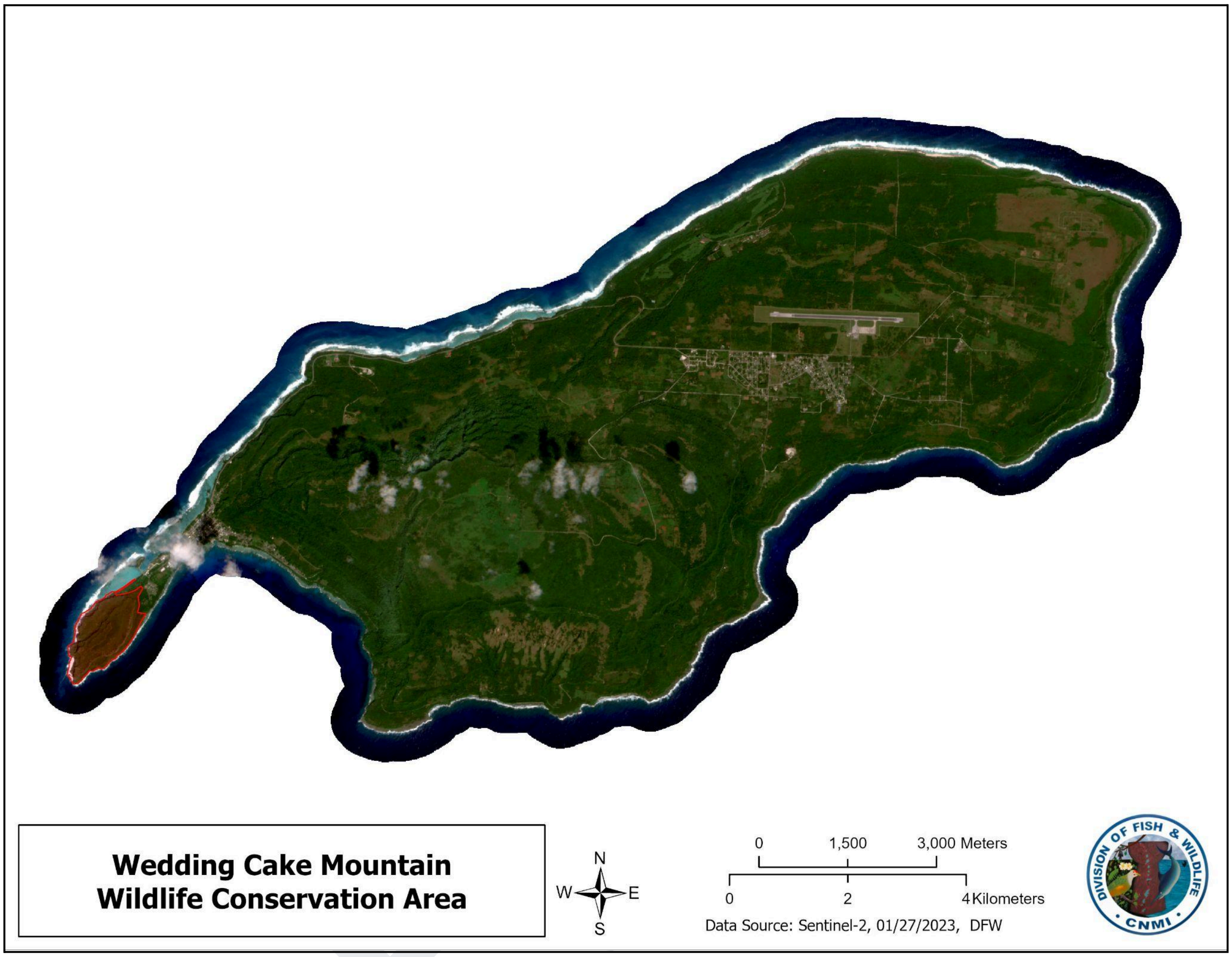



Figure 8. Map of the Wedding Cake (Liyo') Conservation Area boundary on the island of Rota.

## 2.5.5 Mariana Crow Conservation Area

Established in 2014, this area (Figure 9) is set aside to ensure adequate habitat for endangered åga on Rota and serves as a refuge for other native wildlife. Much of the conservation area overlaps with the I' Chenchon Seabird Conservation area.

**Current Management Strategies for the Mariana Crow (**åga**) Conservation Area** - There are signs placed along the boundary of this conservation area. There are currently no management plans for this conservation area. We recommend developing a comprehensive management plan for the Mariana Crow Conservation Area.

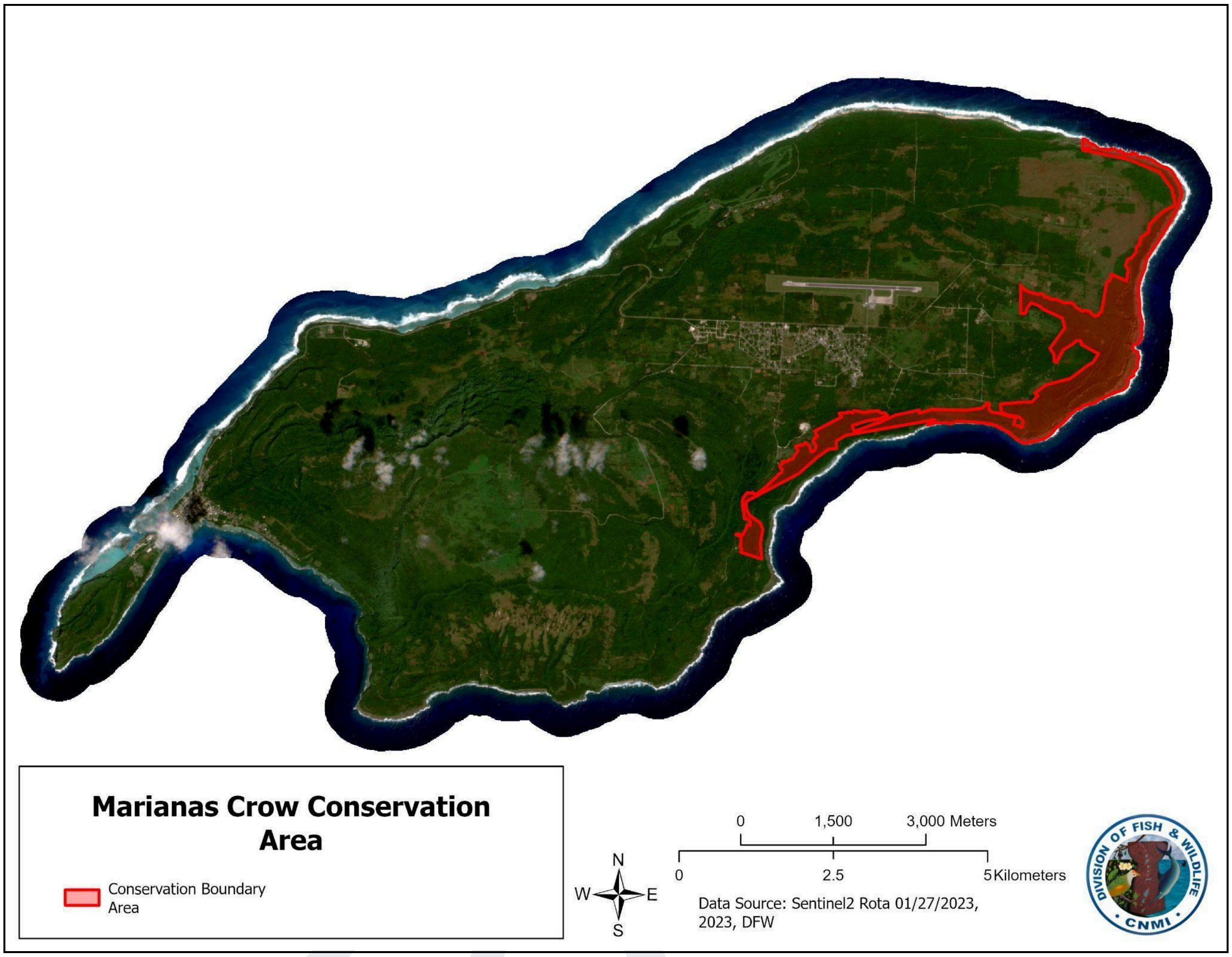



Figure 9. Map of the Mariana Crow Conservation Area boundary on Rota island.

### 2.5.6 Bird Island Wildlife Conservation Area & Bird Island Marine Sanctuary

The conservation area (Figure 9) was established as part of the Commonwealth Mitigation Bank under PL 10-84 in 1998 for the purposes of wildlife conservation. It includes the Grotto and the Bird Island Overlook - two popular sites for visitors and residents. The Bird Island Marine Sanctuary was created under PL 12-46 in 2001 for the continuity of wildlife and marine species. The conservation area contains trails that are easy for everyone to enjoy.

Designation of Bird Island (Figure 9) and Forbidden Island (Figure 19 ) as sanctuaries is in the public interest as it promotes the concept of conserving and protecting our natural resources. If properly managed, these sanctuaries may replenish areas with fishing access and ultimately benefiting fishermen and fishery resources. If properly managed these sanctuaries may replenish areas with fishing access and ultimately benefiting ecosystems and the fishery. These sanctuaries shall also provide a laboratory for students, teachers and research groups to study wildlife and marine species of the Marianas Islands.

**Current and Needed Management Strategies for the Bird Island Wildlife Conservation Area & Marine Sanctuary** - In 2007 DLNR published the final Bird Island Conservation Area and Marine Sanctuary Management Plan. This plan details the legislative and agency mandates, describes the area and its resources and various uses, and outlines specific management goals, objectives and strategies. We recommend updating the monitoring and management plan for the Bird Island Marine Sanctuary.

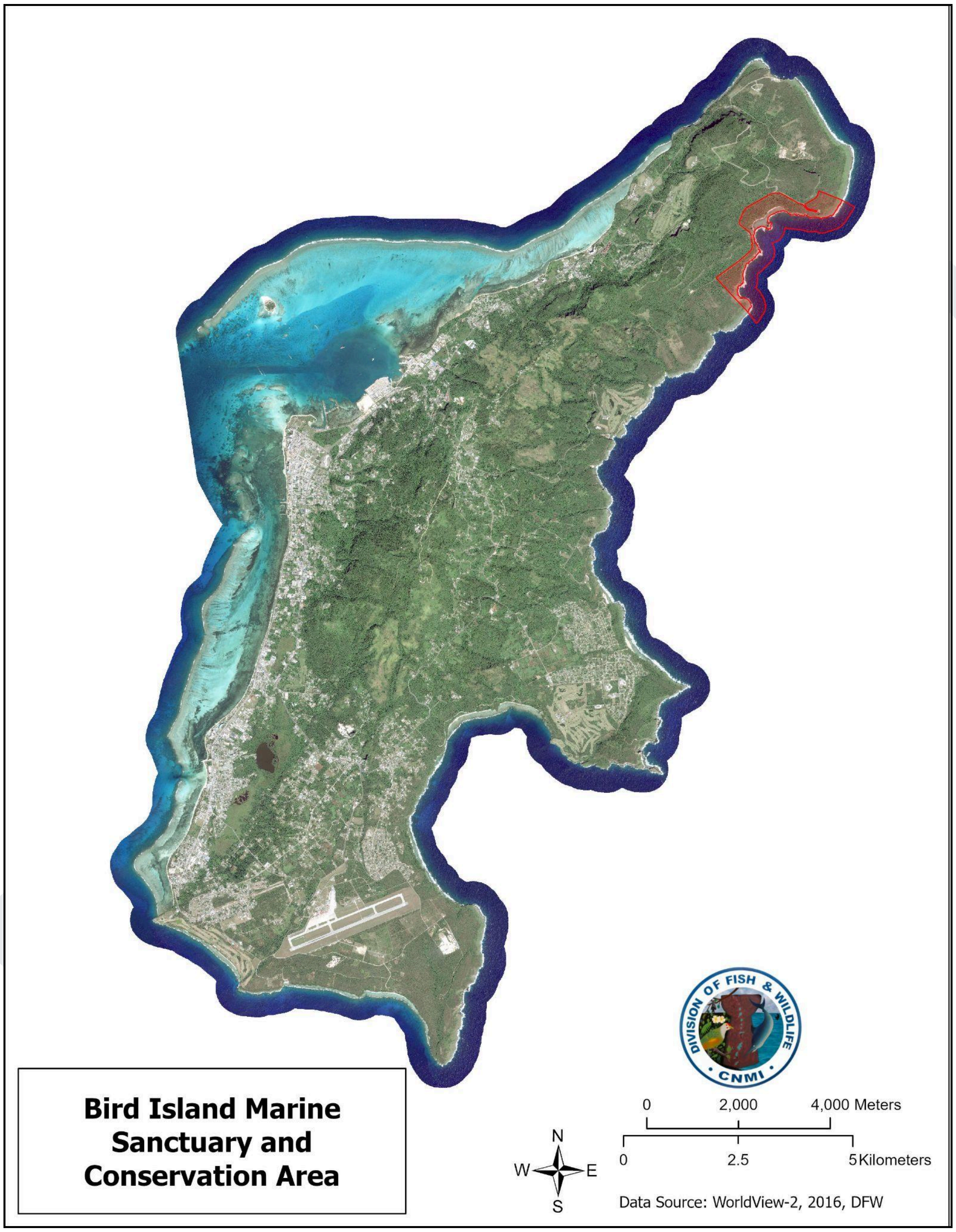



Figure 10. Map of Saipan with the Bird Island Sanctuary and marine protected area shown in red.

### 2.5.7 Lake Susupe Conservation Area

Hagoi Susupe (Figure 11) is a brackish lake surrounded by extensive marshy wetlands. DFW purchased a wetland adjacent to the lake to conserve habitat for the ESA listed Mariana Common Moorhen and to help preserve the ecosystem services provided by the wetland. This is the only conservation area that is not managed by DFW. In 2019, Public Law 20-91 designated the area as Wildlife Park under the management of the Division of Parks and Recreation.

**Current Management Strategies Lake Susupe Conservation Area**

The Division of Parks and Recreation published a five-year strategic plan in 2020. The mission of the management strategy are as follows:

1. To restore Susupe Lake Wildlife Park and surrounding areas to the natural healthy state for maintaining and functioning wetland values.
2. To strengthen the effectiveness of protection and conservation of Susupe Lake through the participation of local muli-stakeholders and related organizations.
3. To encourage wise use of Susupe Lake Wildlife Park and promote it to be a well known eco-tourism destination in the CNMI.

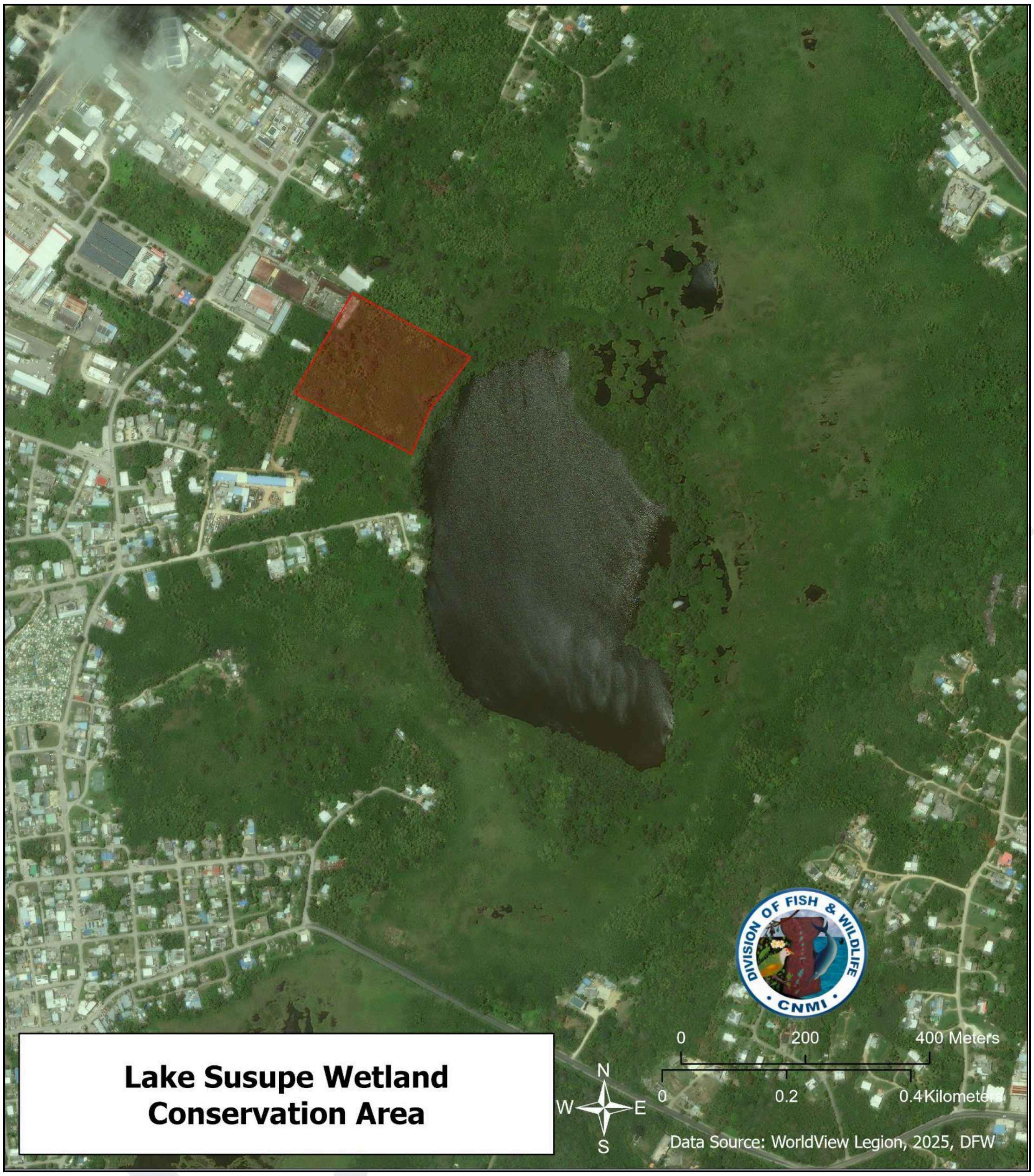



Figure 11. The southern part of Saipan with Lake Suspe wetland conservation area in red.

## 2.5.8 Kagman Wildlife Conservation Area

The Kagman Wildlife Conservation Area (Figure 12) was established in 1998 as part of the Commonwealth Mitigation Bank under PL- 10-84 to conserve wildlife and their habitat. This area includes Forbidden Island Overlook and abuts the Forbidden Island Marine Sanctuary. **Current Management Strategies Kagman Wildlife Conservation Area** In 2007 DLNR published the final Kagman Wildlife Conservation Area Management Plan. This plan details the legislative and agency mandates, describes the area and its resources and various uses, and outlines specific management goals, objectives and strategies. We recommend updating the monitoring and management plan for the Kagman Wildlife Conservation Area.

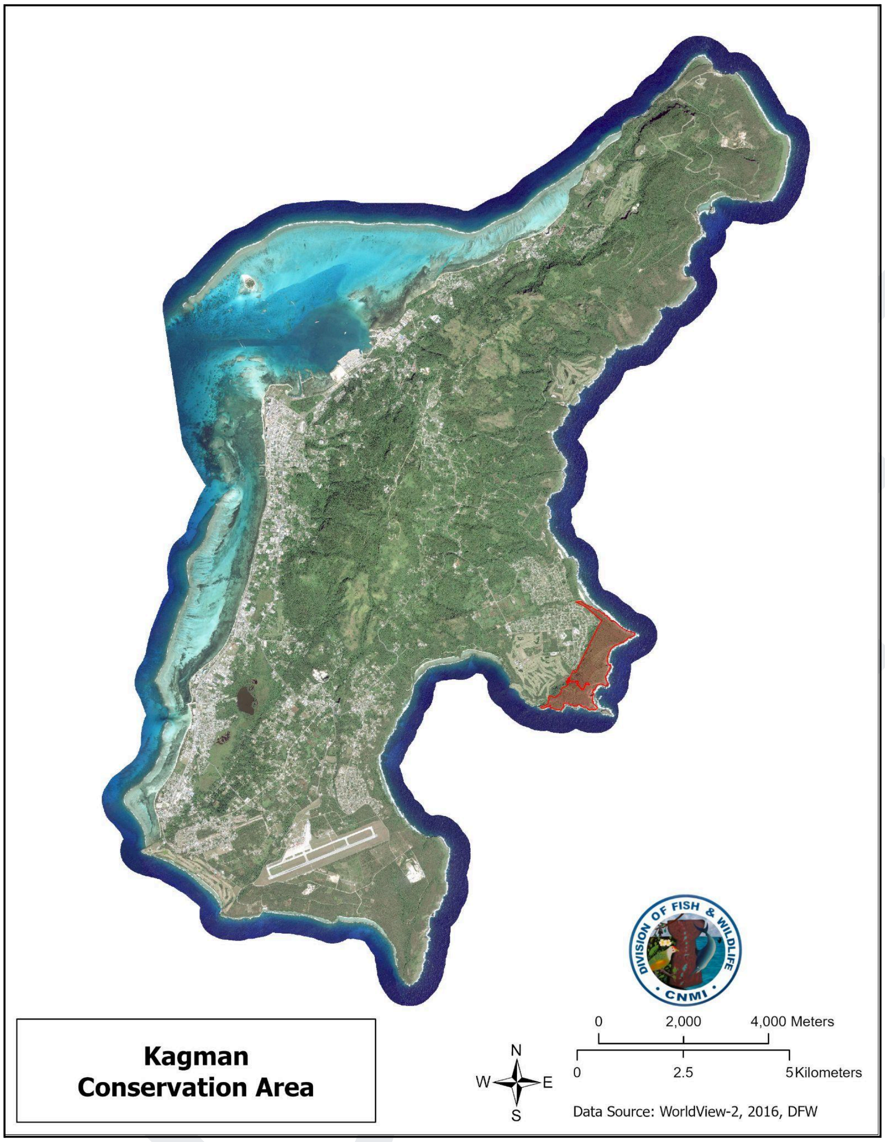



Figure 12. Kagman Wildlife Conservation area is shown in red.

### 2.5.9 Megapode Conservation Area & The Saipan Reed-Warbler Conservation Area

This area (Figure 13) was established after the CNMI Department of Public Lands (DPL) formal Section 7 consultation with the U.S. Fish and Wildlife Service as part of the planning process for Marpi Point village homestead development. DPL deeded land to the Department of Lands and Natural Resources to be used for the conservation of these two species that it was determined would be affected by the proposed development.

**Current Management Strategies Megapode Conservation Area** In 2009 DFW published the Megapode Conservation Area Management Plan. This plan details the legislative and agency mandates, describes the area and its resources and various uses, and outlines specific management goals, objectives and strategies. We recommend updating the monitoring and management plan for the Megapode Conservation Area.

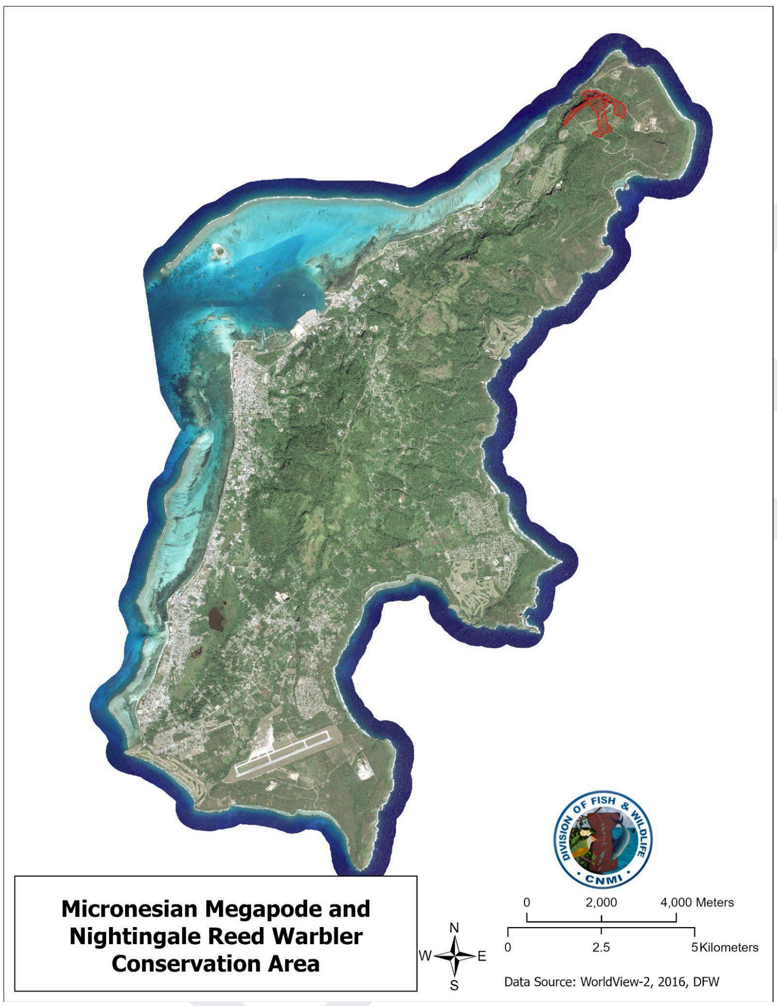



Figure 13. Micronesian Megapode and Saipan reed warbler conservation area shown in red.

## 2.5.10 Saipan Upland Mitigation Bank (SUMB)

This area (Figure 14) was established in 1998 under PL 10-84. This conservation area is set aside to provide high-quality habitat for ESA species like the ga'ga karisu (Saipan reed warbler), sasagnat (Micronesian megapode), and fanihi. The SUMB is a unique agreement between CNMI DLNR and USFWS that allows incidental take of the endangered and protected gaga' karisu in exchange for payment into the mitigation bank which would be a fund to manage the property that provides habitat.

**Current Management Strategies for the Saipan Upland Mitigation Bank**

In 2009 DFW published the SUMB. This plan details the legislative and agency mandates, describes the area and its resources and various uses, and outlines specific management goals, objectives and strategies. We recommend updating the monitoring and management plan for the SUMB Conservation Area.

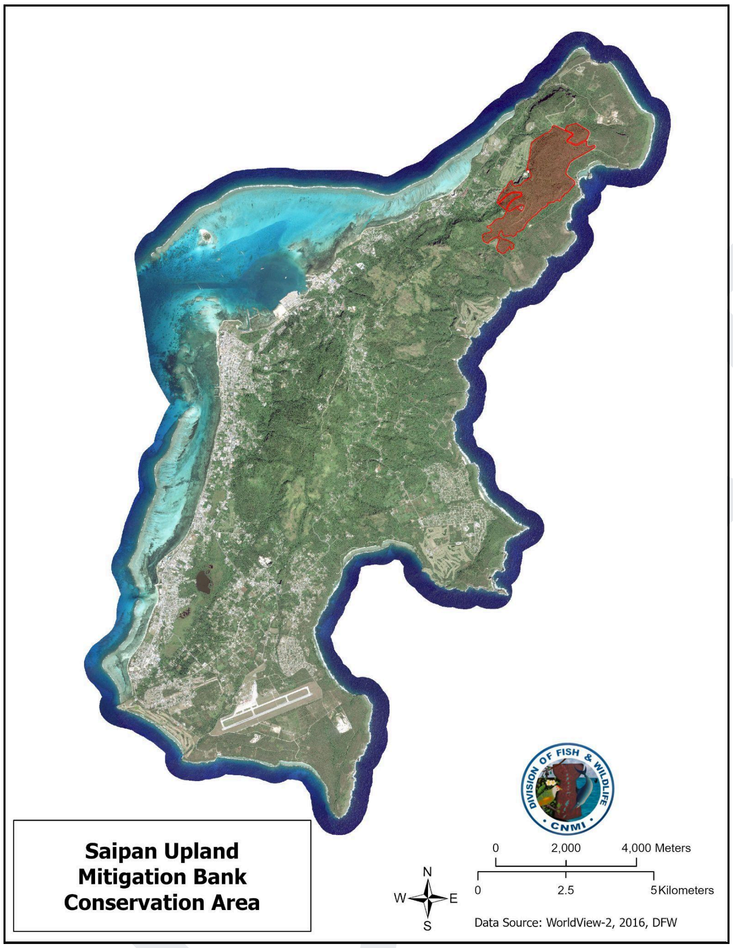
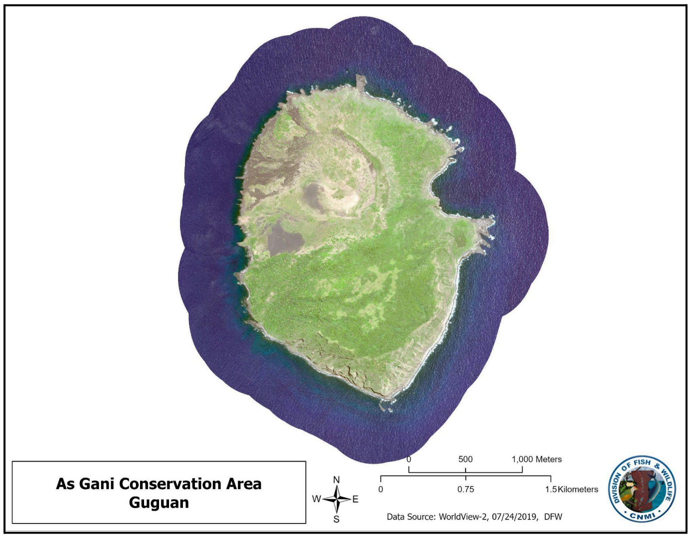


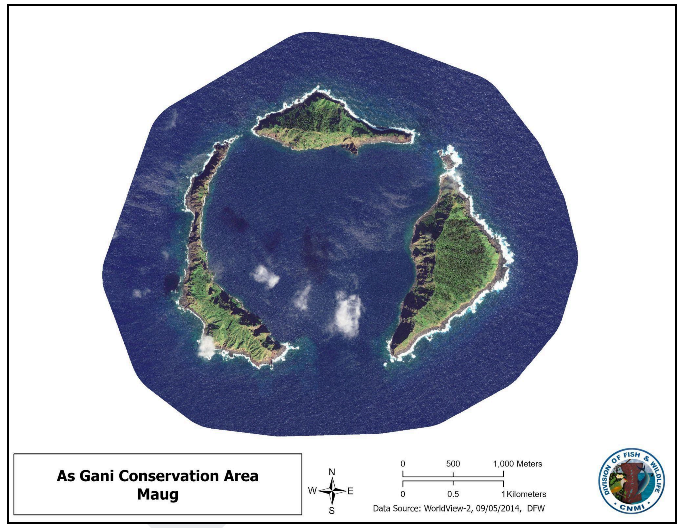

Figure 14. Saipan upland mitigation bank conservation area is shown in red.

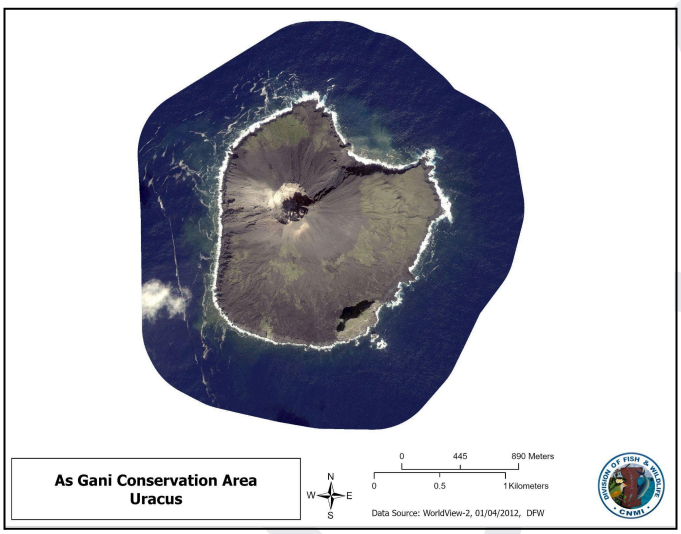
## 2.5.11 As Gani (The Northern Islands)

Guguan (Figures 15), Maug (Figure 16), Uracas (Figure 17) and Asuncion (Figure 18) Islands are designated as wildlife conservation areas in the CNMI constitution (2 CMC5104(a)(5) and article XIV(2). Landing on these islands without prior approval from the CNMI DFW Director, except in the case of an actual emergency and/or removing fish and marine life from the nearshore waters, is prohibited.

**Current Management Strategies for the Northern Island** There is currently no management plan for the As Gani island conservation area. Though, at this time there is little that the division could feasibly do to manage these areas due to how remote they are.



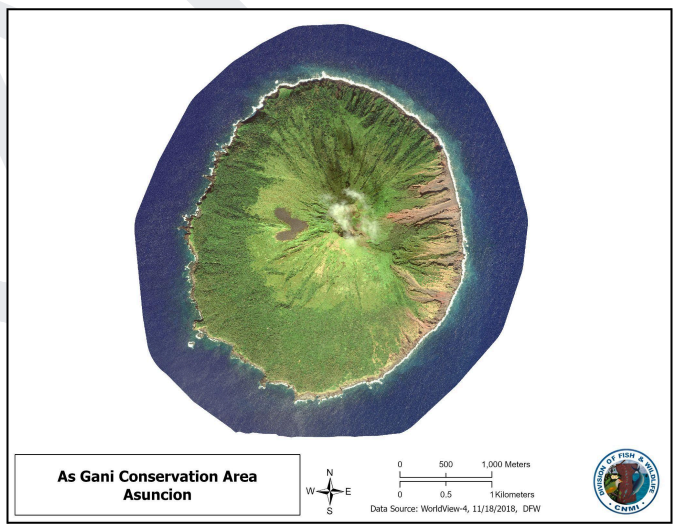




Figure 15. (Top left) Guguan Island is designated a wildlife sanctuary.
Figure 16. (Top right) Maug Island is designated a wildlife conservation area.
Figure 17. (Bottom left) Uracas Island is designated a wildlife conservation area.
Figure 18. (Bottom right) Asuncion Island is designated a wildlife conservation area.

## 2.5.12 Mañagaha Marine Conservation Area

Established by PL 12-12 The purpose of the Mañagaha Marine Conservation Area (Figure 19) is to protect and preserve, by strict regulatory enforcement, the land and water resources, flora, fauna, and marine life that are found in the conservation area for the enjoyment of future generations of Commonwealth residents and visitors.

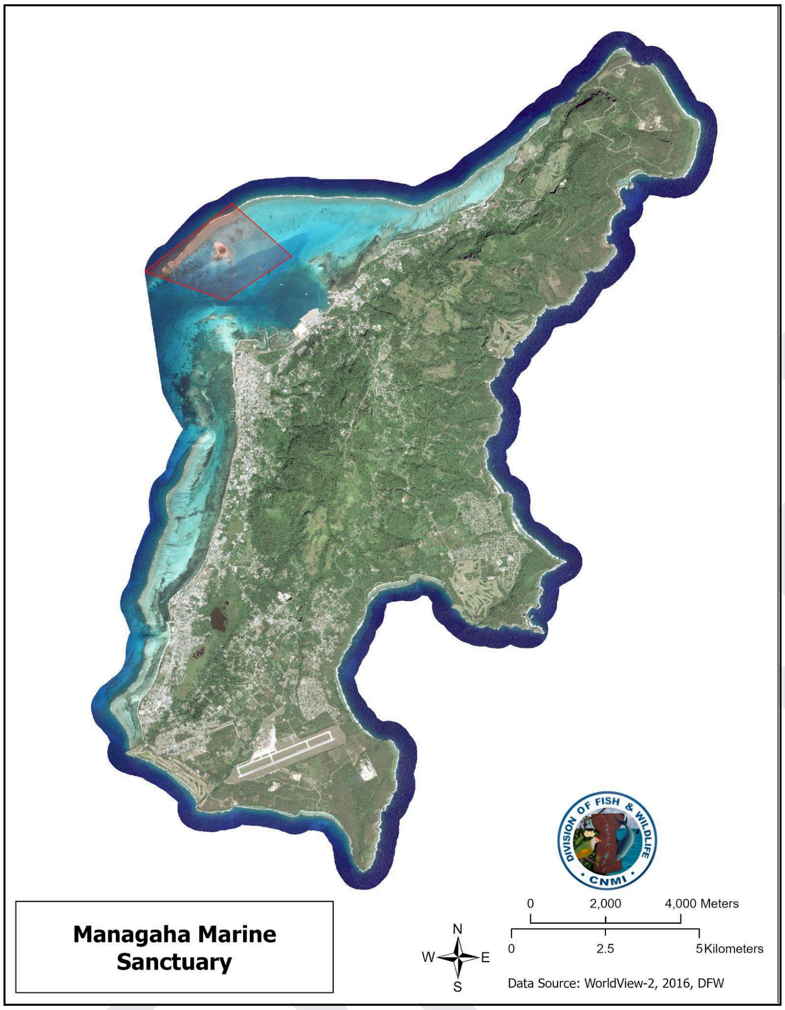



Figure 19. Mañagaha Marine Sanctuary

Mañagaha Marine Conservation Area encompasses 500 ha (1,235 ac) within the Tanapag Lagoon and the adjacent forereef slope (Figure 18). The Tanapag Lagoon is the northern portion of the Saipan Lagoon that covers 3,500 ha (8,645 ac) along Saipan's western coastline. The conservation area encompasses approximately 12% of the Saipan Lagoon.

The conservation area is primarily within a coastal lagoon ecosystem consisting of relatively shallow water (generally 1-6 m deep) with reef flats, reef patches, sand flats, and rubble zones that are protected by an outer barrier reef. A small portion of the conservation area encompasses reef slope habitat along the outer barrier reef (outside of the lagoon). All these habitats provide an excellent environment for coral reefs and their associated flora and fauna.

**Current Management Strategies Mañagaha Marine Conservation Area** - In 2005, DLNR published the Mañagaha Marine Conservation Area Management Plan which details the legislative and agency mandates, describes the area and its resources and various uses, and outlines specific management goals, objectives and strategies. We recommend updating this management plan.

## 2.5.13 Forbidden Island Marine Sanctuary

Designation of Bird Island and Forbidden Island (Figure 20) as sanctuaries is in the public interest as it promotes the concept of conserving and protecting our natural resources. The Forbidden Island marine Sanctuary is along the eastern edge of the Kagman Wildlife Conservation Area. The area can be accessed via a steep trail that cuts into the sandstone cliffside.

**Current and Needed Management Strategies for Forbidden Island Marine Sanctuary** In 2007 DLNR published the final Kagman Wildlife Conservation Area Management Plan, which includes management strategies for Forbidden Island Marine Sanctuary. This plan details the legislative and agency mandates, describes the area and its resources and various uses, and outlines specific management goals, objectives and strategies. We recommend updating the monitoring and management plan for the Kagman Wildlife Conservation Area.

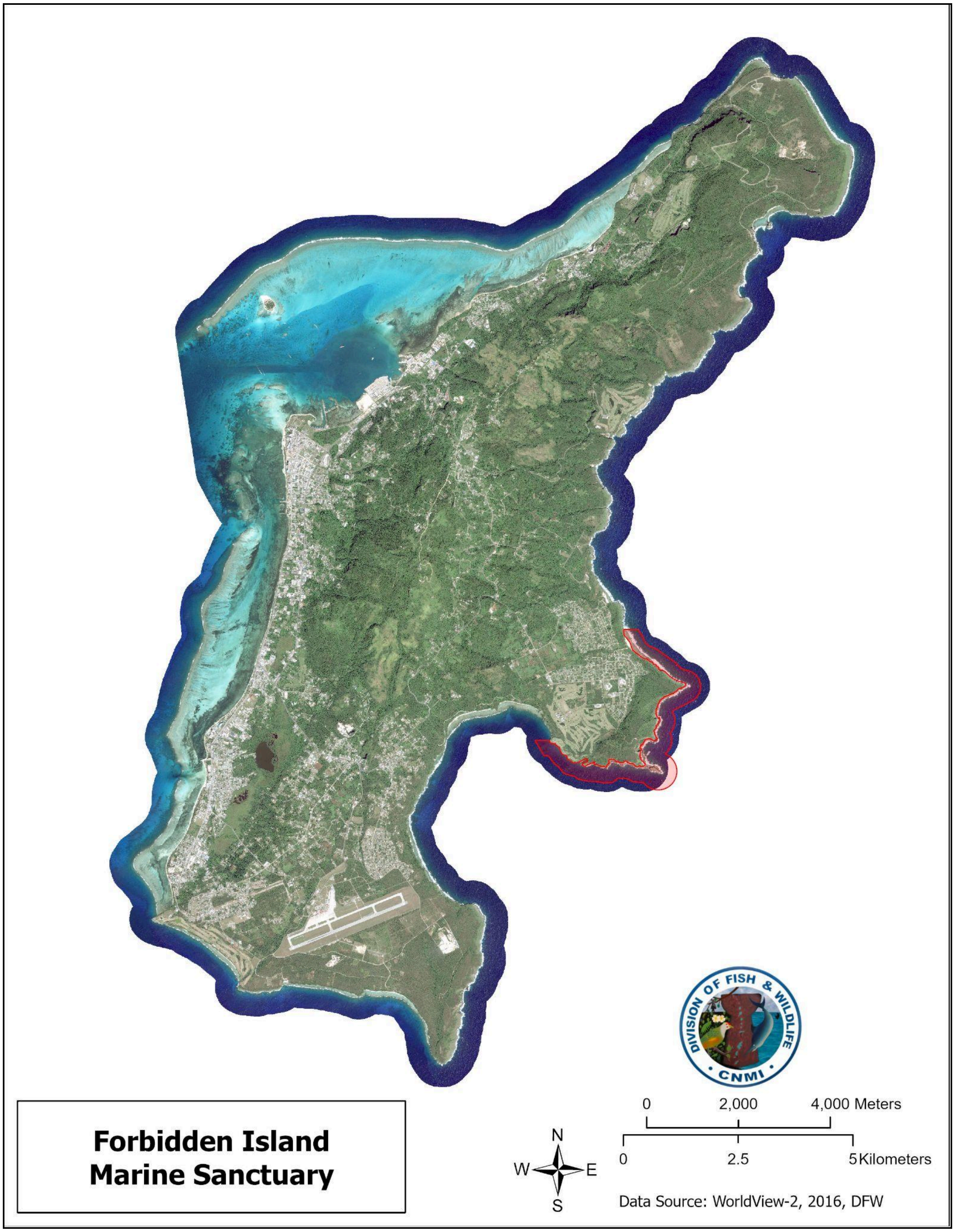



Figure 20. Forbidden Island Marine Sanctuary is shown in red.

## 2.5.14 Sasanhaya Bay Fish Reserve

Rota established the Sasanhaya Bay Fish Reserve (Figure 21) to "...preserve the natural beauty, pristine marine environment and the historical wreckage in the Sasanhaya Bay of Rota, especially from Puña Point to the Coral Gardens. The Delegation further finds that this area is a valuable tourist attraction and that its preservation would be a boost to this industry. The Delegation further finds that the protection of marine life in this area will be best accomplished by establishing a fish reserve within which fishing and other potentially harmful activities shall be restricted".

**Current and Needed Management Strategies for Sasanhaya Bay Fish Reserve -** The fish reserve boundaries are clearly marked within water buoys. Signage for the site along the south road bordering the reserve are outdated and need to be replaced. We recommend developing a comprehensive monitoring and management plan for the Sasanhaya Bay Fish Reserve.

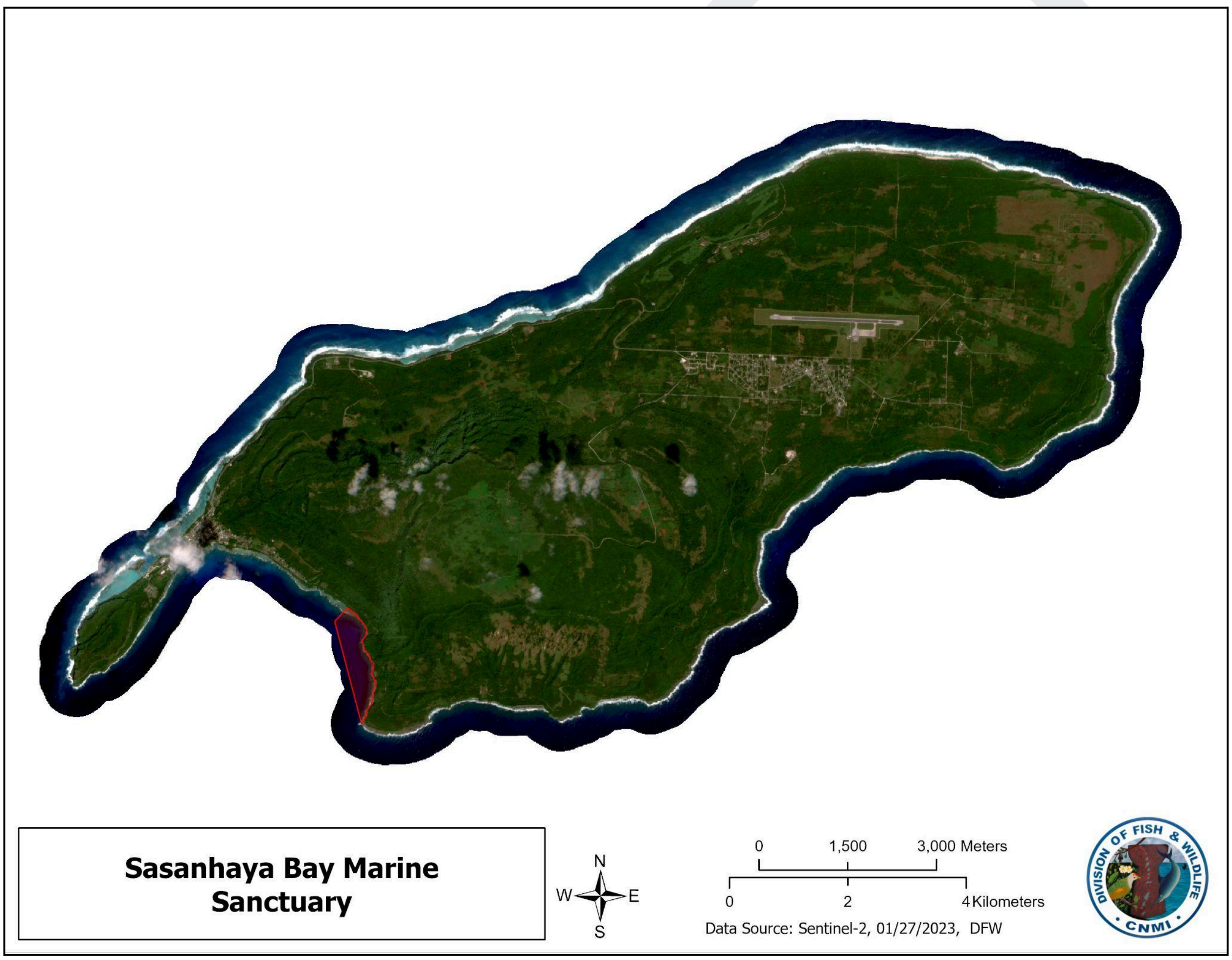



Figure 21. Sasanhaya Bay Fish Reserve shown in red.

## 2.5.15 Laulau Bay Sea Cucumber Sanctuary

The Laulau Bay Sea Cucumber Sanctuary (Figure 22) was established to combat "... over-harvesting or the deleterious effects of beachfront development, heavy recreational use of the Commonwealth's lagoons by motorcraft, the waterside presence of the Puerto Rico dump and its petrochemical, fluorocarbon, and heavy metal contaminants, the population of edible seaweed, sea grass, and sea cucumbers and other edible echinoderms has greatly declined. Since many other elements of marine life dependent on the lagoons and reefs are already threatened it is in the best interest of the Commonwealth's reef ecosystem to put a moratorium on the harvest of those elements most in danger of disappearing." Thus, the Laulau Bay Sea Cucumber Sanctuary was established.

**Current and Needed Management Strategies for the Laulau Bay Sea Cucumber Sanctuary**

Develop a monitoring and management plan for the Laulau Bay Sea Cucumber Sanctuary. Replace signage at popular beach access points. Repair and maintain the beach access sites for Lau Lau Bay to ensure safe and proper access to this Sanctuary.

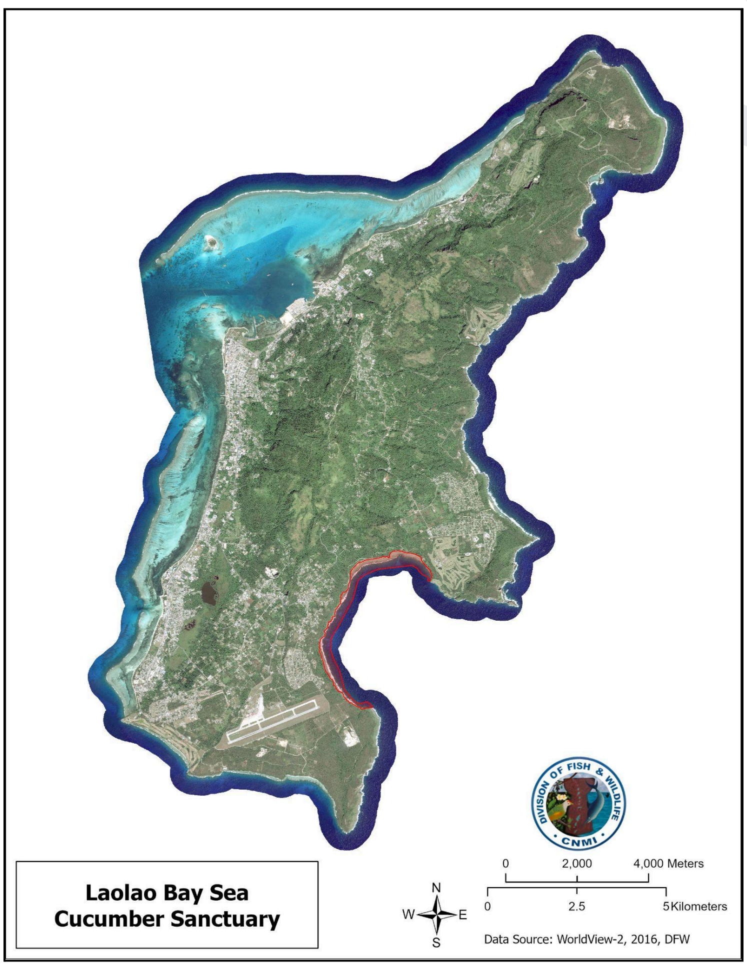



Figure 22. Laulau Bay Sea Cucumber Sanctuary is shown in red.

## 2.5.16 Lighthouse Reef Trochus Sanctuary

The topshell trochus (Trochus niloticus), was introduced to the Mariana Islands in 1938. From 1947-1976, trochus harvest was restricted to two weeks a year but harvest was later unrestricted from 1976 to 1981. In 1981, the CNMI DFW, through its regulatory authority, put a CNMI-wide moratorium on trochus harvest into effect and established the Lighthouse Reef Trochus Sanctuary (Figure 23). The moratorium on the removal of trochus remains in effect today. This sanctuary exists so that, if the trochus moratorium is lifted, a safe haven for trochus growth and reproduction will already be in effect.

**Current and Needed Management Strategies for the Lighthouse Reef Trochus Sanctuary**

Develop a monitoring and management plan for the Lighthouse Reef Trochus Sanctuary to determine the necessity for the continued protection of the area.

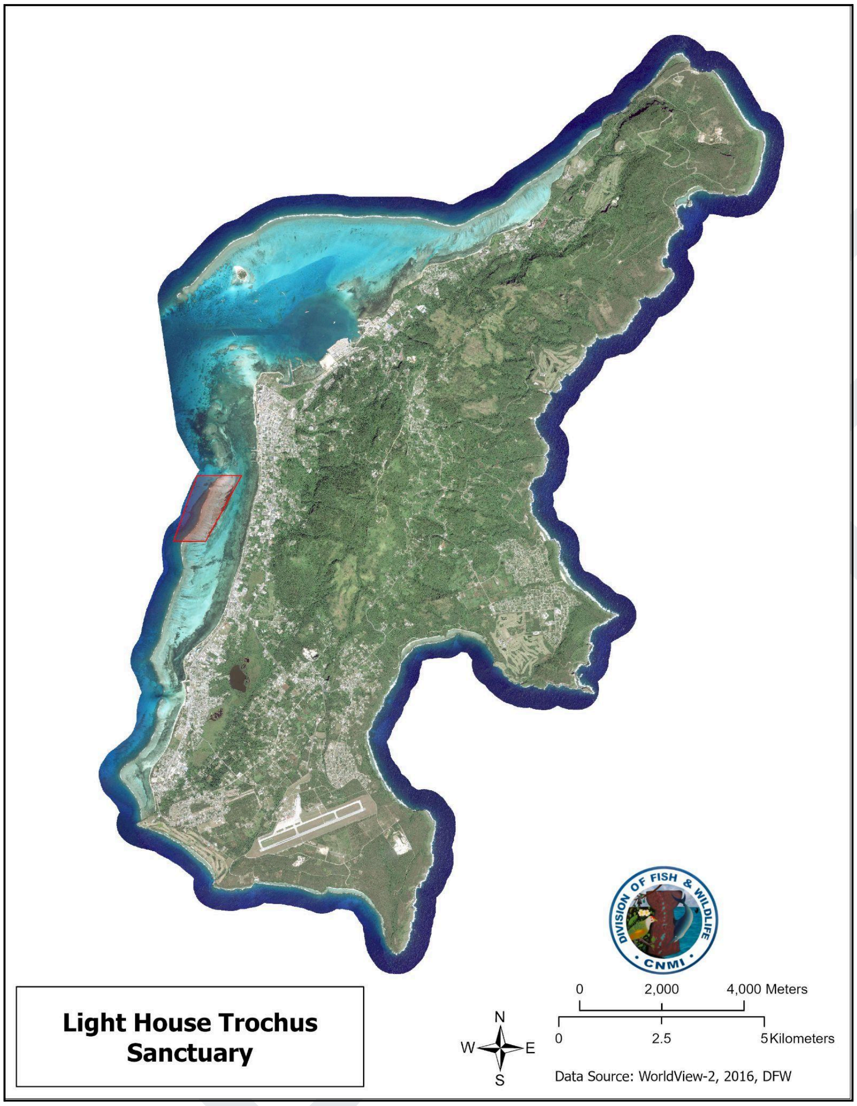



Figure 23. Lighthouse Reef Trochus sanctuary is highlighted in red.

## 2.6 Resource Management

Natural resource management values in the CNMI are directly linked to traditional ecological knowledge of the Chamorro and Carolinian heritages. The long history of colonization of the Mariana Islands has impacted the condition of natural resources and land use. Today the unique and diverse human population of the islands have had varied impacts on the natural resources and thus the management needs for each island. In the CNMI, the current paradigm of natural resource management is largely based on a western traditional framework that emphasizes scientific data and top-down management approaches, however, the place based knowledge of plants, animals, and landscapes are connected to cultural practices of respect, reciprocity, and relatedness (BECQ 2020).

There are several natural resource managers in the CNMI  and the Department of Lands and Natural Resources (DLNR) serves as the primary steward of the CNMI's natural resources. In addition to DLNR, there is a complex network of various local agencies, federal agencies, academic institutions, private sector agencies, non-profits, and community-based groups that participate in natural resource management and conservation activities.

The CNMI also participates in regional and national conservation initiatives and programs including Micronesia Challenge and the US Coral Reef Task Force. The Micronesia Challenge 2030 is a pledge made by five island nations of the Pacific Ocean - Federated States of Micronesia, Palau, Republic of the Marshall Islands, Guam, and the Commonwealth of the Northern Mariana Islands - to effectively protect and manage 50% of marine resources and 30% of terrestrial resources by 2030 across Micronesia, ensure natural resources are supporting economic livelihoods of community members, address and mitigate pressures on natural resources such as the threats of invasive species, and apply cross-regional fisheries management practices.

US President Clinton established the US Coral Reef Task Force (USCRTF) in 1998 to tackle issues surrounding preserving and protecting coral reef ecosystems. This multi-partner task force has been critical to supporting coral reef monitoring and research across the United States, including the Pacific Islands region. The US Coral Jurisdictions are American Samoa, the Commonwealth of the Northern Mariana Islands, Florida, Guam, Hawaii, Puerto Rico, and the US Virgin Islands. Members of various local natural resource management agencies attend Task Force meetings and carry out  initiatives.

This section details the organizations and their jurisdictions and obligations to natural resource management in the CNMI.

## 2.6.1 Natural Resource Managers

### 2.6.1.1 CNMI Office of the Governor

The Department of Land and Natural Resources (DLNR) is the parent organization under the executive branch of the CNMI government responsible for managing, protecting, and enhancing natural resources for the benefit of the natural ecosystem and for the citizens of the CNMI. Below is an organizational chart that outlines the various departments that operate under the direction of DLNR. In addition to the main branch of DLNR on Saipan, there are Resident Directors of municipal DLNR offices on Rota and Tinian which are directly funded by the municipal governments of those islands. The municipal departments are able to address local natural resource concerns and interests and coordinate with other local departments to carry out projects unique to their needs. The Saipan managed branches of DLNR also have some staff housed on Tinian and Rota to carry out projects on these islands in partnership with the municipal divisions. Each division manages an assortment of local, federal, and supplementary grant funding to administer a wide range of projects that fall within their jurisdiction and purview.

Table 2. A list of the various divisions of DLNR on Saipan and a list of some of their programs and mission statements.

| Divisions of DLNR and subsections (subject to change) | Division Mission Statement |
|---|---|
| **Division of Fish and Wildlife**<br>● *Boating Access*<br>● *Fisheries Conservation and Management*<br>● *Wildlife Conservation and Management*<br>● *Aquatic Education*<br>● *Commercial Fisheries Data*<br>● *GIS and Spatial Data Management*<br>● *Conservation Enforcement*<br>● *Brown Tree Snake Interdiction Program*<br>● *Sea turtle Conservation Program*<br>● *Endangered Plants Program* | The Division is tasked with conserving, protecting and enhancing the fish, game, and wildlife resources of our islands for the benefit of the citizens of the CNMI. |

| | |
|---|---|
| **Division of Agriculture**<br>● *Agricultural Services*<br>● *Animal Health*<br>● *Forestry Program*<br>○ *Forest Health*<br>○ *Forest Stewardship Program*<br>○ *Urban and Community Program*<br>● *Specialty Crop Block Grant Program*<br>● *Resilient Food System Infrastructure Program*<br>● *Food Security Program*<br>● *Kagaman Farm Plot Program*<br>● *Ma'a'fala Breadfruit Tree Program* | The Division of Agriculture is tasked with assisting local farmers and ranchers to promote top-quality produce and services, and to promote sound agricultural practices and enhance and maintain current farming and ranging activities, including the protection and improvement of our forest resources for a healthy and beautiful CNMI. |
| **Division of Land Registration and Survey**<br>● *Administration*<br>● *Research*<br>● *Survey*<br>● *Land Registration and Adjudication* | Public Law 3-79 mandates the Division of Land Registration & Survey to Survey Ore-War Properties, Record Documentation & Map, Review & Clearance of all Submitted Check Prints, Provide research areas with professional services for the General Public on a daily basis. |
| **Division of Parks and Recreation** | Parks and Recreational areas have been established by constitutional mandate and public laws to ensure that prime spaces under public land were maintained for community purposes and activities. |

Table 3. A list of the Tinian municipal government Department of Lands and Natural Resources and their divisions, programs, and mission statements.

| Tinian DLNR | Tinian DLNR Mission Statement |
|---|---|
| **Division of Fish and Wildlife**<br>● *Wildlife Enforcement*<br>● *Youth Explorer Program*<br>**Division of Forestry**<br>● *Tinian Forest Nursery*<br>● *Community Urban Forestry Program* | The Department of Lands & Natural Resources' mission is to sustain, enhance, protect, and conserve Tinian & Aguiguan's natural, historic, and cultural resources for present and future generations. To provide efficient public services for the farming and |

| | |
|---|---|
| **Division of Agriculture**<br>● *Slaughterhouse (under Mayor's office)*<br>**Division of Parks and Recreation** | ranching community and other community groups in all areas related to the natural resources development and for the promotion of local products. To enforce the protection and conservation of forests, wildlife, marine, and other related natural resources. To ensure the protection of the islands from the introduction of invasive species that will cause harmful effects to our natural resources and community. To maintain and improve historical sites, public parks, and other government facilities for recreation and economic purposes. To revitalize the farming industry among our locals as Tinian was at one time a major supplier of fruits and vegetables to the Department of Navy in Guam, and Saipan. |

Table 4. A list of Rota municipal government Department of Lands and Natural Resources and their divisions, programs, and mission statements.

| Rota DLNR | Rota DLNR Mission Statement |
|---|---|
| **Division of Fish and Wildlife**<br>● *Wildlife Enforcement*<br>**Division of Forestry**<br>● *Talakhaya Watershed Restoration Project*<br>● *Community Urban Forestry Program*<br>● *Endangered Plants Program (under Saipan DLNR)*<br>**Division of Agriculture**<br>● *Rota Coffee Plantation*<br>● *Rota Cannabis Commission*<br>**Division of Parks and Recreation** | To be responsible for the protection and enhancement of the natural resources of the island of Rota including its marine environment. To protect the island of Rota's wildlife resources including fish and endangered animals. To be responsible for the management and disposition of public lands subject to the supervision of the Board of Public Lands as provided by this Chapter. To conduct surveys of Pre-War Properties and Public Lands on the island of Rota. To work in collaboration with the Department Secretary and Division Directors to adopt rules and regulations in furtherance of its duties and responsibilities. |

The Bureau of Environmental and Coastal Quality (BECQ) is the parent department under the executive branch of the CNMI government responsible for serving the public through wise management of CNMI natural resources, supporting healthy communities, a sustainable environment and a vibrant economy. Below is an organizational chart that outlines the various departments that operate under the direction of BECQ. Each division manages an assortment of local, federal, and supplementary grant funding to administer a wide range of projects that fall within their jurisdiction and purview.

Table 5. A list of the divisions of the Bureau of Environmental and Coastal Quality and some of their programs.

| Divisions of BECQ and subsections (subject to change) | Division Mission Statement |
|---|---|
| Division of Coastal Resources Management<br>● *Permitting*<br>● *Enforcement*<br>● *Education and Outreach*<br>● *Coastal Resource Planning*<br>● *Marine Monitoring*<br>● *Coral Reef Initiative*<br>● *Watershed Management* | To protect and enhance the CNMI's coastal resources for residents and visitors through effective and adaptive resource management, interagency collaboration, and stakeholder engagement, in a manner that builds and sustains community resilience and well-being. |
| Division of Environmental Quality<br>● *Environmental Surveillance Laboratory*<br>● *Pesticide Program*<br>● *Safe Drinking Water and Ground Water Management Program*<br>● *Site Assessment and Remediation*<br>● *Toxic Waste Management*<br>● *Wastewater, Earthmoving, Erosion Control Branch*<br>● *Water Quality Surveillance and Nonpoint Source Program*<br>● *Clean Air Program*<br>● *Solid Waste Management*<br>● *Aboveground Storage Tanks Program*<br>● *Litter Control Branch* | DEQ is committed to serving the community and dedicated to our mission, we work collaboratively with various government agencies, private partners, and the citizens of the Commonwealth to ensure a healthy community and a green and sustainable environment. |

### 2.6.1.2 US Federal Programs

In addition to the local government programs, there are federal agencies that provide natural resources management support to the local agencies and federal projects in the Mariana Islands. These agencies are listed below.

Table 6. A list of some of the Federally managed agencies and programs that operate in the CNMI.

| US Federal Agencies | Agency Mission Statement |
|---|---|
| United States Fish and Wildlife Service<br>-*Pacific Region Mariana Island Branch Office in Garapan* | The Pacific Region USFWS is committed to collaborating with our numerous partners, including Tribes and state, local and federal agencies, Native Hawaiians, and Indigenous Pacific Island communities |
| National Park Service<br>-*American Memorial Park in Garapan* | NPS is committed to conserving the natural resources within the American Memorial Park Grounds including the valuable coastal resources and inland waterways |
| National Oceanic and Atmospheric Administration | Committed to working with a variety of partners, from all sectors, to deliver the products, services, and programs most needed by the nation's coastal communities |
| United States Department of Agriculture<br>-*Natural Resources Conservation Service* | NRCS delivers science-based soil information to help farmers, ranchers, foresters and other land managers effectively manage, conserve and appraise their most valuable investment- The soil. |
| United States Department of Defense<br>-NAVFAC Joint Region Marianas | Under the Sikes Act of 1960 DOD "promotes effectual planning, development, maintenance, and coordination of wildlife, fish, and game conservation and rehabilitation in military reservations" |

### 2.6.1.3 Academic Institutions

Several academic institutions contribute to the management and conservation of the natural resources in the Mariana Islands, including the Northern Mariana College Cooperative Research, Extension, and Education Services program (NMC CREES). "The Northern Marianas College-Cooperative Research Extension and Education Service (NMC-CREES) provides quality technical programs, services and information to benefit the people, the environment and the economy of the Commonwealth of the Northern Mariana Islands (CNMI). With continuous interaction, collaboration and a unified direction, the department is dedicated to help improve the economic well- being, living conditions, and overall quality of life of its stakeholders. Our stakeholders include farmers, families, youth, individuals, government agencies, and various ethnic communities." - NMC CREES mission statement published on their website. The NMC CREES program is renowned for their contributions to advancements in agricultural and aquaculture development in the Marianas and providing equitable and sustainable access to program resources to participants and students across the islands.

In addition to Northern Mariana College; the University of Guam and the University of Washington, Virginia Tech, and many other academic institutions provide expertise, program management, and collaboration for natural resource management and conservation projects in the CNMI.

#### 2.6.1.4 Not-for-Profit and Private Sector

There are several non-profit, for-profit consulting groups, community, and grassroots groups that participate in conservation initiatives, promote conservation, and participate in natural resource management practices. These groups include and are not limited to: Marianas Islands Nature Alliance, Micronesian Climate Alliance, Tasi to Table, 500-Sails, and CNMI Island Keepers, among others. Private consulting agencies including Pacific Coastal Research and Planning, Johnston Applied Marine Sciences, Furey and Associates, and Micronesian Environmental Services.

### 2.6.3 Sustainable development

The CNMI Office of Planning and Development in cooperation with the Green Growth Initiatives group developed the CNMI Comprehensive Sustainable Development Plan (CSDP), which spans a timeframe between 2021-2030. In a letter addressed to the Director of Planning and Development, CNMI Governor Torres states "The 2021 CSDP is a roadmap for sustainable growth. It is the product of a community-wide collaborative effort that takes into consideration our current needs and priorities, is reflective of the community feedback, and includes ways to track progress. The plan highlights strategic planning needs across twenty planning elements, outlines strategic and integrated long-term goals, in addition to mid- and short-range action plans and implementation initiatives. Further, the plan calls for ongoing data collection, information sharing, and opportunities for revision." The CSDP outlines sustainable development goals based on three spheres of society: environmental sustainability, economic sustainability, and social equity. Environmental sustainability goals outlined in the CSDP are addressed in this Plan and reference the CSDP where appropriate.

### 2.6.2 Renewable Energy

As of 2021, none of the Commonwealth of the Northern Mariana Islands' (CNMI) commercial energy needs were met using renewable energy sources (CUC 2024 Citizen Centric Report). The Commonwealth Utilities Corporation (CUC), the primary provider of publicly owned utilities in the CNMI, delivers power and water services to residents, businesses, and government agencies across Saipan, Tinian, and Rota. Currently, the region's power grids rely entirely on petroleum-fueled generators, with 100% of the fuel being imported. This dependence on imported petroleum makes the CNMI highly vulnerable to global fuel price fluctuations and supply disruptions.

Recognizing these challenges, the CNMI's Comprehensive Sustainable Development Plan outlines ambitious goals to transition toward affordable, reliable, sustainable, and modern energy systems. In alignment with this plan, the CUC has committed to expanding renewable energy infrastructure throughout the Mariana Islands. By 2030, the CUC aims to meet 20% of the islands' peak energy demand using renewable sources such as solar, wind, and potentially ocean-based energy technologies.

For a small island economy like the CNMI, investing in renewable energy offers significant benefits beyond reducing dependence on imported fossil fuels. Locally sourced renewable energy systems can help stabilize energy costs, reduce greenhouse gas emissions, and improve air quality. Furthermore, these systems enhance energy security and resilience against global market shocks and natural disasters. By adopting sustainable energy solutions, the CNMI is not only reducing its carbon footprint but also fostering economic development and environmental stewardship, paving the way for a cleaner, more self-reliant future.

### 2.6.3 Water Usage

Water supply and watershed management varies by island. Saipan relies on 13 aquifers to supply water to its over 43,000 residents, commercial, and government buildings. The tap water on Saipan is largely non-potable due to saltwater inclusion and localized aquifer contamination. Tinian has a large sump area that is used as a freshwater source. Rota has a mountain spring that has been capped and is piped around the island to deliver water to residential and commercial areas. Villages in the Northern Islands rely on water catchment systems and bottled water. Many of the Northern Islands water catchment systems are aging and in need of repair. Watershed management plans have been developed for all the major watersheds in the lower three islands of Rota, Tinian, and Saipan.

## 2.6.4 Outdoor Recreation

Ecotourism and responsible outdoor recreation in the CNMI is driven by individual participants. However, Mariana Visitors Authority (MVA) has a tour guide training program that emphasizes sustainable tour activities. Recreating in the habitats where SGCN exist has high potential to create impact - minimizing those impacts are the goal of ecotourism initiatives like the MVA tour guide training. Assuring that there is sufficient and clear signage at access points for our conservation areas will help inform recreators of the appropriate use of these sensitive areas. The CNMI published the 2020 Statewide Comprehensive Outdoor Recreation Plan (SCORP). The SCORP details planning, development, and management priorities for the CNMI outdoor recreation resources and enables the CNMI to access funds from the Land and Water Conservation Fund (LWCF) Act of 1965.

## 2.6.5 Agriculture

The CNMI relies heavily on imports. However, in recent years there has been an increase in local food production (Table 2). Farming has increased on Tinian and Rota especially in the last ten years. The perceived recent increase in local food production may also be a result of inconsistent or a complete lack of data from post WWII to the early 2000’s timeframe. Farmers on Tinian are aiming to provide food for increased military presence and export harvested crops to the larger Saipan and Guam markets. Rota exports food crops mostly to Guam (bananas, sweet potato, and hot peppers). Saipan farmers grow a wide variety of food crops and there is a high availability of locally grown produce in the local grocery stores. Farmed produce on Rota and Tinian are less commonly sold in grocery stores on those islands and are instead part of the ubiquitous subsistence/barter culture.

Renewed interest in agricultural activity in the CNMI presents a unique opportunity to employ agro-forestry practices which mixes food crops with native vegetation. This method of producing food and providing habitat for native species has been shown to increase food production with less reliance on harmful chemical herbicides and pesticides, instead relying on native birds and other animals to control pest species (Udawatta et. al. 2019). Though agricultural land makes up less than 2% of the total land cover in the southern three most populated islands (Table 7), they are the primary source of pesticide and herbicide chemical use. Broad integrated pest management plans developed by local agricultural experts would benefit agricultural operations in the CNMI. Building local capacity for proper pesticide and herbicide application would help increase local knowledge of safe application of these chemicals. In addition to proper pest management strategies, stricter enforcement of imported chemicals and a general farming outreach campaign to reduce chemical use would benefit agricultural producers and their customers.

The number of grazing land on Tinian increased from 600 acres in 2018 to over 1,500 in 2023 which is just under a 40% increase in 5 years (Table 7). Cattle production on Tinian is a major source of cultural pride and economic security. However, cattle grazing increases the spread of invasive species, increases the threat of wildfires, reverts successional land to a disturbed state, and contributes to soil erosion.

Table 7. Overview of agricultural economy in the Northern Mariana Islands based on the 2022 Census of Agriculture, USDA, National Agricultural Statistics Service (values have been rounded up).

| Agricultural Units | CNMI 2018 | CNMI 2023 | Saipan 2023 | Tinian 2023 | Rota 2023 |
|---|---|---|---|---|---|
| Number of farms | 253 | 316 | 181 (182 in 2018) | 60 (44 in 2018) | 75 (27 in 2018) |
| Acres of farmland | 1,515 | 2,833 | 572 | 1,765 | 496 |
| Number of grazing farms | 65 | 104 | 41 | 35 | 28 |
| Acres of grazing land | 924 | 2,025 | 259 | 1,549 | 217 |
| Market Value of Products Sold | $1,580,081 | $2,759,096 | $1,533,805 | $635,817 | $589,474 |

### 2.6.6 Land Development

Land development, or conversion of natural vegetation to man made structures, generally decreases overall habitat available for the CNMI's native species. In addition, some invasive species are shown to benefit from land development, further exacerbating the habitat availability for native flora and fauna (Hileman et al. 2020, Bak et al. 2024) as they compete for resources. Some of the most extensive land development within the past 100 years involved land clearing for sugar cane production and military buildup during pre- and post- World War II occupation. Based on land use land cover models developed from historical imagery, it was estimated that only 27% of forest remained on Saipan in 1945 (NOAA 2024). Today land clearing remains a constant pressure on Saipan, Tinian, and Rota although the focus has shifted towards commercial and residential construction and the annual rate of clearing for land development varies with the CNMI economic status (Figure 23). Of note is that on Tinian, there is also an increasing military buildup and expansion in response to the changing landscape of the Indo-Pacific region. While there are still large tracts of public land in the lower three islands that are still recovering from mass land clearing during the Japanese administration and post WWII, current permanent conversion of land to other uses contributes to the overall less habitat available for species on these islands (Table 8). The CNMI has established a program to create redundant populations of birds on the Northern Islands as insurance populations in the event that BTS were to be introduced to the Southern Islands, however, it should be noted that the habitat on the Northern Islands may not be and an ideal substitute for all species in the Southern Islands we need to mitigate land development for. The Northern Islands are younger and dynamic landscapes that can change dramatically from year to year largely due to their volcanic activity, but also because they have steep, volcanic soil slopes which are prone to erosion during annual storm events (DFW unpub. obs 2025).

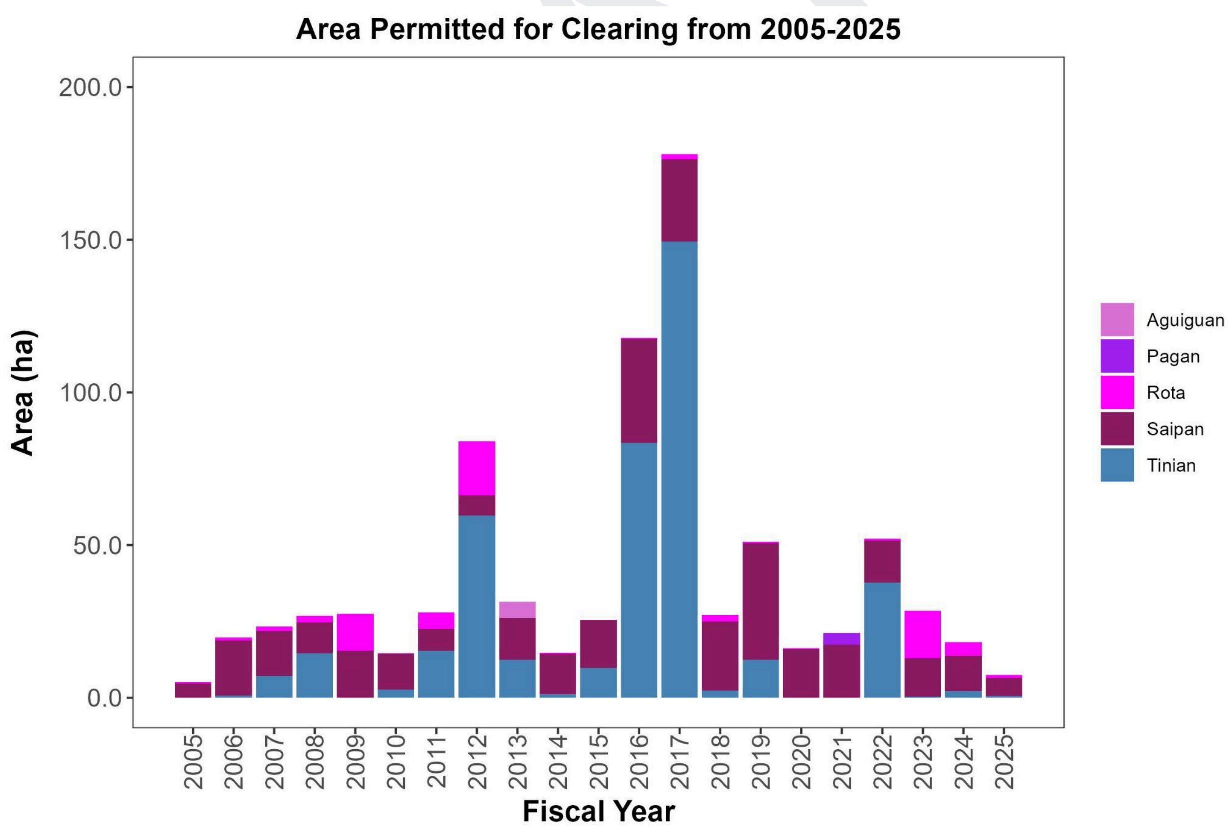



Figure 24. Area permitted for land clearing from 2005-2025 (2025 up to May) across the Northern Mariana Islands as reported from the One-Start Permitting program. The area is

directly mapped from DFW technical guidance site surveys and may not represent what was actually cleared following the issue of the permit.

Table 8. Public Land Inventory: Number of hectares in public and private use for the islands in the CNMI (Northern Islands area is combined into one figure for all 10 islands).

| | Total Land Area | Private Land | Public Land | Public Land in Use | Leased Public Land | Military Leased Public Land |
|---|---|---|---|---|---|---|
| Saipan | 11,913 | 5,822 | 6,090 | 1,057 | 558 | |
| Tinain | 10,177 | 985 | 9,179 | 517 | 590 | 6,260 |
| Rota | 8,693 | 2,412 | 6,282 | 3,042 | 149 | |
| Northern Islands | 13,307 | - | 13,307 | - | - | 91 (FDM) |
| Total | 44,090 | 9,219 | 34,858 | 4,616 | 1,297 | 6,351 |

Source: CNMI Comprehensive Public Land Use Plan Update for Rota, Tinian, Saipan and the Northern Islands, March 2019.

# 3 Selection of Species of Greatest Conservation Need

"Species of Greatest Conservation Need" (SGCN) are those animal species or groups of species that are of particular importance to the people of the CNMI for biological, cultural, or economic reasons. We used separate processes to identify SGCN of biological and cultural/economic importance. For this iteration of the Plan we chose to include a broader selection of species including many invertebrates and marine species. Our aim was to expand the bounds of our considerations while also using rigorous scientific selection processes to come up with a broadly representative and manageable list of species for Natural Resource managers to focus their attention on.

In addition to assessing SGCN for the CNMI, we coordinated with natural resource managers on Guam to compile a list of regional priority species - shared species that are represented on both Guam and CNMI's SGCN list. These species provide opportunities for regional conservation and management collaboration.

## 3.1 Preliminary Criteria

All species first had to meet the following preliminary criteria before further consideration as "Species of Greatest Conservation Need":

- Any species that is considered endangered or threatened under local or federal law
- Native species only (already occurred in the Marianas at the time of Chamorro arrival)
- "Manageable" species only. We can identify potential actions that could reasonably be expected to produce measurable population-level benefits for the species.
- Breeding species only
    - Migratory birds and some marine mammals are the primary groups that may spend only nonbreeding portions of their life cycle in the CNMI. We generally have little information about the state of nonbreeding birds or marine mammals here from which to base a decision. Regardless, the Marianas are not located along a major migratory flyway and therefore are not recognized as a globally important stopover or wintering destination for birds.
- Endangered Species Act (ESA) listed species, International Union of Conservation of Nature and Natural Resources (IUCN) red list species, locally protected species, species identified as endemic but in need of additional data: Species of Greatest Information Need (SGIN; see below).

## 3.2 Biologically-important SGCN

Our overarching goal in the selection of biologically-important SGCN was to use the best available scientific information in a transparent, defensible, and objective process; in which all species assessed were under equal consideration for selection. We used a two-step evaluation process to gather the information we needed to identify these SGCN. For each animal group, we identified regional experts to share and review biological information. Regional experts are the biologists with the most direct experience with these species in the CNMI. Experts were identified for the following groups: birds, terrestrial reptiles, tree snails, bats, terrestrial insects, sea turtles, marine mammals, all other marine species, and plants (Appendix A). In consideration of conserving the unique genetic diversity of subpopulations across our islands, we conducted our evaluation at the subspecies level, if applicable, or for sea turtles, "distinct population segment" (Dutton et al. 2014, Seminoff et al. 2015).

For plants, we largely followed the same process as described for SGCN animals. Our primary list of SGCN plants are those that are locally listed as endangered or threatened or under the Endangered Species Act. Additional plant species were identified during our stakeholder engagement process and through meetings with subject matter experts who helped identify endemic species of conservation concern (CNMI foresters and regional botanists).

We evaluated all native terrestrial vertebrates and all species that were identified as SGCN in the 2015 Plan (Liske-Clark 2015). There are thousands of invertebrate and marine species in the CNMI, and often not enough species information available, so logistically we were unable to evaluate each one individually. We limited the assessment of marine species to those that reside primarily within 100 m of the ocean surface, excluding those animals that reside in our deepest waters. We did this to simplify the SGCN selection process and because of our limited ability to manage deep water habitats. However, we recommend future iterations of this plan to assess deep sea dwelling species of the Mariana Islands. While the evaluation process is objective, the decisions made about which additional invertebrate or marine species to evaluate introduced some subjectivity to the process. By involving many experts in the process, we reduced the influence of bias in our decision.

Feedback from stakeholders and species experts suggested that we assign "indicator species" that represent groups of species that were identified as species of concern. The designation of indicator species was particularly relevant for groups of fish and other marine species of which there are hundreds of possible species per family to assess for SGCN designation. Indicator species were selected for families of fish identified as either biologically vulnerable, culturally important,  or economically important. Each indicator species was assessed like all other SGCN and included in the final selection to represent the species family.

Although the Mariana eight-spot butterfly (*Hypolimnas octocula mariannensis*) is described by USFWS as historically occurring on Saipan, we were unable to verify that this federally endangered species ever occurred in the CNMI and therefore did not consider it a SGCN candidate.

### 3.2.1 Biological Vulnerability

We evaluated the biological vulnerability of all 2015 SGCN, all terrestrial vertebrates, select invertebrates and marine species, and select plants to threats that may affect their population levels and status. Higher vulnerability means a species is less able to recover from catastrophic events and therefore has a higher probability of extirpation.  We used the same method from the 2015 SGCN selection process, which is a modified method originally developed by the Florida Fish & Wildlife Commission (Millsap et al. 1990) to make it more relevant for island systems and for marine and invertebrate species. We considered other related vulnerability ranking systems, including the well-known International Union for the Conservation of Nature (IUCN) and NatureServe systems, but found other systems to be too unwieldy or inappropriate for our purposes.

Scoring was conducted to the subspecies level, and considered at the global level and local level. Biological vulnerability scores, i.e. "bioscores" are therefore a measure of global extinction vulnerability.

We were mindful that some species that are rare in the Marianas are quite common elsewhere, and may better have their needs addressed elsewhere. Our ultimate concern is conservation in the Marianas, so our primary focus is our endemic species which are not found anywhere else and therefore are completely our conservation responsibility; and economically important species in which the people of the CNMI rely on for food or economic gains. Therefore, our scoring system reflects this concern.

We scored species at the finest taxonomic scale available (i.e. the subspecies level) because the Marianas host many endemic subspecies, including federally-listed subspecies (i.e. Mariana common moorhen, fanihi). If we had information that a species occurring in the Marianas constitutes a genetically-distinct breeding population (DPS), we scored that species based on the distinct population. The only species that fit this criteria was haggan (green sea turtle). Bioscores for each species were based on 5 categories:

1) **Population size**

   Throughout the range of the taxon, the estimated number of adults, or the estimated number of colonies of sessile colonial animals.

2) **Population trend**

   Overall trend in number of individuals throughout taxon's range over the last 2 decades (or other appropriate time interval considering taxon's generation time).

   For most endemic birds, we have reasonably good information on island population trends for Saipan, Tinian, and Rota, but no method of producing a statistically-valid overall CNMI population trend. For these, if the population trend was documented declining on any of the three islands, the species was scored as having a known declining trend.

3) **Range size/Endemism**

The number of islands with which the taxon is associated during the season when distribution is most restricted.

In our small island system, we measure range in the number of islands that a species occupies, not in acres. Our islands are small enough that if a species occurs on an island, we can assume that its range includes the entire island, even if not all suitable habitats are occupied. For our purposes, we considered the Mariana Islands to consist of 15 islands, including Guam. The three Maug islets were treated as one island, Naftan Rock as part of Aguiguan, and Mañagaha Island as part of Saipan.

The more islands a species occupies, the less vulnerable it is to extinction, which is reflected in the scoring system. Species that occupy more than 15 islands received zero points under our system, a threshold that we purposefully chose to favor Mariana endemic species.

We never had to question whether a landmass qualified as an island or not (e.g., is Australia an island?). Typically, if a species was associated with more than 15 islands, it was a wide-ranging, often circumtropical species that occupied dozens, if not hundreds, of islands.

**4) Reproductive potential**

Ability of the taxon to recover from serious declines in population size.

Reproductive potential involves two components:

- The average number of offspring per adult female (or hermaphroditic adult) per year that survive to sexual maturity. If survivorship is unknown, then the average number of eggs/offspring produced per adult female per year.
- Minimum age at which females typically first reproduce

**5) Specialization**

Degree to which the taxon is dependent upon certain ecological or environmental requirements which may result in increased vulnerability of the taxon

Species are often subjectively classified as “specialists” or “generalists” in their ecological or environmental requirements. Generalists are species that can adapt to a wide variety of habitats and environmental conditions; specialists have specific requirements and are unable to adapt if requirements are not met.  While this is a subjective simplification to describe species with complex life histories, it is widely used in the conservation and ecology fields. We applied it in our scoring system because, in general, highly specialized species are more vulnerable to extinction.

Except for the “Specialization” category, scores for each category were objective, as scores are based on documented information sources. “Specialization” required the experts to offer professional opinion on the degree of specialization of a species. While the specialization score is therefore subjective, we reduced the influence of bias by having multiple experts review the scores. Full list of species assessed and their final BioScores can be found in Appendix C.

Bioscores could range from 0 to 60 points, with a higher score indicating higher vulnerability.

### 3.2.2 Uncertainty in Biological Scoring

Overall, we had the most information available for the range size and population size categories, and the least information for reproductive potential. Level of uncertainty varied considerably among taxa, ranging from birds and bats, for which there is substantial information available collected by scientifically-valid, peer-reviewed methods, to marine invertebrates, for which there was almost no species-specific information available, except for the few that support commercial fisheries.

In cases where there was no species-specific information source available, we assigned scores based on information for closely related species if available, or by professional opinion. Because the scoring classes are quite broad, it was generally easy to choose a score class. We consider it unlikely that an assigned score, if incorrect, would be off by more than one score class. For example, we rarely found species-specific information regarding the age at maturity for invertebrates. However, based on our general biological knowledge that invertebrates are typically short-lived, fast-reproducing species; we have little doubt that most achieve sexual maturity within 2 years, which is the youngest age at maturity score class.

If there was any question about which score class was appropriate (such as information indicating a value borderline between two score classes), we assigned scores conservatively, i.e. assigned the higher score indicating higher vulnerability.

For many wide-ranging species such as marine species and seabirds, we do not have good information for the global population trend. These generally were conservatively scored as “suspected declining”, rather than “suspected stable or increasing”, and so received more points.

For the population size, range size, and reproductive potential categories, to incorrectly assign a score class off by one class would have little impact on the overall score, usually two points. The population trend category, however, is more sensitive to error. In this case, if the trend is increasing but is classified as declining, or vice versa, there can be a significant difference in points awarded (up to 10). Similarly, while specialization scores are more subjective, the difference between specialization scoring classes is 5 points.

Any ranking process based on incomplete knowledge has inherent uncertainties, and we will never have complete knowledge. If we are transparent in our approach, i.e. acknowledge the uncertainties, they can be addressed. Information gaps can be filled.

It is therefore inevitable that the bioscores we arrive at for some species are lower than the “real” score, and others higher. We do not know today if these errors led to any species being wrongfully assigned or denied SGCN status because of it, but we can address known information gaps and update scores going forward. Because we took a conservative approach throughout the scoring process, it is likely that more species qualified, rather than were excluded, as SGCN according to our criteria.

Other systematic ranking projects similar to ours have created “uncertainty scores” to illustrate the degree of confidence in the information underlying biological scores (e.g. Wallace et al. 2011). We chose not to pursue this method because it was not likely to change any rankings or action recommendations. We are aware that for some species, our scores may have a high degree of uncertainty, i.e. marine invertebrates. In fact, the lack of information is a primary reason why these species were considered for SGCN status. When managers consider addressing the needs of a particular species, we expect that they will examine in detail the information associated with that species and achieve a comprehensive understanding of information needs far beyond what can be reflected in an “uncertainty score”. Rather than developing an “uncertainty score”, we provide all of the sources used from which these scores were derived (Appendix C.3.) so users of this Plan may independently assess uncertainty.

## 3.3 Species Resiliency Assessment

We assessed the relative resilience for each SGCN or SGCN group. Relative resilience scores, help predict a species ability to adapt to changing environmental conditions - does the species have the natural ability to avoid environmental disturbances; if their current habitat changes, how will this impact the population and individuals; will environmental changes over time impact the species ability to survive long term (reproduction, foraging, threat avoidance). The results of the resiliency assessment are used to develop mitigation, management, restoration, and recovery goals for each species.  We used two methods for assessing species resiliency, one for our terrestrial species and one for our marine species. For species that inhabit both marine and terrestrial habitats during different phases of their life, we assessed species resiliency using both methods and combined the results. For our terrestrial species, we used the Climate Change vulnerability Index (CCVI 4.0) Excel-based tool developed by NatureServe. This tool allowed us to calculate a species vulnerability and resilience to dynamic environmental conditions as predicted by national prediction models.

We employed two methods for conducting the resiliency assessments: NatureServe CCVI 4.0 (Lyons et al. 2024) and the Thomas Framework (Thomas et al. 2011). The NatureServe CCVI 4.0 is an excel based tool that allows you to plug in species information and the tool produces a resilience score. The Thomas Framework is a six stage scoring criteria which takes into consideration possible species benefits from changing environmental conditions (e.g. range expansion). See Appendix XX for more details on the Species Resilience Assessments (to be updated in August 2025).

## 3.4 Economically or Culturally-important SGCN

We held over 40 stakeholder meetings during the development of the Species of Greatest Conservation Need list (described in Chapter 9).  The species or groups frequently mentioned were limestone forest species, sea grasses, åmut (medicinal plants), haggan (sea turtles), fånihi (mariana fruit bat, *Pteropus mariannus mariannus*), ayuyu (coconut crabs, *Birgus latro*) and a variety of fish species. The 2015 Plan listed “food fish” to account for the broad list of species identified as important food fish to the people of the CNMI. In this version of the Plan, we aimed to provide more specificity to the category of food fish by selecting an indicator species for each known food fish family. These food fish families were identified using fish market data (DFW 2023).  Indicator fish species were identified by our fisheries biologists as species that we regularly collect data for and species whose status provide an index for the overall health of the rest of the species family. For example, tanguison (Tripple-tail wrasse, *Cheilinus trilobatus*) was selected as an indicator for the group of fishery exploited wrasse fish and Green moon wrasse (*Thalassoma lutescens*) was selected as an indicator for non-exploited wrasse fish. Both are SGCN, because all wrasse fish are SGCN, these two indicator species will be used as a proxy for other species in this group for population assessments and management decisions.

Medicinal plants were mentioned at nearly every stakeholder engagement meeting. The importance of medicinal plants has likely been an emerging concern for the community due to their frequent use during the Covid 19 pandemic.  There are hundreds of medicinal plants in the CNMI including some that are non-native. Since this is the first time the CNMI is including plants in the Wildlife Action Plan, we decided to include native medicinal plants as a generic group. We recommend that in the next iteration of the Wildlife Action Plan, medicinal plants be investigated closer to identify those native plants that deserve more dedicated conservation attention.

## 3.5 Species of Greatest Information Need

There are species that may require conservation management that have yet to be identified because we lack information to determine their conservation status. We have categorized these species as Species of Greatest Information Need (SGIN) and consider these SGCN. Species were designated SGIN if we didn't have adequate information pertaining to two or more of the following fields:

- Species population status
- Range and distribution
- Key life history traits
- Threats
- Taxonomy
- Ecological associations

Climate change vulnerability assessments were calculated for some SGINs where we could make some assumptions based on the data of a similar species. These instances are clearly identified in the species profile pages.

## 3.6 Final SGCN Selection

Biologically-important SGCN were selected based on vulnerability and threat ranking criteria as follows:

- Any species with a bioscore of 18 or higher
- Any species or group of species considered SGIN
- Any species designated culturally important

Species or groups that were frequently mentioned in interactions with the public as important were added as SGCN, regardless of biological status. However, many of the species identified as economically and culturally important were also identified as biologically important (i.e. fanihi, ayuyu, and haggan).

Table 9. Freshwater Associated Species of Greatest Conservation Need. Names of species are presented in Chamorro, Refaluwasch, English (common name), and scientific name*.

| Chamorro | Refaluwasch | English | Scientific/Latin | SGCN |
|---|---|---|---|---|

| | | | Name | Designation[1] |
|---|---|---|---|---|
| Freshwater Associated Species of Greatest Conservation Need | | | | |
| Åsuli, hasule | Ttighitol Araw | Shortfin eel | *Anguilla bicolor* | SGIN |
| Åsuli, hasule | Ttighitol | Indo-Pacific eel | *Anguilla marmorata* | SGIN |
| | | Freshwater goby | *Awaous guamensis* | SGIN |
| Dulalas Luta | | Rota Blue Damselfly | *Ischnura luta* | ESA |
| Umatan | Marep | Jungle perch, rock flagtail | *Kuhlia rupestris* | SGIN |
| Pulan | | Indo-pacific tarpon | *Megalops cyprinoides* | SGIN |
| | | Freshwater goby sp. | *Smilosicyopus leprurus* | SGIN |
| | | Green riffle goby | *Stiphondon elegans* | SGIN |
| | | Palauan Riffle Dwarf goby | *Stiphondon pelewensis* | SGIN |
| Uhang | Lighayirúúr | Atyidae shrimp | *Atyidae sp.* | SGIN |
| Uhang | Lighayirúúr | Australian Amano shrimp | *Caridina typus* | SGIN |
| Uhang | Lighayirúúr | Variable shrimp | *Caridina variabilis* | SGIN |
| Uhang | Lighayirúúr | River prawn | *Macrobrachium lar* | SGIN |

*There are likely many names for each species in several languages spoken in the CNMI. For simplicity we provide Chamorro and Refaluwasch names which were provided by DCCA and other resources.

[1] A. Species of Greatest Information Need (SGIN) are species that lack basic information including: species population status; range and distribution; key life history traits; threats; taxonomy; and/or ecological associations.

B. Endangered Species Act (ESA) are species that are considered threatened or endangered and are protected by federal law.

C. "All Species" means that all native species of the family, genus, or assemblage of species are considered SGCN.

D. "Indicator Species" species that serve as a measure of the environmental conditions that they occupy, and/or provide an index of population health for similar species.

Table 10. Marine Species of Greatest Conservation Need. Names of species are presented in Chamorro, Refaluwasch, English (common name), and scientific name*

| Chamorro | Refaluwasch | English | Scientific/Latin Name | SGCN Designation[1] |
|---|---|---|---|---|
| Marine Species of Greatest Conservation Need | | | | |
| Surgeonfishes, tangs, and unicorn fishes | | | *Acanthuridae* | All species |
| Hugupao Dangkolo | Mwooch | Ringtail surgeonfish | *Acanthurus blochii* | Indicator Species |
| Kichu | Lemel | Convict Tang | *Acanthurus triostegus* | Indicator Species |
| Tataga | Igh-Falafal | Bluespine unicornfish | *Naso unicornis* | Indicator Species |
| Hugupao Attelong | Moghk | Striped Surgeonfish | *Ctenochaetus striatus* | Indicator Species |
| Bottom Fish | | | | All species |
| Abuninas | Taighulupegh | Onaga | *Etelis coruscans* | Indicator Species |
| Trevallies, scads, mackerels, pompanos, jacks | | | *Carangidae* | All species |
| I'e' | | Juvenile runs of trevally | *Carangidae* | |
| | Sereesch | Giant trevally | *Caranx ignobilis* | |
| Tarakitu | Ppalameta | Bluefin trevally | *Caranx melampygus* | Indicator Species |
| Glass eyes, soldierfish, squirrelfish | | | *Beryciforms* | All species |
| | | Glasseye | *Heteropriacanthus cruentatus* | Indicator Species |
| Sagamilon | | Shadowfin soldierfish | *Myripristis adusta* | Indicator Species |
| Sisi'ok | | Sabre squirrelfish | *Sargocentron spiniferum* | Indicator Species |
| Grouper fish | | | *Epinephelinae sp.* | All species |
| Gådao | Ammeschééyaar | Peacock grouper | *Cephalopholis argus* | Indicator Species |
| Gådao | Ameschiyaar | Star spotted grouper | *Epinephelus hexagonatus* | Indicator Species |
| | | Giant grouper | *Epinephelus lanceolatus* | Indicator Species |
| Gådao | Alii yaraw | Black Saddle grouper | *Plectropomus laevis* | Indicator Species |
| Parrotfish - Keystone Species | | | *Scaridae sp.* | All species |
| Palakse' | Maraaw | Spotted parrotfish | *Cetoscarus ocellatus* | Indicator Species |
| Låggua | Igan-wosh/ighal | Steephead | *Chlorurus* | Indicator Species |

| | | | | |
|---|---|---|---|---|
| | woosch | parrotfish | *microrhinos* | |
| Låggua | | Green parrotfish | *Chlorurus spilurus* | Indicator Species |
| Lacha | Kabwara | Seagrass parrotfish | *Leptoscarus vaigiensis* | Indicator Species |
| Palakse', låggua | Igan-wosch | Yellowband parrotfish | *Scarus schlegeli* | Indicator Species |
| Butterflyfish | | | *Chaetodontidae sp.* | All species |
| Ababang | Ligheregher Pékkas | Speckled butterflyfish | *Chaetodon citrinellus* | Indicator Species |
| Wrasses | | | *Labridae sp.* | All species |
| Tanguison | Yaar maam | Triple tail wrasse | *Cheilinus trilobatus* | Indicator Species |
| Tanguison | mwaam | Napoleon wrasse | *Cheilinus undulatus* | |
| | | Green moon wrasse | *Thalassoma lutescens* | |
| Mullet fish | | | *Mugilidae* | All species |
| Aguas | Aitur (Juvenile) and Araf | Juvenile runs of mullet, mixed species | | |
| | Aisátch, Aiyitam | Squaretail mullet | *Ellochelon vaigiensis* | Indicator Species |
| Blennies | | | *Blenniiformes* | All species |
| Gobies | | | *Gobiiformes* | All species |
| | | Saipan dwarf goby | *Eviota saipanensis* | SGIN |
| Emperor fish | | | *Lethrinidae* | All species |
| Mafuti' | Weyaw | Thumbprint emperor | *Lethrinus harak* | Indicator Species |
| Mafuti' | Noot-Uluul | Red-gill emperor | *Lethrinus rubrioperculatus* | Indicator Species |
| | | Yellowlip emperor | *Lethrinus xanthochilus* | Indicator Species |
| Snappers | | | *Lutjanidae* | All species |
| Buha | Liipow | Flame-tailed snapper | *Lutjanus fulvus* | Indicator Species |
| Måtan hågon | Aluut | Big eye emperor | *Monotaxis grandoculis* | Indicator Species |
| Gongunafun | | Green Jobfish | *Aprion virescens* | Indicator Species |
| Goatfishes | | | *Mullidae* | All species |
| Ti'åo | | Juvenile runs of | *Mullidae Juvenile* | |

| | | | | |
|---|---|---|---|---|
| | | goatfish (mixed species) | *runs* | |
| Båbasbas | | Yellowstripe goatfish | *Mulloidichthys flavolineatus* | Indicator Species |
| | | Dash Dot goatfish | *Parupeneus barberinus* | Indicator Species |
| Sweetlips | | | *Plectorhinichus* | All species |
| | Bwiisch | Giant sweetlips | *Plectorhinchus albovittatus* | Indicator Species |
| Hamala | Swiisch | Spotted sweetlips | *Plectorhinchus pictus* | Indicator Species |
| Angelfish | | | *Pomacanthidae* | All species |
| Ababang | | Lemonpeel angelfish | *Centropyge flavissima* | Indicator Species |
| Rabbitfish | | | | All species |
| Mañåhak | | Juvenile runs of rabbitfish mixed species | *Siganidae Juvenile runs* | |
| Hiting kalau | | Forktail | *Siganus argenteus* | Indicator Species |
| Other fish species | | | | |
| | Lighaifaar | Marianas rock skipper | *Praealticus poptae* | |
| Atulai | Peeti | Bigeye scad | *Selar crumenophthalmus* | Indicator Species |
| Guili | Reen | Highfin rudderfish | *Kyphosus cinerascens* | Indicator Species |
| | | Coleman's pygmy seahorse | *Hippocampus colemani* | SGIN |
| | | Short-tailed pipefish | *Microphis brachyurus* | SGIN |
| Eels | | | *Anguilliformes* | All species |
| Hakmang | Ssowfang, Limwarmwar (striped eel), Saiwal maa(Poison) | Eels (moray eels, conger eels, garden eels, pike eels, snake eels, worm eels, etc) | | |
| Native seagrass and macroalgae | | | | All species |
| | alloot | Sea grass | *Enhalus acoroides* | Keystone Species |
| | alloot | Sea grass | *Halodule uninervis* | SGIN |

| | | | | |
|---|---|---|---|---|
| | | Sargassum macroalgae | *Sargassum* | SGIN |
| Native corals - Keystone Species | | | | All species |
| åcho' tåsi | Yeal/Yaal | Acropora globiceps coral | *Acropora globiceps* | ESA |
| åcho' tåsi | Yeal/Yaal | Acropora retusa coral | *Acropora retusa* | ESA |
| åcho' tåsi | Yeal/Yaal | All Staghorn corals | *Acropora spp.* | |
| | | Seriatopora aculeata coral | *Seriatopora aculeata* | |
| Sand clams intertidal area | | | | All species |
| | | Pectinate Venus | *Gafrarium pectinatum* | SGIN |
| himma | tto | Small Giant Clam | *Tridacna maxima* | ESA |
| himma | Suumw | Fluted Giant Clam | *Tridacna squamosa* | ESA |
| Sharks and rays | | | *Elasmobranchii* | All species |
| Halu'u | Limwe/Lumweyi | Grey Reef Shark | *Carcharhinus amblyrhynchos* | |
| | | Whale shark | *Rhincodon typus* | |
| tåktai | | Scalloped hammerhead | *Sphyrna lewini* | ESA |
| | | Porcupine ray | *Urogymnus asperrimus* | SGIN |
| Other Invertebrates | | | | |
| | Likkeschél | Sea slugs, sea snails, limpets, nudibranch | *Mollusca spp* | All species |
| | Larr/Laar | Collector Urchin | *Tripneustes gratilla* | SGIN |
| | Mwe'ell/Mwéél | Horned Helmet | *Cassis cornuta* | SGIN |
| | Sa'wi/Sawii | Triton's Trumpet | *Charonia tritonis tritonis* | SGIN |
| | Abwel/Iyabwel | Branched Murex | *Chicoreus ramosus* | SGIN |
| | Faay Libwuschool | Cowrie | *Cypraeidae* | SGIN |
| | Li'yang/Liyang | Common Spider Conch | *Lambis lambis* | SGIN |
| | Liyang waté | Giant spider conch | *Lambis truncata* | SGIN |
| | | Trocus | *Rochia nilotica* | |

| | | | | |
|---|---|---|---|---|
| Alileng | Lifott maram | Silver-mouthed Turban | *Turbo argyrostomus* | |
| Alileng | Lifott maram | Tapestry Turban | *Turbo petholatus undescribed subspecies* | |
| Alileng | Lifott maram | Rough Turban | *Turbo setosus undescribed subspecies* | |
| | Larr/Laar | Collector Urchin | *Tripneustes gratilla* | SGIN |
| | Apelepéél | Sea cucumber | *Actinopyga mauritiana* | SGIN |
| | Apelepéél | Sea cucumber | *Actinopyga variens* | SGIN |
| | Apelepéél | Sea cucumber | *Holothuria whitmaei* | |
| pulpo | Ghuus | Day Octopus | *Octopus cyanea* | |
| | | Mangrove Crab | *Cardisoma carnifex* | SGIN |
| | | Mangrove prawn | *Palaemon concinnus* | SGIN/Indicator Species |
| Mahongangang | Yuurr/Yuur | Spiny Lobsters | *Panulirus spp* | SGIN |
| Papangpang | Yuurr/Lighayurum wong | Sculptured slipper lobster | *Parribacus antarcticus* | SGIN |
| Sea Mammals | | | | |
| | Roos | Humpback Whales | *Megaptera novaeangliae* | |
| | Uraaaw | Sperm whale | *Physeter macrocephalus* | |
| | Siyé | False killer whale | *Pseudorca crassidens* | |
| Tuninos | Ghu/Ghuuw | Spinner Dolphin | *Stenella longirostris longirostris* | |
| Sea turtles | | | | |
| Haggan | Wong mool/Woong Mool | Green Sea Turtle | *Chelonia mydas* | ESA |
| Haggan | Wong maaw/Woong Maaw | Hawksbill Turtle | *Eretmochelys imbricata bissa* | ESA |

*There are likely many names for each species in several languages spoken in the CNMI. For simplicity we provide Chamorro and Refaluwasch names which were provided by DCCA and other resources.

[1] A. Species of Greatest Information Need (SGIN) are species that lack basic information including: species population status; range and distribution; key life history traits; threats; taxonomy; and/or ecological associations.

B. Endangered Species Act (ESA) are species that are considered threatened or endangered and are protected by federal law.

C. "All Species" means that all native species of the family, genus, or assemblage of species are considered SGCN.

D. "Indicator Species" species that serve as a measure of the environmental conditions that they occupy, and/or provide an index of population health for similar species.

Table 11. Terrestrial Animals Species of Greatest Conservation Need. Names of species are presented in Chamorro, Refaluwasch, English (common name), and scientific name*

| Chamorro | Refaluwasch | English | Scientific/Latin Name | SGCN Designation[1] |
|---|---|---|---|---|
| Terrestrial Species of Greatest Conservation Need | | | | |
| Gå'ga karisu | Malul Ghariisu | Saipan Reed-warbler | *Acrocephalus hiwae* | ESA |
| Chachaguak | Lighakkayang | Mariana Swiftlet | *Aerodramus bartschi* | ESA |
| Såli | Waaw | Micronesian Starling | *Aplonis opaca aeneus* | |
| Såli | Waaw | Micronesian Starling | *Aplonis opaca guami* | |
| Paya'ya | Lifo'ro | Wedge-tailed Shearwater | *Ardenna pacifica* | |
| Canario | Khanooriyo | Golden White-eye | *Cleptornis marchei* | |
| Åga | Mwii'lup | Mariana Crow | *Corvus kubaryi* | ESA |
| Ga'ga' manglo | Asaf | Great Frigatebird | *Fregata minor palmerstoni* | |
| Paluman Å'paka' | Apooka | White-throated Ground Dove (male) | *Gallicolumba xanthonura* | |
| Paluman Fachi' | Apooka | White-throated | *Gallicolumba* | |

| | | | | |
|---|---|---|---|---|
| | | Ground Dove (female) | *xanthonura* | |
| Pulattat | Gherel Bweel | Mariana Common Moorhen | *Gallinula chloropus guami* | ESA |
| Tottut | Mweimwey | Mariana Fruit Dove | *Ptilinopus roseicapilla* | |
| Sasangat | Sasangal | Micronesian Megapode | *Megapodius laperouse laperouse* | ESA |
| Chichirikkan Tini'an | Liteighi'par | Tinian Monarch | *Monarcha tatatsukasae* | |
| Na'abak | Lichakkayang | Rufous Fantail ssp. mariae | *Rhipidura versicolor mariae* | |
| Na'abak | Lichakkayang | Rufous Fantail ssp. saipanensis | *Rhipidura versicolor saipanensis* | |
| Nosa' Luta | | Rota White-eye | *Zosterops rotensis* | ESA |
| Nosa’ | Litchogh | Bridled White-eye | *Zosterops conspicillatus saypani* | |
| Lu'åo | Amwo | Masked Booby | *Sula dactylatra personata* | |
| Lu'åo | Amwo | Brown Booby | *Sula Leucogaster plotus* | |
| Lu'åo | Amwo | Red Footed Booby | *Sula sula rubripes* | |
| Sihek | Waaw | Mariana Kingfisher ssp. albicilla | *Todiramphus albicilla albicilla* | |
| Sihek | Waaw | Mariana Kingfisher ssp. orii | *Todiramphus albicilla orii* | |
| Sihek | Waaw | Mariana Kingfisher ssp. owstoni | *Todiramphus albicilla owstoni* | |
| Egigi' | Liteighi'par | Micronesian Myzomela | *Myzomela rubratra* | |

| | | | | |
|---|---|---|---|---|
| | | | *asuncionis* | |
| Egigi' | Liteighi'par | Micronesian myzomela ssp. saffordi | *Myzomela rubratra saffordi* | |
| Akaleha' | | Native Terrestrial Snails | | All Species |
| Akaleha' | | Humped Tree Snail | *Partula gibba* | ESA |
| Akaleha' | | Langford's Tree Snail | *Partula langfordi* | ESA |
| Akaleha' | | Rota Partulid Snail | *Partula lutensis* | ESA |
| Akaleha' | | Fragile Tree Snail | *Samoana fragilis* | ESA |
| | | Denticulated Stick Insect | *Acanthograeffea denticulata* | SGIN |
| Ayuyu | | Coconut Crab | *Birgus latro* | |
| | | Guam Long-legged land crab | *Discoplax michalis* | SGIN |
| Fanihin Liyang | Payesyes/Pai'Scheei | Pacific Sheath-tailed Bat | *Emballonura semicaudata rotensis* | ESA |
| Fånihi | Pai'Scheei | Mariana Fruit Bat | *Pteropus mariannus mariannus* | ESA |
| Guali'ek halumtånu' | | Littoral Skink | *Emoia atrocostata* | |
| Guali'ek halumtånu' | | Mariana Skink | *Emoia slevini* | ESA |
| Guali'ek | Galuuf | Micronesian Gecko | *Perochirus ateles* | |
| Abbang | | Mariana Wandering Butterfly | *Vagrans egistina* | ESA |
| | | Native invertebrate pollinators | | SGIN |

*There are likely many names for each species in several languages spoken in the CNMI. For simplicity we provide Chamorro and Refaluwasch names which were provided by DCCA and other resources.

[1] A. Species of Greatest Information Need (SGIN) are species that lack basic information including: species population status; range and distribution; key life history traits; threats; taxonomy; and/or ecological associations.

B. Endangered Species Act (ESA) are species that are considered threatened or endangered and are protected by federal law.

C. "All Species" means that all native species of the family, genus, or assemblage of species are considered SGCN.

D. "Indicator Species" species that serve as a measure of the environmental conditions that they occupy, and/or provide an index of population health for similar species.

Table 12. Terrestrial Plant Species of Greatest Conservation Need. Names of species are presented in Chamorro, Refaluwasch, English (common name), and scientific name*

| Chamorro | Refaluwasch | English | Scientific/Latin Name | SGCN Designation[1] |
|---|---|---|---|---|
| Terrestrial Plant Species of Greatest Conservation Need | | | | |
| Siboya halumtånu' | | Wild onion | *Bulbophyllum guamense* | ESA |
| | | | *Dendrobium guamense* | ESA |
| | | Ground orchid | *Nervilia jacksoniae* | ESA |
| | | | *Nesogenes rotensis* | ESA |
| | | Epiphytic orchid | *Tuberolabium guamense* | ESA |
| | | | *Osmoxylon mariannense* | ESA |
| Hufa halumtånu | | | *Heritiera longipetiolata* | ESA |
| Trongkun guafi | | Fire tree | *Serianthes nelsonii* | ESA |
| | | | *Tabernaemontana rotensis* | ESA |
| Fadang | | Micronesian cycad | *Cycas micronesica* | ESA |
| | | | *Maesa walkeri* | ESA |
| Åmut | | All native plants | | All Species |

| | | | | |
|---|---|---|---|---|
| | | used in traditional healing | | |
| Potpuput | | | *Peperomia mariannensis* | SGIN |
| Tupun ayuyu | | | *Elatostema calcareum* | SGIN |
| | | No Common Name | *Procris pedunculata* | SGIN |
| | | Native Limestone Forest Plants | | All Species |
| Tsatsa | | Tree fern | *Cyathea* spp. | |
| Gaogao | | Coral tree | *Erythrina variegata* | |
| | | Cat tail | *Lycopodium phlemaria var. longifolium* | |
| Ifik | Ipil | | *Intsia bijuga* | |
| Angilao | | | *Grewia crenata* | |
| Cator/Pano | Mwesor | | *Claoxylon marianum* | |
| Nunu | | Strangler fig | *Ficus prolixa* | Keystone Species |
| Faniok | | | *Merrilliodendron megacarpum* | |
| Mångli | | Coastal/Mangrove Species | | All Species |
| | | Native Wetland Plant Species | | All Species |

*There are likely many names for each species in several languages spoken in the CNMI. For simplicity we provide Chamorro and Refaluwasch names which were provided by DCCA and other resources.

[1] A. Species of Greatest Information Need (SGIN) are species that lack basic information including: species population status; range and distribution; key life history traits; threats; taxonomy; and/or ecological associations.

B. Endangered Species Act (ESA) are species that are considered threatened or endangeredn and are protected by federal law.

C. "All Species" means that all native species of the family, genus, or assemblage of species are considered SGCN.

D. “Indicator Species” species that serve as a measure of the environmental conditions that they occupy, and/or provide an index of population health for similar species.

Table 13. Regional Priority Species of Greatest Conservation Need as designated during a workshop between CNMI DFW and Guam natural resource management leadership and experts (See section 9.1.5.5.). Names of species are presented in Chamorro, Refaluwasch, English (common name), and scientific name*

| Chamorro | Refaluwasch | English | Scientific/Latin Name | SGCN Designation[1] |
|---|---|---|---|---|
| Regional Priority Species | | | | |
| Host plants for SGCN (butterflies and damselflies) | | | | |
| Tupun ayuyu | | | *Elatostema calcareum* | |
| | | | *Procris pedunculata* | |
| | | Unknown species for dulalas Luta | | |
| Åmut | | All native plants used in traditional healing | | All Species |
| Plants that could benefit from genetic diversity (inter-island seed exchange) | | | | |
| Trongkun guafi | | Fire tree | *Serianthes nelsonii* | |
| | | | *Maesa walkeri* | |
| | | | *Tabernaemontana rotensis* | |
| Hufa halumtånu | | | *Heritiera longipetilata* | |
| Fanihi | Pai'Scheei | Mariana Fruit Bat | Pteropus mariannus mariannus | ESA |
| Chachaguak | Lighakkayang | Mariana Swiftlet | *Aerodramus bartschi* | ESA |
| Åga | Mwii'lup | Mariana Crow | *Corvus kubaryi* | ESA |
| Akaleha' | | Native Terrestrial Snails | | All Species |

| | | | | |
|---|---|---|---|---|
| Guali'ek halomn tano' | | Mariana Skink | *Emoia slevini* | ESA |
| | | Marine mollusks (Giant clams, Triton's trumpet) | | |
| | Apelepéél | Sea cucumber | *Actinopyga spp* | SGIN |
| | | Sea grasses | | |
| Mahonganggang | Yuurr/Yuur | Spiny Lobsters | *Panulirus spp* | SGIN |
| Papangpang | Yuurr/Lighayurum wong | Slipper lobsters | *Scyllaridae spp* | SGIN |
| | | Freshwater gobies | | |
| Uhang | Lighayirúúr | Freshwater atyid shrimp | | |

*There are likely many names for each species in several languages spoken in the CNMI. For simplicity we provide Chamorro and Refaluwasch names which were provided by DCCA and other resources.

[1] A. Species of Greatest Information Need (SGIN) are species that lack basic information including: species population status; range and distribution; key life history traits; threats; taxonomy; and/or ecological associations.

B. Endangered Species Act (ESA) are species that are considered threatened or endangered and are protected by federal law.

C. "All Species" means that all native species of the family, genus, or assemblage of species are considered SGCN.

D. "Indicator Species" species that serve as a measure of the environmental conditions that they occupy, and/or provide an index of population health for similar species.

# 4 Terrestrial Habitats of the CNMI

## 4.1 Introduction to Terrestrial Habitats of the CNMI

The small islands of the CNMI are relatively simple geologically and topographically. The terrain of our islands therefore supports a low diversity of terrestrial habitat types. However, as plants and animals arrived in the Marianas, they evolved in isolation, so that Marianas terrestrial habitats are occupied by many endemic plant and animal species (i.e. species that occur nowhere else in the world).

Several habitat types described in this section are labeled as "key habitats", which indicate that these areas provide essential habitat and ecosystem services to wildlife and people. These areas are considered high priority habitats for conservation and management because of the wide range of impacts if they are depleted or degraded.

### 4.1.1 Forests

Forests are the main terrestrial habitat for SGCN in the CNMI. Forests also provide a wide range of ecosystem services such as soil retention, water retention, temperature regulation, food and shelter, recreation opportunities, building materials, and åmut (medicine). While the larger southern islands support the most forest (~75% of the CNMI total) due to their size, forests of the northern islands play a critical role in supporting redundant populations of SGCN and reduce the probability of extinction from natural disasters, such as typhoons or volcanic activity, or in the event of introduction of brown tree snake in the southern islands.

Feral ungulates pose a threat to the CNMI's forest health and regeneration. Philippine deer (*Rusa marianna*) were introduced to Rota in around 1880 and Saipan and Tinian in 1900 (Wiles et al. 1999). More recent observations of feral pigs and goats (escaped from ranches) present additional ecological concerns for forest health on Rota. Pigs and goats are known to create more severe damage to the forest than deer. In addition to feral goats and pigs, the negative impacts of deer herbivory on forest recruitment and composition are becoming more severe, presumably because of the lack of hunting pressure from current residents of the island. Hunting pressure does limit deer populations on Saipan and Tinian, but localized effects of deer browsing can still be found.

While invasive species are impacting terrestrial habitats on all islands of the CNMI (i.e. rats and invasive plants); the inhabited islands of Saipan, Tinian, and Rota are the most affected by invasive species. In 2004, more than one third of all trees on Saipan, Tinian, and Rota were affected by vines, mostly invasive (Donnegan et al. 2011). Data from a repeated inventory in 2014 show that two thirds of forest in the CNMI had disturbance. Disturbance in forest plots was most prominent on Tinian where some form of disturbance was recorded in every forest plot surveyed. Over half of forest plots surveyed on Saipan had signs of disturbance.

In addition, many invasive species occur on these islands that do not occur elsewhere in the CNMI, such as the coconut rhinoceros beetle (*Oryctes rhinoceros*) on Rota; the musk shrew (*Suncus murinus*) and emerald tree skink (*Lamprolepis smaragdina*) on Saipan and Tinian; and the curious skink (*Carlia ailanpalai*) on Rota, Saipan and Tinian. Although not yet established on any CNMI island, the threat of introduction of brown tree snake (*Boiga irregularis*) on Saipan, Tinian, or Rota remains high.

The 2020 US Forest Service CNMI Forest Inventory summarized forest resources for Saipan, Rota and Tinian from a 2015 assessment of Forest Inventory and Analysis Plots (Dendy et al. 2020) (Figure 14). Based on these plots they estimate that there are just over 60,000 acres of forest in the CNMI and that two-thirds of the forests assessed were characterized as disturbed (natural or human-caused disturbance affecting at least 25% of the trees, understory, or soil surface in the plot). Tree disease, vine cover, livestock damage, and wildfires were cited as sources of forest disturbance. They reported disturbance in all plots on Tinian and the least amount of disturbance across all plots on Rota.

In addition to greater invasive species impacts compared to other CNMI islands; Saipan, Tinian, and Rota also experience habitat conversion to development. Conversion of forest and other “natural” habitats to development currently continues on Saipan and Tinian at a much higher rate than on Rota. Few terrestrial SGCN occupy developed habitat and typically at a lower density than in “natural” habitats (Hileman et al. 2020, Bak et al. 2024). The direct effect of habitat loss is easily measured and results in significant losses to terrestrial SGCN populations. The indirect effects of fragmentation and degradation of remaining habitats are harder to measure and have not been quantified for any terrestrial habitat or SGCN in the CNMI.

Table 14. Forest area by CNMI island. Calculated from NOAA Coastal Change Analysis Program data (NOAA 2021a-n).

| Island | Hectares | Acres | % of CNMI Total |
|---|---|---|---|
| Rota | 6,005 | 14,839 | 24 |
| Aguiguan | 450 | 1,113 | 1.8 |
| Tinian | 3,700 | 9,142 | 15 |

| | | | |
|---|---|---|---|
| Saipan | 6,034 | 14,909 | 24 |
| Noos (FDM) | 7.9 | 19.5 | 0 |
| Anatahan | 928 | 2,292 | 4 |
| Sarigan | 213 | 527 | 1 |
| Guguan | 9 | 21 | 0 |
| Alamagan | 607 | 1,500 | 2.5 |
| Pagan | 2,952 | 7,295 | 12 |
| Agrihan | 3,713 | 9,175 | 15 |
| Asuncion | 118 | 292 | .5 |
| Maug | 33 | 82 | .10 |
| Uracas | 0.0 | 0.0 | 0 |
| **TOTAL** | **24,770** | **66,974** | 100.00 |

#### 4.1.1.1 Native forest Key Habitat

Native forest once covered most inland areas of the Marianas. Widespread disturbance has resulted in loss and change in native forests of the southern islands, having started with Chamorro settlement ~4,000 years ago followed by agricultural development during the early 20th century German and Japanese administrations, and major impacts from WWII on Saipan and Tinian. The label "native forest" cannot be equated with intact, undisturbed forest due to the high level of modification. Instead, this type refers to forest where higher numbers of native species are found and these are considered non-primary forests.

On the southern islands, native forest grows on a limestone substrate and is therefore sometimes referred to as "limestone forest". Common tree species include kafu (*Pandanus tectorius*), paipai (*Meiogyne cylindrocarpa*), gulus (*Cynometra ramiflora*), nunu (*Ficus prolixa*), ottut (*Discocalyx megacarpa*), agate'lang (*Eugenia palumbis*), mapunyao (*Aglaia mariannensis*), pågu (*Talipariti tiliaceum*), trongkun papaya (*Carica papaya*), nonak (*Hernandia sonora*), åhgåo (*Premna obtusifolia*), aplokateng (*Psychotria mariana*), lagansát (*Barringtonia racemosa*), atmahåyan (*Pipturus argenteus*), niyuk (*Cocos nucifera*), yoga (*Elaeocarpus joga*), ifik (*Intsia bijuga*), påhung (*Pandanus dubius*), pånåo (*Guettarda speciosa*), lemai (*Artocarpus altilis*), puting (*Barringtonia asiatica*), fago' (*Ochrosia oppositifolia*), chopak (*Mammea odorata*), lada (*Morinda citrifolia*), katut (*Dendrocnide latifolia*) and mangga (*Mangifera indica*) (Donnegan et al. 2011). Native forest habitat is rare on Saipan and Tinian, but common on Rota.

Figure 25. Typical native limestone forest on Rota featuring kafu (*Pandanus tectorius*), fago' (*Ochrosia oppositifolia*), gulus (*Cynometra ramiflora*), åhgåo (*Premna serratifolia*), and påhung (*Pandanus dubius*). (Wiitala, 2022)

In the northern islands, the soil substrate is volcanic. Native tree species that are important in the northern islands include mapunyao (*Aglaia mariannensis*), kafu (*Pandanus tectorius*), talisai (*Terminalia catappa*), aguanai (*Trema orientalis*), lada (*Morinda citrifolia*), puting (*Barringtonia asiatica*), and gåogåo (*Erythrina variegata* var. *orientalis*), among others (DFW 2022, 2021, 2018; Fosberg et al. 1979; Ohba 1994; Vogt and Williams 2004; Pratt 2011).

Native forest is characterized by a closed canopy of broadleaf trees and dark, humid conditions at the forest floor (Figure 25). Trees may reach heights to 14m, with some individual trees reaching 23m in height (Falanruw et al. 1989). Understory vegetation is dense and multilayered with ground herbs, shrubs, ferns, and small trees of varying heights. Epiphytic ferns and orchids are frequently found in canopy trees (Raulerson and Rinehart 1992; Vogt and Williams 2004).

Figure 26. Top down view of coastal native limestone forest canopy on Aguiguan Island featuring native tree species such as langiti (*Ochrosia mariannensis*), fago' (*Ochrosia oppositifolia*), lala (*Planchonella obovata*), and ifik (*Intsia bijuga*). Photo: Fletcher Moore 2024.



### 4.1.1.2 Mixed forest

This forest habitat is a mixture of native and nonnative species representing forests recovering from disturbance, native forests invaded by nonnatives, and forests that are established in disturbed areas from a mix of seed sources.

Tree species composition in mixed forests varies considerably throughout the archipelago. Some native tree species favor these conditions such as langiti (*Ochrosia mariannensis*) and alum (*Melanolepis multiglandulosa*) (Vogt and Williams 2004). Other tree species found in mixed forest include nonnative species such as tangantangan (*Leucaena leucocephala*), kalaskas (*Albizia lebbeck*), trongkun papaya, chotda (*Musa* spp.), *Spathodea campanulata*, sosugi formosa (*Acacia confusa*), niyuk (*Cocos sp.*), kulalis (*Adenanthera pavonina*), kamachili (*Pithecellobium dulce*), and canafistula (*Cassia fistula*), and native species such as gagu

(*Casuarina equisetifolia*), umumu (*Pisonia grandis*), mapunyao (*Aglaia mariannensis*), kafu (*Pandanus tectorius*), paipai (*Meiogyne cylindrocarpa*), pahong (*Pandanus dubius*), gaogao (*Erythrina variegata*), gulus (*Cynometra ramiflora*), nunu (*Ficus prolixa*), hodda (*Ficus tinctoria*), lada (*Morinda citrifolia*), pågu (*Talipariti tiliaceum*), agate'lang (*Eugenia palumbis*), åhgåo (*Premna serratifolia*), lala (*Planchonella obovata*), alum (*Melanolepis multiglandulosa*), sumak (*Aidia cochinchinensis*), fago' (*Ochrosia oppositifolia*), ifit (*Intsia bujiga*), and påtma bråba (*Heterospathe elata*).

Mixed forests commonly occur in areas that were formerly cleared for cultivated fields and coconut groves, World War II installations, and other developments (Engbring et al. 1986; Vogt and Williams 2004). The canopy is 2-20 meters in height with occasional canopy gaps and dense understory vegetation.

#### 4.1.1.3 Tangantangan forest

Tangantangan (*Leucaena leucocephala*) is a tree species that was introduced in the Marianas in the early 1900s and became widespread following WWII. The islands of Saipan and Tinian are covered with vast monocultures of tangantangan; the islands of Rota and Aguiguan have a few isolated stands of this species (Vogt and Williams 2004).

These medium-sized trees may reach a height of 10m (Vogt and Williams 2004) with an open understory (Figure 8). Other tree species associated with this habitat include gulos, trongkun papaya, atbut del fuego (*Delonix regia*), kalaskas, paipai, alum, aplokateng, åhgåo, kamachili, ifit, chuti (*Cerbera dilatata*), and nunu (Donnegan et al. 2011).

Some forest bird SGCN have adapted well to this introduced habitat type, notably gå'ga' karisu (Saipan reed-warbler) on Saipan and Chichirikan Tinian (Tinian monarch) on Tinian (Vogt and Williams 2004, DFW 2021). However, recent research has shown that Chichirikan Tinian are more productive and densely populated in native limestone forest which suggests that this species can persist in lower quality habitat, native limestone forest remains an important resource for the long-term survival of this species (Swift unpub. data 2025).

#### 4.1.1.4 Agroforest

This habitat type occurs where people have planted tropical food trees (Figure 9). Common food trees include niyuk, lemai, mangga, papaya, alageta (*Persea* spp.), kamachili, chotda, mansanita (*Muntingia calabura*), and trongkun magsum (*Citrus* spp.). On the southern islands of Rota, Aguiguan and Tinian, agricultural forests are scattered in patches. On Saipan, agroforests are more extensive, and situated near urban centers (Engbring et al. 1986). Agroforests consisting mostly of niyuk plantations are found on Anatahan, Sarigan, Alamagan, Pagan and Agrihan.

Agroforests may be currently tended, or have been abandoned. Many  SGCN can be found in agroforest including fanihi and some forest birds that take advantage of the food resources such as flowers, fruits, seeds, and associated insects.

### 4.1.2 Developed

Trees, shrubs, and other vegetation are present in urban or residential areas of the southern islands and wildlife will occupy this habitat. Sihik (Mariana kingfisher), egigi (Micronesian honeyeater), såli (Micronesian starling), nosa' (bridled white-eye), canario (golden white-eye), na'abak (rufous fantail), paluman fachi'/a'paka' (white-throated ground dove), and chichirikan Tinian (Tinian monarch) can be found in developed habitat, although typically at lower densities than in native or mixed forest. There is a lack of data on how these species use developed areas (breeding, foraging, ect).

### 4.1.3 Grassland and Savanna

Grasslands are areas dominated by herbaceous vegetation while savannas are dominated by herbaceous vegetation but also have scattered trees and shrubs (Figure 11, Table 5). Grasslands and savannas occur on limestone soils, such as the Sabana of Rota and around Mt. Tapochau on Saipan, and on volcanic soils, such as the slopes of Mount Pagan. Native and non-native plant species commonly occurring in grasslands and savannas include masiksik (*Chromolaena odorata*)*,* netti (*Miscanthus floridulus*), inifuk (*Chrysopogon aciculatus*), umuk (*Digitaria* spp.), agsum (*Desmodium triflorum*), eskobiya (*Sida acuta*) *Pennisetum* spp, *Gleichenia linearis*, *Nephrolepis* spp., *Blechnum orientale*, *Ipomoea* spp., *Spathoglottis* spp., *Mimosa invisa*, and *Panicum* spp. (Falanruw et al. 1989; Pratt 2011). Chachaguak (Mariana Swiftlet, *Aerodramus bartschi*) forage above grassland and savanna areas on Saipan and Aguiguan where they capture flying insects.

These habitat types are highly susceptible to wildfires (Bubb 2022).Grasslands and savannas on Rota, Tinian, and Saipan are impacted by annual "wildfires" that often spread into native forest resulting in the growth of grasslands and the removal of forests (BECQ 2020). Coastal habitat and water quality monitoring can be a proxy for upland grassland health. The CNMI Division of Coastal Resources Management monitors water quality and coastal health,

Table 15. Area of grassland and savanna habitat by CNMI island. Calculated from NOAA Coastal Change Analysis Program data (NOAA 2009a-n).

| Island | Hectares | Acres | % of CNMI Total |
|---|---|---|---|
| Rota | 2,527.2 | 6,244.9 | 19.52 |
| Aguiguan | 261.1 | 645.3 | 2.02 |

| | | | |
|---|---|---|---|
| Tinian | 2,411.6 | 5,959.4 | 18.63 |
| Saipan | 1,669.6 | 4,125.8 | 12.90 |
| FDM | 48.1 | 118.9 | 0.37 |
| Anatahan | 1,308.5 | 3,233.3 | 10.11 |
| Sarigan | 150.8 | 372.6 | 1.16 |
| Guguan | 190.9 | 471.6 | 1.47 |
| Alamagan | 620.9 | 1,534.3 | 4.80 |
| Pagan | 1,311.0 | 3,239.5 | 10.13 |
| Agrihan | 1,935.3 | 4,782.2 | 14.95 |
| Asuncion | 343.7 | 849.3 | 2.66 |
| Maug | 113.2 | 279.7 | 0.87 |
| Uracas | 53.5 | 132.1 | 0.41 |
| **Grand Total** | **12,945.3** | **31,989.1** | **100.00** |

### 4.1.4 Wetlands Key Habitat

Sosonyan or sometimes spelled susunyan is a Chamorro word used to describe marshy areas.

Wetlands are areas that are permanently or periodically immersed in water, vegetated with plants that are especially adapted for these conditions, and usually have unique soils. Wetland habitats found in the Marianas include lakes, riparian zones, streams, ponds, estuaries, marshes, and mangroves. Wetlands purify and recharge groundwater and provide critical wildlife habitat. The SGCN Pullatat (Mariana common moorhen, *Gallinula chloropus guami*) is completely dependent on wetland habitat, and wetlands are an important habitat for the SGCN gå'ga' karisu (Saipan reed-warbler, *Acrocephalus hiwae*). Some native wetland plants in the CNMI include lakngåyåo (swamp fern, *Acrostichum aureum*), gray mangrove (*Avicennia marina*), månglin låhi (Oriental mangrove, *Bruguiera gymnorrhiza*), karisu (phragmites, *Phragmites karka*), and mamaka (smartweed, *Persicaria minus*) (Marshall 2020). Wetlands areas in the Mariana Islands are commonly cultivated for food crops like taro and, in the past, rice.

In the CNMI, wetlands are extremely limited in extent, totaling 259 hectares and occurring only on the largest islands, i.e. Saipan, Tinian, Rota, Anatahan, and Pagan (NOAA 2009a-n, Greene et al. 2019, DCRM 2019). The largest wetlands are the Lake Susupe complex on Saipan, the Talahkaya stream complex on Rota, and Lake Hagoi on Tinian.

Wetlands in the CNMI are of particular degradation risk due to their high ecological value, low percent of total land coverage, high risk of invasion by non-natives, and high number of obligate species that are vulnerable to displacement. Wetlands are one of the most impacted terrestrial habitat types in the CNMI, with an estimated loss of 64% since the 1920's, when documentation and aerial photography of the islands began (DLNR 1991). Wetland losses can be attributed to historic land development, changes in hydrology, invasive plant species, and the abandonment of historical agricultural practices (rice paddies and taro plantations).

There are several wetland areas that surround lakes or other low lying coastal areas on Saipan and Tinian. Wetlands on Rota are associated with the Talakhaya watershed and are primarily river ravine spring fed wetland systems characterized by hydrophytic vegetation and hydric soils. There are man made wetlands around the Rota Resort which were designed to act as a water treatment system for the resort facilities. The Mahalang, Bateha, and Makpo wetland complexes on Tinian are ephemeral and do not hold water year round (Figure 27). There are 21 identified wetlands on Saipan (DCRM 2019).

While wetlands make up a small portion of total terrestrial land cover, the loss of their effective ecological services are evident during the wet season, especially in urban areas that experience flood events. Non-functional wetlands degrade nearshore coral reef habitat and can cause seagrass bed losses due to inconsistent nutrient cycling. A 2019 Economic Valuation Study of wetlands in the CNMI states that the most valuable service that wetlands provide is pollutant and sediment removal - with nearly $5 million in annual value (DCRM 2019). On Saipan, wetlands located north of Garapan are generally in poor condition due to reduced or negligible buffer size and heavy invasive vegetation pressure, which has significantly reduced the wetlands ability to naturally sequester floodwaters during the rainy season (Dobson et al. 2020). Rather than flowing into wetlands, which act as a natural filtration system, excess surface water flows over roadways and across impenetrable urban ground surfaces directly into the adjacent lagoon. This deposits excessive sediments and land-based pollutants, like chemicals, directly into sensitive near shore habitats. There are ongoing efforts to manage these wetlands and restore ecological function to key areas, but more support is needed.

### Lakes

The CNMI contains 165 hectares of natural lake surface area distributed across five lakes. Four lakes are in the Northern Islands, with one lake each on Tinian and Saipan. Additional artificial lakes and ponds exist on golf courses in Rota and Saipan. These constructed water bodies feature impervious linings that contain water, with water levels fluctuating based on evapotranspiration and precipitation. Golf course water hazard ponds provide important habitat for wetland dependent species such as the pulattat, native dragonflies, wetland plants, freshwater fish, and migratory birds. Lake Hagoi on Tinian is a mostly ephemeral, shallow, clay bottom depression, fed by annual rainfall. Contrary to the name, Lake Hagoi  is not a true lake because it dries during most dry seasons. There are two lakes located on Anatahan, both of which are within the volcano caldera. No recent surveys of these lakes have been conducted. The two lakes on Pagan, Lake Sanhalum and Lake Sanhiyung, were surveyed in 2010 by a USFWS research team for aquatic insects. The team recorded physical characteristics of the lakes along with water quality metrics (temperature and salinity). Lake Sanhalom is a warm (33 C, 91.4 F), brackish water lake (5 ppt salinity), and Lake Sanhiyon is a warm, brackish water (15 ppt salinity) lake with a cold sulfur spring on the north east side which feeds cool (28.5 C, 83.3 F) sulphuric water into the lake. The lakes on Pagan are degraded due to introduced species like tilapia and the presence of feral ungulates, whose feces serve as a contamination source.

Figure 27. Photograph of part of the Beteha wetland complex on Tinian during the rainy season 2023.

Lake Susupe on Saipan is a 17 hectare, perennial, brackish water lake with no outlet. The lake is part of a large wetland complex containing 17 rainfed potholes which are known to dry out during droughts. Lake Susupe has very low water quality (high E. Coli presence, low dissolved oxygen, and high pH) but supports a wide variety of freshwater species, including the pulatta, gå'ga' karisu, black noddies, and freshwater fish. There are also several introduced species that occur there, including mosquito fish (*Gambusia affinis*), *Tilapia* species, apple snails (*Ampullarioidea* sp.), and cane toads (*Rhinella marina*) (Herod et. al. 2008). Lake Susupe has been further degraded by the high volume of polluted runoff draining to the lake from the surrounding urban development, occasionally resulting in fish kill events

Several rare or locally uncommon plant species occur within CNMI's lakes, freshwater wetlands, and riparian zones. Notable among these are native sedges such as *Cyperus polystachyos*, *C. odoratus*, and *Eleocharis geniculata*, which are typically found along lake margins, marshes, and streambanks but are underreported due to their inconspicuous form. Other, less common sedge species like *Fuirena umbellata* are native to Rota, Saipan and Guam. This species only occurs in freshwater wetlands that have volcanic soils. The presence and species diversity of fern species within a wetland habitat can be used as an indicator when determining wetland (and terrestrial) habitat quality. For example, common fern species like *Cyclosorus interruptus* are wildly distributed throughout the understory of forests and wetland of the CNMI, while less common ferns like *Asplenium laserpitiifolium* are restricted to moist shady, windless and low disturbance areas on Rota and Guam. *Lemna perpusilla*, a small floating duckweed, occurs in still-water environments and may be vulnerable to competitive displacement by numerous invasive aquatic plants.

While the rare tree fern *Sphaeropteris aramaganensis* is more accurately classified as a tropical montane forest fern rather than a wetland species, this plant inhabits cloud-immersed montane forests on the islands of Anatahan, Alamagan, and Sarigan, to which it is endemic (Raulerson & Rinehart 1992). Its ecological needs like consistent humidity and mist exposure are met through atmospheric moisture rather than saturated soils or standing water, distinguishing it from true wetland flora. Many of the epiphytic ferns and orchids of the Marianas have potential wetland associates, including *Dendrobium guamense* and *Bulbophyllum* species, which remain poorly surveyed and understudied in the Northern Islands, and occur in moist forest understories and stream margins on Pagan, Agrihan and likely other islands.

### Riparian Zones

Riparian zones are transitional areas between freshwater systems, such as streams, lakes, and upland ecosystems. In the CNMI, these zones are typically found in ravines where streams flow seasonally and in low-lying areas surrounding marsh or lake features. These habitats play a critical role in maintaining ecological balance and provide a wide range of ecosystem services, including water storage, filtration, erosion control, wildfire prevention, flood mitigation, and support for biodiversity.

Saipan, Tinian, and Rota have just over 154 km of non-perennial streams (DCRM 2020). These streams flow within ravine features where water flows both seasonally and, in some cases, year-round (Figure 28). On some islands, perennial surface water flow is fed by groundwater springs, while ephemeral streams occur during seasonal rainfall. During the dry season or extended droughts, many of these water features may "dry up" or experience reduced surface flow, transitioning to underground freshwater movement that eventually resurfaces as coastal freshwater seeps.

Riparian zones in the Marianas are often characterized as mixed forests, which include a combination of native and introduced plant species. Historically, freshwater sources and riparian habitats have been essential for human settlements and agriculture. Islanders planted resource crops along these water features, including bamboo, mango, avocado, citrus, coconuts, breadfruit, taro, and betel nut. These plants provided food, building materials, and medicinal resources, underscoring the cultural and economic importance of riparian zones.

The vegetation in riparian areas plays a vital role in stabilizing streambanks, preventing erosion, and improving water quality by filtering sediments and pollutants. The vegetation in these zones also provide shade, which helps regulate water temperatures and supports aquatic life. Additionally, riparian habitats serve as corridors for wildlife movement, offering shelter, food, and nesting sites for birds, freshwater fish, and other organisms. SGCN snails, freshwater fish, eels, gå'ga' karisu, and dulalas Luta (*Ischnura luta*, Rota Blue Damselfly) reside in freshwater streams and riparian habitat. Several SGCN plants including åmut species, endangered orchids, and *Maesa walkeri* grow in and around riparian zones.

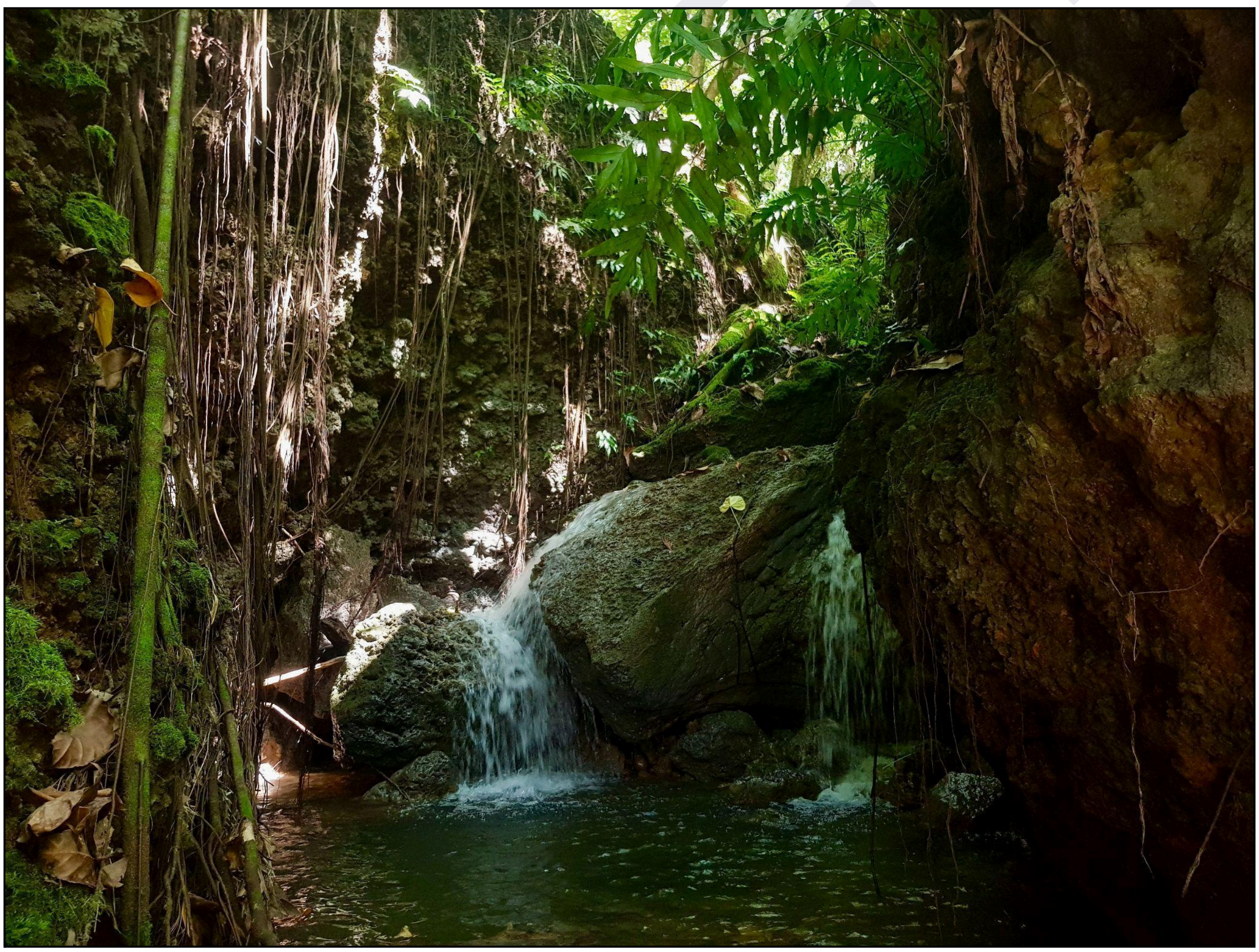


Figure 28. Freshwater stream in the Talakhaya watershed area on Rota.

### Mangroves

Mangroves are a unique forested wetland type composed of saline woodland or shrubland that occurs in depositional coastal environments with fine sediments, high organic content, and low wave exposure. The dominant feature of the mangrove habitat is the mangrove vegetation, including medium-sized trees and large shrubs that grow in saline coastal habitats in the tropics and sub-tropics (Figure 29). The halophytic (salt-tolerant) trees are also adapted to the anoxic conditions of coastal mud.

Figure 29. Mångil machu (*Bruguiera gymnorrhiza*) in the American Memorial Park estuary on Saipan. (Williams, 2025).

Mangroves contribute to maintaining coastal water quality by filtering nutrients, pollutants, and particulate matter from land-based sources, reducing the amount that reach seaward coral reef and seagrass habitats. The root system of mangroves also provide conditions for sediment deposition and accretion, and protect shorelines and coastal infrastructure by absorbing wave energy generated by storms and tsunamis. Where they occur, mangroves are intricately linked to neighboring marine communities and contribute to sustaining populations of commercially and culturally important reef fisheries.

In the CNMI there are 61 acres of tidal mangrove habitat (DRCM 2020). Mangroves are found on Saipan, in scattered patches from American Memorial Park, Smiling Cove, and north to Tanapag. Mangroves on Saipan contain the classic mangrove tree species *Bruguiera gymnorrhiza,* which are found almost exclusively in coastal mudflats and brackish zones. On Rota and Tinian, mangroves are made up of coastal *Pemphis acidula* - which can grow in many coastal habitats including rocky shorelines found in the sandy or rocky tidal zones. On Rota and Tinian, these systems provide patchy mangrove habitat around the islands' coast. Common plants in the mangrove forest are mångli machu (*Bruguiera gymnorrhiza*), nigas (*Pemphis acidula*), hufa (*Heritiera littoralis*), and lalamyok (*Xylocarpus moluccensis*) (Falanruw et al. 1989). Fish species like åsuli (giant mottled eel, *Anguilla marmorata*), short-tailed pipefish (*Microphis brachyurus*), moonyfish (*Monodactylus argenteus*), dusky sleeper (*Eleotris fusca*), and barred mudskipper (*Periophthalmus argentilineatus*) are tightly associated with mangroves for foraging and breeding. As well as mangrove associated plants like *Acrostichum aureum*.

Mangroves are considered important nursery habitat for numerous marine fishes, including commercially valuable species, and invertebrates such as the SGCN mangrove crab (*Cardisoma carnifex*). The marine fishes and invertebrates utilize the habitat provided by the sub-tidal prop roots and pneumatophores of the mangrove trees. Various food fish species, such as rabbitfish (*Siganus* spp.), mullets (*Mugilid* spp.), mojarras (*Mojarra* spp.), and juvenile jacks (*Caranx* spp.), barracudas (*Sphyraena* spp.), snappers (*Lutjanus* spp.), and napoleon wrasse (*Cheilinus undulatus*) can be found among the mangrove prop roots subtidally and at intertidal areas during periods of higher tide levels (Taborosi 2013). They provide habitat for birds like the egigi (*Micronesian myzomeala*) and chuchuku' atilong (*Egreta sacra*). Understudied species (SGIN) such as the barred mudskipper (*Periophthalmus argentilineatus*), short-tailed pipefish (*Microphis brachyurus*), and moonyfishes (*Monodactylus argenteus*) can be found in mangroves in the CNMI.

American Memorial Park (AMP) on Saipan contains over 30 acres of mangrove wetland habitat within its boundaries and currently hosts a *B. gymnorhiza* nursery jointly operated by the National Park Service and a local NGO Pacific Coastal Research and Planning (PCRP). A mangrove wetland mitigation and restoration plan has previously been established and is currently underway AMP. This restoration is a mitigation project that was developed to replace lost mangrove and wetland habitat at the adjacent Governor Eloy S. Inos Peace Park (Green 2019). AMP wetland and associated mangrove complex within the park provides essential ecosystem services for the Garapan watershed. This wetland is a discharge point for surface water runoff from Garapan and is the only filtration area for this water before entering the Saipan Lagoon directly adjacent to the park. Other small stands of mangroves exist along Saipan's western coastal plains, including DFW Lower Base Wetland, but distribution is restricted to a few key pockets.

### 4.1.5 Rocky shoreline

Sea cliffs, steep slopes, rocky headlands, low-lying raised limestone patches, bench platforms, and exposed beachrock; these are all unique rocky shoreline habitats that can be found in the CNMI. Sea cliffs and steep slopes are typically found along raised limestone terraces and rocky headlands where points of land project into the sea (Figure 30).

Cut bench platforms, common features along many rocky shorelines, are relatively narrow erosional platforms cut into limestone or volcanic rocks. These platforms vary in width from a few to 25 meters or more, and typically exist at an elevation slightly higher than mean high tide. Platform elevations can vary, depending on the degree of wave exposure, with benches in high wave energy areas as much as 2 meters or more above mean tide level, and those in lower energy areas found within the intertidal zone to about 1.5 m above mean tide level. The interiors of wider platforms often contain a series of rimmed terrace pools, and the seaward margin of wider benches is usually raised. Narrower platforms are usually flat, or with minimal terrace pool development. Low-lying patches of raised, pitted, and pinnacled limestone can be found interspersed among beach deposits along portions of the leeward coasts of Saipan, Rota, and Tinian. These patches are likely the erosional seaward remnants of low limestone terraces (Eldredge and Randall 1980).

Figure 30. Rocky shoreline along Rota's northern coast, As Matmos fishing cliffs. Dacia Wiitala 2023.

Beachrock, which is cemented sedimentary rock, typically slopes seaward at an angle of 5 to 10 degrees. Large boulders and blocks derived from slumping of the adjacent coastal area may also occur along the shoreline, most commonly along sea cliffs, steep slopes, and bench platforms.

The SGCN littoral skink (*Emoia atrocostata*), also called tide-pool skink, is a habitat specialist that only occupies rocky shorelines areas which are exposed to air but are regularly affected by wave splash. Many seabirds including the SGCN masked booby nest in cliffs associated with rocky shorelines. SGCN plants like the ground covering *Nesogenes rotensis* are known to only occur on one to two rocky shorelines on Rota.

### 4.1.6 Beach and Strand

Beaches are accumulations of unconsolidated deposits that occur along the shoreline. Beaches extend seaward to low tide level or to the edge of the inner reef flat or bench platform and landward to strand vegetation, the first major change in physiographic relief, or to the extent of their deposition, whichever occurs first (Eldredge and Randall 1980). Most beaches in the southern CNMI are composed of the whole (biogenic) and fragmented (bioclastic) skeletal remains of reef organisms, such as corals, calcareous red and green algae (especially *Halimeda* spp.), molluscs, echinoids, foraminiferans, and other organisms (Eldredge and Randall 1980). The porous limestone that predominates the exposed rocks of the southern islands results in high rates of percolation and low rates of surface water runoff, limiting the amount of land-based detrital material delivered to beaches. Exceptions can be found at a few locations along the east coasts of Saipan and Rota, where exposed volcanic rock and resulting surface water runoff occurs, allowing the accumulation of deposits resulting from the erosion of volcanic rocks. These beaches also contain some fraction of bioclastic materials, which are moved from adjacent subtidal areas shoreward by wave action (Eldredge and Randall 1980).

In the southern islands of the CNMI, beaches are most extensively developed along the shoreline of the barrier reef lagoon in Saipan. Beaches are also developed between rocky exposures along portions of the barrier reef lagoon shoreline in Tinian. The shoreline of the Tinian barrier reef lagoon has been substantially altered to accommodate docks and other harbor infrastructure. Beach development on exposed coasts around Saipan and Tinian is limited to areas where reef flat platforms or wide intertidal bench platforms border the shoreline (Figure 14) (Eldredge and Randall 1980). Beach development on Rota occurs along the north west coast line between pockets of tall coastal reef uplift and  on the south side of the island where reef flat platforms or wide intertidal benches occur. Small beach deposits can also be found where rivers reach the shore along the eastern coasts of Saipan and Rota (Eldredge and Randall 1980). The thickness of beach deposits in the southern islands of the CNMI is variable, ranging from a thin, patchy veneer of only a few centimeters to several meters or more; the thickest deposits are found along the shorelines of the barrier reef lagoons at Saipan and Tinian (Eldredge and Randall 1980). Even where beaches are well developed, remnant patches of raised, pitted, and pinnacled limestone are often found; at some locations these limestone patches form a narrow band seaward of beach deposits (Eldredge and Randall 1980).

Beaches are generally barren of vegetation, as few plants can grow in the loose, salty sand. However, some vines, such as alalak tasi (*Ipomoea pes-caprae)* and *Canavalia* spp. may creep seaward from the backshore strand habitat.

Strand is a narrow band of habitat composed of salt-tolerant vegetation located immediately landward from the beach or rocky shoreline (Figure 15). Flora in this habitat are often succulent as an adaptation to the high salt levels and are light green-grey or covered with whitish hairs to provide protection from sunlight exposure (Mueller-Dombois and Fosberg 1998). The substrate supporting strand vegetation around high islands may be volcanic or coral sand beach, gravel beach, or volcanic or coral rocks/bluffs. The loose, shifting substrate of sand and gravel beaches, and the high salinity, high degree of sunlight exposure, and the drying effect of wind, present challenges that few plant species have overcome.

The creeping, mat-forming alalak tåsi (*Ipomoea pes-capra*e) is perhaps the most commonly observed beach strand taxa found throughout the tropics. Alalak tåsi is typically the species found closest to salt water, sometimes growing to the high-tide mark. More complex, diverse vegetation is usually found in the upper portion of the strand, and may include small trees and scrub vegetation, such as hunik (*Tournefortia argentea*), banålo (*Thespesia populnea*), and nanåso (*Scaevola taccada*); vines, such as alalak tåsi, agåsi (*Cassytha filiformis*), and akangkang manulasa (*Vigna marina*), as well as various herbaceous vegetation and weeds (Falanruw et al. 1989).

Strand habitat is occupied by some forest bird SGCN (e.g. rufous fantail, Micronesian honeyeater), but is not a critical habitat for these species. Beaches are required for nesting haggan (*Chelonia mydas*) (Taborosi 2013). Sea turtles also occasionally nest in the strand, but the most important function of strand habitat is to provide a buffer for the turtle nesting beach from human disturbance (i.e. noise and artificial light). Beaches and adjacent strands must both be conserved to manage for nesting sea turtles.

### 4.1.7 Caves Key Habitat

The southern islands contain volcanic, non-carbonate rocks overlain by coral-algal limestone carbonate rocks (Stafford et al. 2004). Many caves and crevices within cliff faces have been created by chemical processes of erosion in the highly porous limestone surface. Caves are a unique landscape feature upon which the SGCN Mariana swiftlet and Pacific sheath-tailed bat are completely dependent for roosting and nesting habitat (Figure 31). SGIN species like the Guam long-legged crab (*Discoplax michalis*) are also associated with cave habitats.

Caves used by swiftlets typically have high entrances (≥2 m), and have chambers with dark zones for nesting (USFWS 1992). They require crevices or pockets high on the walls or ceiling for securing nests (Gorresen 2024, Cruz et al. 2008). Fanihin liyang (Pacific sheath-tailed bat, *Emballonura semicaudata rotensis*) appear to prefer larger caves, and share caves with swiftlets

(Wiles et al. 2011).

Figure 31. Cave entrance on Aguiguan, this cave is used by chachaguak (Mariana Swiftlet, *Aerodramus bartschi*) and fanihin liyang (Pacific sheath-tailed bat, *Emballonura semicaudata rotensis*) (Kohler 2021).

## 4.2 Terrestrial habitat composition of CNMI islands

The composition and condition of terrestrial habitats varies considerably among the islands of the CNMI (Tables 16, 17, 18). On uninhabited islands without feral ungulates (Table 30), the condition of all terrestrial habitats is good to excellent (Sarigan, Guguan, Asuncion, Maug, and Uracas).

The 2003-2008 volcanic activity on Anatahan converted considerable native forest to bare ground, grassland, or other early-successional habitats, but ecological succession continues. The 2021 DFW-led surveys on Anatahan, though limited in scope, found decreased tree species diversity compared to the 2003 surveys and found higher densities of smaller trees. The eruption may have created conditions favorable to the spread of invasive plants.

Although Agrihan, Pagan, Alamagan, and Aguiguan are uninhabited or have very few residents, and so experience fewer human impacts, the terrestrial habitats of these islands are severely impacted by feral ungulates (cows, goats, deer, and/or pigs). Feral ungulates have multiple negative impacts on terrestrial habitats including reducing forest understory through grazing and browsing, creating soil disturbance through hoof action or rooting that can increase the spread of invasive plants and cause soil loss through erosion, inhibiting forest regeneration by repeated grazing and browsing of tree seedlings, and altering forest species composition through selective grazing and browsing of preferred food plants. While the impacts of feral ungulates are severe, the eradication of feral ungulates on Sarigan demonstrated that terrestrial habitats and associated SGCN can recover rapidly and dramatically following eradication (Kessler 2011b). Despite the negative impacts associated with feral ungulates, these islands continue to provide important habitats for many terrestrial SGCN.

In addition to greater invasive species impacts compared to other CNMI islands, Saipan, Tinian, and Rota also experience habitat conversion to development.  Conversion of forest and other "natural" habitats to development currently continues on Saipan and Tinian at a much higher rate than on Rota. Few terrestrial SGCN occupy developed habitat and typically at a lower density than in "natural" habitats.  The direct effect of habitat loss is easily measured and results in significant losses to terrestrial SGCN populations.  The indirect effects of fragmentation and degradation of remaining habitats are harder to measure and have not been quantified for any terrestrial habitat or SGCN in the CNMI.

## 4.2.1 Rota

Most of Rota was forested prior to the arrival of people over 4,000 years ago (Engbring et al. 1986). Land clearing began when the island was first colonized by Chamorros, but proceeded on a much larger scale during the Japanese administration (1914-1944) with sugar cane farming on flat lands and phosphate mining on the Sabana plateau (Amidon 2000). Although Rota was spared invasion during World War II, it was heavily bombed (Engbring et al. 1986). By the end of the war, approximately 25% of Rota was covered in well-developed forest divided into small parcels or located at the base of cliffs (Amidon 2000).

Falanruw et al. (1989) classified Rota's vegetation types based on 1976 aerial photography and found 62% in forest and 5% in agroforest for a total of 67% of Rota in forest habitat. In 2004, the U.S. Forest Service (Donnegan et al. 2011) also found 67% forest. While the two vegetation mapping efforts used different methods and classification systems, it appears that loss of forest habitat to development was balanced out by succession of savanna and other habitats to forest from 1976-2004. In 2014, the U.S. Forest Service completed data collection to repeat the 2004 forest inventory and analysis and found that forested landscapes on Rota were largely unchanged from the 2004 report (Dendy 2024).

Over half of Rota is native forest, a substantially higher proportion than any of the other southern islands. With over 4,000 hectares of native forest, Rota has by far the most native forest of any CNMI island (Figures 3, 18, and 19; Table 7).

Table 16. Composition of Rota terrestrial habitats, 2016 (Amidon et al. 2017).

| Vegetation Type | Hectares | Acres | % of Total Area |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Agriculture | 42.7 | 105.4 | 0.5 |
| Bamboo Thicket | 27.3 | 67.5 | 0.3 |
| Bare Rock | 102.1 | 252.4 | 1.2 |
| Bare Soil/Gravel | 76.5 | 189.1 | 0.9 |
| Casuarina Forest | 68.9 | 170.2 | 0.8 |
| Coastal Scrub | 123.7 | 305.6 | 1.4 |
| Coconut Forest | 200.5 | 495.5 | 2.3 |
| Developed | 145.2 | 358.8 | 1.7 |
| Emergent Wetland | 0.3 | 0.8 | 0.0 |
| Grassland | 90.8 | 224.4 | 1.1 |
| Hibiscus Thicket | 17.8 | 43.9 | 0.2 |
| Leucaena Thicket | 92.4 | 228.3 | 1.1 |
| Mixed Grass/Herb | 1,983.5 | 4,901.2 | 23.1 |
| Mixed Introduced | 853.2 | 2,108.4 | 10.0 |
| Native Limestone | 4,047.4 | 10,001.4 | 47.2 |
| Sand | 27.6 | 68.1 | 0.3 |
| Scrub Shrub | 396.0 | 978.6 | 4.6 |
| Urban Vegetation | 279.2 | 689.9 | 3.3 |
| **Total** | **8,575.1** | **21,189.3** | **100.0** |

The native forest on Rota consists of two types, divided by elevation. At low elevations, forests are drier due to low rainfall during the dry season. At higher elevations, predominantly wet forests develop due to the persistent accumulation of clouds over the Sabana and higher levels of rainfall (Amidon 2000).

Engbring et al. (1986) found Rota's habitats to be in an altered condition due to its history of agricultural development. Native forest is restricted to the slopes leading up to the Sabana, areas too steep to be farmed. Areas of the eastern plateau and coastal shelves that were formerly farmed have regenerated with native species in a scrubby mixed forest. Where grazing by cattle or browsing by deer occurs, this mixed forest is open; otherwise the openings are heavily overgrown with grasses, vines and shrubs. The Sabana plateau is characterized by grasslands, native forest and mixed forest.

The majority of high elevation forests along the upper plateau of Rota have not been threatened by development or clearing because of their rugged topography. However, these high elevations have been exposed to the force of numerous typhoons. Rota experienced 5 supertyphoons between 1988 and 2023, in addition to many other typhoons and tropical storms in the last 30 years. Clearing of land on the Sabana has been limited, but may have contributed to damage to mature native forests on the Sabana by typhoons, because fragmentation of the forest increases the forest edge and exposes more of the forest to typhoon force winds. Large areas of mature native forest are being converted to *Pandanus tectorius* thickets as canopy trees are damaged and die off. We do not know if these *Pandanus* thickets are a successional stage and mature native forest will re-grow, or if factors such as browsing by deer (*Rusa marianna*), spread of *Pandanus* seeds by fanihi or typhoon frequency and intensity may be impacting natural regeneration of native forests in the Sabana.

Because of the high percentage of intact habitat on Rota, the island is home to the highest number of rare and endangered species in the CNMI. Rota is home to the largest single island population of the threatened fanihi. This is an extremely important source population for the other southern islands who are still struggling to recover the tremendous loss of fanihi in the last 50 years. In addition to the fanihi on Rota, the endangered åga, nosa' Luta, pulattat, ko'ku' (Guam rail, *Hypotaenidia owstoni*), akaleha land snails, dulalas Luta, fadang, trongkun guafi, *Osmoxylon mariannense*, *Nesogense rotensis*, and all the ESA listed orchids can be found on Rota.

## 4.2.2 Aguiguan

The island of Aguiguan essentially has three levels, two lower benches and a plateau, separated by limestone cliffs or steep slopes. The lowest bench is at 20-40 m elevation, the intermediate bench is at about 70-80 m elevation, and the plateau at about 150 m elevation (Rice 1991). Naftan Rock is a small islet 1 km off the southwest coast of Aguiguan (Figure 20)

When the island was inhabited during the Japanese administration (1914-1944), much of the plateau was converted to sugarcane fields. When these fields were abandoned after World War II, weeds invaded, primarily the non-native perennial *Chromolaena odorata* (Engbring et al. 1986). Many of these abandoned agricultural fields have since succeeded to monocultures of the invasive shrub *Lantana camara*, a species with few wildlife benefits and unpalatable to livestock.

Native forest is now limited to steep scarps and shelves rimming the high plateau. Common forest trees include gulus, paipai, and umumu. Puting, figs (*Ficus* spp.), and leami (*Artocarpus altilis*) also occur in some areas (Rice 1991).

Feral goats (*Capra hircus*) are abundant, lending Aguiguan its alternate name, “Goat Island”. At the time of a goat control effort in 1989-1990, the goat population was estimated at ~200 goats. No control efforts have occurred since, and hunting pressure is relatively light. We estimate that the population is now over 1,000 goats (Chynoweth et al. 2013; DFW, pers obs). The forest understory is extremely open as unrestricted goat browsing has consumed most understory vegetation.

The U.S. Fish and Wildlife Service produced a land cover of Aguiguan in 2008, primarily by ground truthing a map digitized from 2001 imagery (USFWS 2009). Since the 1980s, grasslands and savannas have succeeded to forest habitats (Table 17).

Table 17. Change in terrestrial habitat composition of Aguiguan, 1982-2008. Adapted from USFWS 2009 and Amidon et al. 2017 - some classes may not directly crosswalk between classifications.

| **Habitat Class** | **1982 (ha)** | **% of Total** | **2008 (ha)** | **% of Total** | **2016** | **% of Total** | **Change** |
|---|---|---|---|---|---|---|---|
| Native Forest | 281 | 47 | 340 | 49 | 380 | 55 | +8% |
| Mixed Forest | 21 | 4 | 95 | 14 | 25 | 4 | +0% |
| Tangantangan | 0 | 0 | 44 | 6 | 30 | 4 | +4% |
| Grassland/Savanna | 256 | 43 | 158 | 23 | — | — | -43% |
| Scrub/Shrub | | | | | 181 | 26 | 26% |
| Strand | 15 | 3 | 28 | 4 | — | — | +1% |
| Bare Land | 23 | 4 | 34 | 5 | 83 | 12 | +8% |
| **TOTAL** | 596 | 100 | 699 | 100 | 696 | 100 | 0% |

## 4.2.3 Tinian

Like the other southern islands, Tinian has had a long history of disturbance and habitat conversion by human settlers. When the Chamorros arrived around 2,000 B.C., they brought agriculture to Tinian and likely converted substantial terrestrial habitats (Steadman 1999). The Spanish reached the Mariana Islands in 1521, colonizing the Marianas over the next centuries. Although Tinian was probably uninhabited during the Spanish administration, they introduced wild cattle, pigs, and feral junglefowl that became abundant (Engbring et al. 1986). Between 1899 and 1914, Tinian was a German possession, resulting in a large increase in agriculture that included expanded crop production and large coconut plantations for oil (Spennemann 1999).

During the Japanese era, from 1914 to 1944, nearly the entire island of Tinian was deforested and replaced with sugar cane fields, except for the craggy, forested cliffs and ridges with shallow soils (Lusk et al. 2000b). During World War II, all vegetation on Tinian was virtually leveled, and only tiny pockets of native vegetation remained (Engbring et al. 1986). In addition, the Japanese established Tinian as a major military base that included four airfields (Rottman 2004).

The Americans captured Tinian from the Japanese in 1944 and converted the island into a major air base for the war on Japan. Two large airfields and associated structures were constructed on land used for sugarcane production, and the island housed up to 50,000 personnel, approximately five times the density under the Japanese administration (Bowers 2001).

In 1946, Tinian was largely abandoned by the military, and the first Chamorro families returned to the island from Saipan (Farrell 1992). The U.S. military continued administrative authority of the Mariana Islands until 1962, when the Islands reverted to civilian control. The Department of Defense (DoD) leased 6,211 ha in the northern two-thirds of Tinian (U.S. Navy 2013) (Figure 4). The U.S. military occasionally conducts low-impact military training on the Tinian lease land, and has recently proposed using the lease area for large-scale, high-level live-fire training (U.S. Navy 2015a). Portions of the northern half of the island are also used for public recreation, grazing, and agriculture.

In 2024 the DoD began to restore the North Field, removing over 50 years of vegetation growth (largely tangantangan, secondary mixed introduced forest, and grasses) from the WWII era landing strips. Around 180 hectares of North Field airfield including taxi ways, landing strips, and associated aprons have been cleared of vegetation as planned in the 2010 Mariana Islands Training and Testing (MITT) Range Complex plans. To accommodate the increase in DoD activity on Tinian, urban and agricultural development has increased over the last ten years. Additional DoD infrastructure is planned for the Tinian MLA, though the full extent of land alterations is uncertain, we should expect habitat alteration to be prominent on Tinian for at least the next ten years.

Land cover mapping for Tinian in 2008 indicated that 68% of Tinian was forest habitat (Table 18) (USFWS 2009), an increase from 62% total forest as mapped by the U.S. Forest Service in 1982 (Engbring et al. 1986).  Grassland and savanna habitats had apparently succeeded to mixed forest habitat. Over the same time period, developed area increased by about 10 times; most new developed habitat apparently was also converted from grassland/savanna. Land cover mapping using a different methodology in 2016 (Amidon et al. 2017) suggests a combination of succession from grasslands to forests and clearing of forests over the 34 year period since 1982.

Table 18. Change in Tinian terrestrial habitat composition, 1982 to 2008 to 2016. Adapted from USFWS 2009 and Amidon et al. 2017.

| Class | 1982 (ha) | % of Total | 2008 (ha) | % of Total | 2016 (ha) | % of Total | Change (%) |
|---|---|---|---|---|---|---|---|
| Native Forest | 490 | 4.9 | 549 | 5.4 | 418.3 | 4.1 | -0.8 |
| Mixed Forest | 1927 | 19.2 | 2916 | 28.8 | 2,819.4 | 27.9 | +8.7 |
| Tangantangan | 3852 | 38.3 | 3417 | 33.8 | 3,350.2 | 33.1 | -5.2 |
| Agroforest | 0 | 0.0 | 40 | 0.4 | 43.6 | 0.4 | +0.4 |
| Grassland/Savanna | 3107 | 30.9 | 1950 | 19.3 | 2,441.0 | 24.1 | -6.8 |
| Cropland | 190 | 1.9 | 134 | 1.3 | 31.3 | 0.3 | -1.6 |
| Strand | 356 | 3.5 | 223 | 2.2 | 251.4 | 2.5 | -1.0 |
| Developed | 78 | 0.8 | 776 | 7.7 | 589.1 | 5.8 | +5.0 |
| Wetland | 26 | 0.15 | 26 | 0.3 | 27.3 | 0.3 | +0.1 |
| Bare Land | 33 | 0.3 | 81 | 0.8 | 144.5 | 1.5 | +0.5 |
| **TOTAL** | 10,048 | 100 | 10,113 | 100 | 10,116.1 | 100 | 0.0 |

Tangantangan forests dominate most of the level and moderately sloping areas in extensive, homogeneous stands which cover a great portion of the island of Tinian. Native forest is limited in extent to patches at cliff lines and escarpments around the Kastiyo, Piña and Carolinas plateaus on the southeast side of Tinian, and a narrow corridor on the escarpment that connects Mt. Lasso with Maga in the center part of the island.

Tinian's wetlands are formed by impermeable clay that impounds water. The largest is Lake Hagoi, 15.5 ha in area and situated in the northern part of the island within the Tinian Military Lease Area (MLA). Water levels at Lake Hagoi drop during periods of drought and have completely dried out during extreme dry seasons. Lake Hagoi is an important wetland for pulattat (Mariana common moorhen, *Gallinula chloropus guami*). Other wetlands in Tinian are smaller and ephemeral, i.e. dry up between rainfall events; among these are Mahalang and Bateha complexes within the MLA. Makpo Swamp in the southern part of Tinian once had open water, but it became heavily overgrown by woody vegetation after municipal groundwater pumping altered water levels.

## 4.2.4 Saipan

The following brief history is taken from Engbring et al. (1986):

"Similar to other Mariana Islands, Saipan was likely mostly forested prior to Chamorro arrival. Chamorros likely cleared land by cutting vegetation and using fire, probably converting large areas of forest to grasslands. A variety of plants and animals were introduced, including rats (*Rattus* spp.) and the red junglefowl (*Gallus gallus*). During the Spanish era (1521 to 1899), ungulates were introduced to Saipan, including goats, cattle, pigs and deer. These animals became feral and greatly modified the vegetation composition."

During the German administration (1899-1914), an active coconut planting program ensued. During the Japanese administration (1914-1944), sugar cane fields replaced much of Saipan's native forests, leaving forests only on rocky ridges and cliffs that were unsuited for sugar cane production. World War II brought tens of thousands of people to Saipan, and virtually all of the vegetation on the island of Saipan was leveled, leaving only tiny pockets of forest. After the war, fields on Saipan formerly cultivated by the Japanese were colonized by tangantangan.

Post-war development on Saipan has included rapid expansion of tourism (including golf courses); residential, commercial and industrial development along the western shore and in Kagman; and agriculture in Kagman and on scattered private farms.

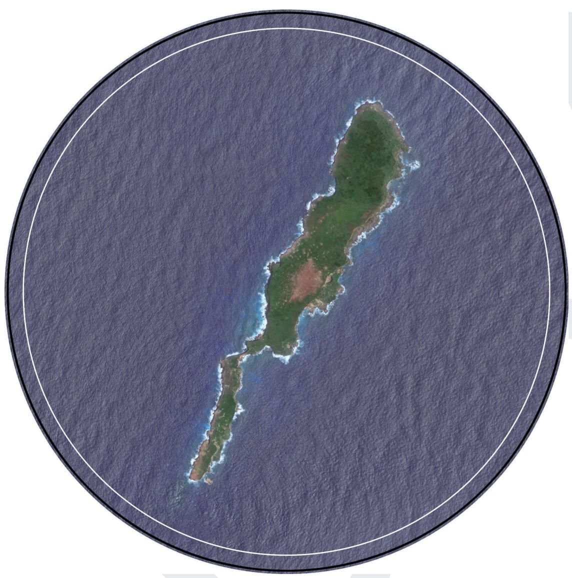
Falanruw et al. (1989) classified Saipan's vegetation types based on 1976 aerial photography. In 2004, the U.S. Forest Service conducted another vegetation mapping effort (Donnegan et al. 2011) (Table 10). The Falanruw and Donnegan vegetation mapping efforts used different vegetation classification systems, so direct comparisons of all habitat types is not possible, but clearly significant forest habitat was converted for development between 1976 and 2004. Falanruw et al. (1989) found 75% of Saipan in forest habitat, while ~30 years later Donnegan et al. (2011) found 64% forest. Developed areas (including "urban and built up and "urban vegetation") increased from 6% to 21% over the same time period. The most recent estimate comes from 2016, where an estimated 57% of forest cover on Saipan (Amidon et al. 2017) (Table 19).

Table 19. Composition of Saipan terrestrial habitats in 2016 (Amidon et al. 2017).

| Mapped Class | Wildlife Action Plan Class | Hectares | Acres | % of Total Area |
|---|---|---|---|---|
| Agroforest -- Coconut | Coconut Forest | 119.5 | 295.3 | 1.0 |
| | **Agroforest Total** | **119.5** | **295.3** | **1.0** |
| *Casuarina* Thicket | Mixed Forest | 93.3 | 230.6 | 0.8 |
| Mixed Introduced Forest | Mixed Forest | 4,310.1 | 10,650.4 | 36.3 |
| | **Mixed Forest Total** | **4403.4** | **10,881.1** | **37.1** |
| Native Limestone Forest | Native Forest | 157.1 | 388.3 | 1.3 |
| *Leucaena leucocephala* (Tangantangan) | Tangantangan | 2,222.4 | 5,491.7 | 18.7 |
| | **All Forest Total** | **6.902.5** | **17,056.3.1** | **58.2** |
| Agriculture | Other | 52.8 | 130.5 | 0.4 |
| Bamboo Thicket | Grassland/Savanna | 2.4 | 5.8 | 0.0 |
| Bare Rock | Bare Land/Beach | 97.4 | 240.6 | 0.8 |
| Bare Soil/Gravel | Bare Land/Beach | 44.0 | 108.7 | 0.4 |
| Coastal Scrub | Grassland/Savanna | 137.1 | 338.8 | 1.2 |
| Developed | Other | 1,176.7 | 2,907.6 | 9.9 |
| Developed Veg | Other | 1,490.9 | 3,684.0 | 12.6 |
| Emergent Wetland | Wetland | 146.9 | 363.1 | 1.2 |
| Grassland | Grassland/Savanna | 483.3 | 1,194.2 | 4.1 |
| Hibiscus Thicket | Wetland | 15.8 | 39.0 | 0.1 |
| Mangrove | Wetland | 0.8 | 2.1 | 0.0 |
| Mixed Grass/Herb | Grassland/Savanna | 858.8 | 2,122.2 | 7.2 |
| Sand | Bare Land/Beach | 53.9 | 133.2 | 0.5 |
| Scrub Shrub | Grassland/Savanna | 415.5 | 1,026.8 | 3.5 |
| | **Grand Total** | 11,906.6 | 29,420.7 | 100.00 |

Today, Saipan's native forest is limited to steep limestone escarpments. The most extensive and best developed native forest on Saipan is in the Marpi region. Much of the island's native forests fall within the boundaries of established conservation areas, including the Saipan Upland Mitigation Bank, the Bird Island Wildlife Preserve, the Kagman Wildlife Conservation Area, and terrestrial portions of the Bird Island and Forbidden Island Sanctuaries (Figure 5). Mixed forests and tangantangan thickets are distributed throughout the island of Saipan.

Agroforests (notably coconut and betelnut plantations) are clustered around residential areas in Susupe and Garapan, and on agricultural homesteads scattered throughout the island. Grasslands and savannas cover much of the hillsides flanking Mt. Tapochao. Wetlands, including man-made wetlands, are located primarily on the southern part of Saipan and along the western coast, in flat areas. Lake Susupe is the largest wetland, with about 18 ha of open water surrounded by 518 ha of marsh vegetation. Lake Susupe along with numerous smaller wetlands provide important habitat for the Saipan reed-warbler and the Mariana common moorhen. Saipan supports the only mangrove forest in the CNMI, as a narrow intermittent coastal strip from American Memorial Park in Garapan to Tanapag on the western side of the island.



### 4.2.5 Noos (Farallon de Medinilla)

Noos is generally flat, but slopes gradually from east to west, with the highest point reaching 82 m. The southern third of the island is a narrow peninsula separated from the main body of the island by a partially collapsed isthmus. The entire island is surrounded by steep sea cliffs, particularly on the east side, which make access by boat exceptionally difficult. There are two small beaches, both of which are overwashed during periods of high tide (Lusk et al. 2000a). Although Noos likely never supported a permanent human settlement, it does have a history of exploitation for human consumption. At the turn of the 20th century, exotic feathers for the European, American, and Australian hat industry were in high demand. Historical records show that between 1897 and 1915 more than 3.5 million seabirds were killed on islands in the central Pacific Ocean, including Noos and other islands in the Marianas. Noos was leased by Germany in 1909 for the exploitation of birds. By the end of the lease, which terminated in 1911, bird numbers were reduced to the point where further hunting became uneconomical (Spennemann 1999).

The U.S. military has used Noos as a bombing range since at least 1971, and in 1983 the agreement between the U.S. and CNMI Governments was formalized in a 50-year lease agreement. The U.S. Navy recently announced its intention to increase the current rate of bombing from 2,150 explosive bombs per year to over 6,000 bombs per year (U.S. Navy 2015b).

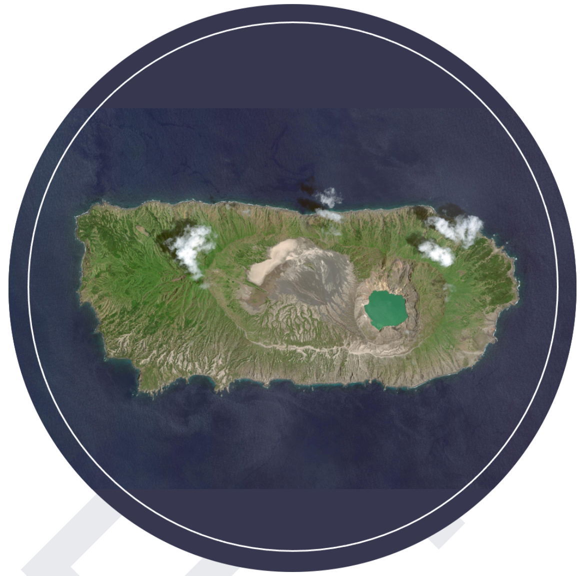
Few vegetation surveys have been conducted on Noos. The first published flora record by Fritz in 1902 described the island as a plateau covered by brush approximately 13 ft. (4.0 m) high; however, aerial photographs from 1944 show large canopy trees on Noos (U.S. Navy 2015b). Noos' vegetation appears to have undergone significant changes since the island was leased by the DoD and the subsequent bombardment for military training (Figures 28, 29). The most intensive bombardment to date of Noos occurred during the Vietnam era, when as much as 22 tons of ordnance per month was dropped on the island (Lusk et al. 2000a). Based on early 20th century descriptions of Noos vegetation and aerial photographs of the island prior to military bombardment activities, island tree height and canopy cover have been greatly reduced (Lusk et al. 2000a; Mueller-Dombois and Fosberg 1998).

Currently, habitat conditions at Noos cannot be studied on the ground due to the presence of unexploded ordnance and ongoing military bombing activities. Landcover data indicate that about 2/3rds of the island consists of grassland and savanna habitats (Figure 20). A brief botanical survey of the northern portion of the island carried out in 1996 identified 43 plant species, 32 of which were native (Mueller-Dombois and Fosberg 1998). Sasagnat (Micronesian megapode, *Megapodius laperouse laperouse*), a forest dwelling species, is known to breed on Noos. The cliffline ecosystem continues to provide important habitat for colonies of ground-nesting seabirds, including the Marianas' largest known nesting site for SGCN masked booby (*Sula dactylatra*), and one of two known nesting colonies of SGCN great frigatebird (*Fregata minor palmerstoni*) in the Marianas (Lusk et al. 2000a).

Table 20. Composition of Noos terrestrial habitats, 2011 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---|---|---|
| Bare Land | 18.1 | 44.8 | 25.0 |
| Grassland | 42.4 | 104.8 | 58.6 |
| Scrub Shrub | 10.0 | 24.6 | 13.8 |
| Unknown | 1.9 | 4.8 | 2.6 |
| **TOTAL** | 72.64 | 179.50 | 100 |

## 4.2.6 Anatahan



Anatahan is a stratovolcano containing the largest caldera in the Northern Mariana Islands (Figure 32). The caldera contains two lakes. In May 2003, the volcano erupted for the first time in recorded history. Minor eruptions and low-level volcanic activity continued through the 2000's, with the last recorded eruption in 2008 (Global Volcanism Program 2025).

Prior to the eruption, the island had a small number of human inhabitants, and extensive habitat degradation by feral goats and pigs (Cruz et al. 2000a, DFW unpub. 2000, Kessler 2011b). Historically, Anatahan was documented to be a heavily forested island with minimum levels of degradation in the early half of the 20th century (Pratt 1984, Reichel 1988). Pigs were already established on Anatahan during the late 1890's, and goats are thought to have been introduced in about 1960. An eradication campaign was underway around the time of the eruption, when the volcanic activity removed nearly all of the island's vegetation and was thought to extirpate all land birds (Kessler 2011b). DFW island-wide surveys conducted in 2021 detected totot (Mariana fruit dove, *Ptilinopus roseicapilla*), egigi (Micronesian myzomela, *Myzomela rubratra saffordi*), sasangat (Micronesian megapode, *Megapodius laperouse laperouse*), såil (Micronesian Starling, *Aplonis opaca aeneus*), na'abak (Rufous Fantail ssp. mariae, *Rhipidura versicolor mariae*), chungi' (white term, *Gygis alba*), paluman fachi'/apåka'(White-throated ground dove, *Gallicolumba xanthonura*), sihek (Mariana kingfisher, *Todiramphus albicilla owstoni*) and fanihi (Mariana fruit bat, *Pteropus mariannus mariannus*)  along with several species of seabirds.

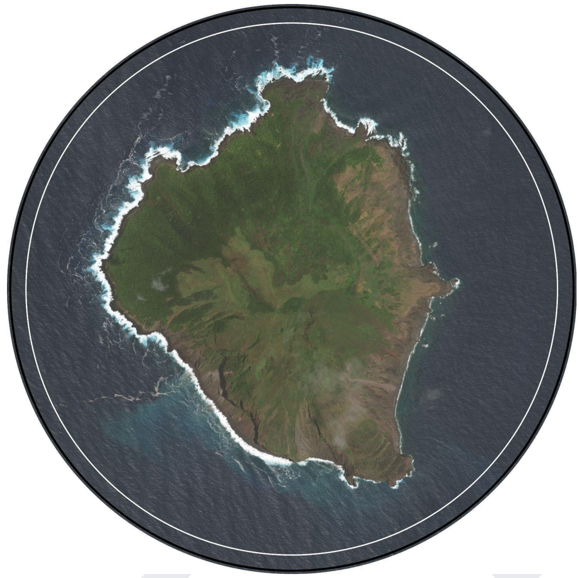
Figure 32. Panoramic view from the southwest  looking north east into the crater and two lakes of Anatahan. Drone photo by Bradly Eichelberger 2021.

In 2005, over half of the island was classified as bare land (Table 21) (NOAA 2009d). Vegetation is recovering (Figure 33), but has not been recently quantified. Feral cats persist on the island. Feral pigs are considered eradicated as no evidence of live pigs was found during the 2013 and 2021 island-wide searches (U.S Navy 2013, DFW 2021).

DFW lead an expedition to Anatahan in 2021 and discovered that several of the southern ravine forests were still intact with many mature native trees (DFW 2021). From the base camp where they landed, the island was largely impenetrable due to unstable ground along the ridgelines that lead to the island interior. A total of 8 vegetated plots were sampled for species composition and structure. They found an increase in density of trees and that coastal and ravine forests had noticeable regeneration of tree species compared to similar forest surveys conducted in 2003. In addition to measured forest regeneration the team recorded several native fauna with surprising abundance indicating that animals were either successfully repopulating the island post eruption, or had not been extirpated during the 2000's eruption as was originally thought.

Table 21. Composition of Anatahan terrestrial habitats, 2012 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---|---|---|
| Bare Land | 1,305.3 | 3,225.5 | 38.6 |
| Forest | 165.80 | 409.8 | 4.9 |
| Grassland | 784.6 | 1938.9 | 44.0 |
| Scrub Shrub | 122.3 | 302.3 | 3.6 |
| Wetland | 100.7 | 248.8 | 3.0 |
| Unclassified | 200.0 | 494.2 | 5.9 |
| **Total** | 3,383.7 | 8,361.3 | 100.0 |



## 4.2.7 Sarigan

Sarigan consists of a central volcanic cone with steep eastern and southern slopes sparsely vegetated with grasses and ferns, and gentler western and northern slopes supporting native forest and coconut forest. The last eruption on the island probably occurred in the Holocene (Global Volcanism Program 2025). The coconuts were planted as part of copra (dried meat of the coconut used for coconut oil extraction and animal feed) production around 1900 which continued into the Japanese administration (1914-1944) (Russell 1998; Spennemann 1999). Currently the island is uninhabited. Feral pigs and goats were once found on the island but were removed in 1998 with subsequent tremendous positive responses of wildlife and vegetation (Kessler 2011b). Feral cats are still found on the island.

In 1999, Fancy et al. (1999) reported Sarigan as 133 ha agroforest (coconut) (82% of forest area), and 29 ha native forest (18% of forest area). In 2013, approximately 30% of Sarigan was generally classified as “forest” (Table 22) (Amidon et al. 2017).

Table 22. Composition of Sarigan terrestrial habitats, 2013 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---:|---:|---:|
| Bare Land | 165.5 | 409.0 | 37.2 |
| Forest | 134.2 | 331.5 | 30.2 |
| Grassland | 138.0 | 341.1 | 31.0 |
| Scrub Shrub | 6.1 | 15.1 | 1.4 |
| Unknown | 0.9 | 2.2 | 0.2 |
| **TOTAL** | 444.7 | 1,098.9 | 100.0 |

## 4.2.8 Guguan

Guguan is uninhabited and constitutionally designated as a wildlife sanctuary, managed by the CNMI Division of Fish and Wildlife. The island consists of two volcanoes, one older and one newer. The only known historical eruption of the island occurred between 1882 and 1884 (Global Volcanism Program 2025). The rift valley between the two volcanoes is dominated by lava flows with sparse vegetation.

The newer volcano dominates the northern half of the island and has a maximum elevation of 248 m. In this portion of the island, the terrain is dominated by relatively recent volcanic activity, as evidenced by large cinder fields, cinder cones, and lava flows (Cruz et al. 2000b).

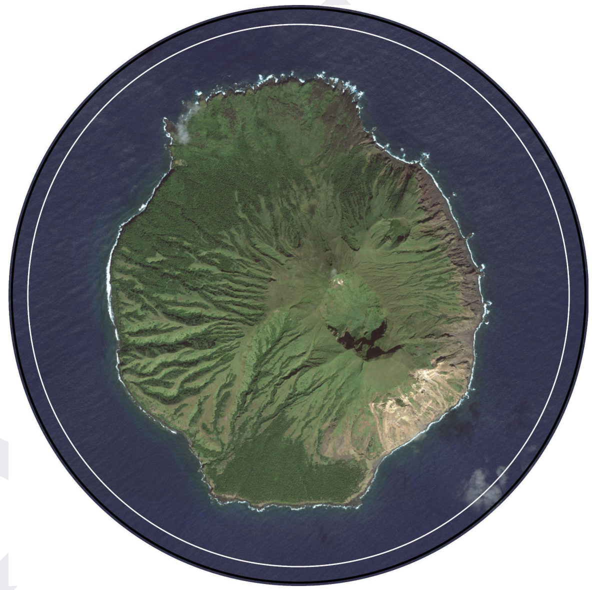
This area has apparently undergone many changes over the last 100+ years. Visitors in 1876 described a rift in the western rim of a high (2000 foot) caldera that was large enough for boats to enter a brackish water lagoon. In the early 1900's, visitors described craters on the western side that had partially slipped into the sea (Ludwig 1978). There are no lagoons or evidence of such craters currently. The large volcanic cone and surrounding cinder fields are in the process of being vegetated by grasses, vines and trees (Cruz et al. 2000b).

The older volcano makes up the southern half of the island and has a maximum elevation of 301 m. The southern portion of the island is bounded by high cliffs, and is heavily vegetated. The southern plateau is dominated by nette (*Miscanthus floridulus*). Native forest, composed of mapunao (*Aglaia mariannensis*), talisai (*Terminalia catappa*), and pågu (*Hibiscus tiliaceus*), *Pandanus* spp., lalaha (*Planchonella obovata*), umumu (*Pisonia grandis*) dominates the areas along the old crater wall and the ravines formed along the slopes of the old volcano (Amidon et al. 2010, DFW 2016). The forests, which occupy 39% of the island (Table 23), have among the highest frequency and density of native trees in the northern islands (Cruz et al. 2000b, DFW 2016).

Table 23. Composition of Guguan terrestrial habitats, 2012 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---|---|---|
| Bare Land | 95.6 | 236.1 | 22.8 |

| | | | |
|---|---|---|---|
| Forest | 165.7 | 409.5 | 39.4 |
| Grassland/Herbaceous | 158.8 | 392.4 | 37.8 |
| TOTAL | 420.1 | 1,038.0 | 100.0 |



### 4.2.9 Alamagan

Alamagan is composed of a single active volcanic cone with a maximum elevation of 744 m. The volcano has erupted at least twice in the last ~1,500 years (Global Volcanism Program 2013).

Copra production on Alamagan began around 1900 (Spennemann 1999) and occurred up to the 1970s (Russell 1998). Villages were once found on the southern and northern coasts. The island currently has only transient residents, but was regularly populated up until 2009 when residents were evacuated from the island after Supertyphoon Choi-Wan passed over the island. Terrestrial habitats are currently degraded by populations of feral goats, pigs, and cattle (*Bos taurus*), and feral cats (Amidon et al. 2010).

Figure 33. Sandy beach on the west side of Alamagan with steep mountain slopes. (Fandel 2025)

Alamagan's higher elevation areas are dominated by nette grassland and savanna (Figures 41, 42). Coastal areas of the island are dominated by coconut forests. The island is approximately 30% forested (Table 24) with the majority consisting of coconut forest (Amidon et al. 2010). Native forests areas of Alamagan are mostly dominated by mapunao (*Aglaia mariannensis*), tal amama (*Terma orientalis*), talisai (*Terminalia catappa*), and pågu (*Hibiscus tiliaceus*) (DFW 2018). Fadang (*Cycas mariannensis*) and other less common trees like gåogåo (coral tree, *Erythrina variegata*) can also be found. Netti (Ohba 1994) dominates the majority of the non-forested areas. *Leptecophylla mariannensis* and *Psychotria hombroniana var. mariannensis*, are two rare plants known to only exist on Alamagan

Table 24. Composition of Alamagan terrestrial habitats, 2012 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---|---|---|
| Bare Land | 204.3 | 504.9 | 15.7 |
| Developed | 0.1 | 0.2 | 0.0 |
| Forest | 390.8 | 965.66 | 30.2 |
| Grassland | 619.1 | 1,529.7 | 47.8 |
| Scrub Shrub | 59.1 | 146.1 | 4.6 |
| Unknown | 22.2 | 54.8 | 1.7 |
| **TOTAL** | 1,296.1 | 3,202.7 | 100.0 |

## 4.2.10 Pagan

The following description is largely taken from Pratt (2011): Topographically, Pagan is composed of two active volcanoes (one in each of the northern and southern parts of the island) connected by a rocky isthmus.

Chamorros who practiced agriculture and cultivated plants (Bellwood 1989) settled the island by 1,500 BC. It is likely that the original inhabitants altered the original vegetation, at least near the coast. During the Japanese administration (1914-1944), Japanese settlers had farms on the island, and many areas with suitable soils were intensively cultivated and delineated with windbreaks (Fosberg and Corwin 1958).

In 1981, Mt. Pagan, the volcano of the northern half of the island, experienced a major eruption and continues to produce intermittent lower level volcanic activity (Global Volcanism Program 2025). After the 1981 eruption, the human population was evacuated from the island, and subsequently inhabitation has consisted of transient residence by a few families.

The eruption eliminated much of the vegetation in the northern part of the island. There was apparently little re-vegetation for almost two decades following the eruption, apart from an increase in ironwood (*Casuarina equisetifolia*) tree cover (Mueller-Dombois and Fosberg 1998). Feral goats (*Capra hircus*), pigs (*Sus scrofa*), deer (*Rusa mariana*), and cattle (*Bos taurus*) are present on the island, and browsing damage has led to removal of natural vegetation, vegetation degradation, and loss of native species (Kessler 2011c; Mueller-Dombois and Fosberg 1998). Over browsing has led to the total degradation of the Pagan's wetland habitat, which historically supported a small population of SGCN pulattat. This species has not been detected on the island since 1979 (Stinson 1991).

The circular caldera of Mt. Pagan encompasses most of the northern region of the island. Remnants of the old caldera wall are seen as prominent vegetated cliffs in the northern part of the island. Lava flows from the 1981 eruption cover the northern and southern slopes of Mt. Pagan, and much of the remaining northern section of the island is covered by historic and recent flows dated to a few hundred years. Thick ash and tephra deposits blanket most of the northern part of the island, particularly on the western and southern slopes (Figures 44, 45) (Trusdell et al. 2006). Only the far southern slope and patches of land on the northeastern side of the island predate the caldera (Fosberg and Corwin 1958), which formed about 1,000 years ago (Trusdell et al. 2006).

The isthmus connecting the two parts of the island and the southern tip of the island are old substrates predating the caldera. The summit peaks and western slope of the southern part of the island are of more recent origin (Fosberg and Corwin 1958). Limestone is present only on the northern part of the island in the form of raised coastlines in the far north and south (Fosberg 1960).

Historically, two native bird species were found near Pagan's two lakes: the pulattat (Mariana Common Moorhen, *Gallinula chloropus guami*) and the Pagan Reed-warbler (*Acrocephalus luscinia yamashinae*). Both species have been extirpated from the island due to multiple factors including severe habitat modification from military land clearing activities, damage from feral ungulates, volcanic activity, and predation by introduced rats and cats (Marshall et al. 2021, Hume 2017).

While the pulattat could potentially recolonize Pagan's lake and wetland habitats, the most recent island surveys have not detected this species (DFW 2021). Additional studies could be conducted to determine whether these birds have naturally returned to the area, identify specific ecological factors that may be preventing recolonization, or assess whether distance from source populations (such as those in other parts of the Mariana Islands) is a limiting factor in natural recovery.

Besides the loss of these birds, tree snails are also in decline on the island. The humped tree snail (*Partula gibba*) were not detected and there was a lack of suitable habitat for the species in the northern part of the island during the 2021 surveys. Snails could still persist in the southern part of the island which is more remote and harder to access (DFW 2021). Introduced invasive predators such as the New Guinea flatworm (*Platydemus manokwari*) are a serious threat to tree snails throughout the Mariana Islands, though they were not detected during snail surveys on Pagan. More extensive surveys are needed to determine whether they have already become established on Pagan.

With growing threats and loss of populations on the southern islands, Pagan and a few other northern islands represent important refuge for the species survival. Biosecurity on Pagan is extremely important to ensure the remaining native species persist there. This can most effectively be accomplished through the establishment of robust biosecurity measures such as cargo inspections, awareness campaigns, and sterilization of any soil or plant materials that originate from outside Pagan.

A total of 215 vascular plant species are known from Pagan (Pratt 2011). Non-native plants make up a significant component of the flora of Pagan, with the number of non-native species increasing over the last 50 years (Pratt 2011). New non-native plant species recorded in 2010 included scarlet gourd (*Coccinia grandis*), which is a serious, rapidly growing pest. Because non-native plant introductions are occurring at a rapid pace and occur over large areas of the island, they are considered a substantial threat to ecosystem health on Pagan (Pratt 2011).

DFW surveys in 2021 found the island's forests and grasslands "severely overgrazed" due to the abundance of feral cattle, goats, and pigs that have done considerable damage to island vegetation. Non-native Phillippean deer (*Rusa marianna*) were introduced to Pagan in 2020 in an ecologically unfortunate attempt to bring additional food source to the island. It is unclear if the few deer brought to Pagan in 2020 will reproduce and establish a population there. Overgrazing has resulted in large open areas susceptible to soil erosion. There is a significant lack of native ground cover, deterioration of the forest cover, and a distinct browse line within the vegetation communities where grazing by non-native ungulates (e.g., cattle, goats, pigs) is seen (DFW 2021, Cruz et al. 2000c; Kessler 2011b). The southern region of the island is less affected by feral ungulates. Despite the degraded forest conditions, Pagan hosts several SGCN species including fanihi (Mariana fruit bat, *Ptepturus mariannensis*), egigi (Micronesian myzomela, *Myzomela rubratra saffordi*), sihik (Mariana kingfisher, *Todiramphus albicilla owstoni*), paluman å'paka'/fachi' (white-threated ground dove, *Gallicolumba xanthonura*), and såli (Micronesian starling, *Aplonis opaca*).

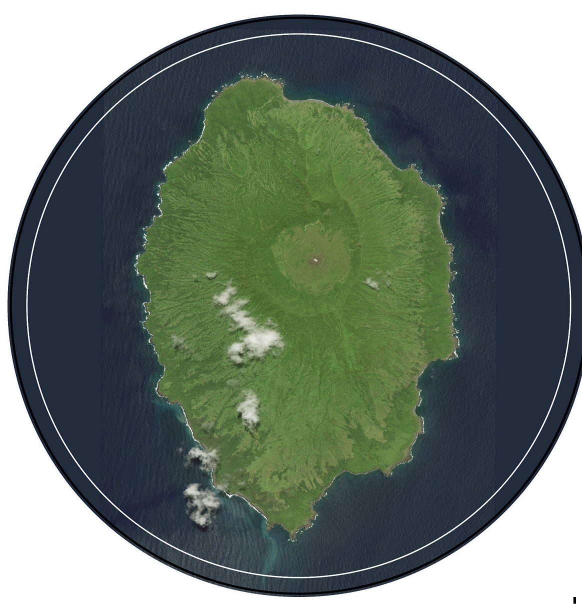
Although over 31% of Pagan is classified as native forest (Table 25), 75% of the native forest is a monoculture of ironwood (*Casuarina equisetifolia*) (DFW 2021, Rogers 2010). Ironwood is a native early-successional tree species in the Marianas that colonized the airstrip and other portions of the northern part of Pagan following the 1981 eruption. These forest stands will eventually succeed to a more diverse native forest (Pratt 2011), however at present, we expect that they support lower diversity and abundance of SGCN than native forest with higher tree species diversity.

Table 25. Composition of Pagan terrestrial habitats, 2010 (Rogers 2010).

| **Habitat Class** | **USFWS Mapped Class** | **Hectares** | **Acres** | **% of Total Area** |
|---|---|---|---|---|
| Agroforest | Coconut | 347 | 858 | 7.5 |
| Mixed Forest | Mixed forest | 161 | 398 | 3.5 |
| Native Forest | Casuarina | 1,092 | 2,698 | 23.5 |
| Native Forest | Casuarina mixed | 202 | 499 | 4.3 |
| Native Forest | Native forest | 169 | 418 | 3.6 |
| | **Native Forest Total** | **1,463** | **3,615** | **31.4** |
| | **All Forest Total** | **1,971** | **4,871** | **42.3** |
| Bare Land | Bare Ground | 379 | 937 | 8.2 |
| Bare Land | Lava/Cinder | 1,024 | 2,531 | 22.0 |
| Bare Land | Sand | 11 | 28 | 0.2 |
| | **Bare Land Total** | **1,415** | **3,497** | **30.4** |
| Grassland | Grass | 690 | 1,706 | 14.8 |
| Savanna | Lava scrub | 182 | 449 | 3.9 |
| Savanna | Scrub | 369 | 912 | 7.9 |
| | **Savanna Total** | **551** | **1,362** | **11.8** |
| | **Grassland and Savanna Total** | **1,241** | **3,067** | **26.7** |
| Wetland | Lake | 27 | 67 | 0.6 |
| | **Grand Total** | **4,655** | **11,502** | |

## 4.2.11 Agrihan

Agrihan's volcano, at 965 m, is Micronesia's highest point. The only eruption known from the island occurred in 1917 (Global Volcanism Program 2013), though active steam vents are found throughout the island. A large crater dominates the center of the volcanic cone, with a continuous series of steep, narrow



ridges and ravines on the slopes. This steep terrain separates populations of feral goats, pigs, and possibly cattle into different sectors, and limits the movement of the few people who live on Agrihan. Most of the ridge lines and upper slopes are covered with nette, which is thought to be maintained with regular burning by people on the island (Ludwig 1978, Ohba 1994). The coconut forests, which dominate the lower slopes of the island, were likely first established for copra production around 1900 (Spennemann 1999) and expanded during the Japanese Administration (1914-1944) and after WWII (Russell 1998). The U.S. military is reported to have broadcast tangantangan on Agrihan (Cruz et al. 2000d). Prior to the end of copra production on the island in the mid-1970s, a population of over 150 people was reported for the island (Ludwig 1978). Agrihan is now intermittently occupied by less than 10 inhabitants.

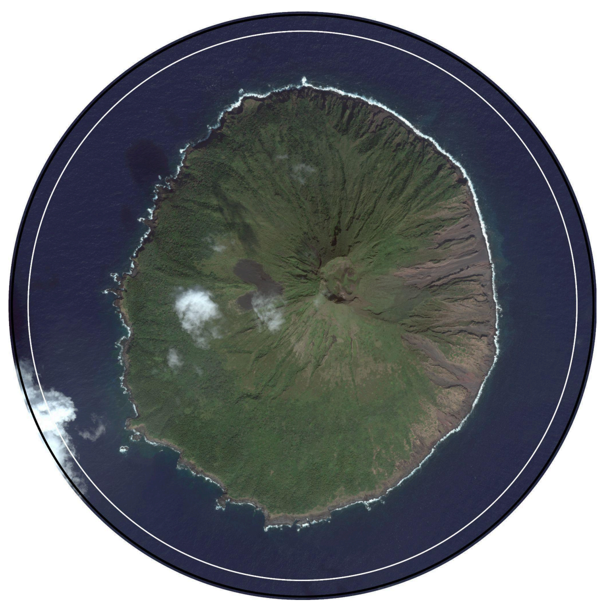
Over half of Agrihan is forest (Table 26). Compared to other northern islands, Agrihan is heavily vegetated, i.e. less than 3% is classified as bare land.

Table 26. Composition of Agrihan terrestrial habitats, 2013 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---|---|---|
| Bare Land | 89.9 | 222.1 | 2.0 |
| Developed | 0.0 | 0.0 | 0.0 |
| Forest | 1,514.3 | 3,742.0 | 34.4 |
| Grassland | 2,168.0 | 5,357.2 | 49.2 |
| Scrub Shrub | 487.6 | 1,204.8 | 11.1 |
| Unknown | 144.6 | 357.4 | 3.3 |
| **TOTAL** | 4,404.4 | 10,883.5 | 100.0 |



### 4.2.12 Asuncion



The entire island of Asuncion is a constitutionally-designated wildlife sanctuary, managed by the CNMI Division of Fish and Wildlife. The island is an active volcanic cone, with the last confirmed eruption in 1906 (Figure 49) (Global Volcanism Program 2024).

Asuncion has only been sporadically inhabited since the arrival of the Spanish in the late 1600’s.

A coconut forest on the southern coast was likely planted as part of copra production in the 1890s (Spennemann 1999). Asuncion is currently uninhabited and no feral ungulates are recorded for the island.

The native tree species kafu and talisai are common in Asuncion forests (Ohba 1994). Falanruw (1989) mapped vegetation types using 1969 aerial photography, circumnavigations in 1972 and 1975, and an overflight of the island in 1975. She reported 12% in barren areas, 45% in sparse or low growth, and 43% in thickets, forests and coconuts. Based on 2012 land cover mapping, the island appears to have changed little in the last few decades (Figures 50, 51, Table 18) (Amidon et al. 2017).

Table 27. Composition of Asuncion terrestrial habitats, 2012 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---|---|---|
| Bare Land | 128.3 | 316.9 | 16.3 |
| Forest | 259.3 | 640.9 | 33.0 |
| Grassland | 334.9 | 827.5 | 42.5 |
| Scrub Shrub | 40.1 | 99.1 | 5.1 |
| Unknown | 24.7 | 61.0 | 3.1 |
| **TOTAL** | 787.3 | 1,945.4 | 100.0 |

### 4.2.13 Maug

The entire island of Maug is a constitutionally-designated wildlife sanctuary, managed by the CNMI Division of Fish and Wildlife. Maug comprises three islets which make up the wall of a sunken volcano. The volcano is not known to have erupted in the last 10,000 years (Global Volcanism Program 2024). The sides of the islets facing the sunken volcano crater are steep cliffs.

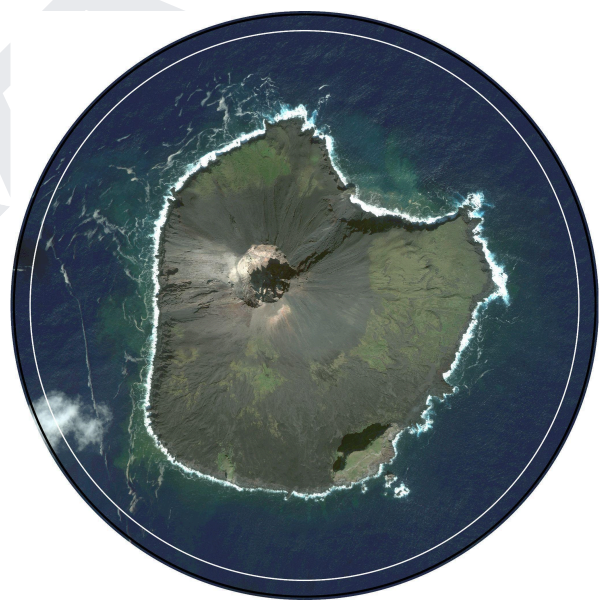
The island was briefly used for fish processing and as a weather station by the Japanese during their administration (1914-1944) (Russell 1998). Coconut forest and mixed umumu (*Pisonia grandis*) and talisai (*Terminalia catappa*) forest are found on the east and north islets, while the remainder is covered in grassland and savanna (Ohba 1994). Approximately 20% of the island is forested (Table 28), and there are no feral animals.

Table 28. Composition of Maug terrestrial habitats, 2011 (Amidon et al. 2017)

| **Class** | **Hectares** | **Acres** | **% of Total Area** |
|---|---|---|---|
| Bare Land | 45.1 | 111.5 | 20.9 |
| Forest | 40.1 | 99.0 | 18.5 |
| Grassland | 86.6 | 213.9 | 40.1 |
| Scrub Shrub | 4.7 | 11.6 | 2.2 |
| Unknown | 39.6 | 97.9 | 18.3 |
| **TOTAL** | 216.1 | 534.0 | 100.0 |



## 4.2.14 Uracas



The entire island of Uracas is a constitutionally-designated wildlife sanctuary, managed by the CNMI Division of Fish and Wildlife. The island is a volcano cone (Figure 55). The volcano is the most active in the Mariana Islands, earning it the nickname “Lighthouse of the western Pacific”, but it has not erupted since 1967 (Global Volcanism Program 2024). The remote island is little visited, and has no history of inhabiting humans or pets.

Most (78%) of Uracas is unvegetated (Table 29). The majority of the vegetated areas are covered by *Fimbristylis cymosa*, a native sedge (Ohba 1994).

Table 29. Composition of Uracas terrestrial habitats, 2012 (Amidon et al. 2017).

| Class | Hectares | Acres | % of Total Area |
|---|---|---|---|
| Bare Land | 175.9 | 434.7 | 78.4 |
| Grassland | 48.4 | 119.6 | 21.6 |
| TOTAL | 224.3 | 554.3 | 100.0 |

| | Dog | Cat | Rat | Shrew | Cow | Pig | Goat | Deer | Mosquito Fish | Tilapia | Orange cheeked waxbill | Black Drongo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rota | Y | Y | Y | N (2) | | Y | Y | Y | Y | | N | Y |
| Aguiguan | N (6) | N (6) | Y (6) | N (4) | N | Y (7) | N | N | | | N | N |
| Tinian | Y | Y | Y (2) | Y (2) | N | N | N | N | Y | | Y | N |
| Saipan | Y | Y | Y (2) | Y (2) | N | N | N | Y | Y | Y | Y | N |
| FDM | N | N | Y | | N | N | N | N | | | N | N |
| Anatahan | N | Y (7) | Y (11) | N (13) | N | N | N (12) | N | | | N | N |
| Sarigan | N | Y (7) | Y (11) | N (15) | N | N | N | N | | | N | N |
| Guguan | N | N | Y (11) | N | N | N | N | N | | | N | N |
| Alamagan | Y (7) | Y (11) | Y (11) | N (18) | Y (11) | Y (11) | Y (11) | N | | | N | N |
| Pagan | Y (19) | Y (11) | Y (11) | N (21) | Y (11) | Y (11) | Y (11) | Y | | Y | N | N |
| Agrihan | Y (11) | Y (11) | Y (11) | N (22) | | Y (11) | Y (11) | N | | | N | N |
| Asuncion | N | N | Y (11) | N (23) | N | N | N | N | | | N | N |
| Maug | N | N | Y (11) | N | N | N | N | N | | | N | N |
| Uracas | N | N | Y (11) | N | N | N | N | N | | | N | N |

Table 30. Presence across CNMI islands of select terrestrial invasive vertebrates or feral animals of concern to native wildlife*. Y=known or presumed present, N=known or presumed absent; blank indicates status unknown. Numbers in parentheses indicate the source reference, listed below.

Table 31. Presence across CNMI islands of select terrestrial invasive invertebrates and reptiles of concern to native wildlife*. Y=known or presumed present, N=known or presumed absent; blank indicates status unknown. Numbers in parentheses indicate the source reference, listed below.

| | Giant African Land snail *Euglandina* snail | Yellow crazy ants | *Platydemus* flatworm | Coconut rhinoceros beetle | Curious Skink *Carlia ailanpalai* | Oceanic Gecko *Gehyra oceanica* | Red Ear Slider | Cane Toad | Emerald tree skink |
|---|---|---|---|---|---|---|---|---|---|
| Rota | N (3) | Y | Y (3) | Y | Y (4) | Y (5) | N | Y | N |
| Aguiguan | N (8) | | Y (8) | N | Y (4) | Y (4) | N | Y | N |
| Tinian | N (8) | Y | Y (8) | N | Y (4) | Y (4) | N | Y | Y |
| Saipan | Y (9) | Y | Y | N | Y (10) | Y (10) | Y | Y | Y |
| FDM | | | | N | | | | | N |
| Anatahan | | | | N | N (13) | Y (14) | | N | N |
| Sarigan | N (15) | | N (15) | N | N (15) | Y (14) | | N | N |
| Guguan | | | | N | N (16) | Y (17) | | N | N |
| Alamagan | | | | N | N (18) | Y (17) | | N | N |
| Pagan | N (20) | | | N | N (21) | Y (21) | | N | N |
| Agrihan | Y (9) | | | N | N (22) | Y (22) | | N | N |
| Asuncion | | | | N | N (23) | Y (17) | | N | N |
| Maug | | | | N | | | | N | N |
| Uracas | | | | N | | | | N | N |

*This is not a comprehensive list. Cuban slug, cane toads, various ants and wasps, and other invasive animals are present and negatively impacting native wildlife.

**Different rat species occur on different islands, but all prey upon native birds and snails and impact forest regeneration.

Sources (see References section for full citations):

1, Zarones et al. 2015; 2, Wiewel et al. 2009; 3, Bauman 1996; 4, USFWS 2009; 5, Wiles et al. 1990; 6, Amidon et al. 2014; 7, Amidon et al. 2010; 8, Smith 2013; 9, Bauman and Kerr 2013; 10, Wiles and Guerrero 1996; 11, Kessler 2011a; 12, U.S. Navy 2013; 13, Cruz et al. 2000c; 14, Vogt et al. 2001; 15, Martin et al. 2008; 16, Cruz et al. 2000d; 17, Rodda et al. 1991; 18, Cruz et al. 2000b; 19, Kessler 2011b; 20, Hadfield 2010; 21, Reed et al. 2011; 22, Cruz et al. 2000a; 23, Williams et al. 2009; 24, Gawel 2012

# 5 Marine Habitats of the CNMI

## 5.1 Introduction to Marine Habitats of the CNMI

The marine habitats presented below represent broad categories commonly used to describe coral-reef and marine ecosystems with relevance to human uses and needs. The amount of information presented for each major habitat type is proportional to the total area covered, and the biological diversity and social and cultural importance of the biological assemblages within. Some features of the Mariana Trench are detailed in this section, though there are not currently feasible ways in which we can manage these deep water environments beyond their Federal Monument designation status.

Comparisons of the relative condition of marine habitats across the CNMI must take into account differences in the degree of coral reef development, seagrass presence, and community composition that are driven by natural variation in geomorphology and wave exposure, as well as by acute natural disturbances such as typhoons and volcanic activity. The northern islands are active or dormant stratovolcanoes that have formed along the tectonically active portion of the Mariana Arc, with many of the islands having erupted multiple times in recent centuries. The northern islands are all small, with land areas ranging from 2-34 $km^2$, except for Pagan (46 $km^2$). The northern islands along with Rota, and Aguiguan have little to no lagoon habitat compared to Tinian and Saipan. These factors, accompanied by the strong influence of the northeast trade winds in the CNMI, together dictate that coral reefs in the northern islands are considerably less developed, lack sheltered sandy bottom lagoons, and host a lower number of species than those found in the older, larger, inactive southern islands. Despite less reef development and species richness, the marine communities are subjected to less human stress, notably fishing pressure and pollution. The southern islands and associated offshore banks lie atop much older, extinct volcanoes and are covered by carbonate formations. Except for the uninhabited island of Aguiguan, the southern islands are the largest in the CNMI, with land areas of 85-544 $km^2$. In addition, the seafloor around the southern islands is typically more gently sloping than the northern islands, and with step-like limestone topography. These conditions yield a larger range of habitat types and a greater diversity of marine species, but with greater exposure to human caused stressors.

In summary, based on an assessment of the available NOAA MARAMP survey results and other available literature, and in concordance with Starmer et al. (2008), the marine habitats of the

CNMI exhibit a range of conditions as a result of various environmental and anthropogenic factors. The reefs of the southern populated islands have clearly been impacted by anthropogenic stressors, such as runoff and fishing pressure, and crown-of-thorns starfish in the mid-2000s. In contrast, the northern islands have mainly been impacted by natural environmental regimes, including volcanic activity, periodic ashfall from adjacent watersheds, and naturally slow recovery rates. Both the northern and southern islands have been significantly impacted by the recent back-to-back coral bleaching events. Coral reef areas impacted by chronic anthropogenic stressors are less resilient to acute disturbances, such as cyclones, COTS outbreaks, and temperature stress events, and can be expected to deteriorate further, potentially shifting from coral-dominated to less productive and less diverse fleshy algae- and cyanobacteria-dominated systems. The predicted increase in the frequency and severity of thermal stress events in the coming decades and the looming threat of ocean acidification will likely challenge even the healthiest of reef systems, but those systems with suitable water quality and robust reef fish communities will have the best chance at adapting to rapidly changing environmental conditions and continuing to provide essential goods and services to human populations.

### 5.1.1 Coral Reefs

Coral reefs are carbonate structures formed by the deposition of skeletal material produced by corals, coralline algae, and other calcium carbonate-secreting organisms (Figure 34). The mutually beneficial relationship between the coral host and single-celled algae that live within, called zooxanthellae, allow corals to harness sunlight through photosynthesis and grow extensively in nutrient-poor waters. Through time, this process allows for the formation of complex, sometimes immense reef structures, and facilitates globally significant amounts of carbon sequestration (Crossland et al. 1991). While corals can be found across the world's oceans and at depths of thousands of meters, the extensive development of structurally complex coral reefs requires nutrient-poor, warm (~23°C-29°C) water. As a result, coral reefs are generally restricted to shallow tropical and subtropical waters between 30°N and 30°S of the Equator. Coral reefs serve as the foundations of complex ecosystems that support an incredible diversity of organisms, with estimates ranging from ~600,000 to nine million coral reef-associated species worldwide (Reaka-Kudla et al. 1997; Small et al. 1998; Bouchet 2006). Despite occupying less than one-tenth of one percent of the world's oceans (Spalding et al. 2001), coral reefs account for a quarter to a third of all marine species.

Figure 34. Cauliflower coral (*Pocillopora sp*) of coral on Tinian. Kaeli Swift 2023

With their varying geological histories, the islands of the Mariana Archipelago, their associated banks and offshore reefs, and the distant banks and offshore reefs of the West Mariana Ridge represent a range of coral reef habitats (Brainard et al. 2012). Often coupled, geology and other aspects of the physical environment play a significant role in shaping each island's coral reef ecosystem (Brainard et al. 2012; Houk and Van Woesik 2010; Riegl and Dodge 2008). In the older southern islands, coral reef development during previous sea level stands resulted in the formation of carbonate terraces, which lie atop volcanic structures and, in some instances, have been uplifted and others downthrown (Brainard et al. 2012). The relatively flat, porous carbonate rock comprising the southern islands allows for little surface-water retention or runoff, leading to groundwater discharge as a major contributor of freshwater to nearshore marine ecosystems. Despite the volcanic nature of the active northern islands, freshwater discharge from the steep, sloping watersheds has both surface runoff and groundwater discharge components that influence reef growth, modern assemblages, and species diversity patterns (Houk and Starmer 2010).

According to estimates arrived at by the NOAA National Centers for Coastal Ocean Science (NOAA 2004), the total area of shallow coral reef habitat (all hard and soft bottom habitat less than ~30 m water depth) around the islands of the CNMI is approximately 204 km$^{2}$. Of this total, approximately 151.5 km$^2$ is hardbottom habitat while an estimated 93.4 km$^2$ is of soft bottom (e.g., unconsolidated sediments such as rubble, sand, silt, and mud) (Table 23). Previously, Hunter (1995) estimated the total area of coral reef hardbottom less than 100 m deep occurring within 3 nm of landforms in the CNMI at 45 km$^2$, with an estimated 534 km$^2$ occurring between 3 nm and 200 nm from land forms. The reef area offshore FDM was identified as the largest in the CNMI, at 311 km$^2$, or 58% of the total offshore reef area in the CNMI. The Allen Coral Atlas (2022) incorporated satellite imagery and remote sensing to update the United Nations Environment Programme’s 2010 Coral Layer dataset to approximate coral cover within 10-m water depth and estimated 9.8 km$^2$ of coral benthic habitat and 88.33 km$^2$ of total reef for the CNMI between the period of 2019-2022. However, direct comparisons between the NOAA 2004 and Allen Coral Atlas are difficult given the differences in sampling methodology, water depths, and sampling area.

The CNMI archipelago also boasts relatively high coral reef species diversity, with a total of over 5,600 known reef-associated species (Paulay 2003a). More than 1000 species of reef-associated fish species, 280 species of hard coral (Randall 2003), 200 macroalgae species (Lobban and Tsuda 2003), 1,700 molluscs (Paulay 2003b; Smith 2003; Carlson and Hoff 2003; Ward 2003), 200 echinoderms (Paulay 2003c), and 800 crustaceans (Paulay et al. 2003) have been reported from the Mariana Islands. The actual number of reef-associated species that inhabit the archipelago's varied marine habitats is likely considerably higher than what is currently known. Even at currently reported numbers the coral reef ecosystems of the Mariana Archipelago are among the most biologically diverse of all U.S. States and Territories.

**Relative Condition of Marine Habitats**

Coral reef ecosystems in the CNMI are undergoing a sustained period of decline, driven by recurrent stressors that impair both coral survival and recruitment. These stressors include natural environmental fluctuations, compounded by increasing anthropogenic pressures such as fishing pressure, pollution, and climate-related impacts. In response, natural resource managers in the CNMI have implemented improvements in coral reef monitoring and management strategies (DCRM Marine Monitoring Team), particularly around the southern islands of Saipan, Tinian, and Rota. Additionally, the CNMI maintains two coral nurseries on Saipan that support active reef restoration initiatives and contribute to research focused on coral resilience and adaptive capacity (CNMI Coral Reef Management Priorities 2019). Here we describe recent coral habitat conditions across the CNMI.

Although the coverage of living coral is a somewhat limited measure of benthic habitat condition, some general statements could be made about relative benthic habitat condition of reef areas in the CNMI based on the amount of living coral observed across reef areas. The DCRM Marine Monitoring Team (MMT) assessed the relative condition of long-term monitoring sites within the Saipan Lagoon from 2020-2021. Their assessment found severe coral reef decline and overall species composition changes across sites, likely due to mass coral bleaching events from 2013-2017, damage from Super Typhoons, and crown-of -thorns seastar (COTS) outbreaks. Staghorn coral sites were among the most affected coral types with 90% mortality of this species in the Saipan Lagoon (DCRM 2015). Several heavily damaged areas have shown coral recruitment and recovery in recent years, but many sites have shifted from coral to algae dominance (DFW observations 2024).

An examination of live coral cover values from 2003-2007 NOAA MARAMP towed-diver surveys suggest levels were highly variable across the CNMI, with no obvious north-south gradient or other archipelago-wide patterns. The highest levels of coral cover estimated from towed-diver surveys were reported from Maug and Guguan, both with 27% for at least one of the survey years. Among the volcanic islands, these two are associated with the longest time frame since the last volcanic eruption. Saipan also had relatively high coral cover, with an overall mean of 21%, perhaps owing to the most favorable environmental regimes for modern reef growth. Relatively moderate coral cover was recorded at Aguiguan, Sarigan, Agrihan, and Asuncion, with means ranging from 12-18% across the three survey years; these are all small islands with stronger natural environmental limitations to coral growth. The lowest coral cover levels were reported from Rota (4-9%) and Uracas (5-10%), where conditions selecting against coral growth were greatest, with groundwater contribution likely influencing reef development around Rota and volcanic activity with continuous ash resuspension affecting reef development at Uracas. Low coral cover was also recorded at Anatahan, with an overall mean of 8% from surveys conducted in 2003, shortly after the eruption. Coral cover estimates for the remote banks of the West Mariana Ridge were highest at Stingray Shoal in 2003 and Pathfinder Reef in 2005 (55% and 25%, respectively), although the lack of sampling stratification and high variance among coral cover values make it difficult to accurately assess coral cover at these locations. In addition, despite the high reported coral coverage, these reefs appeared to be dominated by only a few species (Brainard et al. 2012).

The *Archipelagic Benthic Condition Index* developed by NOAA Coral Reef Ecosystem Division (NOAA CRED), while itself not a perfect measure, offers a more robust means of comparing relative benthic habitat condition by integrating various metrics of benthic habitat condition that were assessed during towed-diver surveys. The *Archipelagic Benthic Condition Index* includes rankings (high, medium, and low) for live coral cover, stressed coral cover, macroalgae cover, crustose coralline algae cover, and Crown of Thorn Seastar (COTS) density. A high overall *Archipelagic Benthic Condition Index* ranking, typically characterized by high cover of coral and crustose coralline algae, low macroalgae and stressed coral cover, and low COTS densities, indicates better condition relative to other reef areas in the CNMI. A low ranking, typically characterized by low coral and crustose coralline algae cover, high macroalgae and stressed coral cover, and high COTS densities, indicates poor habitat condition relative to other reef areas in the CNMI. In general, the condition of marine benthic habitats as measured using 2005 and 2007 *Archipelagic Benthic Condition Index* rankings decreased when moving from the northern to the southern islands, as expected, mirroring known human stressor gradients. The condition of benthic habitats along the reef slopes at Maug, Alamagan, Sarigan, and Guguan ranked the highest, with high or increasing coral cover and low stressed coral cover and COTS densities. The condition of benthic habitats around Asuncion and Uracas were also relatively high, but apparent decreases in coral cover and crustose coralline algae between 2005 and 2007 resulted in slightly lower rankings. Pagan and Agrihan had medium and medium-low benthic habitat condition rankings, respectively, with the lower rankings influenced by areas with high COTS densities. The benthic habitat condition of the southern islands of Saipan, Tinian, Aguigan and Rota were low to medium-low, with the exception of the southeast region of Saipan, northeast region of Tinian, and the west side of Rota, which had medium to high benthic habitat condition rankings. The generally lower rankings for the southern islands were attributed to relatively high stressed coral and macroalgal cover and low coral cover.

Crown-of-thorns starfish is a native coral reef predator in the CNMI. However, they can become problematic and considered a threat to overall coral reef health when their numbers exceed tolerance thresholds for our reefs. The only native predator of COTS in the CNMI is the Tritons Trumpet sea snail. According to the COTS Outbreak Response Plan developed by CNMI DCRM in 2022, there are two theories for recent COTS outbreaks in the CNMI. The first is more successful recruitment of the larval stage of COTS due to nutrient availability coupled with the second theory which is reduced predation of larvae due to the cumulative trophic effects of high fishing pressure on the reef (DCRM 2022). Recent COTS outbreaks have been reported in Rota (2018), Saipan (2019-2020), and Pagan (2022) (DCRM 2022). Outbreaks of COTS have been treated through different methods since the first outbreak was reported in the 1960's. Community based responses have been successful in the past, and were utilized again recently. Trained volunteers were supplied with removal devices (vinegar injection gear used to inject COTS with a lethal dose of vinegar) and sent to reef areas with reported high coverage of COTS. Standardized, local monitoring efforts have been ongoing across the southern islands since 2000. Through these efforts periodic significant COTS disturbance periods (2003-2007 and 2018-2022) and subsequent recovery were well-documented. Because coral-reef disturbance and recovery rates are influenced by both natural environments and human stressors, their documentation offered insight into trends over the years. Recovery after the 2003-2007 COTS outbreak was found to be lowest on Saipan and some Tinian reefs, while increasing for Aguigan and Rota (Houk et al. 2014). Rota reefs naturally differ from others in the southern islands, and so lower disturbance impacts and faster recovery may be due to the distinct species assemblages that exist there, or a combination of natural regimes and relatively low localized stressors (Maynard 2015). More notably, the gradient in recovery of both healthy substrates and coral species richness that existed on platform fringing reefs around Saipan and Tinian (i.e., 'spur-and-groove' reefs that represent the most optimal settings for reef growth in the CNMI) were significantly explained by a combination of compromised fish assemblages and watershed pollution proxies (Houk et al. 2014), with the former being most influential. The magnitude of impact from disturbances was simply predicted by the maximum density of COTS observed on the reefs.

The CNMI's coral reefs have also been affected by thermal stress events during the past decade. The coral bleaching events in the CNMI from 2013 to 2017 were part of a larger global phenomenon characterized by unprecedented marine heatwaves and severe coral mortality (Reynolds 2014). This period saw significant impacts on coral reefs, driven primarily by temporary elevated sea temperatures and exacerbated by local stressors. The 2014-2017 global coral bleaching event (GCBE) was marked by record-breaking ocean temperatures, leading to widespread coral bleaching and mortality. Approximately 80% of surveyed reefs globally experienced significant bleaching, with 35% suffering substantial mortality (Eakin 2019, NOAA Coral Reef Watch 2020). According to the CNMI Coral Reef Management Priorities report, in 2017 coral found in the Saipan lagoon experienced extensive stress after a bleaching event reaching 9 degree heating weeks (CRW 2025). The CNMI DCRM Marine Monitoring Team (MMT) reported 30-98.7% *Acropora* species coral cover loss in the Saipan Lagoon, severe coral bleaching on the reefs of Asuncion, Maug, and Pagan, dead *Acroporid* and *Pocilloporid* colonies around Guguam, Sarigan, and Anatahan. Post-bleaching mortality was thought to be high based upon preliminary observations, but not confirmed in the northern CNMI. The long-term effects of the GCBE on coral reef structures and associated marine life are concerning, as the ability of reefs to recover is compromised by oscillating habitat conditions and local anthropogenic pressures (Eakin 2019, NOAA Coral Reef Watch 2020, Van Ee 2024). Field assessments indicated that coral reefs in Saipan were under immense pressure from unfavorable sea conditions and human activities, which heightened their vulnerability to bleaching events (Maynard 2012, Van Ee 2024).

The resilience of reefs at 16 sites across Guam, Saipan and Pagan were tested, with many sites experiencing ecologically severe heat stress during the GCBE (Courtney 2022).  In addition to heat stress resilience assessments, ecological resilience of forereef sites in the CNMI were assessed to help direct management priorities in the CNMI (Maynard 2015). The ecological resilience assessment compiled forereef data from Saipan, Tinian, Aguiguan, and Rota to determine resilience based on a set of 11 measurable resilience indicators (McClanahan 2012). The study found that Aguijan, Tinian, and Saipan had more high ecological resilience sites and sites on Rota had low to medium-low ecological resilience. Rota may have less ecological resilience based on connectivity to larval sources and its unique geologic profile. Results from this study should be considered with some scrutiny as coral reef monitors in the CNMI have reported that some of the high resilience sites on Saipan were some of the most degraded sites by 2018 (JAMS personal communication 2025). Resilience factors that affected reef sites on Saipan and Tinian include reduced presence of herbivorous fish which are directly linked to reef health (Heenan and Williams 2013, Van Ee 2024). Management recommendations for reef sites on all four islands were identified for conservation actions, fishery management, LBSP reduction, coral bleaching monitoring, reef restoration, and tourism outreach.

Table 32. Area ($km^2$) of coral reef and hardbottom, unconsolidated sediment, and total shallow reef for the 14 islands of the CNMI, calculated using benthic habitat spatial data developed in 2005 by the NOAA Center for Coastal Monitoring and Assessment's Biogeography Team (< 30 m depth) and the Allen Coral Atlas (general reef extent at < 10 m depth). The total shallow reef area ($km^2$) for the 14 islands and several offshore banks and reefs are provided in Brainard et al. 2012. The values from Brainard et al. (2012) were calculated from multibeam bathymetry data and are likely more accurate; however, the area of Coral Reef and Hardbottom and Unconsolidated Sediment were not provided. The Allen Coral Atlas uses satellite imagery to map generalized "reef extent" at a much shallower depth and therefore direct comparisons are not reasonable.

| Island/ Offshore reef | Coral reef and hardbottom | Unconsolidated sediment | Total shallow reef | Total Shallow Reef (Brainard et al. 2012) | Reef Extent (Allen Coral Atlas 2022) |
|---|---|---|---|---|---|
| Uracas | 0.52 | 0.00 | 0.52 | 1.38 | - |
| Asuncion | 2.17 | 0.05 | 2.22 | 7.86 | 0.31 |
| Maug | 3.44 | 0.03 | 3.47 | 3.17 | - |
| Agrihan | 5.54 | 0.93 | 6.47 | 9.5 | 0.11 |
| Pagan | 11.23 | 0.88 | 12.11 | 16.29 | 1.28 |
| Alamagan | 2.92 | 0.47 | 3.39 | 4.28 | 0.1 |
| Guguan | 2.07 | 0.00 | 2.07 | 2.0 | - |
| Sarigan | 2.54 | 0.02 | 2.56 | 2.0 | 0.03 |

| | | | | | |
|---|---|---|---|---|---|
| Anatahan | 5.84 | 0.64 | 6.48 | - | 0.28 |
| Farallon de Medinilla | 4.66 | 1.36 | 6.02 | - | 1.17 |
| Saipan | 65.68 | 31.79 | 97.47 | 73.04 | 57.25 |
| Tinian | 20.76 | 5.45 | 26.21 | 16.2 | 18.46 |
| Aguiguan | 7.54 | 2.25 | 9.79 | - | 6.20 |
| Rota | 16.61 | 8.67 | 25.28 | 16.03 | 21.58 |
| Supply Reef | - | - | - | 0.1 | - |
| Tatsumi Reef | - | - | - | 2.26 | - |
| Pathfinder Reef | - | - | - | 0.85 | - |
| Stingray Shoals | - | - | - | 0.21 | - |
| Arakane Reef | - | - | - | 0.53 | - |

#### 5.1.1.1 Reef types, zonation, and associated habitats

There are three principal types of coral reef formations: fringing, barrier, and atoll reefs. These reef types are consistent across oceanic islands, with younger fringing reefs developing around newly emergent land masses; barrier reefs forming after the land mass begins to subside and a lagoon develops between the reef and the land mass; and atoll reefs forming once land masses have subsided completely below sea level, leaving only a ring of shallow reef surrounding a lagoon. Fringing reefs are the most common reef type found in the Mariana Islands, found surrounding the entirety of most islands. Four barrier reef systems are found in the archipelago, with two occurring in the CNMI. Interestingly, CNMI barrier reef complexes, such as the Saipan Lagoon barrier reef, have had an atypical geological formation. Barrier reefs were created due to flooding of the Pleistocene shelf along the western coastline during sea level rise associated with the Holocene transgression (Cloud 1959). The barrier reef formed along the edge of the flooded Pleistocene shelf, and kept up with slow sea-level rise during the early Holocene. No atoll reef systems are present in the Mariana Islands. However, other reef types, including bank or platform reefs and flooded volcanic craters, are also considered here. Bank or platform reefs have no obvious connection to a coastline and do not possess the structure of barrier reef or atoll systems. Also sometimes referred to as shoals, these offshore reefs often grow on the surface of topographically raised areas of the seafloor or may have origins similar to barrier or atoll reef systems (Spalding et al. 2001). A flooded volcanic crater reef is partly or mostly surrounded by subaerial remnants of the volcanic land mass.

Each major reef type can be further divided into zones based upon unique natural environmental regimes. Abiotic factors of greatest significance to modern biological assemblages and reef development in the CNMI include the underlying geological structure, wave energy, freshwater input, temperature, salinity, and light availability. Abiotic environments can also be modified by human activities, such as nutrient and sediment input, and fishing for grazing herbivores and large, long-lived species that sequester carbon. Cumulatively, human stressors serve to enhance the growth and competitive dominance of algal substrates on reefs, and limit coral diversity, coral cover, and reef growth through time. Therefore, both natural and human-induced environmental regimes influence the composition and structure of biological assemblages in a given reef zone. While many coral reef organisms can be found in more than one reef zone across the stages in their life history, the relative abundances of dominant species are generally consistent within each zone. The reef zones for the Mariana Islands recognized in this document follow terminology used by Randall and Siegrist (1996) and Randall and Burdick (in prep). Common and notable reef organisms are presented for each zone. Particular focus is made on reef organisms that have been designated Species of Greatest Need (SGCN). The total shallow (both < 30 m depth and <10 m depth) reef area occupied by the primary reef zones, including reef flat platform, lagoon, and reef slope, is presented for each island in Table 33.

Table 33. Area ($km^2$) of primary reef zones for shallow coral reefs around the 14 islands of the CNMI, calculated using benthic habitat spatial data developed in 2005 by the NOAA Center for Coastal Monitoring and Assessment's Biogeography Team (NCCOS) (< 30 m depth) and geomorphic features in 2019-2022 by the Allen Coral Atlas (ACA) (< 10 m depth) . The Reef Flat Platform zone includes the "Shoreline Intertidal", "Reef Flat", "Back Reef" and "Reef Margin" zones utilized for the NOAA Biogeography Team spatial data and "Reef Crest", "Outer Reef Flat", "Terrestrial Reef Flat", "Plateau", "Shallow Lagoon", "Deep Lagoon", "Inner Reef Flat" zones from ACA . The Lagoon zone includes the "Lagoon" and "Dredged" zones from NOAA and "Deep Lagoon" and "Shallow Lagoon" zones from ACA. The Reef Slope zone includes the "forereef" and "Bank/Shelf" zones from NCCOS and the "Reef Slope", "Back Reef Slope", and "Sheltered Reef Slope" zones from ACA.

| **Island** | **Reef Flat Platform** | | **Lagoon** | | **Reef Slope** | |
|---|---|---|---|---|---|---|
| Data Source | NCCOS | ACA | NCCOS | ACA | NCCOS | ACA |
| Uracas | 0.00 | - | 0.00 | - | 0.52 | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| Asuncion | 0.00 | 0.02 | 0.00 | 0.11 | 2.07 | 0.00 |
| Maug | 0.01 | - | 0.00 | - | 3.46 | - |
| Agrihan | 0.00 | 0.01 | 0.00 | 0.00 | 6.47 | 0.01 |
| Pagan | 0.00 | 0.32 | 0.00 | 0.02 | 12.11 | 0.03 |
| Alamagan | 0.03 | 0.02 | 0.00 | 0.00 | 3.36 | 0.01 |
| Guguan | 0.00 | - | 0.00 | - | 2.07 | - |
| Sarigan | 0.00 | 0.01 | 0.00 | 0.00 | 2.56 | 0.00 |
| Anatahan | 0.00 | 0.07 | 0.00 | 0.02 | 6.53 | 0.00 |
| Noos (FDM) | 0.00 | 0.02 | 0.00 | 0.01 | 6.15 | 0.00 |
| Saipan | 7.94 | 18.0 | 25.08 | 5.80 | 65.62 | 5.00 |
| Tinian | 1.09 | 1.28 | 0.45 | 0.78 | 24.94 | 1.11 |
| Aguigan | 0.01 | 0.01 | 0.00 | 0.00 | 9.80 | 0.01 |
| Rota | 3.15 | 3.03 | 0.00 | 0.32 | 22.52 | 1.78 |

Coral-reef habitats represent the final level of detail, beyond major reef types and reef zones. Habitats refer to keystone species and/or physical features that influence the overall biological community at a specific locality. For instance, the primary defining feature of a given habitat may be a particular species (e.g., the seagrass *Enhalus acoroides*) or group of related species (e.g., staghorn *Acropora* corals). A defining physical structure, such as mudflat or coral-dominated hardbottom could also be used to distinguish a habitat. Dominant and notable habitat types and their associated biota are presented for each reef type/zone below. The total shallow (< 30 m depth) reef area occupied by the major benthic cover types, including coral, coralline algae, macroalgae, turf algae, seagrass and uncolonized, measured in 2005 is presented for each island in Table 34. The total shallow (< 10 m depth) reef area occupied by the major benthic cover types estimated from the Allen Coral Atlas, including coral/algae, microalgae, rock, rubble, sand, seagrass, is presented for each island in Table 35. Note that these benthic cover types do not necessarily represent distinct marine habitats, but are typically just a dominant biological component of a given habitat.

Table 34. Area ($km^2$) of major benthic cover types for shallow (< 30 m depth) coral reef habitat around the 14 islands of the CNMI, calculated using benthic habitat spatial data developed in 2005 by the NOAA Center for Coastal Monitoring and Assessment's Biogeography Team.

| Island | Coral | Coralline algae | Macroalgae | Turf algae | Seagrass | Uncolonized |
|---|---|---|---|---|---|---|
| Uracas | 0.03 | 0 | 0 | 0.49 | 0 | 0 |
| Asuncion | 1.1 | 0.56 | 0 | 0.52 | 0 | 0.05 |
| Maug | 2.34 | 0.91 | 0.03 | 0.16 | 0 | 0.03 |
| Agrihan | 3.36 | 1.14 | 0.03 | 1.04 | 0 | 0.9 |
| Pagan | 7.64 | 2.56 | 0.1 | 0.93 | 0 | 0.88 |
| Alamagan | 2.08 | 0.68 | 0.03 | 0.13 | 0 | 0.47 |
| Guguan | 1.35 | 0.56 | 0.02 | 0.15 | 0 | 0 |
| Sarigan | 1.84 | 0.44 | 0.002 | 0.25 | 0 | 0.02 |
| Anatahan | 0.21 | 2.36 | 0.22 | 3.27 | 0 | 0.42 |
| Noos (FDM) | 4.36 | 0.02 | 0.64 | 0.27 | 0 | 0.71 |
| Saipan | 30.89 | 5.52 | 10.43 | 21.19 | 6.67 | 22.78 |
| Tinian | 9.42 | 7.47 | 2.02 | 1.85 | 0 | 5.46 |
| Aguiguan | 0.87 | 4.0 | 2.53 | 0.14 | 0 | 2.25 |
| Rota | 6.51 | 5.21 | 3.66 | 1.19 | 0 | 8.71 |

Table 35. Area ($km^2$) of major benthic cover types for shallow (< 10 m depth) coral reef habitat around the 14 islands of the CNMI, calculated from the Allen Coral Atlas for periods 2019-2022.

| Island | Coral/Algae | Microalgae | Rubble | Rock | Sand | Seagrass |
|---|---|---|---|---|---|---|
| Uracas | - | - | - | - | - | - |
| Asuncion | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.12 |
| Maug | - | - | - | - | - | - |
| Agrihan | 0.02 | 0.00 | 0.00 | 0.32 | 0.00 | 0.00 |
| Pagan | 0.08 | 0.00 | 0.00 | 0.17 | 0.05 | 0.08 |
| Alamagan | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 |
| Guguan | - | - | - | - | - | - |
| Sarigan | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Anatahan | 0.02 | 0.00 | 0.00 | 0.04 | 0.00 | 0.02 |
| Noos (FDM) | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Saipan | 6.88 | 2.06 | 7.42 | 6.63 | 2.82 | 0.40 |
| Tinian | 1.05 | 0.00 | 0.10 | 0.64 | 0.31 | 0.10 |
| Aguiguan | 0.10 | 0.00 | 0.00 | 0.02 | 0.02 | 0.01 |
| Rota | 1.68 | 0.01 | 0.23 | 1.48 | 0.17 | 0.12 |

## Fringing reefs

Generally, fringing reefs associated with oceanic islands are geologically young compared to barrier and atoll reef systems. Fringing reefs can occur as veneering reef communities, which exhibit no significant accretion of reef deposits; apron reefs, which exhibit accretions of reef material but which have not reached sea level equilibrium; and fringing reef platforms, where accretions of reef deposits have reached sea level equilibrium and have extended outward from shore as a shallow platform. Fringing reefs are the dominant reef type in the Mariana Islands. They range from volcanic boulders with incipient coral assemblages around much of the remote northern islands, to actively accreting reef platforms with well-developed reef flats at Obyan Beach and Bird Island, Saipan. Veneering and apron reef communities (i.e., limited modern coral growth) are the most common of the fringing reef types. Platform fringing reef systems (i.e., accreting reefs) are restricted to certain locations in the southern islands, and to very limited areas in the northern islands.

### *Veneering and apron fringing reef communities*

The principal zones of veneering and apron fringing reef communities are similar, and can generally be divided into the upper, lower, and forereef slopes. The **upper slope** extends from the shoreline to “wave base” depth, which is typically between 4 to 8 meters, depending on the degree of exposure to the prevailing wind. The **lower slope** extends from the base of the upper reef slope to the depth at which light-dependent zooxanthellate corals give way to azooxanthellate corals. This transitional boundary is commonly called the mesophotic zone. The **forereef slope** extends from the depths where light-dependent organisms are absent downward to the ocean floor. The marine biota associated with veneering and apron fringing reef systems is similar to that of the seaward reef slopes of platform fringing reef and barrier reef systems (see below). However, environmental regimes (i.e., high-wave energy, groundwater discharge, and/or steep bathymetry) are unfavorable for many species of framework building corals, thus modern reefs typically do not reach sea-level equilibrium and reef deposits from previous geological time periods persist in shallow waters (Houk and van Woesik 2010). In sum, coral growth and species richness on veneering and apron reefs is limited, and represents a subset of that found on more favorable platform fringing reef foundations.

*Sea level platform fringing reefs*

Sea level platform fringing reefs are fringing reef systems that have developed in conditions favorable to framework-building coral growth, and thus, have significant reef accretion. Coral communities on these reefs have reached sea level equilibrium, and have been growing seaward for thousands of years, often reaching several hundred meters from shore.

The **shoreline intertidal zone** of platform fringing reef systems occurs in the coastal area between mean low and mean high tides. Depending on the geology of a given area, the dominant substrate type of a shoreline intertidal zone may be comprised of unconsolidated sediment, such as sand, mud, or rubble; hardbottom, such as carbonate benches or volcanic rock; or a combination of both soft and hardbottom substrates. Depending on the width of the platform and the degree of exposure to wave energy, shoreline intertidal zones range from tumultuous areas of strong wave action to areas of relatively calm waters. But even in calm, protected shoreline intertidal zones the regular tidal changes in sea surface height, which cause the intertidal zone to be completely or partially exposed subaerially at low tide and partially or completely submerged at high tide, make these zones a dynamic environment. Shoreline intertidal zones of fringing reef systems host marine species adapted to major changes in temperature, salinity, and dissolved oxygen and those able to tolerate subaerial exposure. These harsh environmental conditions limit the diversity of organisms that can inhabit the shoreline intertidal zone, but many of these organisms are found only in this zone. The biological assemblages found in shoreline intertidal areas can vary significantly in response to substrate type, degree of exposure to wave energy, freshwater input, and other environmental conditions. Examples of shoreline intertidal organisms commonly found in sandy intertidal habitats include ghost crabs, mysid shrimp, bivalves, gastropods, isopods, copepods, and polychaete worms. Biota associated with rocky intertidal zones include motile organisms, such as rock crabs (*Grapsus* spp.), gobies, blennies, and damselfishes, that can avoid harsh wave action and seek deeper tide pools, as well as less mobile or sessile organisms, such as chitons (e.g., *Acanthopleura gemmata*), barnacles (*Balanus* spp. and *Chthamalus* spp.), bivalves, neritid snails, limpets (*Patelloida* spp.), and algae that can tolerate emersion using an array of strategies to avoid desiccation. At higher tide levels, highly mobile organisms, especially fishes such as juvenile blacktip reef sharks (*Carcharhinus melanopterus*), trevally (carangid spp.), fringelip mullet (*Crenimugal crenilabis*), and mojarras (*Mojarra* spp.), enter the intertidal zone in search of prey or to avoid larger predators. Juvenile rabbitfishes (*Siganus spinus*), known locally as mañahak, also venture into the shoreline zone during seasonal runs, where fishers can catch them using throw nets. Corals are rarely found in the shoreline intertidal zone, but hardy species such as *Leptastrea purpurea*, *Pocillopora damicornis*, and *Porites* spp. can sometimes be found there, particularly in tide pools with at least a moderate degree of flushing. The mangrove crab (*Cardisoma carnifex*) is an SGCN found on mudflats associated with mangrove habitat in the shoreline intertidal zone.

The **reef flat platform** is a shallow platform extending seaward from the shoreline to the reef margin. The outer portion of the platform may be slightly elevated compared to the inner portion. The shallower outer platform, and occasionally the slightly deeper inner portion, may be exposed during low spring tides or may be only shallowly covered with water. A diversity of habitats and associated biota can be found on reef flat platforms depending upon the degree of wave exposure, flushing rates, the adjacent watershed size and geology, and the width between the shoreline and where the waves break. Examples of reef flat platform habitats include sandy bottoms, seagrass beds, algal pavement, rubble fields, and areas of scattered or dense coral growth. Each of these habitats support distinct assemblages adapted to environmental conditions specific to each micro-environment. Eldredge and Randall (1980) describe coral distribution on fringing reef platforms as absent to widely scattered on the inner third, scattered to locally abundant on the middle third, and most abundant on the outer third. A similar pattern is observed for coral diversity, with few (one to five) species on the inner platform and up to 20 or more at the outer seaward edge. Numerous coral species are commonly found on reef flat platform, including *Leptastrea purpurea*, *Porites* spp., *Pocillopora* spp., *Pavona* spp., *Acropora* spp., *Psammocora* spp., *Favia* spp., and *Favites abdita*. Within the CNMI, some species of staghorn *Acropora*, such as *A.* cf. *pulchra*, A. *muricata*, and A. *intermedia* can be found on reef flat platforms; these staghorn species can sometimes form extensive thickets and provide important habitat for various reef fishes including SGCN juvenile tanguison (Napoleon wrasse, *Cheilinus undulatus*) and other organisms. Other sessile benthic organisms, such as soft corals (e.g., *Sinularia* spp., *Sarcophyton* spp., and *Lobophytum* spp.) and many species of sponges and algae can also be found on reef flat platforms. Reef flat platforms also host a wide variety of reef fishes, including parrotfishes (scarid spp., including the seagrass parrotfish, *Leptoscarus vaigiensis*, and juvenile and sub-adult green humphead parrotfish, *Bolbometopon muricatum*), emperors (*Lethrinus* spp.), rabbitfishes (*Siganus* spp.), goatfishes (mullid spp.), juvenile and subadult napoleon wrasses (*Cheilinus undulatas*), groupers (*serranid* spp.), needlefishes (belonid spp.), trevally (carangid spp.), surgeonfishes (acanthurid spp.), squirrelfishes (holocentrid spp.), triggerfishes (balistid spp.), damselfishes (pomacentrid spp.), butterflyfishes (chaetodontid spp.), and cardinalfishes (apogonid spp.). Numerous non-coral invertebrates, such as sea cucumbers (e.g., *Holothuria atra*, *H. leucospilota*, *Actinopgya varians*, *Synapta maculata*), sea urchins (e.g., *Diadema savignyi*, and the collector urchin, *Tripneustes gratilla*), gastropod snails (e.g., the branched murex, *Chicoreus ramosus*), bivalves (e.g., giant clams, *Tridacna maxima*, and the pectinate venus, *Gafrarium pectinatum*), the day octopus (*Octopus cyanea*), and crustaceans such as panulirid lobsters (*Panulirus* spp.) can also be found on reef flat platform.

The **reef margin** is the relatively narrow seaward edge of the reef flat platform zone where the waves break, straddling the reef flat and open ocean. The reef margin slopes gently seaward, and remains submerged for most of the time except during spring low tides. Surge channels are often cut into the reef margin, running perpendicular to the margin at more or less regular intervals. The narrow portion of the reef margin that receives the brunt of the wave action is dominated by coralline algae, including encrusting and sturdy branching species, which thrive in the high energy conditions. Tough brown algae species, such as *Sargassum* spp. and *Turbinaria* spp. are often found shoreward of the coralline algal ridge. Corals like some *Acropora* spp. (including *Acropora globiceps*) and *Pocillopora* spp., can be found across the reef margin, but are generally sparse along the algal ridge, increasing in abundance and diversity with increasing depth. Numerous fish species, such as rabbitfishes (*Siganus* spp.), surgeonfishes (*Acanthurus* spp. and *Naso* spp.), guili (rudderfishes, *Kyphosus* spp.), tarakitu (trevally, *carangid spp*.), and wrasses (*labrid spp*.), as well as specialized invertebrates, such as rock boring sea urchins (*Echinometra* spp.), the himma (small giant clam, *Tridacna maxima*), and coral-dwelling crabs (*Trapezia* spp.) actively use this reef zone either intermittently or permanently.

The **reef front** extends from the reef margin downward to wave base depth. This reef zone typically experiences strong surging water movement. Buttress ridge and channel topography, also sometimes referred to as “spur and groove” formations, commonly develop in reef front zones that occur along windward exposed coasts. This kind of reef topography is caused by the formation of surge channels, which are cut at right angles to the reef margin and to prevailing wave action. The channels are lined with vertical to overhanging walls, and typically have flattened floors that extend downward to the wave-base depth. The floors of these channels, or ‘grooves’, remain mostly uncolonized, as the movement of coarse sand, rubble, and larger material prevent the establishment of coral, algae or other benthic organisms. In between the channels, or ‘grooves’, are lobate buttresses, or ‘spurs’, with a somewhat flattened surface and which slope downward in a seaward direction. This part of the reef front is generally considered to be the reef zone where modern reef assemblages grow most vigorously, as conditions appear to be optimum for the growth of often densely-packed coral colonies, coralline algae, and other reef building organisms. Beyond these major features, numerous microhabitats also exist within the reef front, such as the exposed upper surface of the buttresses, the steep and shaded channel walls, and various nooks and crannies. Corals, such as *Acropora* spp. (including *Acropora globiceps* and *Acropora retusa*), *Pocillopora* spp., *Porites* spp., as well as *Leptoria phrygia* and *Goniastrea retiformis*, tend to dominate the coral communities along the reef front. Macroalgae, such as *Valonia* spp., *Bryopsis* spp., *Chlorodesmis fastigiata*., and *Halymenia* spp., are conspicuous here, as are the sea cucumbers, *Actinopyga varians* and *Stichopus chloronotus*, the sea urchin *Echinostrephus aciculatus*, giant clams (mainly *Tridacna maxima*), the day octopus (*Octopus cyanea*), panulirid lobsters (*Panulirus* spp.), many other crustaceans, as well as many other invertebrates. Reef fish species that can be observed in the reef front include låggua (parrotfishes, *Scarid* spp.), including the steephead parrotfish, *Chlorurus microrhinos*), surgeonfishes (*Acanthurid* spp.), butterflyfishes (*Chaetodontid* spp.), wrasses (*Labrid* spp.), grey reef sharks (*Carcharhinus amblyrhynchus*), and various other fish species.

The **seaward reef slope**, also referred to as the forereef slope by some authors, extends downward from the reef front. The degree of steepness of the reef slope can vary considerably**,** and at many locations can be interrupted by flattened regions referred to as submarine terraces. The seaward reef slope extends to mesophotic depths, where light-dependent zooxanthellate corals give way to azooxanthellate corals, to the forereef and ultimately to the seafloor. A number of different habitats occur within the reef slope zone. The underlying structure of these habitats include a variety of hardbottom types, ranging from veneering communities, which are composed of scattered corals on low relief pavement, to highly complex, coral-dominated aggregate reef structure. Various types of unconsolidated sediment habitats can also be found within the reef slope, including areas of turf or coralline algae-covered coral rubble, uncolonized sand, and rock/rubble with varying dominant cover types (e.g., turf algae, coralline algae, or coral). Owing to the varying hardbottom and softbottom structural types, the wide range of environmental conditions, and the comparative breadth of the reef slope, a high degree of biological diversity can be found in this important reef zone, including nearly all marine SGCNs.

Coral assemblages can vary significantly across gradients of exposure, depth, and other environmental factors, but within the CNMI the genera *Porites*, *Pocillopora*, *Montipora*, and *Acropora* typically dominate. While not commonly observed, the corals *Acropora globiceps*, *A. retusa*, and *Seriatopora aculeata* can also be found in the reef slope zone. Other coral genera, including *Favia*, *Goniopora*, *Astreopora*, *Lobophyllia*, and many others can also be found in the reef slope zone. The algae genera *Halimeda* spp., *Microdictyon* spp., *Caulerpa* spp., and *Liagora* spp., are frequently encountered, as are numerous species of soft corals, sponges, and other sessile organisms. Hundreds of species of reef fishes representing all major families and trophic groups are found in the reef slope zone, but parrotfishes (*Scarid* spp., including the steephead parrotfish, *Chlorurus microrhinos*), surgeonfishes (*Acanthurid* spp.), snappers (*Lutjanid* spp.), emperors (*Lethrinid* spp.), goatfishes (*Mullid* spp.), rabbitfishes (*Siganid* spp.), butterflyfishes (*Chaetodontid* spp.), wrasses (*Labrid* spp., including the napoleon wrasse*, Cheilinus undulatus*), damselfishes (*Pomacentrid* spp.), and reef sharks (including the grey reef shark, *Carcharhinus amblyrhynchos*) are particularly common or notable reef fish taxa found in this zone. Notable non-coral invertebrates found in the reef slope zone include sea cucumbers (e.g., *Stichopus horrens*, *Thelenota ananas*, and *Holothuria whitmaei*), sea stars (e.g., *Acanthaster planci*, *Linckia* *guildingi*, and *Leiaster leachi*), sea urchins (e.g., *Echinothrix diadema* and *Echinometra* spp.), panulirid lobsters (*Panuliris* spp.) and other crustaceans (e.g., *Dardanus* spp. and *Zosimus aeneus*), giant clams (*Tridacna maxima* and *T. squamosa*), the day octopus (*Octopus cyanea*), and other molluscs, including the horned helmet (*Cassis cornuta*), the Chiragra spider conch (*Harpago chiragra*), turban snails (*Turbo setosus*, *T. argyrostomus*, and *T. petholatus*), Triton's trumpet (*Charonia tritonis*), and the branched murex (*Chicoreus ramosus*). Spinner dolphins (*Stenella longirostris*) and hawksbill (*Eretmochelys imbricata*) and green (*Chelonia mydas*) sea turtles can also be observed in the reef slope zone.

#### 5.1.1.2 Barrier reefs

A barrier reef system consists of a platform reef that is separated from land by a deeper lagoon. There are two general types of barrier reef systems, one comprised of a linear barrier reef and associated lagoon that does not encircle a land mass (e.g., those found at Saipan and Guam) and one comprised of a peripheral barrier reef and lagoon that encircles one or more lagoon islands (e.g., those found at Chuuk and Palau). Barrier reef systems can be divided into three distinct regions: the barrier reef platform, the lagoon that separates it from the landmass, and fringing reefs developed around lagoon island land masses. Each of these regions can be further divided into zones, each with distinct environmental attributes. The only barrier reef systems in the CNMI are found along portions of the western, or leeward, coasts of Saipan and Tinian. The barrier reef and its associated lagoon (called Saipan Lagoon) in Saipan occurs along most of the western coast. It contains a small islet, Mañagaha, that is a particularly important site for tourism. The barrier reef in Tinian is located off of Tinian Harbor, and is attached to the shore by a fringing reef.

As with platform fringing reef systems, the **shoreline intertidal zone** of barrier reef systems occurs in the coastal area between mean low and mean high tides and may be composed of sand, mud, rubble, hardbottom, or a combination of these substrates. Depending on the width of the platform and the degree of exposure to wave energy, intertidal zones range from tumultuous areas affected by strong wave action to less dynamic, calmer environs. But even in calm intertidal zones protected against strong wave action, the regular changes in sea surface height cause the intertidal zone to be completely or partially exposed subaerially at low tide and partially or completely submerged at high tide. The biota of the shoreline intertidal zone of barrier reef systems is similar to that of fringing platform reef systems (see above).

The **lagoon** can be divided into floor, mound, pinnacle, and patch reef zones. Individual lagoon systems may not possess all of these zones. The lagoon floor, which is typically the most extensive region of a barrier reef system, generally deepens towards the center and often possesses scattered raised areas, including mounds, pinnacles, and patch reefs. Lagoon floors are typically composed of sand, although areas of coral rubble and turf algae- and macroalgae-covered pavement with scattered coral may also occur. Mounds and pinnacles rise abruptly from the lagoon floor but do not reach the surface; mounds are those features with a width greater than their height, while pinnacles are higher than they are wide. Patch reefs rise from the lagoon floor and form a flattened platform that has reached sea level equilibrium. Mounds, pinnacles, and patch reefs can vary significantly in their size and shape and can be further subdivided in subzones that reflect the different biological assemblages that can occur in association with each of these features. For example, the upper surface of the patch reef flat platform, which may be exposed or have only a shallow covering of water during spring low tides, is suitable only for those organisms that can tolerate the temporary aerial exposure and rapid changes in temperature and salinity. The slopes of larger mounds, pinnacles, and patch reefs may be interrupted by submarine terrace subzones.

Coral assemblages associated with the lagoon can vary significantly across this zone, depending on the substrate, water depth, and other environmental factors. Sandy areas support little coral growth, although some staghorn *Acropora* corals and clusters of *Sinularia* soft corals may be present, while areas with hardbottom substrate, such as areas with pavement as well as mounds, pinnacles and patch reefs, can host a variety of corals, such as massive *Porites* spp., *Porites cylindrica*, *Isopora palifera*, staghorn *Acropora* spp. and other *Acropora* spp., *Pocillopora* spp., and the reef-building octocoral, *Heliopora coerulea*. Similar to the varied lagoonal coral communities, fish and non-coral invertebrate assemblages can also vary significantly across lagoon habitats. Fish associated with sandy and rubble habitats include goatfishes (*Mullid* spp.), mojarras (*Gerreid* spp.), trevally (*Carangid* spp.), rays (*Myliobatid* spp.) and some wrasses (*Labrid* spp.), while some common or notable non-coral invertebrates associated with sandy habitats include sea cucumbers (e.g., *Holothuria* spp., *Bohadschia* spp. *Stichipus* spp., and *Synapta* spp.); urchins, such as the collector urchin (*Tripneustes gratilla*); and molluscs, including the pectinate venus (*Gafrarium pectinatum*), the branched murex (*Chicoreus ramosus*), and the horned helmet  (*Cassis cornuta*). Hardbottom lagoonal habitats typically host a greater diversity of reef fish species, with different assemblages associated with each of the different hard bottom habitats.

In general, some of the more common or notable reef fishes found in association with lagoon hardbottom habitats may include parrotfishes (*Scarid* spp., including the seagrass parrotfish, *Leptoscarus vaigiensis*), surgeonfishes (*Acanthurid* spp.), emperors (*Lethrinus* spp.), rabbitfishes (*Siganus* spp.), wrasses (*Labrid* spp., including juvenile and subadult napoleon wrasse, *Cheilinus undulatus*), snappers (*Lutjanus* spp.), goatfishes (*Mullid* spp.), groupers (*Serranid* spp.), needlefishes (*Belonid* spp.), trevally (*Carangid* spp.), squirrelfishes (*Holocentrid* spp.), damselfishes (*Pomacentrid* spp.), butterflyfishes (*Chaetodontid* spp.), and cardinalfishes

(*Apogonid* spp.). Numerous non-coral invertebrates, such as sea cucumbers (e.g., *Holothuria* spp., *Actinopyga* spp., *Synapta maculata*); sea urchins (e.g., *Echinothrix diadema*, *Diadema savignyi,* and *Tripneustes gratilla*); and molluscs, such as giant clams (*Tridacna* spp.), the day octopus (*Octopus* spp.), turban snails (*Turbo setosus*, *T. argyrostomus*, and *T. petholatus*), the Triton's trumpet (*Charonia tritonis*) and other gastropod snails, and panulirid lobsters (*Panuliris* spp.) and other crustaceans can also be found in association with lagoon hardbottom habitats (DFW 2023) Green sea turtles (*Chelonia mydas*) may also be found in the lagoon reef zone.

**Lagoonal islets** may be present, and may range from very small, barely exposed rocks or aggregations of rubble, to substantial, vegetated land masses that can support human habitation. These islets and the land mass adjacent to the lagoon may possess veneering, apron, or platform fringing reefs, each with zonation patterns similar to those exposed directly to the ocean. The suffix "lagoon" can be added to these zones to differentiate them from their seaward analogues (e.g., "lagoon upper reef slope zone, lagoon lower reef slope zone, lagoon reef flat platform zone, lagoon reef margin zone, etc.). A lagoon channel zone, characterized by a relatively deep and narrow channel with steep to vertical walls, may be present where lagoon islands are closely associated. Strong bi-directional tidal currents occur in these channels, which are similar in morphology to channels through the barrier reef.

The **barrier reef flat platform** is a flattened region between the seaward reef margin and the lagoon that has reached sea level equilibrium. Similar to the fringing reef flat platform, the outer portion of the barrier reef flat platform may be slightly elevated compared to the inner portion, and the platform may be exposed during low spring tides or may be only shallowly covered with water. Where an islet (e.g., Mañagaha Island in Saipan Lagoon) is present on the reef flat platform, the ocean side can be referred to as the seaward islet reef flat platform and the lagoon side the lagoon islet reef flat platform. The seaward edge of the barrier reef flat platform can be divided into the same physiographic zones described for fringing platform reefs, but the prefix "seaward" can be added to differentiate them from similar zones on the lagoon side of the barrier reef flat platform (e. g. **seaward reef margin**, **seaward reef front**, and **seaward reef slope**). Where the barrier reef platform abruptly slopes into the lagoon the same zones discriminated on the seaward side can be found, and in order to discriminate from the seaward zones the prefix "lagoonward" can be added (e.g., **lagoonward reef margin**, **lagoonward reef front**, **lagoonward reef slope**). Most barrier reef-lagoon systems also possess channels that bisect the barrier reef platform and connect the lagoon waters with open ocean waters. The biota of the barrier reef platform, and the seaward reef margin, seaward reef front, and seaward reef slope zones, are similar to the biota described above for the analogous platform fringing reef zones. However, distinct assemblages may occur along deeper portions of the barrier reef platform. This is exemplified by the robust growth of *Isopora palifera* and massive *Porites* along the slightly deeper, lagoonward extent of the reef platform adjacent to the Saipan Lagoon. The biota of the lagoon ward reef margin, lagoon ward reef front, and lagoon ward reef slope are also often distinct from their seaward analogues, particularly adjacent to deeper portions of the lagoon, owing to the low wave energy conditions typical of these areas. For example, the lagoon ward reef margin along the lagoon waters near Mañagaha Island is typically inhabited by relatively large stands of *Isopora palifera* and massive *Porites* spp., with some corymbose *Acropora* and scattered *Pocillopora* spp.; in contrast, the seaward reef margin coral assemblages typically dominated by smaller *Acropora* spp. (and the occasional *Acropora globiceps* colony), *Pocillopora* spp., and smaller *Porites* colonies. Similarly, the low energy conditions of the lagoon ward reef front and reef slope zones often support larger, more topographically complex, and more delicately-structured coral species not typically observed in their seaward analogues. The fish and non-coral invertebrate biota associated with the predominantly hardbottom habits of the lagoonward reef margin, reef front, and reef slopes are similar to that described above for hardbottom lagoonal habitats.

### Offshore banks and platforms

Offshore or open ocean banks are raised features of the seafloor topography or organic buildups that extend near the ocean surface, but which have not reached sea level equilibrium. Offshore or open ocean platform patch reefs are similar to banks, but they have reached sea level equilibrium. Offshore banks can be divided into submerged platforms and slope zones. The submerged platforms generally have a somewhat truncated or undulating surface, and are surrounded by a slope that extends downward from the margin to mesophotic depths, the forereef, and ultimately to the seafloor. As with the seaward reef slopes of barrier reef and fringing reef systems, the slope of offshore banks may be interrupted by a flattened submarine terrace at various depths. The zonation of open ocean patch reefs is similar to that of open ocean banks, but the reef platform has developed upward to sea level equilibrium. The diversity of organisms represented on offshore banks and platforms is typically lower than that observed around islands, likely a result of lower habitat diversity, small size, and distance to sources of larvae. Still, numerous fish, coral, and non-coral invertebrate species can be found on offshore banks and platforms. A significant number of SGCN may be found on offshore banks and platforms, including spinner dolphins (*Stenella longirostris*), green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles, the grey reef shark (*Carcharhinus amblyrhynchos*), the napoleon wrasse (*Cheilinus undulatus*), steephead parrotfish (*Chlorurus microrhinos*), *Acropora globiceps*, *A. retusa*, *Seriatopora aculeata*, giant clams (*Tridacna maxima* and *T. squamosa*), the day octopus (*Octopus cyanea*), the horned helmet (*Cassis cornuta*), the common spider conch (*Lambis lambis*), turban snails (*Turbo setosus*, *T. argyrostomus*, and *T. petholatus*), Triton's trumpet (*Charonia tritonis*), the branched murex (*Chicoreus ramosus*), and panulirid lobsters (*Panulirus* spp.).

## Submerged caldera

A submerged caldera is essentially a flooded volcanic crater, which is partly or mostly surrounded by subaerial remnants of the volcanic land mass, represents a unique reef type that cannot be strictly considered a fringing or barrier reef system, although it shares some characteristics with the latter. The subaerial remnants of the volcanic land mass form a partial or complete barrier that provides protection from wave action, producing relatively calm, lagoon-like conditions within the crater. No special terminology has been designated for this rare reef type, but these systems can be generally divided into an upper reef slope, which extends from the shoreline to wave base depth, and a lower reef slope, which extends from the base of the upper reef slope to the crater floor. Depending on the water depth within the crater, the lower reef slope may extend into the mesophotic zone, where it then transitions to the forereef slope until it reaches the sea floor. The seaward side of the crater typically hosts a veneering or apron fringing reef community, with zones as described above for these reef types. Maug hosts the only flooded volcanic crater in the Mariana Islands, and is one of the few flooded volcanic craters world-wide with conditions that allow for coral reef growth.

## Mariana Trench features

Since its designation as a Marine National Monument, the Mariana Trench has seen a flurry of exploration and scientific discovery. The Mariana Trench is a deep oceanic subduction zone where the Pacific plate is thrust under the Mariana plate (Figure 3). Within the Mariana Trench is the Challenger Deep, the deepest oceanic point on earth at nearly 36,000 ft below sea level. The Challenger Deep is just beyond the boundary of the Mariana Trench Marine National Monument, though the vast trench holds several other unique deep sea features. Many newly described species have been described from the Mariana Trench including the Mariana snailfish, Dumbo octopus, and deep sea dragonfish (Linley et al. 2016, Blasiak et al. 2022). Much of the hard to reach area has yet to be explored. Here are some of the features described by the National Ocean and Atmosphere Administration (NOAA) reports.

**Seamounts -** there are 12 submerged seamounts within the Mariana Trench National Monument in the CNMI (Bell 2017). Some of the sea mounts are considered serpentine mud volcanoes with thermal vent features that support a unique array of hearty species evolved to thrive in these harsh deep sea conditions. They are called serpentine mud volcanoes due to their production of rare blue mud which is formed at the subduction zone and bubbles up through the sea mounts (Wheat, 2020). The associated hydrothermal vents produce highly acidic and mineral rich hot fluids (140°F - 867°F) which support unique sea creatures including crabs, shrimp, squat lobsters, fish, and tubeworms (Swan et. al. 2021, Gerringer et. al. 2017).

**Champagne vent** this benthic feature is located north of Maug at the submerged Eifuku volcano. This vent is one of two known vents in the world that produce pure liquid carbon dioxide (NOAA, 2016).

### 5.1.2 Seagrass beds

Seagrass beds are a distinct marine habitat typically found on fringing reef platforms and within barrier reef lagoons, but are addressed here separately due to their ecological, cultural, and economic importance (Figure 35). Seagrass beds in the CNMI are limited to the shallow reef flat and barrier reef lagoon areas along the west coast of Saipan, comprising approximately 6.7 $km^2$ (about 2.8%), of the island's shallow nearshore environment. There are a few other known stands of seagrass habitat in the CNMI: in the lagoon along the south west side of Laulau bay; two patches of translocated *Enhalus acoroides* that were planted in the 1990's as part of the mitigation measures for the construction of the adjacent causeway to Small Island in the Tweksberry Lagoon on Rota; one patch of naturally occurring *Enhalus acoroides* that grows in a narrow sandy bottomed reef bench cut on the east side of Tinian at Chigit Beach. The smaller isolated patches of seagrass on Rota and Tinian provide habitat for the reef communities on those islands. However, the patches are so small they are not likely to be providing measurable or essential ecosystem services to the area.

Three seagrass species occur in the CNMI, including the largest species, *Enhalus acoroides*, which has thick blades that can grow up to 1.5 meters in height, and the more diminutive species, *Halodule uninervis and Halophila minor,* which grow up to 15 cm and 1.5 cm, respectively. Individual stands of *E. acoroides* are typically circular in shape, apparent when viewed from aerial photographs, and when clustered densely they form contiguous 'beds' or 'meadows'. *Halodule uninervis* and *Halophila minor* can be found in shallow sandy reef flats and deeper lagoon environments (Taborosi 2013).

*Enhalus acoroides* primarily relies on sexual reproduction throughout its range, producing flowers that release pollen at the ocean's surface, facilitating wide dispersal. Consequently, unlike many other seagrass species, *E. acoroides* exhibits extremely slow growth when limited to clonal propagation via rhizomes. Genetic analyses conducted in 2024 revealed that Guam and Saipan may be home to the largest and oldest known *E. acoroides* clone in the Pacific (Swain et. al 2020). The data suggest that this clone colonized the Mariana Islands over 10,000 years ago through a single dispersal event, and gradually spread from island to island. This clone is likely male, as surveys across both islands have failed to detect female flowers. Unfortunately, the absence of sexual reproduction renders this clone particularly vulnerable to disease and habitat loss, as it lacks the genetic diversity and reproductive capacity to recover from environmental disturbances (Dierick et al. 2024).

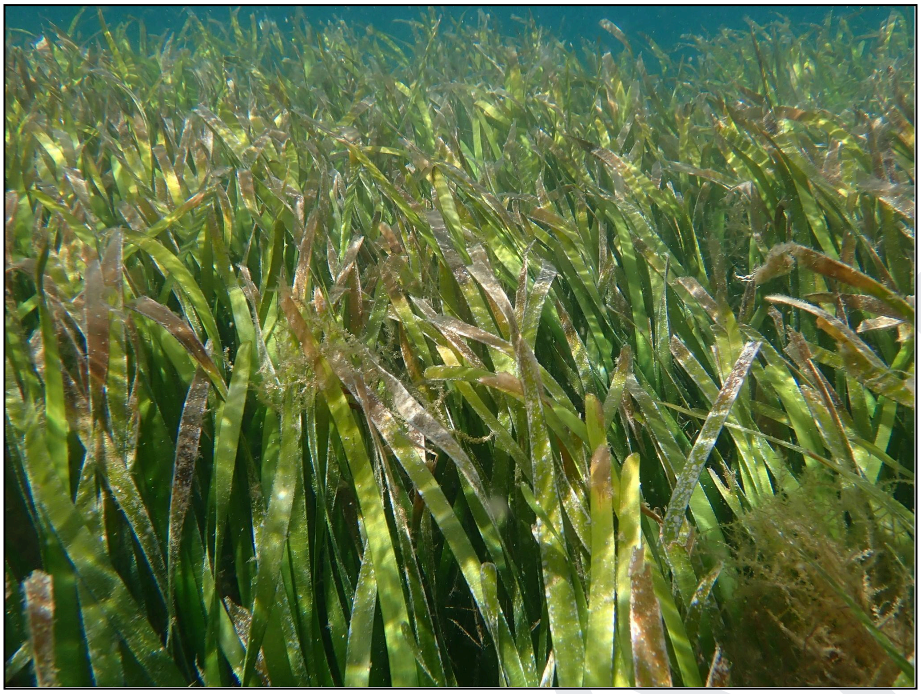


Figure 35. Photo of *Enhalus sp.* seagrass bed in the Saipan Lagoon. Nate Van Ee 2024



Seagrass communities are integrally linked to coral reef and mangrove ecosystems, serving as food for sea turtles, numerous fish species, sea urchins, and other marine invertebrates, and also providing shelter and substrata for a range of marine life, such as rabbitfishes (*Siganus* spp.), wrasses (labrid spp., including juvenile napoleon wrasse, *Cheilinus undulatus*), puffers (*Arothron* spp.), parrotfishes (scarid spp., including the seagrass parrotfish, *Leptoscarus vaigiensis*), and emperors (e.g., *Lethrinus harak*). Examples of invertebrates found in association with seagrasses include the collector sea urchin (*Tripneustes gratilla*) and sea cucumbers (e.g., synatpid spp. and *Holothuria* spp.). Seagrasses provide services for human populations by providing habitat for subsistence and commercial food fishes and invertebrates, stabilizing sand, trapping coastal sediments, filtering nutrients and contaminants, and protecting shorelines from erosion. Seagrass beds also serve as sources of biodiversity and sequester carbon from the ocean (Taborosi 2013).

The extent and species present in seagrass beds within the Saipan Lagoon were related to watershed sizes in a 2008 study, while the 'health' within each seagrass habitat was better predicted by the amount of development and human population in the adjacent watersheds (Houk and van Woesik 2008). More recently, seagrass beds in the Saipan Lagoon have experienced weather and water quality induced dynamics. Large areas of seagrass have been buried in littoral drift sands converting the substrate to sandy bottom. A benthic mapping study in the Saipan lagoon found a 12% to 17% of locations had measurable declines in seagrass cover from 2001-2016 (Kendall and Poti 2015). Similar studies  have also reported 22% loss of seagrass habitat around Guam (LaRoche et al. 2018). While there has been a decline in *E. acoroides* seagrass beds, the greater losses in the Saipan lagoon are the beds of *Halodule uninervis* which is an important food source for herbivorous SGCN food fish like palakse' (parrot fish spp.) and hiting kalau (rabbit fish spp.) (Houk and Camacho 2010).

#### 5.1.3 Man-made submerged structures

Man-made submerged structures, such as wharfs, piers, breakwaters, pilings, sunken vessels, and other structures that occur in nearshore waters can support some organisms typically associated with coral reefs. In some instances, these structures can provide important habitat for SGCN and other ecologically and commercially important species, especially in areas with limited natural hard bottom habitat. However, it is generally held that man-made structures cannot replace or replicate the diversity and functions of natural coral reef ecosystems. The preponderance of available literature suggest that man-made structures may host a larger proportion of non-native species than their natural counterparts, owing to the unique substrate they provide or to use of some of these structures by ships, barges, and other vectors for these non-native species. For this reason, some man-made structures can be considered potentially facilitative of the spread of destructive invasive species to nearby natural habitats.

### 5.1.4 Open Water/Pelagic

Open water/pelagic habitat includes all waters that occur beyond coastal waters. For the purposes of this document, this habitat extends from coastal waters to the 200 nm limit of the U.S. Exclusive Economic Zone around the CNMI and from the sea surface to a depth of 1000 m. This depth limit represents the lower depth range of the grey reef shark (*Carcharhinus amblyrhynchos*), the deepest-occurring SGCN. The first 200 m of the open water/pelagic environment is referred to as the epipelagic zone, while the mesopelagic zone extends from a depth of 200 m to 1000 m. Each of these depth zones host different, but often overlapping and interdependent, assemblages, which are influenced by differences in light, pressure, temperature, nutrient availability, dissolved oxygen, and other physical and chemical conditions.

Figure 36. Open water school of bigeye barracuda (*Sphyraena forsteri*) in Saipan. Kaeli Swift 2024

The abundance of light in the epipelagic, or photic, zone supports photosynthetic plankton, or phytoplankton, such as diatoms, dinoflagellates, and coccolithophores. Phytoplankton are responsible for all primary production in the open ocean environment and serve as the basis of the oceanic food web. Phytoplankton serve as prey for small heterotrophic organisms known as zooplankton, such as protozoa, copepods, euphasiid shrimp, jellyfish, siphonophores, as well as the fish and invertebrate larvae (Taborosi 2013). Free-swimming animals, known as nekton, feed on zooplankton and other nekton. Nekton in the open ocean waters around the Mariana Islands include the commercially important fish species (Figure 36) mahi (*Coryphaena hippurus*), wahoo (*Acanthocybium solandri*), skipjack tuna (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), and Pacific blue marlin (*Makaira mazara*), as well as sharks, such as silky sharks (*Carcharinus falciformis*), Galapagos sharks (*C. galapagensis*), and tiger sharks (*Galeocerda cuvier*). While the grey reef shark (*Carcharinus amblyrhynchos*) is typically associated with coral reefs, they can also be found in the open water/pelagic environment, and have been recorded at depths up to 1000 m. Resident or migrating marine mammals, such as short-finned pilot whales (*Globicephala macrorhynchus*), sperm whales (*Physeter macrocephalus*), and dolphins

(*Stenella attenuata* and *S. longirostris*), and sea turtles, such as the leatherback (*Dermochelys coriacea*), the green (*Chelonia mydas*), and hawksbill (*Eretmochelys imbricata*) can be found in the epipelagic zone (Taborosi 2013).

Some light penetrates the mesopelagic zone, also known as the twilight zone, but not enough to support photosynthetic activity. The epipelagic zone quickly becomes very dark, and bioluminescent organisms, such as *Ctenophores*, *Siphonophores*, lanternfishes (*Myctophid* spp.), moonfish (*Lampris guttatus*), hatchetfishes (*Sternoptychid* spp.), and deep sea anglerfish (*Melanocetus johnsonii*), as well as the commercially targeted oilfish (*Ruvettus pretiosus*), snake mackerel (*Gempylus serpens*), and sickle pomfret (*Taratichthys steindachneri*) may be found in the mesopelagic zone (B. Tibbatts, personal communication). Some organisms, such as some sharks and marine mammals more commonly observed in the epipelagic zone descend into the mesopelagic to feed, while some mesopelagic organisms ascend to the nutrient-rich epipelagic zone to feed.

## 5.2 Marine Habitat Composition of CNMI Islands and Offshore Reef Areas

This section includes summaries of the general composition of marine habitats of the islands and offshore reef areas in the CNMI. For each island or reef area, a brief description of its location, size, and general topography is provided, followed by a description of the overall submarine topography and the dominant and notable marine habitats around the island.

Maps of the shallow (< 30 m) coral reefs of each of the islands of the CNMI are presented in Figures 37-50. Figures are not provided for the offshore banks and platforms due to the lack of benthic habitat spatial data for these reef areas. The extent and zonation of CNMI reefs are based upon spatial data developed by the NOAA Center for Coastal Monitoring and Assessment's Biogeography Team and presented in their 2005 *Atlas of the Shallow-Water Benthic Habitats of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands*. The NCCOS spatial data was modified to accommodate the small map scale used to depict benthic habitat data around entire islands. In particular, reef zones were combined into three primary reef zones, including the reef flat, lagoon, and reef slope. Beyond the depiction of reef zonation, areas of unconsolidated sediment are distinguished from the predominant coral reef and hardbottom structure. With the exceptions of seagrass beds in Saipan Lagoon, individual habitat types are not depicted in these maps, due primarily to the small map scale, which prevents the effective depiction of the large number of habitat types, most of which are small in spatial extent and embedded within a highly heterogeneous, complex mosaic of reef habitats.

## 5.2.1 Rota

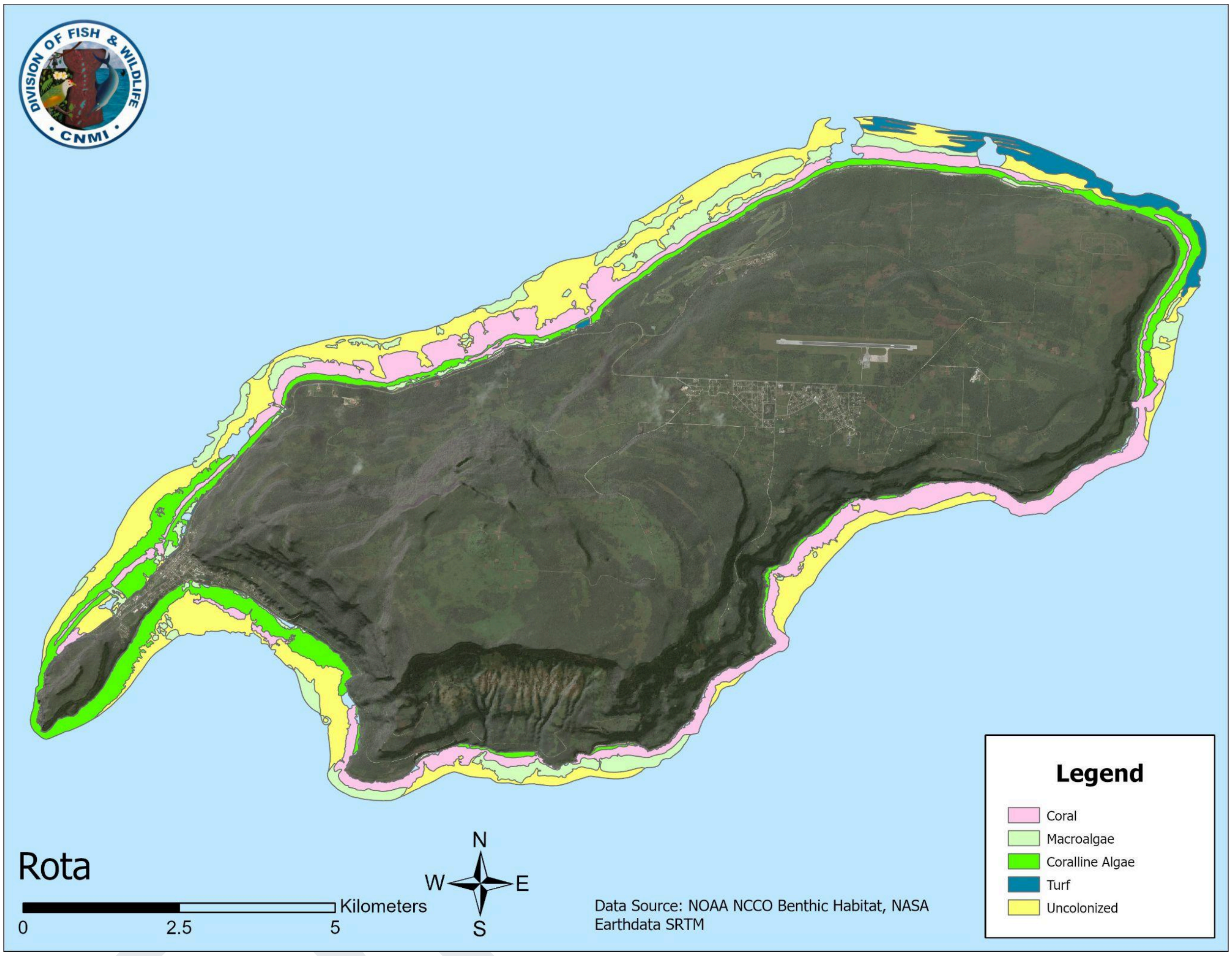



Figure 37. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Rota.

Rota, the CNMI's southernmost island, is 76 km north of Guam and 117 km southwest of Saipan. Rota has a land area of 85.5 $km^2$ (Starmer 2005) and possesses approximately 25 $km^2$ of shallow (< 30 m) reef area (Figure 37). While the island is the fourth largest in the CNMI, the human population is small, accounting for only 1.5% of the total CNMI population. Rota's coast is almost entirely composed of raised limestone, except for the Talakhaya area on the southern shoreline. This region hosts several intermittent streams, which deposit volcanic material originating from the island's interior. The eastern, high wave exposure shorelines are dominated by steep cliffs and slopes edged by a sea level bench; reef development is generally limited along these shorelines (Eldredge and Randall 1980; Eldredge 1983; Houk and van Woesik 2010).

Much of Rota’s shoreline represents emergent Holocene reefs due to geological uplifting and slight, eustatic sea level drop during the mid-Holocene (Kayanne et al. 1993). The vast expanses of emergent, fossilized reefs along most of Rota’s shoreline are unique in the CNMI. However, the emergence of these reefs has prevented extensive biological production within reef flats and lagoons, as most of Rota’s reef flats are completely exposed or isolated at lower tides. This has likely influenced the reef slope communities as well. Holocene limestone is a porous rock that allows for rapid transport of groundwater to the nearshore assemblages, influencing modern coral growth on the reef slopes (Houk and van Woesik 2010).

Although the raised, shallow reef platform surrounding Rota is mostly narrow, it reaches a width of 250 m (Pinatang lagoon) along the leeward northwestern coastline (Eldredge and Randall 1980). Other areas of significant modern reef development include wave-sheltered portions of the northwest coast and west of Teteto Beach, Sasanhaya Bay, and a portion of the west coast (Starmer 2005). Likely due to Rota's unique geology, island-wide mean coral cover estimated from towed-diver surveys during the 2003-2007 NOAA Mariana Archipelago Reef Assessment and Monitoring Program (MARAMP) expeditions was low (4-9%) compared to other islands in the archipelago. In contrast to the low mean coral cover island-wide, towed-diver surveys along the eastern edge of Sasanhaya Bay indicated relatively high coral cover in the Coral Gardens marine protected area (Brainard et al. 2012).

## 5.2.2 Aguiguan


Figure 38. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Aguiguan.

Aguiguan, also known as Goat Island, is a small (7.3 sq. km) island located approximately 9 km southwest of Tinian, to which it is connected by a submerged ridge at a depth of ~380 m. The island comprises a relatively flat, uplifted limestone plateau and is surrounded by steep cliffs. Aguiguan possesses approximately 9.8 $km^2$ of shallow (< 30 m) reef area (Figure 38). A narrow sea-level bench occurs along the eastern side, but no wide reef flats occur around the island (Eldredge and Randall 1980). A sloping bank surrounds the island, descending to approximately 400 m depth within about 2 km of the coast. Naftan Rock, a neighboring islet, was used as a bombing target prior to the U.S. Navy's use of FDM. Unexploded ordnance can be found in the waters surrounding this islet (Starmer 2005). Aguigan has been uninhabited since 1945, but is occasionally visited by hunters. Coral reef development is limited around Aguiguan, with the reefs off the northwest coast, which are situated on the most gently sloping seafloor, are the largest and most developed (Starmer 2005), The substrate is primarily hardbottom; a limited amount of unconsolidated sediment (primarily sand) is primarily found on the west side of the island, between Aguiguan and Naftan Rock. Island-wide mean coral cover estimated from towed-diver surveys was moderate (12-18%) compared to other islands in the CNMI (Brainard et al. 2012).

## 5.2.3 Tinian

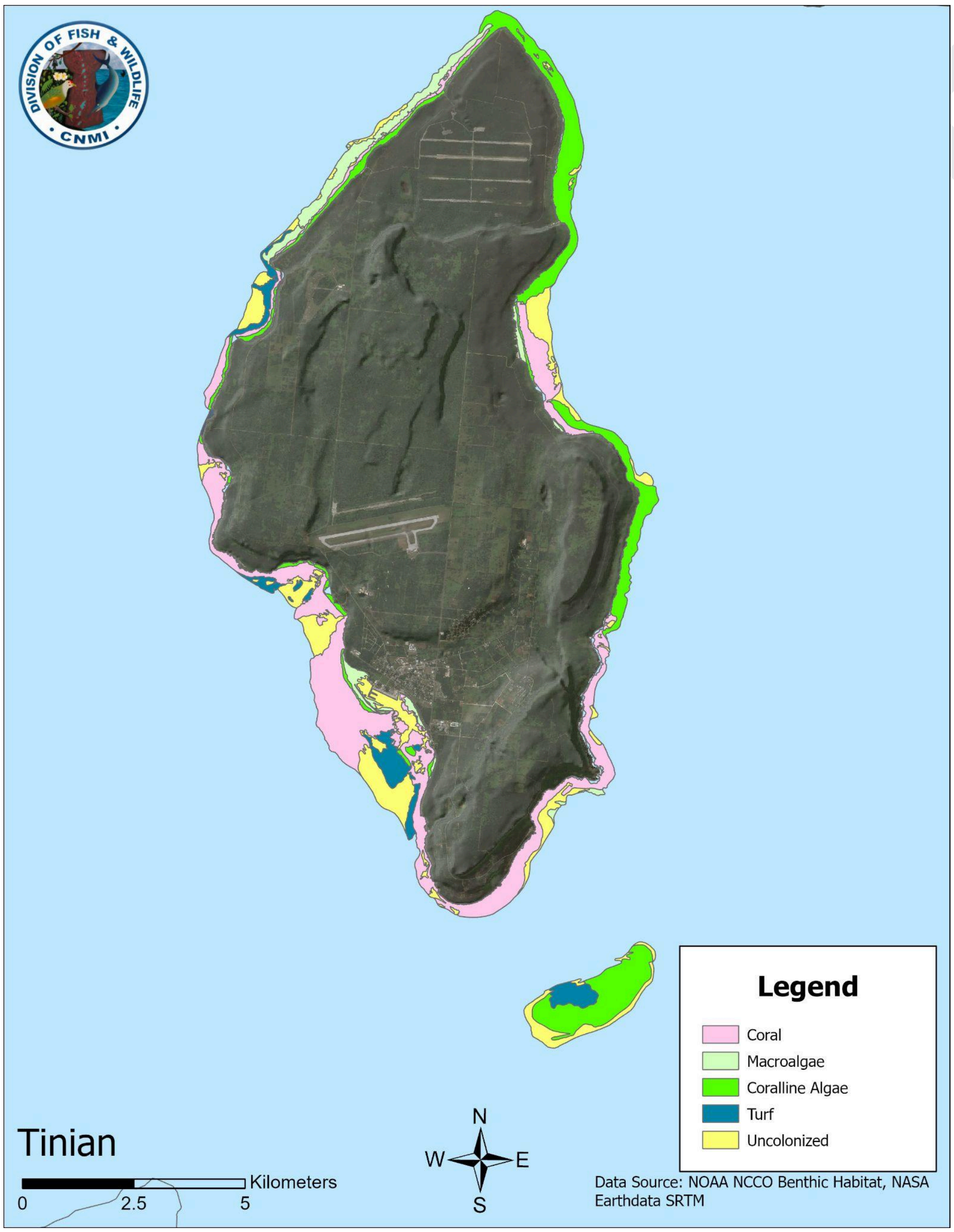



Figure 39. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Tinian.

Tinian is the second largest island in the CNMI, with a land area of 102 $km^2$ and approximately 26 $km^2$ of shallow reef area (including the adjacent Tatsumi Reef) (Figure 39). Tinian hosts the second largest human population in the CNMI, at 2,040 (~4% of total population) in 2020. The island is relatively flat and consists of a series of uplifted carbonate platforms (Brainard et al. 2012). Although no permanent streams occur on Tinian, there are several small wetlands, with the most notable one adjacent to Unai Babui and Unai Chulu on the northwest coastline. In addition, freshwater runoff from unpaved roads enters nearshore waters and groundwater discharges through the porous karst aquifers at certain localities. As a result of unfavorable conditions promoting reef accretion through time, beaches are not well developed, with the exception of those at Tinian Harbor and at Unai Dankulu (Eldredge 1983). Most beaches are narrow with raised limestone features between the isolated pocket beaches (Eldredge 1983). The sand is primarily composed of coral-algal-mollusk rubble (Eldredge 1983). A sea-level bench can be found at the base of low to high cliffs around much of the coast (Eldredge 1983). Tinian sits atop a steeply sloping bank primarily composed of carbonate terraces. The submarine bank forms ridges as it extends from various portions of the island. Most of the island is surrounded by raised reef platforms with limited reef flat and lagoon development, likely due to a combination of groundwater discharge, high wave exposure, and unfavorable geological foundations. Reef flats of relatively limited extent can be found at several locations around the island, and vary in width from less than 15 m to approximately 180 m at Tinian Harbor (Eldredge 1983). The reef flats are mostly shallow, with irregular surfaces and a grooved margin. A single small lagoon with patch reefs is near Tinian Harbor, along the southwest shore. A barrier reef, attached to the shore by a fringing reef at Tinian Harbor, was altered to serve as a breakwater for the harbor. The lagoon, which was originally about 7 m deep, was altered during the construction of docking facilities (Doan et al. 1960; Eldredge 1983). Similar to Rota, long-term monitoring sites examined by local monitoring teams highlight low coral cover associated with unfavorable geology, but also show one key region of high coral growth in Barcinas Bay associated with low wave exposure on the leeward side of the island. Island-wide mean coral cover estimated from NOAA MARAMP towed-diver surveys along the seaward reef slope was low (8-13%) compared to other islands in the CNMI (Brainard et al. 2012).

## 5.2.4 Saipan

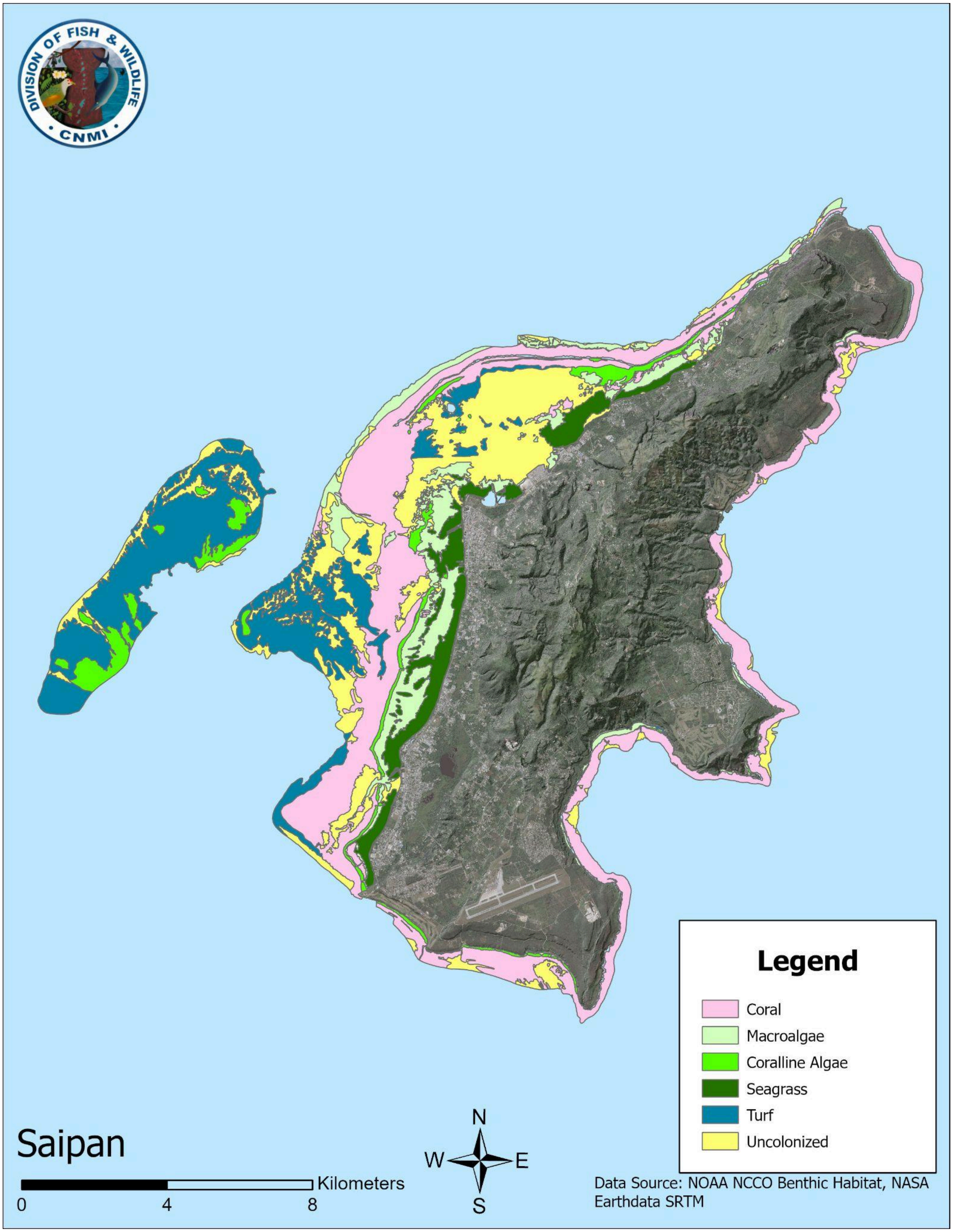

DIVISION OF FISH & WILDLIFE
CNMI
Legend
Coral
Macroalgae
Coralline Algae
Seagrass
Turf
Uncolonized
Saipan
0
4
8
Kilometers
N
W
E
S
Data Source: NOAA NCCO Benthic Habitat, NASA Earthdata SRTM

Figure 40. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Saipan.

Saipan, the largest island in the CNMI with a land area of 122 $km^2$, also possesses the largest reef area, with a total of 98 $km^2$ of reef (including the adjacent western banks) (Figure 40). The island is composed of a volcanic basement covered at most places by limestone (Cloud et al. 1956). Owing to its primarily limestone composition, surface water runoff is also limited on Saipan, with only a few intermittent streams. However, the amount of surface runoff is comparatively more than the other populated islands. Streams are found to the west of Okso' Talufo'fo and Okso' Achugao in the northeast of the island, and on the east-central coast adjacent to the island's largest watersheds. Perhaps due to the comparatively favorable geological and environmental setting, approximately 90% of the total CNMI population resides on Saipan, with most development concentrated along the west (leeward) coast. Steep headlands and cliffs, often buttressed with blocks and boulders, line much of Saipan's coast, similar to other islands (Eldredge and Randall 1980; Eldredge 1983). However, larger watersheds provide for greater amounts of low lying coastal plains, and gentler nearshore bathymetry that facilitates reef growth. Extensive fine-sand beaches are found along the western shore within the barrier lagoon, while most other beaches are composed of sand and gravel (Eldredge 1983). While most of the shoreline is limestone, volcanic material is exposed at Maigo Fhang (Bird Island), Puntan Fununchuluyan, near Puntan Hagman, and north of Puntan I Naftan (Eldredge and Randall 1980; Eldredge 1983).

Saipan hosts the most diverse set of coral-reef habitats and reef-associated assemblages in the CNMI (Starmer 2005). The Saipan Lagoon, which occupies an area of approximately 30 $km^2$, is deeper in the central part due to dredging to provide access to shipping vessels. In the northern and southern parts, a shallow-water lagoon exists with more limited coral growth. Mañagaha Island, a small lagoonal islet, is an important cultural and tourist destination in the central portion of the lagoon. Seagrasses and sand habitats dominate the lagoon, with coral habitats, which host coral, algal, fish, and other species not found elsewhere in the CNMI, covering smaller areas. All three seagrasses and other macro algae known to occur in the CNMI, including *Enhalus acoroides*, *Halodule uninervis*, and *Halophila minor* are found there (Tsuda et al. 1977). Fringing reef flat platforms are more frequent around Saipan compared to all other CNMI islands, and vary in width from a few meters to nearly 200 m at Bird Island (Eldredge and Randall 1980).

The reef flat platforms are covered by scattered boulders and exposed blocks, with coral growth most prevalent just behind the reef margin (Eldredge and Randall 1980). Corals are generally widely scattered on the shallow platforms, and are more abundant in deeper portions (Eldredge and Randall 1980). Limited reef development occurs on the windward eastern side of Saipan, likely due to exposure to high wind and wave energy (Houk and van Woesik, 2010). Broad shallow shelves like those found along the west coast are not as extensive. However, Bird Island and Lau Bay are two notable features with extensive reef flat platforms. Two large banks, including one that extends from approximately 10 km to the west of Saipan and another that extends from the harbor in the north to the southern end of the island, are used as anchorages for commercial and military vessels.

Island-wide mean coral cover estimated from MARAMP towed-diver surveys was moderately high (21%) in 2003, but appears to have declined in 2005 and 2007 (10-11%). While island-wide coral cover in 2003 was higher compared to other southern islands with similar marine habitats, coral cover was also highly variable around Saipan. NOAA MARAMP detected high coral cover Towed Optical Assessment Device (TOAD) video surveys at depths between 61-70 m on the western banks (Brainard et al. 2012). Local monitoring efforts have also found Saipan to be the most favorable southern island for reef growth and modern assemblages given the geological setting (Houk and van Woesik 2010).

## 5.2.5 Noos (Farallon de Medinilla)

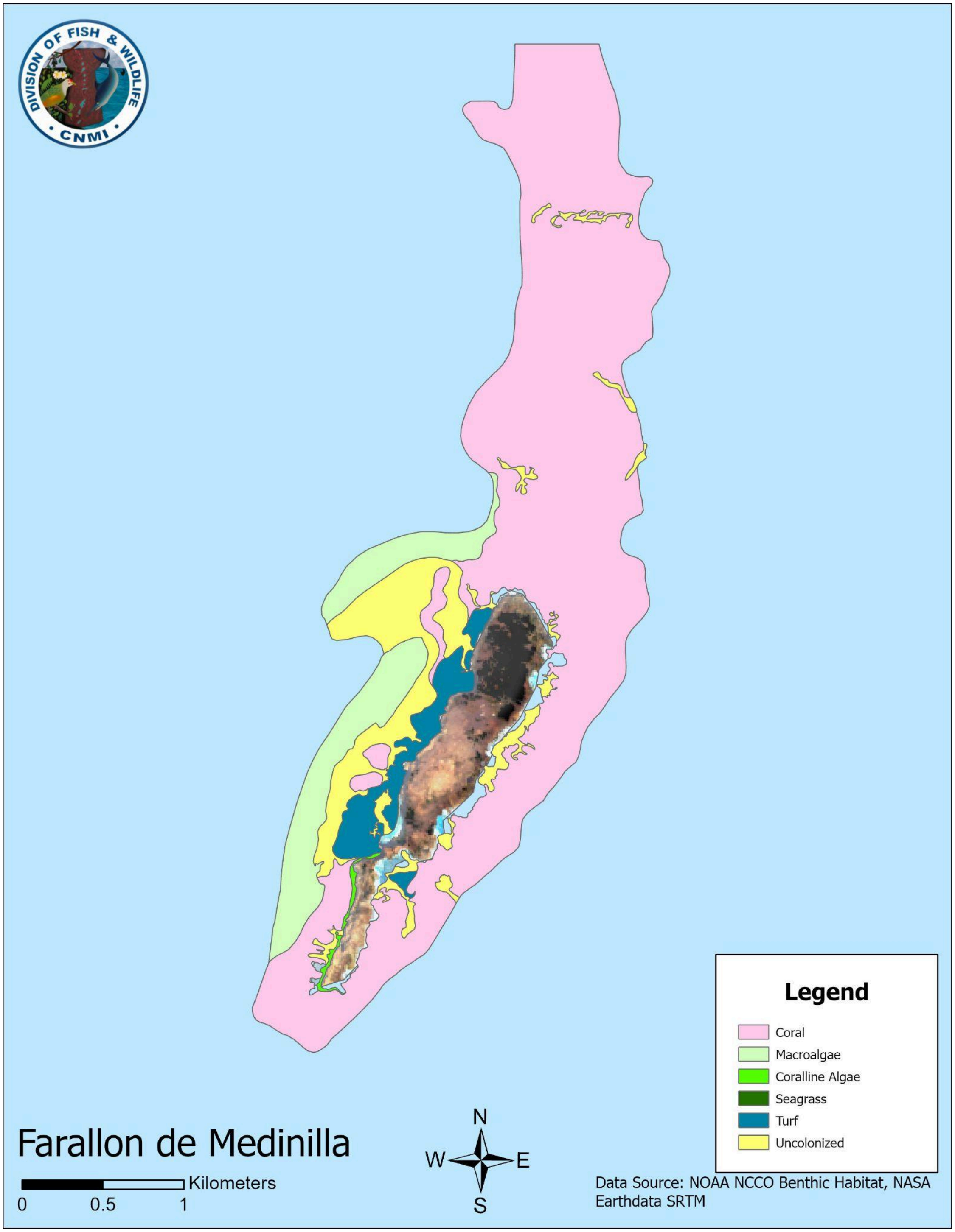



Figure 41. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Noos (Farallon de Medinilla).

Noos is a raised limestone island located approximately 83 km northeast of Saipan. The island has a total land area of about 0.9 km$^2$ and 6 km$^2$ of shallow reef area (Figure 41). The coastline has been reported as having near-vertical cliffs with some slumping along the northeastern shore (Eldredge and Randall 1980). Eroded large blocks and boulders form small islets around the island. The U.S. Navy and Air Force have used Noos as a bombardment range since 1971 (Eldredge 1983). A fringing reef that surrounds the island has been reported to be comprised of pavement with scattered boulders, some spur and groove formations, and sandy flats (Starmer 2005). A shoal reaching a depth of about 35 m is found approximately 1.8 km to the north of the island. A full assessment of marine habitats around Noos has yet to occur.

## 5.2.6 Anatahan

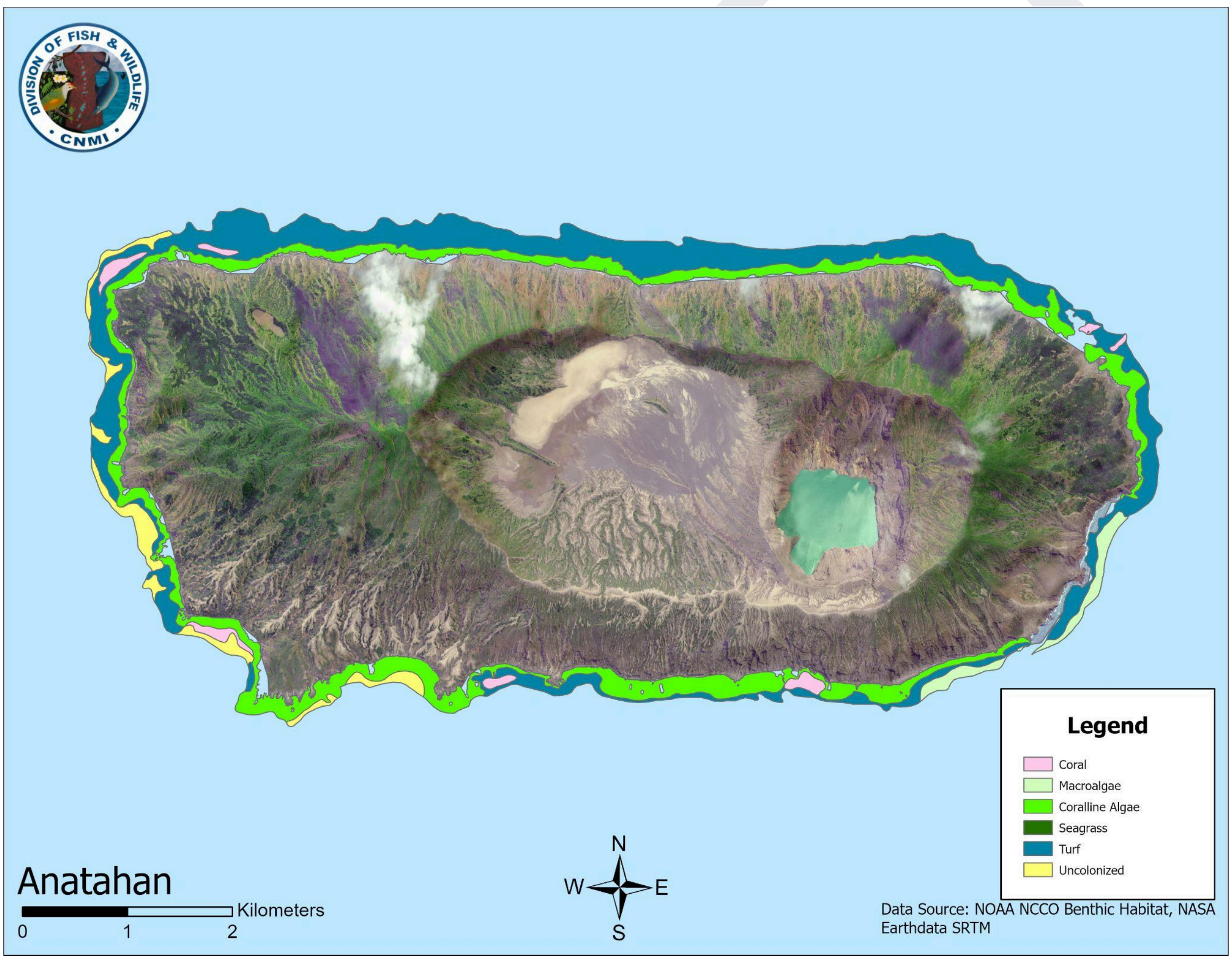
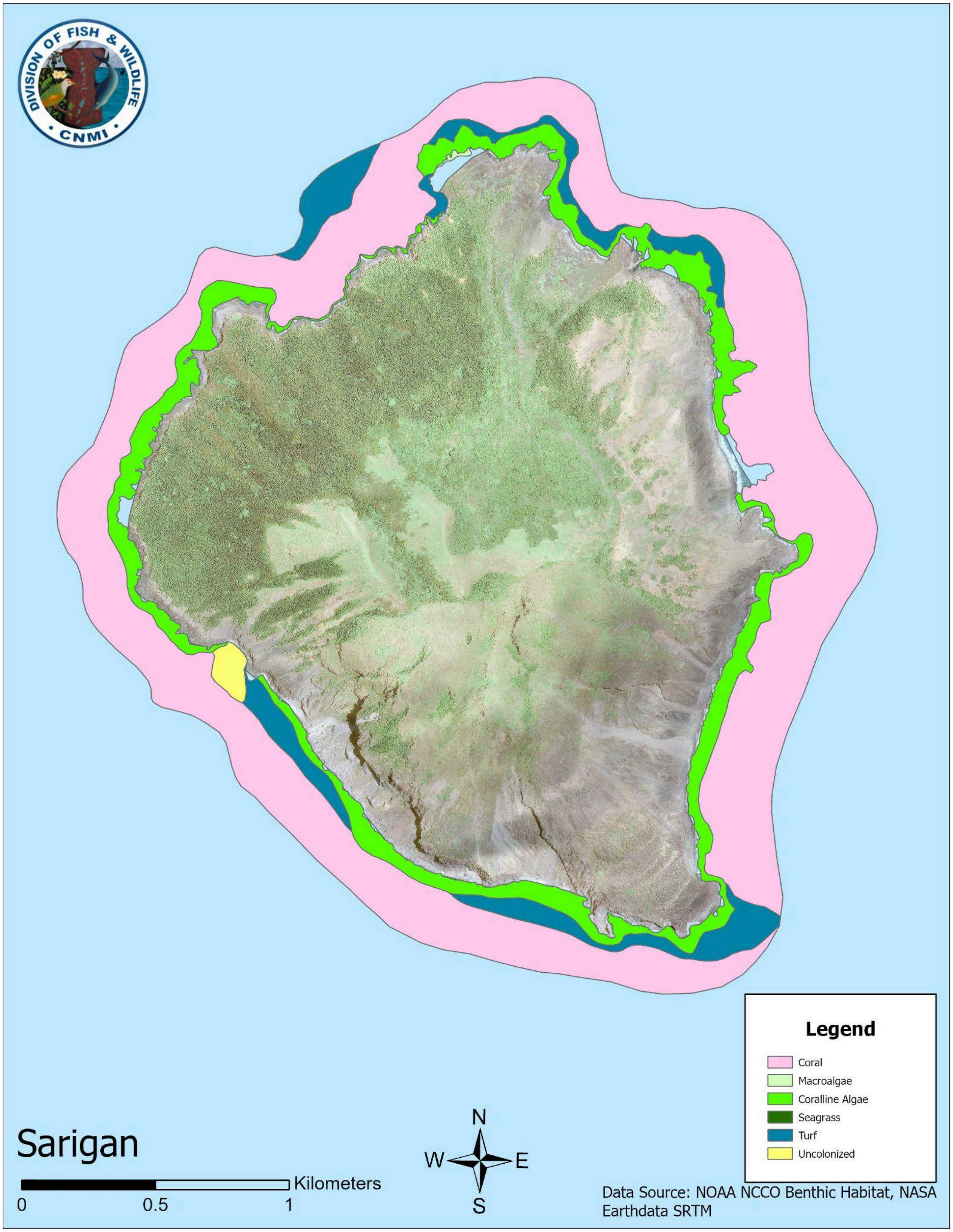



Figure 42. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Anatahan.

Anatahan is an active volcanic island 120 km north of Saipan and 40 km south of Sarigan. The island is the southernmost island in the Northern Islands Municipality, with a land area of about 33 $km^2$ and 6.5 $km^2$ of shallow (< 30 m) reef area (Figure 42). The steeply, highly irregular sloping flanks that surround the compound caldera continue underwater (Brainard et al. 2012). Steep cliffs and headlands line most of the shore, and in more protected areas large blocks and boulders buttress the cliffs. The southwestern shoreline consists of truncated basaltic platforms. Only a few, small, widely scattered sand beaches occur around Anatahan (Eldredge 1983). Recent seismic and thermal activity of the Anatahan Volcano has prevented human habitation in recent decades. A major eruption in 2003 covered Anatahan village, and much of the island, in volcanic ash. The ash also affected nearshore waters. In 2005 and 2007 NOAA CRED reported that the waters surrounding the island were a deep brown color due to the large amount of ash and volcanic input. Visibility was reported as < 0.6 m, which prevented surveys of any kind during the 2005 and 2007 MARAMP expeditions. It was also reported that the entire island was void of vegetation, and it was suspected that rainfall would easily wash ash and other material into nearshore waters (Brainard et al. 2012). Prior to the recent volcanic activity and associated destruction of most or all vegetation, the landscape of Anatahan had been significantly altered by pigs and goats, rapidly transitioning from high native forest cover as recent as 1994 to a primarily sword grass-dominated landscape in 2000 (Cruz et al. 2000a). Observations from NOAA MARAMP towed-diver surveys and TOAD video surveys suggest that the marine habitats of Anatahan are primarily sandy substrates supporting very low levels of live coral cover. Ash was observed covering benthic habitats in most of the towed-diver surveys. Habitat off the north and northeast coasts were of low to medium complexity, with high sand cover and relatively low coral cover. Sand flats with boulders, including a portion of the southeast coast with medium to medium-high complexity, were encountered in the south and southeast of Anatahan, while coral cover was variable. Sandy habitats, with scattered boulders and low coral cover, were reported from the west region, while in the northwestern point of the island relatively high coral cover was recorded. Island-wide mean coral cover estimated from towed-diver surveys was relatively low (8%).

## 5.2.7 Sarigan



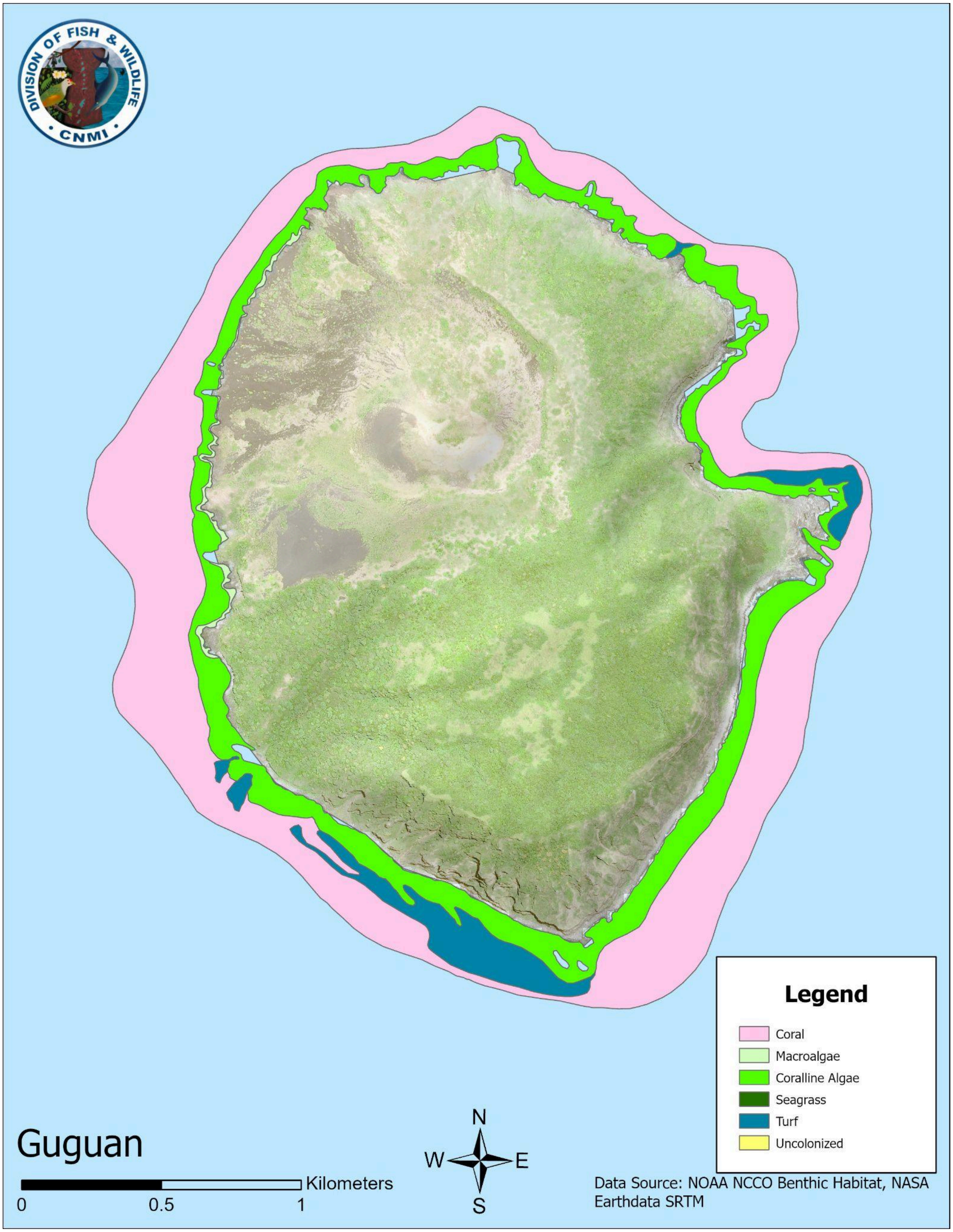
DIVISION OF FISH & WILDLIFE
CNMI
Legend
Coral
Macroalgae
Coralline Algae
Seagrass
Turf
Uncolonized
Sarigan
0
0.5
1
Kilometers
N
W
E
S
Data Source: NOAA NCCO Benthic Habitat, NASA Earthdata SRTM

Figure 43. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Sarigan.

Sarigan, which is centrally-located in the archipelago between Guguan to the north and Anatahan to the south, is, like most other islands in the CNMI, formed by the exposed summit of a mostly submarine volcano. With a land area of 4.9 $km^2$, the island is the fourth-smallest in the archipelago. A crater is located at the southern part of the island, and steep cliffs and irregular shorelines created by lava flows surround the island. Vegetation cover is relatively sparse, possibly indicating that the most recent eruption occurred sometime during the Holocene. It is generally held that Sarigan has been uninhabited since residents were removed after WWII, but 2010 legislation encouraging repatriation may lead to the repopulation of the island in the future. Owing to its lack of inhabitants and isolation, there are believed to be minimal anthropogenic pressures on Sarigan's marine environment; however, multi-day fishing trips to Guguan and banks to the south may impact fish stocks around Sarigan. Feral animals had significantly impacted the landscape of Sarigan, but since the elimination of the animals between 1997 and 1998, vegetation has dramatically recovered and sedimentation of nearshore waters has likely decreased as a result (Starmer 2005).

In contrast to the steep submarine slopes that surround most of the northern islands, Sarigan is surrounded by a shallow shelf (30-150 m) that extends east for 2.7 km before it drops off steeply. The island possesses approximately 2.6 $km^2$ of shallow (< 30 m) reef area (Figure 43). Along the west side of the island, the edge of the shelf is intersected by channels and ridges. Towed-diver observers reported habitat complexity in the east as medium to medium-high, with a variety of habitats including boulders and pinnacles, rocky crags, and sand with boulder patch reefs. Habitat complexity in the northwest ranged from low to high, with patchy sand cover, boulders, steep walls, and continuous rocky reef. NOAA MARAMP TOAD video surveys at depths of 91-190 m found hard substrates with no living coral cover. Habitat in the southwest consisted of boulders and continuous reefs with sand patches. The substrate in the southwest was described as mainly hard substrate, with limited sand cover, and no live coral cover. Island-wide mean coral cover estimated during NOAA MARAMP towed-diver surveys was moderate (13-18%) compared to other islands in the archipelago. High coral cover (> 50%) habitat was observed at localized areas along the southwest and eastern shores.

## 5.2.8 Guguan



DIVISION OF FISH & WILDLIFE
CNMI
Legend
Coral
Macroalgae
Coralline Algae
Seagrass
Turf
Uncolonized
Guguan
Kilometers
0
0.5
1
N
W
E
S
Data Source: NOAA NCCO Benthic Habitat, NASA Earthdata SRTM

Figure 44. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Guguan.

Guguan, which is located in the middle of the archipelago, is formed by two volcanoes, including an older, eroded, vegetated volcano to the south, and a barren active volcano to the north. The island has a land area of 4.2 $km^2$, making it the third smallest island in the archipelago, and it possesses approximately 2.1 $km^2$ of shallow (< 30 m) reef area (Figure 44). Compared to neighboring islands of Alamagan and Sarigan, Guguan's elevation is relatively low and its slopes less steep. Guguan has not been inhabited and remains relatively undisturbed, supporting a diversity of terrestrial habitats and wildlife. The CNMI Constitution bans development on Guguan and has been declared a wildlife conservation area (Starmer 2005). Guguan's coastline is mostly surrounded by steep cliffs and is highly irregular. Low, truncated basaltic platforms are found along the southwest shore, and a narrow, well-protected boulder and cobble shore occurs on the west coast. Vertical cliffs buttressed with blocks comprise the shore along the north and northwest of the island, and a small embayment surrounded by vertical cliffs occurs along the east coast (Eldredge 1983). The north of Guguan is surrounded by flanks with ridges in shallower (< 300 m) depths, but the slopes are relatively uniform and smooth below these depths. NOAA CRED towed-diver observers reported marine habitat of medium to high complexity, primarily spur and groove habitat, in the north. The substrate was reported as primarily hardbottom, with low sand cover. Irregular shelves extend off the south of Guguan, including a flat, shallow (25-50 m) shelf composed of hard substrate and a deeper (80-130 m) shelf that is predominantly composed of unconsolidated substrate. The steeply sloping flanks to the north and west and the extensive shelves in the south are highly similar to the general seascape of neighboring Sarigan. Island-wide mean coral cover estimated from NOAA MARAMP towed-diver surveys was moderate (23-27%) compared to other islands in the archipelago.

## 5.2.9 Alamagan

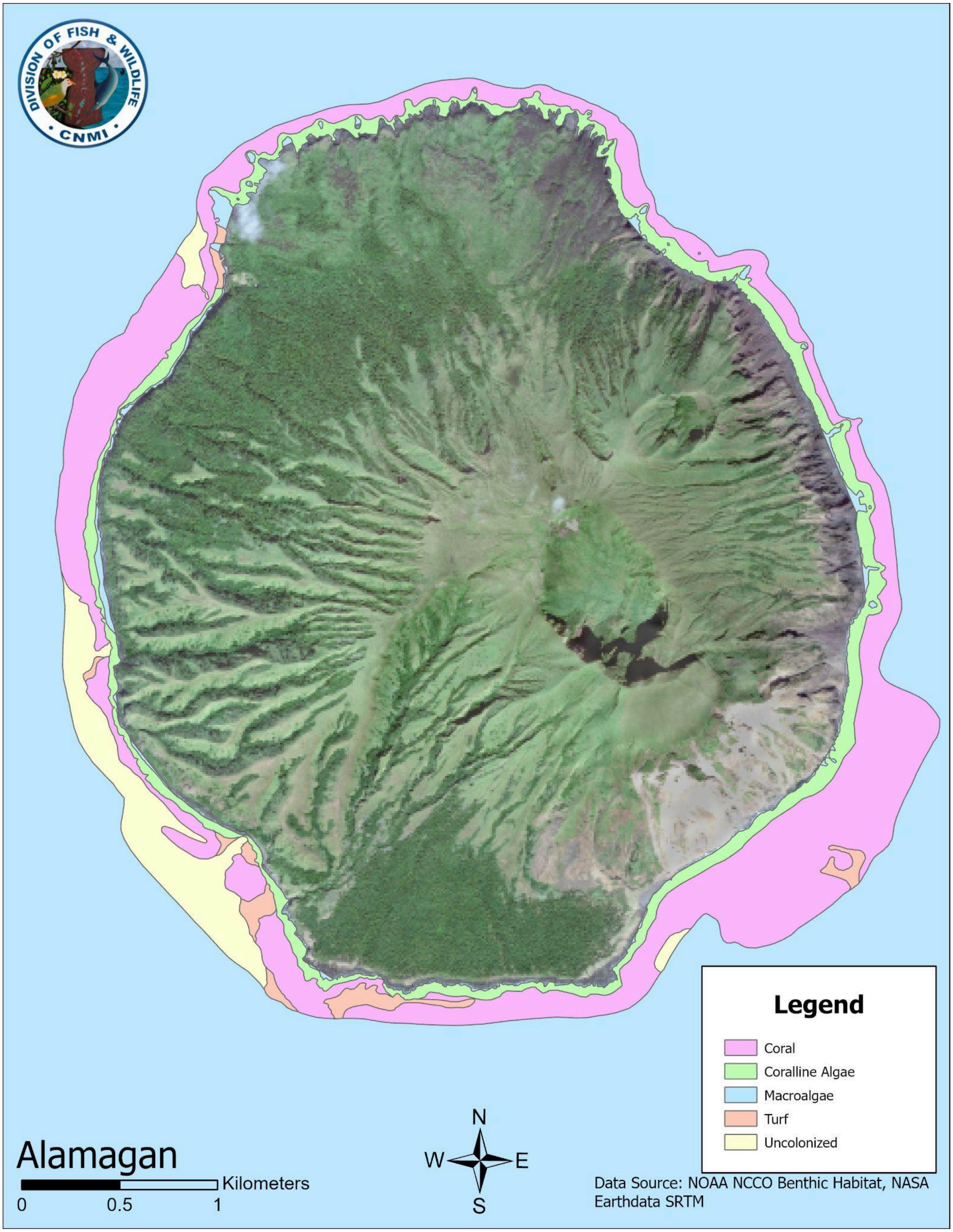
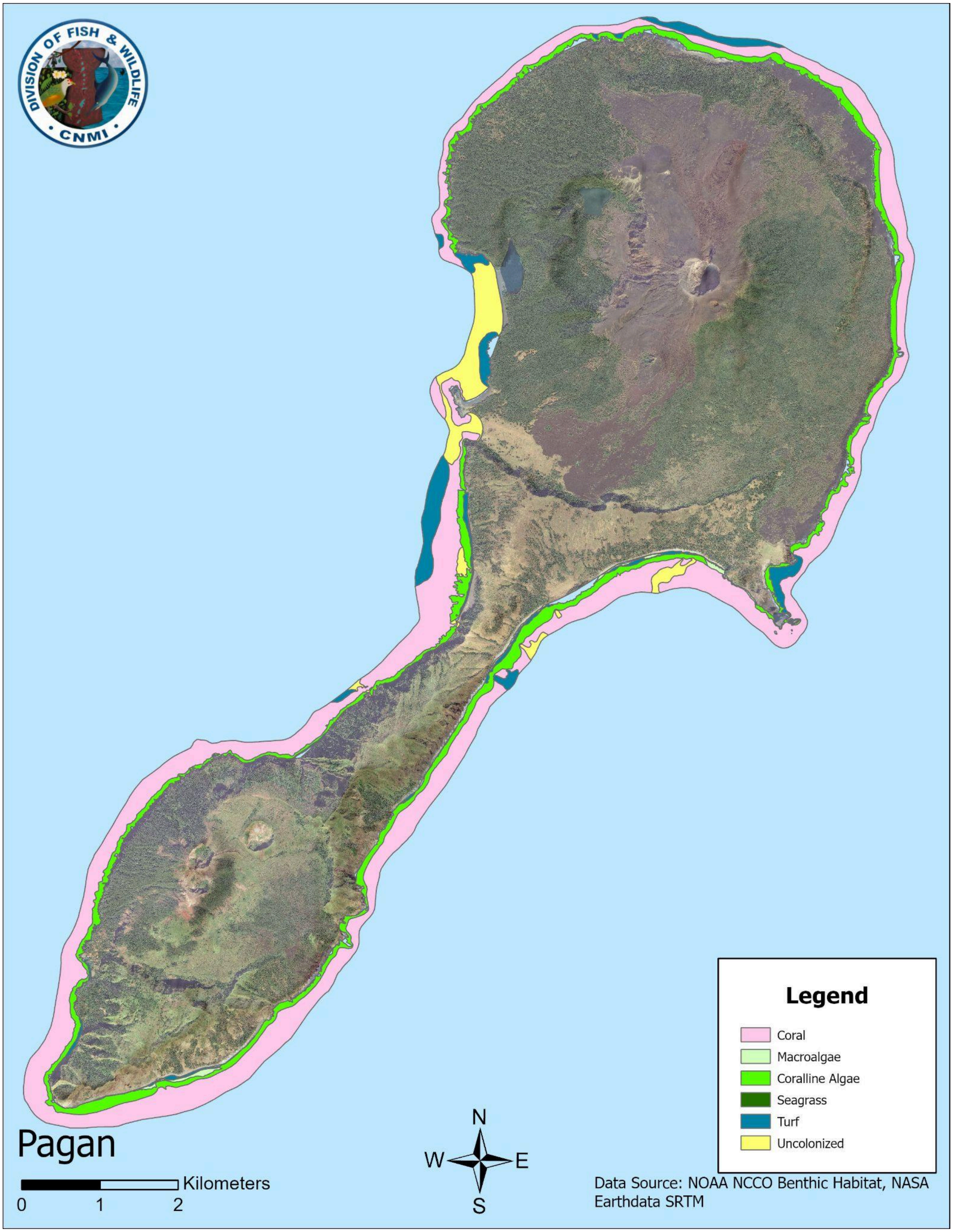


Figure 45. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Alamagan.

Alamagan is a steep-sloped active volcano in the middle of the archipelago with an area of 12.96 $km^2$ and approximately 3.4 $km^2$ of shallow (< 30 m) reef area (Figure 45). A deep crater sits atop Bandeera Peak, which is surrounded by steep slopes; flatter areas formed by lava flows extending to the north and south of the peak. Sea cliffs line most of the coastline. No small-grained beaches occur on the island. No recent volcanic activity has been reported for Alamagan, with the last known eruption occurring around AD 870. Small human populations have inhabited the island in the past, and a small homestead site has been established on the northwestern side of the island. The island's human population is expected to increase in the future, due to legislation enacted in 2000 that encourages settlement of Alamagan. Extensive impacts to vegetation by feral pigs, goats, and cattle are likely resulting in increased sedimentation of nearshore marine habitats (Starmer et al. 2008). Moderately steep submarine flanks in the north and northeast are interrupted by steep, narrow ridges that are described by towed-diver survey observers as composed of hard substrate of medium to high complexity. A small shelf with a complex substratum occurs in the southeast, while in the west a more extensive shelf is found at depths of 25-40 m. A second deep shelf occurs on the southwest of the island at depths of 80-120 m. Marine habitat in the south was described as having lower complexity, with high sand cover. Island-wide mean coral cover estimated from NOAA MARAMP towed-diver surveys was relatively high (17-22%) compared to other islands in the archipelago.

## 5.2.10 Pagan



Legend
Coral
Macroalgae
Coralline Algae
Seagrass
Turf
Uncolonized
Pagan
Kilometers
0
1
2
N
W
E
S
Data Source: NOAA NCCO Benthic Habitat, NASA Earthdata SRTM

Figure 46. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Pagan.

Pagan is the fourth largest island in the CNMI, with a land area of 46 $km^2$ and 12.1 $km^2$ of shallow (< 30 m) reef area (Figure 46). The island was formed by two large volcanoes, the northern one active and the southern one dormant; the volcanoes are separated by a narrow isthmus. The steeply sloping flanks of Mount Pagan in the north descend to depths > 2000 m, while the slopes in the south extend to depths > 3000 m. Ridges and pinnacles can be found on the steep slopes. Pagan has been inhabited sporadically and mainly on a seasonal basis since the evacuation of residents after a major volcanic eruption of Mount Pagan occurred in 1981 and subsequent recent volcanic activity in the 2020's have prevented full-time residency. The ashfall from the 1981 event was reported to have negatively impacted coral reef habitat around the island (Eldredge and Kropp 1985), and continued erosion of ash into nearshore waters and sedimentation resulting from damage to vegetation by feral pigs and cattle are potentially impacting reef habitat (Starmer et al. 2008). The depth of ash outfall on land from the 1981 eruption was correlated with compromised assemblages assessed in the mid-2000s (Houk and Starmer 2010), suggesting that coral recovery is impeded by naturally unfavorable environments or intermittent ash deposition into adjacent waters over the years.

NOAA MARAMP towed-diver observers described shallow marine habitats in the north and east as moderately complex with hard substrate. TOAD video surveys conducted at depths of 50-100 m in the north and east suggest primarily hard substrates with patchy sand cover. Coral colonies were rarely observed at the TOAD survey depths, although it should be noted that these surveys covered only a small portion of the island. Shallow habitat in the northern parts of the south and west regions were of low complexity, dominated by soft-sediment habitats and possessing very little coral cover, while habitats were moderately complex on either side of the narrow isthmus connecting the north and south, and were primarily hardbottom with moderate coral cover. Sand and other low complexity habitats were dominant around South Point, more so than any other part of Pagan. TOAD video surveys conducted off the south coast at depths of 15-100 m suggest relatively low coral cover. Island wide mean coral cover estimated from towed-diver surveys was moderate-to-high (10-19%) compared to other islands in the CNMI.

## 5.2.11 Agrihan

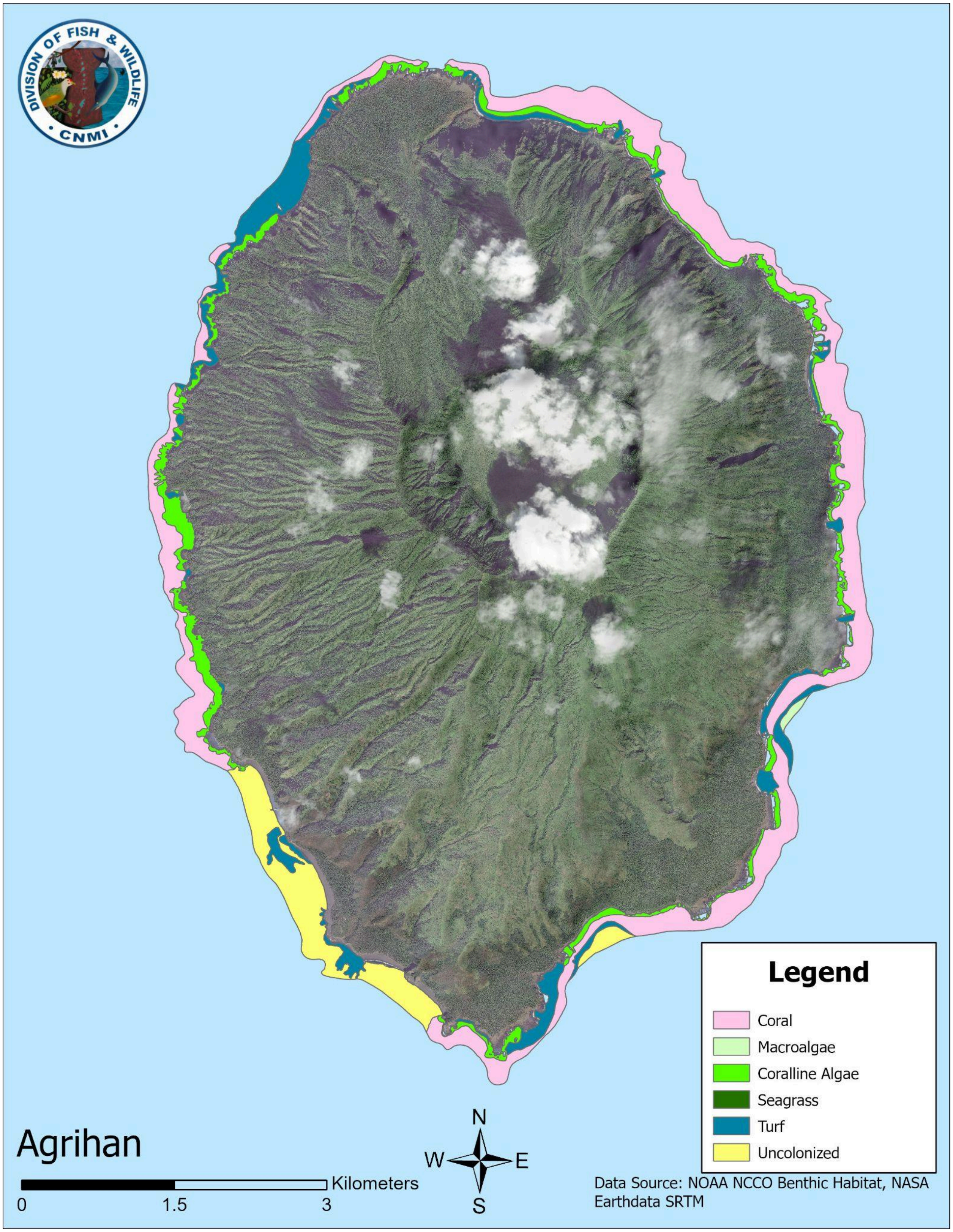


Figure 47. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Agrihan.

Agrihan, the tallest island in the Mariana Archipelago, is 65 km north of Pagan. Agrihan is also one of the largest northern islands, with a land area of 44 $km^2$, and possesses approximately 6.5 $km^2$ of shallow (< 30 m) reef area (Figure 47). The island, which reaches a summit of 965 m, is surrounded by steep slopes and sea cliffs. Agrihan has been inhabited sporadically over the last century, owing to volcanic activity. One of the four original villages has been resettled and now has a small permanent population. As with many of the northern islands, the vegetation has been impacted by feral animals. The impact of feral animals on vegetation is particularly severe on the east side of the island. Coral reef habitats on that side of the island are believed to have been impacted by the resulting sedimentation of nearshore waters (Starmer 2005).

The seascape of Agrihan consists of steeply sloped volcanic flanks cut by channels. A submarine ridge created by lava flow occurs off the northwestern coastline, and a shallow (30-40 m) shelf is found around much of the island. Towed-diver observers reported marine habitats of medium to high complexity in the northwest, dominated primarily by hardbottom and possessing little sand cover. Habitat in the northeast was more varied, ranging from medium-low to high complexity, and consisted of pavement, boulders on sand, and rocky ridges. Habitat in the southeast was of low complexity, and was characterized primarily by areas of high sand cover alternating with moderate-relief patch reefs and higher complexity spur-and-groove habitat. A large portion of the shallow southwest benthos was of low to medium-low complexity and was characterized by high sand cover and very low coral cover. Island-wide mean coral cover estimated from NOAA MARAMP towed-diver surveys was moderate (14-16%) compared to other islands in the CNMI.

## 5.2.12 Asuncion

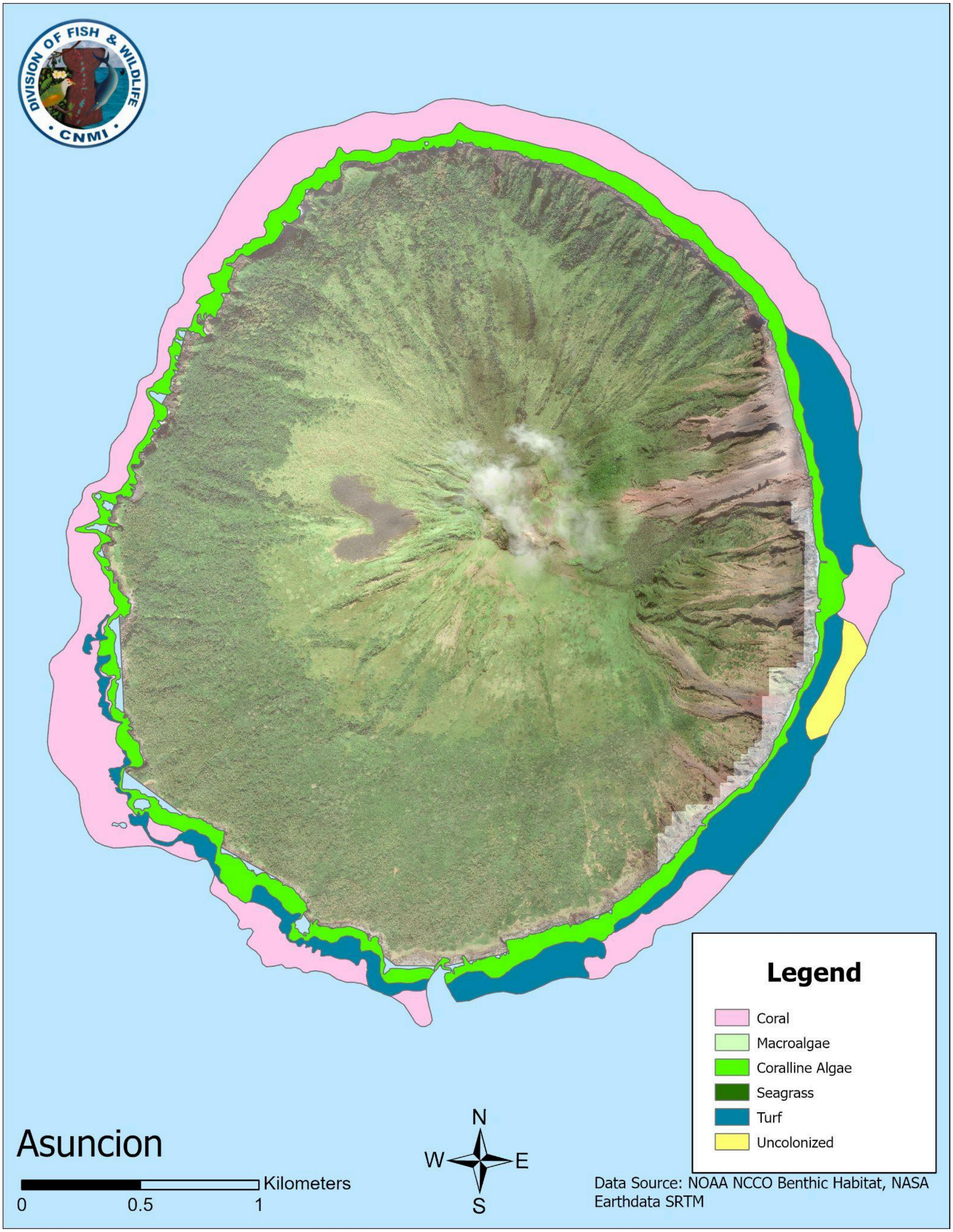
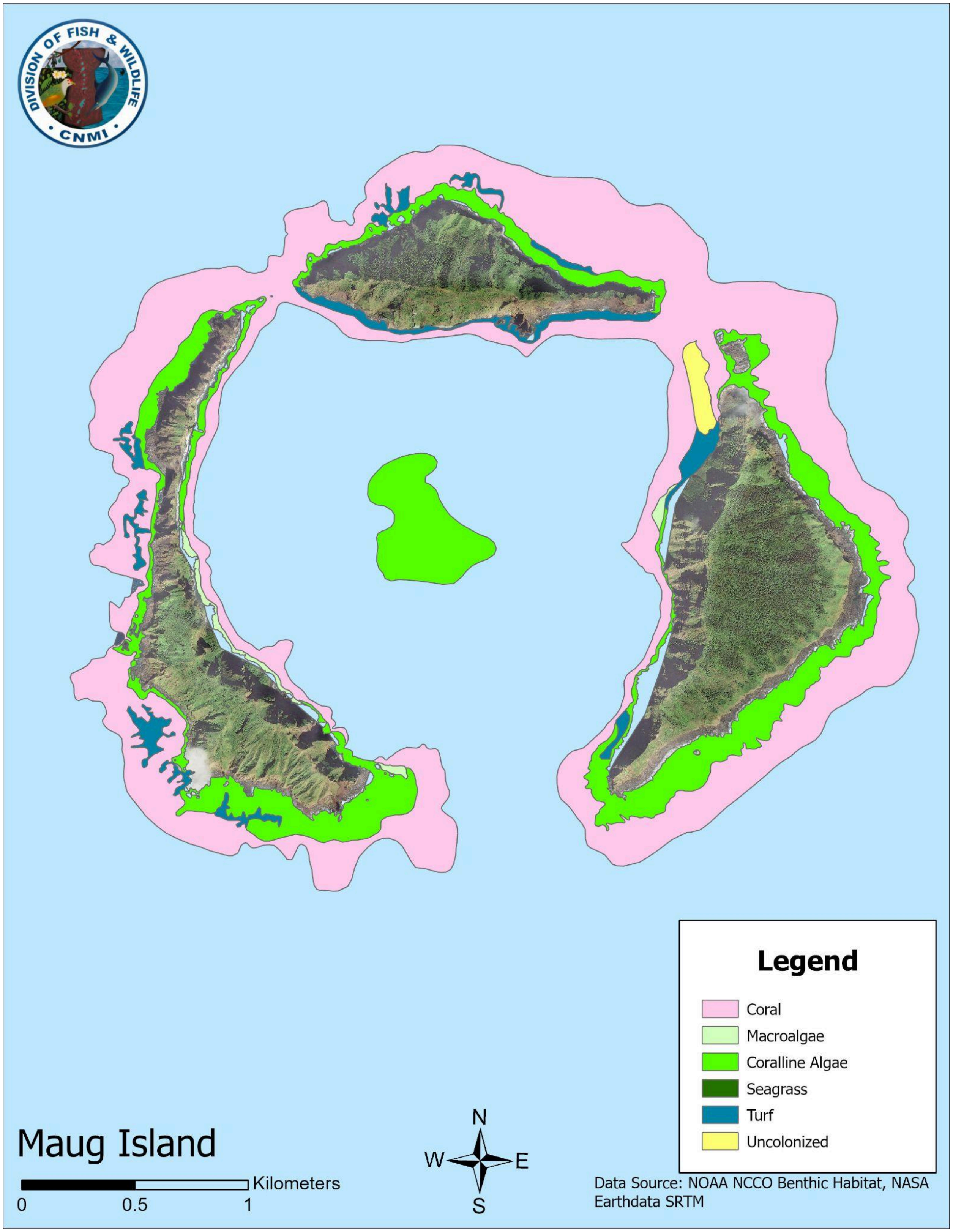


Figure 48. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Asuncion.

Asuncion is the third most northerly island of the Mariana Archipelago, located approximately 100 km north of Agrihan. Asuncion has a land area of 7.76 $km^2$ and 2.2 $km^2$ of shallow (< 30 m) reef area (Figure 48). The active volcanic island is protected under the CNMI Constitution as an important habitat for birds, wildlife, and plants. In 2009 the waters and submerged lands around Asuncion were designated part of the Islands Unit of the Marianas Trench Marine National Monument. Asuncion's slopes are the steepest among the northern volcanic islands. NOAA MARAMP towed-diver surveys reported marine habitat of medium to medium-high complexity, predominantly hardbottom supporting relatively low hard coral cover. The seafloor on the south of Asuncion is dominated by a large, flat shelf with several terraces. Island-wide mean coral cover estimated from NOAA MARAMP towed-diver surveys was moderate (10-18%) compared to other islands in the CNMI. Coral cover and colony density was highest on the west side of the island. Hard corals and sea pens (Order Pennatulacea) were observed between 70 and 600 m in TOAD survey video.

## 5.2.13 Maug



Legend
Coral
Macroalgae
Coralline Algae
Seagrass
Turf
Uncolonized
Maug Island
Kilometers
0
0.5
1
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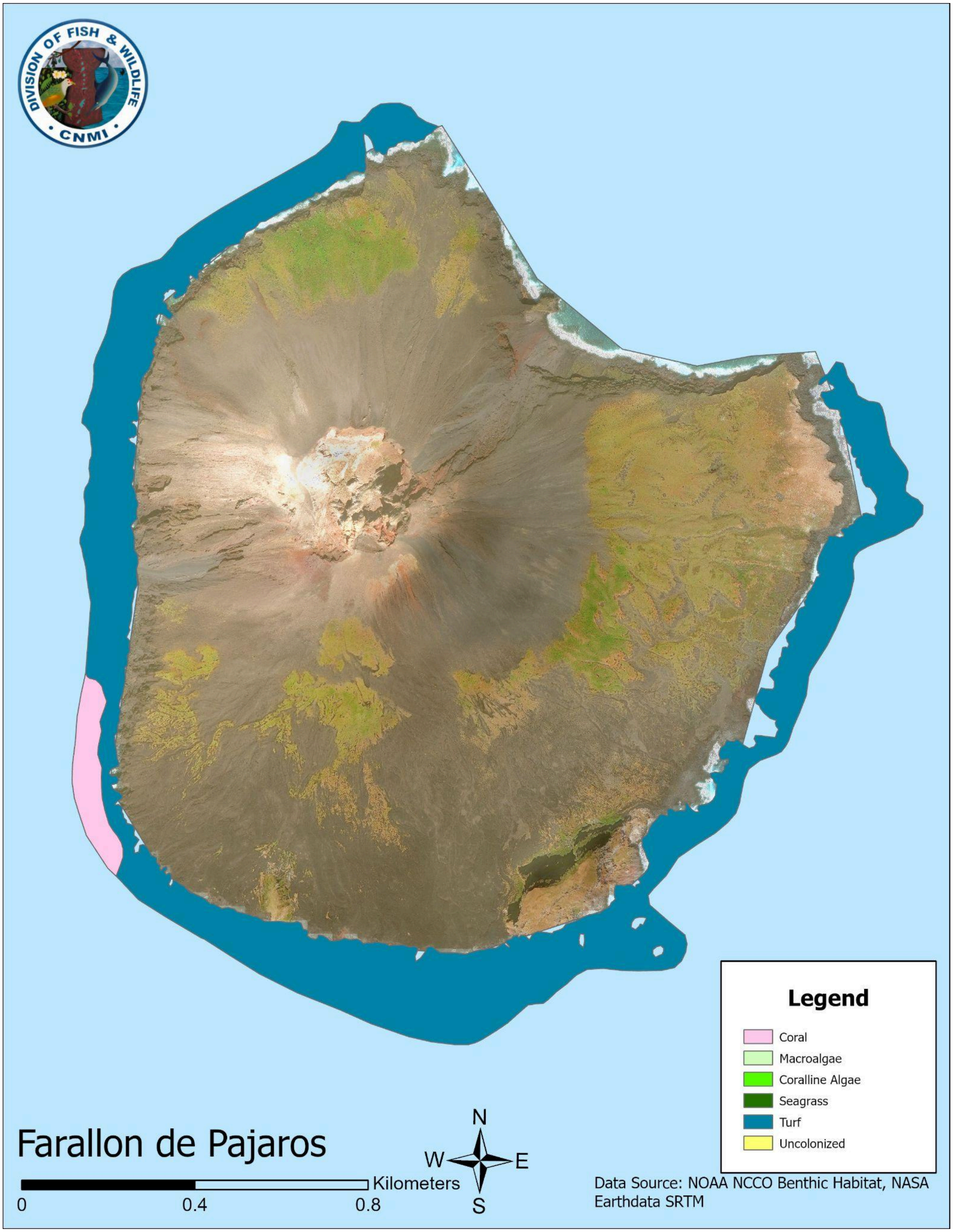
W
E
S
Data Source: NOAA NCCO Benthic Habitat, NASA Earthdata SRTM

Figure 49. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Maug.

Maug comprises three separate islands (Higashi, Kita, and Nishi) formed by the rim of a submerged caldera. At a combined area of just over 2 $km^2$, these islands are the smallest in the CNMI. However, Maug possesses approximately 3.5 $km^2$ of shallow (< 30 m) reef area (Figure 49), second highest of the northern islands after Pagan. The islands each possess a narrow central ridge with steep slopes that terminate in sea cliffs along the coast. There have been no recent eruptions of the Maug volcano, but an active hydrothermal vent was observed during the 2003, 2005, and 2007 MARAMP cruises. Habitation or the building of permanent structures is prohibited on Maug under the CNMI Constitution, and in 2009 the islands, submerged lands, and waters of Maug were included in the Islands Unit of the Marianas Trench Marine National Monument. The steep outer slopes of the Maug volcano extend to a depth greater than 1500 m, while the submerged caldera reaches depths of between 200 and 240 m. A twin-peaked submarine dome rises to a depth of 20 m within the caldera. Towed divers reported habitat complexity as medium to high, with the benthos dominated by hardbottom and with low levels of sand cover compared to other areas in the archipelago. Island-wide mean coral was high 21-27% in the shallow waters surveyed during NOAA MARAMP towed diver surveys. Little coral cover was detected from TOAD video surveys in deeper waters, although some live coral was observed on the central dome at a depth of about 160 m.

## 5.2.14 Uracas


DIVISION OF FISH & WILDLIFE
CNMI
Legend
Coral
Macroalgae
Coralline Algae
Seagrass
Turf
Uncolonized
Farallon de Pajaros
N
W
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S
0
0.4
0.8
Kilometers
Data Source: NOAA NCCO Benthic Habitat, NASA Earthdata SRTM

Figure 50. National Centers for Coastal Ocean Science (NCCOS) shallow water (<30m) benthic habitat map of Uracas (Farallon de Pajaros).

Uracas, also known as Farallon de Pajaros, is the northernmost island in the Mariana Archipelago, located 67 km northwest of Maug. It is the second-smallest island, with a land area of 2.2 $km^2$ and 0.5 $km^2$ of shallow (< 30 m) reef area (Figure 50). While the summit of this active volcano reaches an elevation of 360 m above sea level, the feature rises more than 2000 m from the seafloor and is between 15 and 20 km in diameter at its base. The aerially exposed summit is surrounded by steeply sloping sides covered with lava, cinders, and ash. The slopes extend downward to precipitous cliffs, which surround much of the coast. Uracas is one of the most volcanically active islands in the CNMI, with at least 15 known eruptions recorded since 1864 and the most recent in 1967. Volcanic activity and landslides are likely the most significant drivers of change in benthic habitat structure and community composition. Anthropogenic pressures are likely minimal, as CNMI-based fishing activity tends to be focused around the southern islands and multi-day fishing trips focused primarily on the islands and banks south of Guguan (Western Pacific Fishery Management Council, 2009). However, the level of fishing pressure from foreign vessels is unknown. With limited reef area and limited reef fish biomass, reef fish stocks could likely be significantly affected by relatively little fishing pressure. Uracas, including the island and the surrounding waters and submerged lands, is also part of the Islands Unit of the Marianas Trench Marine National Monument. Multibeam acoustic bathymetry data collected during NOAA MARAMP expeditions revealed steeply sloping flanks surrounding Uracas, with ridges extending from < 30 m to 400-600 m. The data also indicate a narrow shelf between 10 and 40 m along the South and East sides of the island, and another larger shelf that extends from the northeastern point at depths between 150 and 250-300 m. Boulders were common along the slopes, indicating mass-wasting of surface material. Observations made during towed-diver surveys carried out during MARAMP expeditions indicate that the northeast and southeast regions, particularly on the shallow shelf extending from large embayments, possessed the lowest levels of habitat complexity and relatively high sand cover. In contrast, the west and south regions exhibited medium to medium-high habitat complexity, with patches of rocky reef and boulders on sand. Hard coral cover estimated from MARAMP towed-diver surveys was generally low (< 10%) in comparison to other islands in the archipelago. An exception was 30-40% coverage observed on the shallow shelf in the southeast region.

## 5.2.15 Offshore banks and shoals

### 5.2.15.1 Esmeralda Bank

Esmeralda Bank is a submerged stratovolcano located on the Mariana Arc, approximately 57 km southwest of Saipan and 37 km west of Tinian. The bank, which is one of 21 seamounts protected within the Volcanic Unit of the Marianas Trench Marine National Monument, is one of the southernmost active volcanoes in the Mariana Arc (Stern and Bibee 1984). Multibeam acoustic bathymetry data collected during NOAA Ocean Explorer expeditions indicated that the summit of Esmeralda Bank, which reaches a minimum depth of 43 m, is the rim of a crater approximately 300 m deep. No diver surveys have been carried out on Esmeralda Bank, but three TOAD surveys covering a distance of about 1 km at depths between 63 and >100 m were conducted during MARAMP 2003. Analysis of the TOAD surveys, all of which were located on the north crater rim, revealed both sandy seabeds and hard substrate. Live corals appeared quite rare, with only one of the 189 analyzed video frames revealing any coral colonies (Brainard et al. 2012).

### 5.2.15.2 Marpi Bank

Marpi Bank, which is located ~18 km north of Saipan, is a flat-topped structure that is likely composed of uplifted limestone overlying a volcanic basement. The bank is part of the older Mariana frontal arc, formed 15 to 20 million years ago. Multibeam bathymetry data collected by NOAA CRED indicate that the bank reaches a minimum depth of 53 m and that it has an elongated shape approximately 7 km long and 3 km wide. The bathymetry data suggests that the seafloor surrounding the bank is characterized by low slopes with ridges, fissures, and blocks of material likely derived from erosional processes. While observational data are not available to describe the habitat composition, mounds and channels on the top of the bank revealed by the NOAA CRED multibeam data may be indicative of coral habitat. Marpi Bank is reported to be a popular fishing location (Starmer 2005).

### 5.2.15.3 Zealandia Bank

Zealandia Bank is a submerged stratovolcano located on the active Mariana Arc, approximately 25 km northeast of Sarigan Island. The flat-topped bank, which is part of the Volcanic Unit of the Marianas Trench Marine National Monument, is elongated and formed by two volcanic pinnacles located approximately 1 km apart. One of the two pinnacles extends about 1 m above sea level during low tide (Siebert and Simkin, 2002) (NOAA CRED). Insufficient data exists to thoroughly describe the habitat of Zealandia Bank, but a single TOAD survey conducted during MARAMP 2003 at depths between 70 m and 120 m suggests that the substrate is variable, with about a third classified as hard substrate and the remainder as sand or mixed. No live hard corals were recorded during the survey.

### 5.2.15.4 Supply Reef

Supply Reef is a stratovolcano located on the active Mariana Arc, approximately 18.5 km northwest of Maug. Maug and Supply Reef form a twin volcanic massif, connected by a low saddle at a depth of about 1800 m (Siebert and Simkin 2002). Supply Reef was mapped using multibeam acoustic sonar during MARAMP 2007, adding to data collected by the NOAA Vents Program. The data indicated that Supply Reef reached a minimum depth of approximately 10 m, that the reef is conical with steep sides, and that the total area of shallow (< 30 m depth) reef was approximately 0.1 $km^2$. Observations made from a single towed-diver survey (4-25 m depth) during a 2003 NOAA MARAMP expedition suggest that the upper reaches of Supply Reef possessed habitat of medium-high to high complexity, with high live coral cover (30-50%) and low sand cover (<5%). The results of the two TOAD surveys indicate that reef habitat at mesophotic depths was similarly dominated by hard substrate, but live corals were rare (Brainard et al. 2012).

### 5.2.15.5 Arakane Reef

Arakane Reef is a small, shallow bank located approximately 110 km southwest of Tinian on the West Mariana Ridge. Multibeam bathymetry data collected during a MARAMP expedition indicated that the total area of shallow (< 30 m depth) reef was about 0.5 $km^2$. Observations made during towed-diver surveys conducted during the 2003 and 2005 MARAMP expeditions suggested that the shallower depths of Arakane Reef were dominated by hard substrate with medium-low to medium complexity, but small, scattered sand patches were also present. Mean coral cover estimated from towed-diver surveys was 24% in 2003 and 12% in 2005, the lowest of the other surveyed reefs on the West Mariana Ridge. Towed-diver observers noted a high abundance of soft corals and fire corals. Analysis of TOAD survey video suggested a great degree of variability in coral cover (0-100%) at depths ranging from 20-280 m.

### 5.2.15.6 Pathfinder Reef

Pathfinder Reef is a remnant volcanic ridge located approximately 150 km west of Saipan, on the southern part of the West Mariana Ridge. Pathfinder Reef was surveyed in 2003 and 2005 as part of NOAA CRED's MARAMP. While no multibeam acoustic bathymetry data were collected at the site, single-depth soundings from 2003 indicated a minimum depth of 10 m and a total area of shallow (< 30 m depth) reef of about 0.9 $km^2$. Observations made during towed-diver surveys and the results of an analysis of TOAD video indicate that the seafloor at the summit of Pathfinder Reef is predominantly composed of hard substrate, with medium-low to medium-high habitat complexity. The reef was described as “atypical spur and groove, with gently sloping mounds of coral interspersed with hard pavement channels.” Estimates of live coral cover from NOAA MARAMP towed-diver surveys ranged from 10-40%, with a mean of 24% in 2003 and 25% in 2005. Coral cover was highest (35%) along the interior, western edge, and northern border of the reef. Estimates of live coral cover from an analysis of TOAD video surveys, which cover more restricted portions of the seafloor compared to towed-diver surveys, were highly variable, ranging from 0-100%.

#### 5.2.15.7 Stingray Shoals

Stingray Shoals is a remnant volcanic seamount located on the northern end of the West Mariana Ridge approximately 275 km west of Uracas. The steep-sided pinnacle, which reaches a minimum depth of 13 m, is part of the Volcanic Unit of the Marianas Trench Marine National Monument. NOAA CRED surveyed Stingray Shoals in 2003 during the first MARAMP research expedition. While the full suite of coral reef surveys were not carried out at the site, towed-diver surveys were conducted near the summit of the shoals and two TOAD surveys were conducted at depths of ~20-100 m. Multibeam acoustic bathymetry data were not collected during the 2003 MARAMP, but single-depth soundings collected across the shoals indicated that the seamount is an overall conical shape and has a total shallow (< 30 m depth) reef area of approximately 0.2 $km^2$. Observations made during the towed-diver surveys and the results of the analysis of TOAD video indicate that Stingray Shoal is predominantly covered by hard substrate. Towed-diver observers recorded habitat complexity ranging from medium-high to high, and noted high coral cover ranging from 40-100% (mean of 55%) that extended across a continuous, well-developed reef. The hard coral cover recorded at Stingray Shoal in 2003 was the highest recorded for any of the islands or banks in the Mariana archipelago surveyed between 2003 and 2007. The highest coral cover was observed in the north and west (75% and 76%, respectively). The analysis of TOAD video suggested that areas of high coral cover were more sporadic in the deeper waters of the northern and southern portions of the shoal.

In summary, based on an assessment of the available NOAA MARAMP survey results and other available literature, and in concordance with Starmer et al. (2008), the marine habitats of the CNMI exhibit a range of conditions as a result of various environmental and anthropogenic factors. The reefs of the southern populated islands have clearly been impacted by anthropogenic stressors, such as runoff and fishing pressure, in addition to crown-of-thorns starfish in the mid-2000s. The northern islands appear to have mainly been impacted by natural environmental regimes, including volcanic activity, periodic ashfall from adjacent watersheds, and naturally slow recovery rates. Both the northern and southern islands appear to have been significantly impacted by the recent back-to-back coral bleaching events. Coral reef areas impacted by chronic anthropogenic stressors are less resilient to acute disturbances, such as cyclones, COTS outbreaks, and temperature stress events, and can be expected to deteriorate further, potentially shifting from coral-dominated to less productive and less diverse fleshy algae- and cyanobacteria-dominated systems. The predicted increase in the frequency and severity of thermal stress events in the coming decades and the looming threat of ocean acidification will likely challenge even the healthiest of reef systems, but those systems with suitable water quality and robust reef fish communities will have the best chance at adapting to rapidly changing environmental conditions and continuing to provide essential goods and services to human population.

# 6 Threats

Threats to our SGCN are variable, emergent, and some are unknown. The threats identified in this section contribute to the overall loss of biodiversity and deplete the quality and availability of our natural resources. The importance of addressing threats to our SGCN is to seek ways to reduce or eliminate their direct impacts. Our primary goal of managing and conserving natural resources in the CNMI is to preserve the biodiversity of our ecosystems including the genetic variation among species. Threats are conditions, features, and pressures that can be a part of the natural system or new factors in a species life cycle or habitat. Threats to our SGCN include factors that reduce their lifespan, reproductive success, overall health and fitness, and survival. New threats can arise at any time and those listed in this section are not an exhaustive account of all the factors that contribute to species declines in the CNMI.

We conducted a threat assessment for 2015 SGCN and candidate SGCN for this Plan. The threat assessment was highly specific in that we examined the threats acting on a particular species (or subspecies) in the CNMI. There were many specific threats identified that are only acting on one SGCN. However, broad-scale themes emerged through this process. All species-specific threats identified (see Appendix C) fit under one of the following themes described below.

## 6.1 Invasive Species

Invasive species are species that are not native to the CNMI and whose introduction here does or is likely to cause environmental or economic harm or harm to human health. Due to their evolutionary history and high levels of endemism, animals of the Marianas are particularly susceptible to the threats posed by the introduction and spread of invasive species. Invasive species (sometimes called "non-native," "alien," or "exotic") may outcompete native species, or may directly harm native species through predation. Virtually no habitat important for SGCN is free from the threat of invasive species. Most habitats important for SGCN experience some negative effects related to invasive species which can cause habitat loss or degradation for our SGCN. Invasive species, once established, are nearly impossible to eradicate. Successful eradication efforts involve long-term costly campaigns involving some collateral damage (Wenger et. al. 2018, Stolzenburg 2011). In the CNMI, these types of eradication campaigns would be unsavory and unpopular. It is in our best interests to focus on prevention through strict biosecurity protocols, public outreach and education, and rigorously thorough customs and security inspections of cargo.

### 6.1.1 New arrivals and introductions

In addition to invasive species already established in the CNMI, numerous species are positioned to invade. While a potentially invasive species can be introduced through our air and sea ports from anywhere, with the high frequency of travel between Guam and the CNMI, and the similarity of climate, we are particularly at risk to receive new invasive species introductions from Guam. Guam has several invasive species that have yet to invade the CNMI, but pose a serious threat to our native wildlife, ecosystems, economy, and public health. Measures have been established in the CNMI to prevent introduction of brown tree snake (*Boiga irregularis*), which has extirpated nearly all of Guam's native avifauna. However, Guam hosts other invasive species that could have devastating impacts if they became established in the CNMI, including the little fire ant (*Wasmannia auropunctata*) and coconut rhinoceros beetle (*Oryctes rhinoceros*).

Most invasive species introductions are accidental from species "hitchhiking" on a plane or boat. However, introductions can and have occurred intentionally. The CNMI has strict laws regarding importation of live organisms into the Commonwealth, but residents may be unaware of the laws, or disregard them. For example, apple snail (*Pomacea* spp.) appears to have been intentionally introduced on Saipan by individuals presumably trying to create a readily available "wild" food source, without knowledge of the devastating impact this species can have on natural communities. Apple snails can compete with native species for limited resources, consuming all types of aquatic plants, potentially altering the natural balance of a wetland system.

Other introductions have occurred from legally or illegally imported pets that then escaped or were released and formed wild populations. Orange-cheeked waxbills are now ubiquitous on Saipan for this reason. The Division of Fish and Wildlife has taken measures on Saipan to control an incipient population of rose-ringed parakeets (De La Torre 2015).

In addition to preventing new invasive species introductions to the CNMI, it is equally important to prevent the spread of invasive species among islands of the CNMI. Many of the invasive species that already occur in the CNMI may currently be restricted to just a few islands, often the southern inhabited islands (Table 21). Islands with few invasive species are refugia for many of our terrestrial SGCN.

## 6.1.2 Current Invaders

### 6.1.2.1 Habitat Modifiers

#### Invasive Vines and Nuisance Plants

The forests of Saipan have undergone a rapid transformation, shifting from native limestone forests and mixed introduced forests with dense leafy understories and layered secondary and primary canopies to forests dominated by a closed canopy entangled with dense, invasive vines. The uncontrolled spread of invasive plants poses a significant threat to forest-dependent Species of Greatest Conservation Need (SGCN). Many invasive plant species produce seeds that can persist for years and are often dispersed by birds, making eradication exceedingly difficult once the plants are established. Invasive vines are present on Tinian and Rota, but are less widespread than on Saipan, however, every effort should be made to ensure that invasive vines do not spread on these islands as once vines are established they are notoriously difficult and costly to remove.

Invasive vines are of particular concern, including species like scarlet gourd (*Coccinia grandis*), chain-of-love (*Antigonon leptopus*), alalag/paper rose (*Operculina ventricosa*), bitter vine (*Mikania micrantha*), bitter gourd (*Momordica charantia*), and wood rose (*Merremia tuberosa*). These vines are spreading rapidly across many islands, where they can smother and kill host trees, causing the canopy to collapse and converting forests into scrub-shrub or grassland habitats. Additionally, they reduce light availability beneath the canopy, affecting plant species composition and slowing forest regeneration. Vines increase the connectivity of the lower understory to the upper forest canopy and can act as a highway for other non-native pests like rats and ants that may affect species that take refuge in the upper canopy like forest nesting birds and native pollinators. The proliferation of invasive vines likely influences the abundance, distribution, and reproductive success of forest-dependent SGCN. However, species-specific responses and the most harmful invasive plants to SGCN remain poorly understood. Invasive vine proliferation is also unsightly and roadside swaths of vines create the appearance of degraded environmental conditions on Saipan,which reduce the sense of well being for residents and visitors alike.

In freshwater wetlands, Ipomoea aquatica represents a significant and often overlooked invasive threat. Although likely naturalized in the CNMI, its aggressive growth habit enables it to rapidly colonize open water and shallow wetland areas, forming dense mats that choke out native aquatic vegetation and eliminate open-water habitat. This directly threatens the ecological integrity of wetland systems by displacing native plant species and reducing habitat availability for the Mariana moorhen, snails, amphibians, and other wetland-dependent fauna.

Its proliferation alters wetland hydrology and limits light penetration, further disrupting native species recruitment and ecosystem function.

Dense mats of *I. aquatica* obstruct flow and create stagnant, shaded water – conditions that are known to alter water temperature. Even a modest warming of 5 °C can boost trematode prevalence in snails by roughly 10–20%. Cercarial shedding from snails typically peaks near 23–25 °C, thereby amplifying infection pressure on host species. (Paull & Johnson, 2011)

Native vines such as agasi (*Cassytha filiformis*), can become a nuisance in certain conditions, overcrowding vegetation and creating thick mats along treetops and shrubs. This prolific parasitic vine is also a medicinal plant, though not a species of particular concern for conservation and is considered a nuisance in areas where it dominates canopy cover.

There are several encroaching plants that can degrade nesting beach habitats for sea turtles by forming a dense blanket over the beach. Water hyacinth (*Eichhornia crassipes*), although currently limited to a few wetlands on Saipan, has the potential to spread to other areas, including wetlands that support the Mariana common moorhen.

The invasive plant *Chromolaena odorata*, commonly known as Siam weed, is another significant threat to native ecosystems in the region. This fast-growing shrub is already widespread on Rota and Tinian and is beginning to spread aggressively across Saipan. *Chromolaena odorata* thrives in disturbed areas and quickly forms dense thickets that outcompete native vegetation, altering plant community composition and reducing biodiversity. Its ability to grow rapidly and produce large quantities of seeds enables it to invade various habitats, including forests, grasslands, and agricultural areas. This plant is known to be toxic to ungulates and could pose a threat to ranchers who will lose grassland to this aggressive plant that provides no food source to their livestock. Proactive management is crucial to prevent its further spread and mitigate its ecological impact.

The African tulip tree (*Spathodea campanulata*) is another invasive species of concern, particularly on Saipan, where it is widespread. This fast-growing tree is highly competitive, often dominating disturbed areas and wetland edges, forming dense stands that displace native vegetation. The African tulip tree alters native ecosystems by outcompeting native tree species, reducing biodiversity, and impacting the structure and function of forest habitats. Additionally, its flowers are known to be toxic to some native insects, potentially disrupting local pollination networks. For forest-dependent Species of Greatest Conservation Need (SGCN), the spread of the African tulip tree poses a direct threat by degrading habitat quality and limiting the availability of resources for native flora and fauna. Effective management strategies are needed to mitigate its ecological impact and prevent further proliferation.

Overall, the proliferation of invasive plants and changing plant communities has ecosystem wide consequences likely beyond what we currently understand. Native plants provide food and shelter to our native species and, while some introduced species can fill those needs, it is important to consider the decreased value of these replacement species. The nutritional value of fruits, pollen and nectar that non-native plants provide may not fulfill the metabolic needs of native species who have evolved to consume native plants which decreases their fitness for reproduction and survival in the face of novel pathogens, competitors, and predators.

### Introduced Ungulates

Introduced ungulates (hoofed animals) in the CNMI, including goats (*Capra hircus*), deer (*Rusa marianna*), pigs (*Sus scrofa*), and cattle (*Bos taurus*), have significant ecological impacts. These animals damage vegetation through grazing and browsing, trample seedlings, spread non-native plant seeds and plant pathogens, disturb soil, and increase erosion. Such activities alter forest ecosystems by affecting forest regeneration, moisture levels, and nutrient cycling. The resulting modifications can greatly alter native plant communities, reduce soil water retention, increase erosion, and degrade water quality.

Figure 51. A pair of feral goats freely roam the island of Aguiguan. People who obtain permits from the Mayor of Tinian opportunistically hunt goats on Aguiguan. Aguiguan has little to no forest understory and stunted forest regeneration due to overgrazing by the abundant feral goats. Source: DFW 2016.

Native plants in the CNMI, having only recently encountered grazing pressures (on an ecological timeline), lack natural defenses like thorns or toxins. As a result, ungulates often preferentially feed on native plants which exacerbates their decline. Grazing and browsing can lead to the local extinction of native plant populations, and even low-intensity browsing alters habitat composition which favors non-native species over native ones (Figure 51). Rooting by pigs, in particular, disturbs soil in ways that benefit alien plant species which thrive under such conditions. Native species are unadapted to these disturbances and are negatively affected. Such impacts alter plant communities and indirectly impact animals dependent on those communities, with native invertebrates being especially vulnerable.

Efforts to manage feral ungulates have had mixed success. The eradication of feral ungulates on islands like Anatahan and Sarigan has led to significant recovery of wildlife and vegetation, as observed on Sarigan (Kessler, 2011). However, control or eradication efforts are more contentious on islands where these animals remain (e.g., Aguiguan, Alamagan, Pagan, and

Agrihan). Many residents value these populations for food or recreational hunting, making support for eradication or control measures limited.

#### 6.1.2.2 Non-native Predators and Pathogens

Our terrestrial animals evolved in ecosystems devoid of mammalian predators, making them highly susceptible to predation by invasive species, particularly rats (*Rattus spp*.), cats (*Felis catus*), and dogs (*Canis lupus familiaris*). These predators pose a severe threat to native species by preying on eggs, nestlings, and adult birds, significantly limiting population growth and survival.

##### Rats as a Pervasive Threat

Rats are widespread across the islands and are notorious predators of all native bird species, including those nesting in tree canopies. They also prey on tree snails and consume the seeds of numerous native plants, disrupting seed dispersal and regeneration. Their omnipresence represents a critical threat to both flora and fauna, undermining the delicate balance of island ecosystems.

##### The Impact of Cats

Cats are highly adept hunters and have been responsible for bird extinctions on other islands. In the CNMI, their presence is extensive, as highlighted in distribution data (Table 30). High densities of feral cats are considered a significant factor in the decline of the Mariana crow (*Corvus kubary*i) on Rota. Feral and domestic outdoor cats both pose threats to bird populations as it is well documented that even fed cats prey on birds due to their instincts to catch and kill flying critters. Recent studies suggest that some individual cats preferentially prey on birds and are known as “bird killers” - able to create a tremendous impact on bird populations within the animals territory.

##### Additional Predator Threats

Other predators, such as feral and unleashed dogs (*Canis lupus familiaris*), also threaten native wildlife. Not only do dogs prey on native fauna, feral dog feces wash into freshwater drainage systems and eventually make it into the ocean. High levels of fecal coliform are typically reported after major rain events and dog feces contribute to the presence of this dangerous bacteria in our waterways. Existing predators and the threat of new predators like the brown tree snake (*Boiga irregularis*) present the need for systematic predator management in the CNMI. The potential introduction of the brown tree snake, which decimated bird populations in Guam, is a threat in the CNMI due to its transportation and cargo connections with Guam and would likely have catastrophic consequences for the CNMI's avifauna. Biosecurity measures are in place in both the CNMI and Guam to prevent the accidental transportation of brown tree snakes and the species has not yet established themselves in the CNMI.

Cane toads (*Rhinella marina*) were introduced in the 1930s. This amphibian species is a silent predator of the invertebrate ecosystem in the Mariana Islands. The adults are omnivores and predatory. They are known to prey on beetles, ants, millipedes, snails, spiders, grasshoppers, skinks and geckos. Their pervasiveness in the watersheds of the southern islands pose risks to our understudied freshwater ecosystems.

Aquatic pet trade is a major contributor to the accidental introduction of invasive fish and freshwater invertebrates around the world (Dickey et al. 2023, Liang et al. 2005). Often, invasive fish can disrupt fragile ecosystems and wreak havoc for natural resource managers. Common invasive pets have already been established in the CNMI including the red slider turtle and guppies (Herod et. al. 2008).

The black drongo (*Dicrusrus macrocercus*), native to Taiwan, is currently only known to reside on Rota and Guam in the Mariana Islands where it is notorious for harassing native species and humans. Black drongos have similar feeding traits as fly catchers, they swoop and catch prey mid-air and can often be seen on telephone wires capturing insects that congregate around street lights in the evenings. They are aggressively territorial and will swoop at and haze “invaders” until they are beyond the birds nesting territory. They have been observed eating small song birds and pose a threat to SGCN forest birds and native flying insects on Rota.

### Invasive Invertebrates

Invasive invertebrates, including ants, snails, and wasps, have proliferated across the CNMI, with devastating impacts on native species. Invasive invertebrates directly prey upon and parasitize native species, they also act as pathogen vectors and out compete native species for food and shelter resources. Non-native ants can also help spread other noxious pests like scaly bugs that damage both native plants and food crops. Invasive invertebrates can be linked to direct declines and extirpations of some endemic species (Plentovitch et. al. 2021). For instance, the SGCN tree snail *Partula langfordi*, once found exclusively on Aguiguan, persisted for centuries despite threats from rats, goats, and habitat loss. However, the introduction of the invasive flatworm *Platydemus manokwari* in the 1990s led to its likely extinction (Smith, 2008) (Figure 52). *Platydemus* flatworms and the predatory giant African land snails (*Achatina fulica*) have dramatically reduced the number of terrestrial land snails across Rota, Aguiguan, Tinian and Saipan. We need to make every effort to ensure that these invasive predators are not introduced to the Northern Islands where our native terrestrial snails still exist in relative abundance.

Cuban slugs present a unique challenge on Rota, where they devour seedlings, young trees, and herbaceous plants, hindering forest regeneration and degrading native limestone habitat. Alongside other invasive species like alien wasps, English honey bees, and various ant species, these slugs underscore the urgent need for stricter inter-island biosecurity to prevent the establishment and spread of harmful invasive species.

Figure 52. An invasive flatworm *Platydemus manokwari* on a freshly eaten native *Partulid* snail shell

European honeybees (*Apis mellifera*), are considered important pollinators for food crops and are in global decline due to a variety of factors (Lopez-Uribe 2021). Introduced to the CNMI in the last century, honeybees are both feral and managed (by bee keepers that use their honey and wax products). Additional introduced bees include carpenter bees and leafcutter bees. Nonnative bees can out compete native bees and other native pollinators for high quality pollen resources, non-pollen food, shelter, and can even act as vectors for novel pathogens (Graystock et al. 2015).

Cycad scale beetle (*Aulacaspis yasumatsui*) and Cycad blue butterfly (*luthrodes pandava*) are two invasive invertebrates ubiquitous with fadang (*Cycas micronesica*) decline throughout the islands (Deloso 2020). Both cycad scale beetle and cycad blue butterfly were introduced to the Mariana Islands as hitchhiker species on ornamental cycads brought to the islands in the popular cycad trade. Unfortunately, both species have firmly established on the Southern Islands and contribute to the steep decline in fadang population and overall plant health.
Scale insects or scaly bugs are non-native sap sucking insects with a hard outer shell that can cause significant damage to native plants and even die off. They typically have a mutual relationship with ants who harvest nectar-like excrement from the scale insects and in turn the ants provide defense and transportation for the scale insect. Massive infestations of scale insects have damaged native forests throughout the Southern Island and are a common pest for foresters growing rare and endangered plants.

### The Coconut Rhinoceros Beetle (CRB)

The recent introduction of the Coconut Rhinoceros Beetle (CRB) to Rota highlights the rapidity with which invasive species can spread. First detected at Tweksberry Beach Park near West Harbor, quarantine and removal efforts revealed additional invasion sites. Despite these measures, the CRB is slowly spreading, and island-wide infestation appears inevitable. This invasion demonstrates the immense difficulty and expense of controlling invasive species, with potentially disastrous ecological and cultural consequences. CRB impacts not just coconut palms, but can feed on other palm trees like betel nut and date palms. The insect feeds on the leaves and bores through the heartwood of the tree stunting growth and production of coconuts and reducing quality of palm fronds used for weaving and thatch roofs.

## 6.1.2.3 Invasive and nuisance avian species

Invasive bird species also pose challenges to native ecosystems. The CNMI hosts many non-native birds that don't seem to pose a threat to native bird populations because they tend to inhabit more urban and developed areas such as the Eurasian tree sparrow and rock doves. There are avian species that have been either accidentally introduced by way of escaped pets such as budgies and parakeets (Lockwood et. al. 2019) . While we do not know of any nuisance populations of budgies and parakeets, we do know that people keep them as pets in the CNMI and that an accidental or intentional release of these species could result in them establishing a breeding population which could pose a threat to our native forest birds. Released non-native birds can out compete native birds for nesting sites and foraging habitat. The orange-cheeked waxbill (*Estrilda melpoda*) and black drongo (*Dicrurus macrocercus*) are concerning for wildlife managers. These species compete with native birds for resources, disrupt local ecosystems, and may prey upon on native fauna. The black drongo, in particular, is an aggressive bird known to attack native species and disrupt nesting sites.

## 6.1.2.4 Introduced Pathogens

Pathogens are a persistent threat. Though some pathogens are endemic to the Mariana Islands, novel and introduced pathogens can wreak havoc on native species. Emerging pathogens that could have catastrophic impacts to the CNMI include Highly Pathogenic Avian Influenza (HPAI) or H5N1. HPAI has been devastating both commercial flocks for chickens and wild bird populations globally for the last few years. The presence of the disease has not been detected in the CNMI, however, migrating shore and sea birds could be a vector to other birds that are located here.

Ironwood disease (*Ralstonia solanacearum*), a soil-borne bacterial pathogen that poses a significant risk to native plant species. Known for causing wilt diseases in various hosts, this pathogen could severely impact native flora and agricultural crops if allowed to continue to spread within the CNMI.

Vigilant monitoring and proactive measures are critical to preventing its spread and safeguarding the islands' ecosystems. This pathogen is known to be present on Rota and has affected the iconic coastal ironwood tree stands and likely other native limestone forest species.

The brown root rot fungus (*Phellinus noxius*) poses a serious threat to both native forests and agricultural trees in the CNMI and is known to be present on Guam, Rota, and Saipan (Figure 53). This aggressive pathogen spreads through root-to-root contact or soil contamination, infecting a wide range of tree species. Once established, it causes extensive root decay, leading to tree instability, defoliation, and eventual death.

Figure 53. Several *Hernandia* trees show clear signs (dark brown scaling fungus encircling the trunks) of brown root rot infection in native limestone forest on Rota.

Native forest ecosystems are particularly vulnerable, as *P. noxius* can decimate canopy-forming trees, disrupting habitat for countless terrestrial species and altering microclimates essential for forest regeneration. Agricultural systems are also at risk, with economically important trees such as breadfruit (*Artocarpus altilis*) and coconut (*Cocos nucifera*) suffering significant losses. The presence of *P. noxius* underscores the need for monitoring, early detection, and integrated management strategies to mitigate its spread and preserve both native biodiversity and agricultural productivity.

Coral reef pathogens such as Stony Coral Tissue Loss Disease (SCTLD) pose a significant threat to the marine ecosystems of the Commonwealth of the Northern Mariana Islands (CNMI), where coral reefs play a vital ecological and economic role. SCTLD, first identified in the Atlantic, is a rapidly spreading disease and has garnered concern for its potential to affect other regions, including the Indo-Pacific (Alvarez-Filip 2019). SCTLD is poorly understood, but it is known to cause high mortality rates in diverse coral species, disturbing reef structures, reducing biodiversity, and impairing ecosystem services such as fisheries and coastal protection (Florida Sea Grant 2025). The introduction of the disease to CNMI's reefs could occur via ballast water, contaminated marine equipment, or natural ocean currents. Once established it could exacerbate existing pressures from altered habitat conditions, climate change, pollution, and overfishing. Urgent research and proactive management strategies are essential to prevent its spread and safeguard CNMI's marine biodiversity. The CNMI's continued participation in the US Coral Reef Task Force, allows researchers in the Marianas to be at the forefront of monitoring and responses to invasive marine species and pathogens.

### 6.1.3 Invasive and nuisance marine species

Non-native marine species have the potential to become invasive and cause significant impacts to marine habitats and species by out-competing and replacing native taxa and even altering the entire ecosystem. In recent years Hawai'i has been plagued with invasive marine species including several species of smothering seaweeds which grow into thick patches that smother other native corals and macroalgaes. The introduction of non-native and potentially invasive coral reef species such as these can be intentional, typically as a means to enhance fisheries, or accidental, primarily by transport on ship hulls and ballast water or by aquarists disposing of unwanted organisms. There are also concerns that red tilapia, *Oreochromis mossambica*, which was intentionally introduced in the 1950s, may enter the Saipan Lagoon from adjacent open-system pools (Starmer 2005).

Within the CNMI, non-native marine species that have been intentionally introduced include the topshell, *Tectus niloticus*, which was introduced by the Japanese in 1938. Topshell populations have been established in the CNMI and have become an important fishery requiring regulation, including a moratorium and the establishment of two no-take reserves. The effects of the introduced topshell on native taxa and coral reef ecosystems is unknown (Starmer 2005), but its abundance in un-fished areas suggests that it may out-compete native topshell species and perhaps other organisms that share food sources and refugia. The potential for additional (and likely unplanned) introductions currently exist and will likely increase with an increase in ship activity directly or indirectly related to U.S. military activities in the CNMI and throughout the region. Unintentional introductions of non-native and potentially invasive marine species would mostly likely occur via transport on ship hulls or ballast water, although the risk associated with ballast water is at least somewhat mitigated by a prohibition on the discharge of ballast water in commercial port areas, and because vessels are more likely to take in rather than discharge ballast water in the CNMI (Starmer 2005).

A small number of coral reef species native to the CNMI, most notably the corallivorous crown of thorns seastar (*Acanthaster planci*), may be considered nuisance species in certain circumstances. Crown of thorns seastars can appear in great numbers, sometimes resulting in severe and potentially widespread coral mortality. The causes of periodic outbreaks are not well-understood, and while there may a natural component to their occurrence, it is possible that increased levels of nutrients and organic matter in nearshore waters, as well as fisheries-associated cascade effects, may influence the frequency and severity of the outbreaks.

## 6.2 Development

### 6.2.1 Land use land change

Between the closure of the garment factory industry and the reduction in tourism with the global economic recession, and unstable Contract Worker visa programs, we saw widespread abandonment of properties on Saipan, Tinian, and Rota since the early 2000's. The tourism market has been unstable since the COVID-19 pandemic and changes in the availability of flights from countries with a tourism base. Large development projects (i.e. casino and resorts) have been largely unsuccessful and existing hotels and resorts have not been operating at full occupancy. Development on Tinian has increased sharply in light of the construction projects centered around the military buildup on the Military Lease Area (MLA) there. Major development on Rota has stagnated in the last few decades punctuated with the closure of the Rota Resort, the only high end accommodations on the island, and the closure of the Bay View Hotel. However, there are proposed construction projects for Military use areas on the island and other local infrastructure projects that have kept the island's public spaces updated and improved.

"Development" encompasses the conversion of natural habitats for commercial, residential, or agricultural uses. Development impacts terrestrial SGCN through direct conversion from natural habitats. Developed areas typically support few terrestrial SGCN, and usually at reduced densities. Development can also cause fragmentation or degradation of adjacent natural habitats, further reducing terrestrial SGCN populations.

Commercial development is considered the primary threat to terrestrial SGCN and their habitats, as it will likely cause conversion of the most habitat acres. It is also considered the primary type of development threatening marine SGCN, as commercial development encompasses resorts and other tourism infrastructure that are typically concentrated in coastal areas. Removal of natural vegetation nearer to the shoreline results in increased pollutant runoff, which impacts most of our marine SGCN (see Pollution section).

Development can require supporting activities that impact species and habitats, such as quarrying and mining land to supply aggregate to support development projects. Quarry sites are limited in the CNMI and aggregate quality varies within the substrate. Establishing new quarry sites within the CNMI irreversibly converts land from its natural state to a striped down state - removing all vegetation, soil, and actively changes the layout of the land and natural habitat of the area. Quarry activities impact soil, water, and air quality in the immediate vicinity of the operations.

The CNMI published a Comprehensive Sustainable Development Plan (CNMI CSDP) in 2021. The plan details strategic actions to ensure the CNMI has sufficient *Sustainable Systems*, *Networks of Care*, *Inclusive and Equitable Communities,* and *Partnerships* for building a resilient society. There are elements of the plan that pertain to the preservation of natural resources including clean air, water, and environment. Relevant elements, goals, and actions of the CNMI CSDP will be incorporated into this Plan.

### 6.2.2 Marine industry

The development of industries that utilize the vast marine and benthic zones around the Mariana Islands threaten not only our marine SGCN, but also some of our terrestrial SGCN such as sea birds who nest on land but forage in the ocean. Marine industrial development that could be proposed in the Mariana Islands include deep sea mining, desalination plants, and offshore wind farms. Deep sea mining is a developing industry due to the increasing demand for rare metals needed in modern devices like smartphones and solar panels. International studies have been published detailing the detrimental effects of deep sea mining on both animals (Sharma 2015) and microorganisms (Orcutt et al. 2020). The impacts to SGCN in the Mariana Islands are suspected to be the same as these international studies, though we lack the baseline inventory data to pinpoint exact effects. Mining activity along the seafloor and around seamounts would create plumes of sediment in the water column that could affect the water quality for all organisms that live in the mining impacted zones. Decreased water quality affects both the feeding and breathing apparatus of many deep sea creatures.

A desalination facility has been proposed on the island of Tinian to serve the increased water needs for military expansion on the MLA. Desalination plants directly threaten nearshore marine life, displace coastal nesting species, and alter nearshore water quality.
Offshore wind farms offer renewable energy prospects, which are enticing for island communities that rely on imported oil for all current energy needs (See Our Islands section

2.6.2). While offshore wind farms are a renewable energy source, they do come with some compromises. Wind turbines can be deadly for flying animals including seabirds and bats (Bergstrom 2014). Noise disturbance can negatively impact marine mammals during the construction, operation, and maintenance of wind turbines. Conversely, offshore wind turbines can create artificial habitat that marine species may utilize (Bergstrom 2014).

## 6.3 Long-term Environmental Shifts

Unpredictable environmental conditions can threaten the stability of our natural resources and the habitats they inhabit (East West Center 2021, IPCC 2014). Some of these threats are wide ranging and potentially catastrophic, and include an increase in ocean temperatures, a decrease in ocean pH, and a rise in sea levels. Evidence of long-term environmental shifts are already evident in areas of the CNMI such as the Saipan lagoon, where coral bleaching and seagrass growth patterns have caused changes in the coastal habitat availability for species that live in the lagoon.

Table 36. Key long-term environmental condition projections for the CNMI derived from East West Center report on Climate Change in the CNMI 2021 (Grenci et. al. 2021).

| **Variable** | **Projection** |
|---|---|
| Air temperature | Hot days have increased and cool nights have decreased. Air temperatures will continue to rise under all future scenarios. |
| Precipitation | Global and regional models show a range of possible precipitation changes from 7% less precipitation to 20% more precipitation. Predictions for precipitation remain uncertain. |
| Sea level | Sea level is expected to become damaging during high tides and storm surges and contribute to coastal erosion and could affect low lying properties and infrastructure. |
| Sea surface temperature | Sea surface temperatures are expected to and have been causing significant coral bleaching events which have cascading trophic effects to the marine ecosystem. |
| Freshwater availability | Hotter temperatures will affect the need for and the availability of freshwater, which will be further threatened by sea level rise via saltwater intrusion into groundwater sources. |
| Storms | Typhoon intensity is expected to increase while their frequency is expected to decrease. |
| Biodiversity | Changes in air temperature, rainfall, and typical weather regimes contribute to the loss of biodiversity through the spread of invasive species and by increasing stress on native species |

### 6.3.1 Air temperature

Air temperature has been rising and may be problematic for nesting sea turtles (Figure 54). The sex of sea turtles is determined in the egg by the ambient temperature of the nest, with higher temperatures favoring development of females. Turtle biologists are concerned that air temperature rise in the future could cause only females and no males successfully hatching.

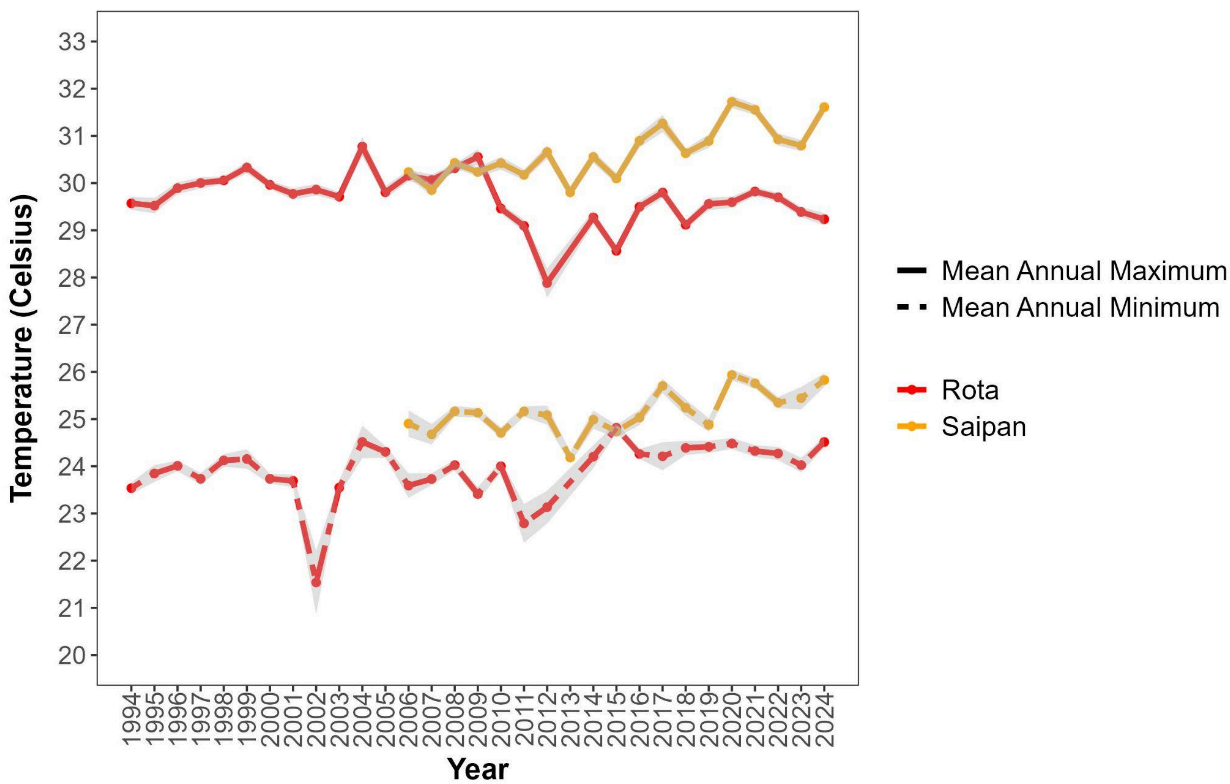


Figure 54. Mean annual maximum and minimum air temperature recorded at the Rota and Saipan airports from 1994-2024 with 95% confidence intervals (grey) (Source: NOAA National Centers for Environmental Information, 2025).

### 6.3.2 Sea temperature rise and coral bleaching

While shallow reef-building corals thrive in warm tropical waters, they live near the thermal threshold beyond which the association between the host coral animal and the symbiotic zooxanthellae begins to break down. The breakdown of this association results in the expulsion, absorption, or ingestion of the zooxanthellae, causing coral tissue to lose its color and appear "bleached." If this condition persists beyond a few weeks the coral colony may experience partial or whole colony mortality. Coral bleaching and the resulting coral mortality can occur across large areas, from entire islands, to archipelagos, and even whole regions. With sea temperature rise, more frequent and severe coral bleaching events are expected.

The CNMI's coral reefs have also been affected by significant thermal stress events during the past decade. The coral bleaching events in the CNMI from 2013 to 2017 were part of a larger global phenomenon characterized by unprecedented marine heatwaves and severe coral mortality. This period saw significant impacts on coral reefs, driven primarily by unseasonably warm waters and exacerbated by local stressors. The 2014-2017 global coral bleaching event (GCBE) was marked by record-breaking ocean temperatures, leading to widespread coral bleaching and mortality. Approximately 80% of surveyed reefs globally experienced significant bleaching, with 35% suffering substantial mortality (Eakin et al., 2019) (NOAA 2018). According to the CNMI Coral Reef Management Priorities report, all species of coral found in the Saipan lagoon in 2017 experienced coral bleaching in one of the most extensive and damaging coral bleaching events ever recorded. The CNMI DCRM Marine Monitoring Team (MMT) reported 30.0-98.7% coral cover loss in the Saipan Lagoon, severe coral bleaching on the reefs of Asuncion, Maug and Pagan, dead acroporid and pocilloporid colonies around Guguan, Sarigan and Anatahan. Post-bleaching mortality was thought to be high based upon preliminary observations, but not confirmed in the northern CNMI.

The resilience of reefs at 16 sites across Guam, Saipan and Pagan were tested, with many sites experiencing ecologically severe heat stress during the GCBE (Courtney et al., 2022). The long-term effects of the GCBE on coral reef structures and associated marine life are concerning, as the ability of reefs to recover is compromised by uninhabitable sea temperatures and local anthropogenic pressures (Eakin et al., 2019, NOAA Coral Reef Watch 2020, Van Ee 2024).

The CNMI has experienced several major coral bleaching events. The first was recorded in 2013 followed by bleaching events in 2014, and in 2017 nearly 90% of corals in Saipan experienced mortality in the most extensive and damaging coral bleaching event ever recorded (CNMI CRMP). The potential for the mass mortality of corals across large spatial scales make sea temperature rise and associated coral bleaching a major threat to coral SGCN, with indirect cascading effects on reef-dependent SGCN. In 2019, the CNMI produced the Coral Reef Management Priorities document. A multiagency Coral Reef Initiative which formed the CNMI Coral Reef Working group drafted the document. The working group banded together to identify priorities for managing essential coral reef resources.

Aside from direct degradation of coral reefs resulting in reduced coral reef diversity, coral reef health is linked to reef fish resources. Loss of coral reef due to bleaching can cause decreased fish availability for subsistence, commercial, and human enjoyment (EPA 2024).

### 6.3.3 Ocean acidification

A large proportion of the increasing amount of carbon dioxide in the atmosphere diffuses into the oceans, resulting in increased carbon dioxide concentrations in the ocean waters. It is estimated that the oceans have absorbed about half of the carbon dioxide released by human activities over the past 200 years (Feely et al. 2004; Sabine et al. 2004). The increased carbon dioxide concentration causes the ocean to become more acidic, reducing the carbonate saturation state of oceanic surface waters. Average ocean pH has declined by 0.1 units, which is indicative of an increase in ocean acidity of approximately 30%. Ocean pH is expected to fall from the current pH of 8.2 to about 7.8 by 2100 (Orr et al. 2005).

Ocean acidification negatively affects survival, calcification, growth, and reproduction in many marine groups. Corals, molluscs and echinoderms appear particularly vulnerable to the effects of ocean acidification, as increased acidity makes it more difficult (i.e. energetically costly) to build skeletons and shells (Kroeker et al. 2013). The effects of ocean acidification on reef building corals could cause major alterations of entire reef ecosystems, including significant shifts in coral community structure or large-scale phase shifts from coral-dominated to algae-dominated systems (Orr et al. 2005). By the end of the 21st century, ocean acidification may become the single greatest threat to the viability of coral reef ecosystems worldwide.

Although we cannot predict the rate of species impacts, we expect ocean acidification to directly impact our coral, giant clam, sea urchin, and other marine invertebrate SGCN in coming decades. Reductions in coral abundance may have cascading effects, as many of our marine SGCN are reef-dependent.

### 6.3.4 Sea level rise

Sea levels may rise by several meters over the next century due partly to thermal expansion of warmer waters, but primarily due to land ice melt from polar regions (USGCRO, 2018).

While significant rapid sea level rise would clearly have devastating, costly effects on coastal human communities, the effect of sea level rise on coral reef ecosystems is not entirely understood. The increase in sea surface height may actually cause more habitable shallow substrate, expanding the area occupied by coral reefs including staghorn coral-dominated communities, or at least balancing the effect of a loss of available habitat due to reduced light at the deeper extent of reef growth. However, coral reefs adjacent to shorelines susceptible to erosion may be impacted by poor water quality associated with relatively rapid sea level rise. It is unlikely that sea level rise will outpace the growth of at least moderately-growing coral reefs, at least in the first half of the 21st century, but in areas where anthropogenic impacts have stymied reef building, sea level rise may outpace the ability of some reef systems to keep up, resulting in shifted reef community structures and potentially leaving coastal areas more vulnerable to storm surge and coastal erosion.

Sea level rise, possibly exacerbated by the inability of some coral reefs to maintain sea level equilibrium, could be expected to impact shorelines, causing erosion in some and accretion in others. Beaches, including those in the CNMI that are particularly important to tourism and sea turtle nesting, could be significantly impacted. Mangroves, an extremely limited habitat in the CNMI, may be eroded, inundated by seawater, and/or converted to other habitat types, threatening the persistence of SGCN who rely on this limited habitat.

### 6.3.5 Increased severity of typhoons

The CNMI experienced fewer, but more severe, typhoons from 1990 to 2010 relative to the preceding 20 year period (NOAA 2013) (Figure 55). Notably super typhoons Souledor (2015), Yutu (2018), and Hagabis (2019) severely impacted the CNMI. Models suggest that this pattern will continue through the coming decades (Grenci et. al. 2021). Severe typhoons can have significant short- and long-term effects on terrestrial and marine SGCN populations (See Section 6.8 Natural Disasters).

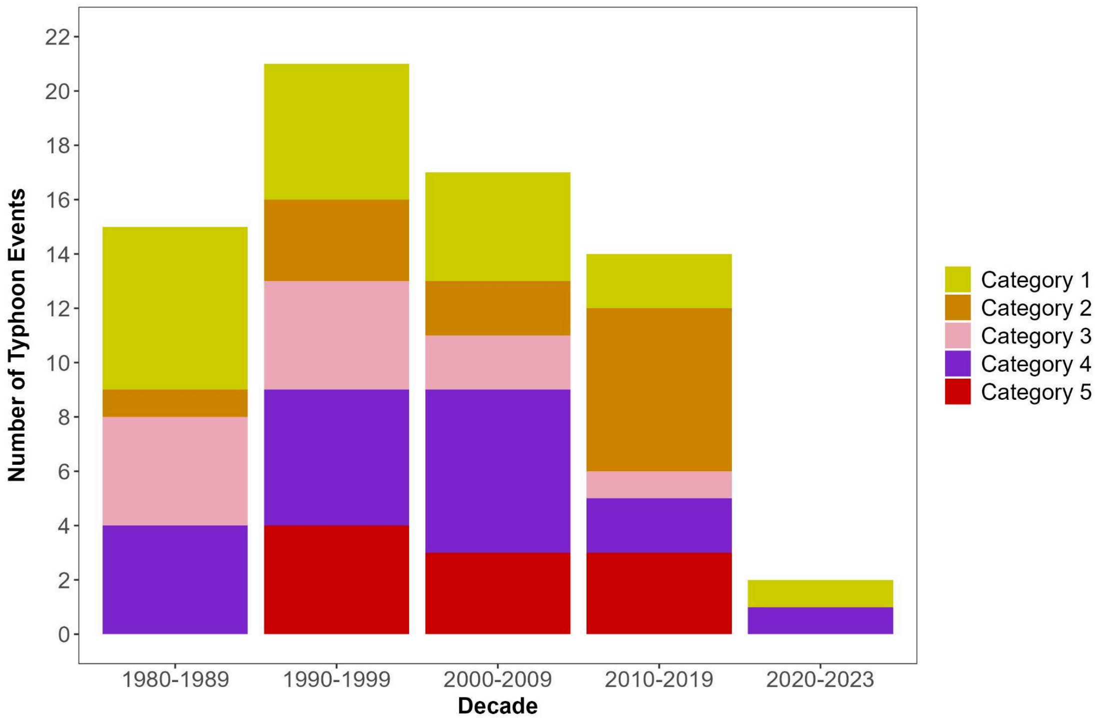


Figure 55. Number of typhoon events that passed through the Northern Mariana Islands per decade from 1982-2023. Data source: United States Naval Research Lab, Monterey, and Joint Typhoon Warning Center 2025.

Severe typhoons cause significant wind damage (Figure 56) which puts the short-term survival of frugivorous SGCN such as fanihi at risk, as they may be unable to find fruits to eat immediately post-typhoon. Long-term persistence of forest-dependent SGCN is compromised, as it takes decades for trees to re-grow.

Figure 56. Typhoon damage on Saipan at Obyan Beach following Super Typhoon Yutu, 2018.

### 6.3.6 Altered precipitation patterns

Global projection models indicate that the Marianas will experience altered precipitation patterns in the future. Overall, rainfall projections suggest that the wet season will get wetter, and the dry season drier. There may be an increase in mean annual precipitation overall, but a greater proportion of annual precipitation is expected to come in the form of extreme events (Grenci et. al. 2021). With an even drier dry season, we expect impacts to the endangered SGCN's Mariana common moorhen and Rota blue damselfly, which require wetlands or ephemeral streams for reproduction and survival. Wetland availability will be reduced because smaller ephemeral wetlands will dry up faster, and larger wetlands will hold less water.

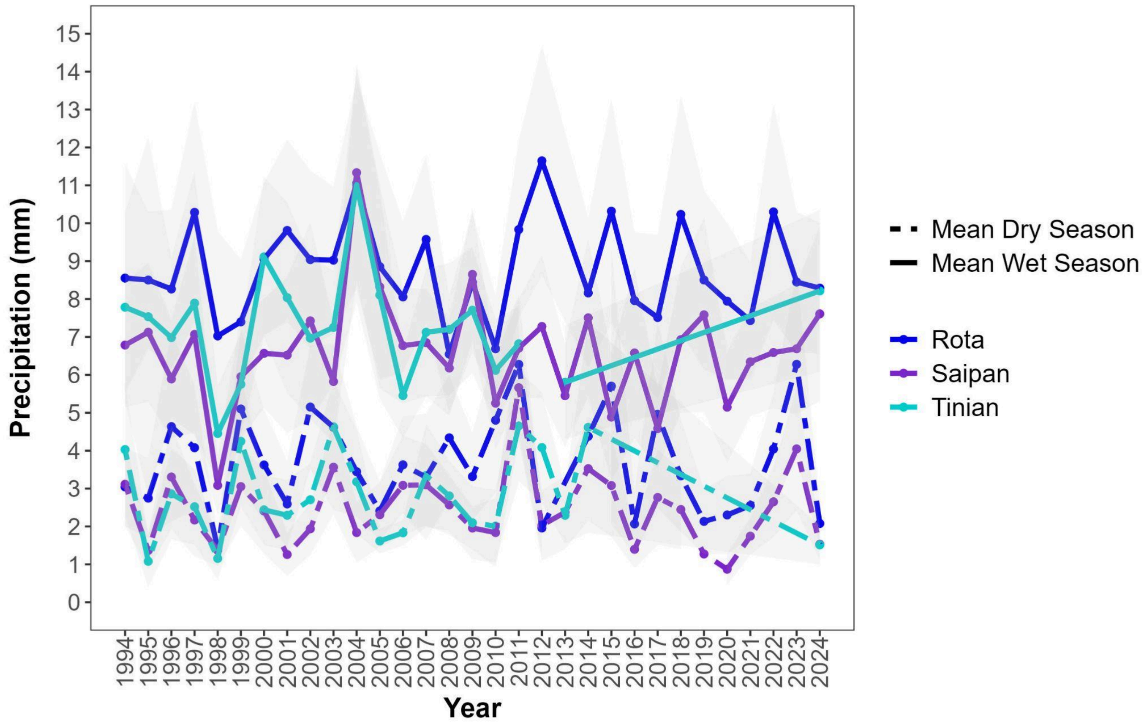


Figure 57. Mean daily precipitation (mm) for dry and wet seasons recorded at the Rota and Saipan airports from 1994-2024 with 95% confidence intervals (grey) (Source: NOAA National Centers for Environmental Information, 2025).

With changes in precipitation patterns, we anticipate changes in terrestrial habitat composition and structure, and shifts in species abundance including invasive species. The timing of precipitation triggers some life cycle events for many terrestrial species including freshwater fish and many insects. Though, we don't know if the changes in precipitation patterns will inhibit the life cycles for these species, we can expect some changes in the baseline ecosystem functions from land to sea in the Marianas.

## 6.4 Military Expansion

The U.S. military is expanding their bases in the Mariana Islands. On Tinian, they are constructing a new divert airfield adjacent to the commercial runway and restoring the WWII era North Field in the Military Lease Area (MLA) to its original extent. Other infrastructure projects on the MLA are in the works, though the full live-fire and bombing ranges planned in 2015, have not been installed and are yet to be confirmed for construction. While the ultimate outcome of their proposed installation build-up is still uncertain, for our purposes we took a conservative approach with our threat assessment and assumed the highest proposed impacts to SGCN and their habitats. We assumed that the military's preferred alternative to install live-fire and explosives detonation locations within the MLA, Landing Zones, increased training activities, and planned flight training exercises on Tinian (CJMT Revised Draft EIS 2025) would occur in the next ten years, and accordingly assessed the predicted impact on SGCN populations.

The military's preferred alternative would impact a variety of SGCN, both terrestrial and marine. For example, on land, the military proposes to eliminate nearly 10% of the habitat of the Tinian monarch. Live fire ranges, explosives detonation areas, and a near 100% increase in mixed military aircraft activity would cause noise disturbance to roosting fanihi and nesting Mariana common moorhen. In the water, the military has proposed the development of several amphibious craft landing sites that could damage shallow water reef flats and nesting sea turtle beaches. Overall, increased military activity on Tinian directly impacts the CNMI's objectives to recover ESA listed species and prevent additional listings for SGCN. DLNR-DFW produced written comments for the 2024 draft Environmental Impact Assessment (ESA) which describe in detail the anticipated impacts of the military's proposal on fish and wildlife populations (DLNR 2024).

In addition to the improvements and developments planned for the Tinian MLA, divert airfields are approved for construction on Rota and Saipan. Although Environmental Impact Assessments have not been developed for those two projects yet, we anticipate impacts to SGCN to be less than what is planned for the Tinian MLA. The spread of invasive species from Guam to the CNMI through military activities remains the primary environmental concern for natural resource managers in the Mariana Islands.

## 6.5 Habitat Contamination

### 6.5.1 Land-based sources of trash and toxins

Land-based sources of toxins, such as bacteria from human and animal waste, nutrients from agricultural land use, nutrients and chemicals from urban land use, and sediments from unpaved roads or improper land clearing are carried by rainfall into our waters. Such contaminates can reduce survival and reproduction of marine SGCN, especially those nearer to shore and source points.

Land-based sources of toxins and runoff are among the primary causes of coral reef degradation worldwide. A variety of pollutants, including sediment, organic matter, nutrients, sewage, herbicides, pesticides, petroleum products, and other substances detrimental to the health of marine organisms can enter coastal waters through riverine discharge, stormwater runoff, sewage outfalls, and submarine discharge of aquifer waters. Anthropogenic sources of heavy metals and trash have also been detected in the deepest parts of our oceans (Blum et. al. 2020, Chiba et. al. 2018) Conversely, a study of submarine groundwater discharge by Knapp et al., suggests that nutrient rich groundwater discharge in the Saipan Lagoon may be favoring the growth of *Enhalus* sp. seagrasses and that efforts to clean up groundwater inputs could be contributing to seagrass declines in the lagoon (Knapp et al. 2020).

The presence of these pollutants in nearshore waters is generally a result of coastal development, land clearing, burning, and other activities that alter the landscape, increasing the amount of runoff and introducing pollutants or elevating levels of substances (e.g., sediment) than may occur naturally at lower levels. The discharge of sediment at levels greater than the level to which coral reef communities in the receiving waters are adapted can result in mortality of corals and other benthic organisms through burial in extreme instances of sedimentation, but more often results in sublethal impacts that may eventually lead to whole colony mortality and to a shift in community structure and condition. Excess nutrients can fuel algal growth, allowing fleshy macrophytes and cyanobacteria to out-compete corals through direct interaction and by making substrate conditions unsuitable for the recruitment of many coral species. Pesticides, herbicides, petroleum products, and other chemicals can interfere with important physiological processes, such as reproduction and growth, of corals and other marine organisms. Besides supplying excess nutrients and other chemicals to coastal waters, sewage discharge and runoff may also introduce pathogens that directly cause diseases of marine organisms.

### 6.5.2 Coastal development and associated runoff

Overall, the marine impacts of coastal development and associated runoff are relatively low across the CNMI, and limited primarily to nearshore areas adjacent to high density development and agricultural activities in Saipan, and to a lesser extent on Tinian and Rota. Most of the marine waters of the CNMI meet the high water quality standards designated by the CNMI Bureau of Environmental and Coastal Quality (BECQ), but where high density development does occur, impacts to nearshore water quality and marine ecosystems can be pronounced.

According to Starmer et al. (2008), impaired coastal waters in the southern islands are primarily a result of failing sewer collection systems, urban runoff, discharge from reverse osmosis water purification systems (addressed in more detail below), sedimentation from unpaved roads and improperly managed construction activities. Unlike the populated southern islands, the very sparsely populated northern islands are largely removed from these development issues.

Of the 83 locations monitored for water quality by BECQ, a high number of microbiological violations occur in the highly developed Garapan district adjacent to the Saipan Lagoon, as well as at sites near Saipan's marinas and boat docks (Starmer 2005). According to a 2020 Coastal Resilience Study, the West Takpochao area is particularly susceptible to episodic flooding which degrades nearshore water quality. The area is home to nearly 30% of the human population on

Saipan, is situated in a low lying area (average 2.5m/8ft) above sea level, and lacks infrastructure for floodwater runoff (Dobson et al. 2020). This area historically supported mangrove and wetland species which aid in absorbing floodwaters, filter pollutants and sediment, and act as a buffer to the nearshore habitats during flooding events. There are efforts to restore mangrove and wetland habitat in the West Takpochao watershed particularly around American Memorial Park, Smiling Cove Marina, and Governor Eloy Inos Peace Park.

Waters impaired by excessive nutrient or bacteria levels can be found across the southern islands, with 42%, 28% and 9% of the beach shorelines in Saipan, Tinian, and Rota, respectively, classified as impaired (Starmer et al. 2008). Data collected by the CNMI Marine Monitoring Team (MMT) suggests a continued decline in reef condition at sites with impaired water quality, indicated by decreased coral species richness and recruit abundance (Starmer et al. 2008).

### 6.5.3 Wastewater discharge

As with other kinds of pollutants, wastewater can enter coastal waters at discrete locations, such as sewage outfalls , or diffusely across a relatively large area . Two sewage outfalls exist in the CNMI, including one at Agingan Point and one at Sadog Tasi, Saipan. The Agingan Point outfall currently discharges treated effluent at the surf line into Class A receiving waters of the Tinian Channel, while the Sadog Tasi outfall discharges treated effluent approximately 365 m offshore into the Class A receiving waters in Tanapag Harbor, Saipan Lagoon, at a depth of 15 m. Both outfalls are in violation of local water quality standards, and although the U.S. Environmental Protection Agency has been working with the Commonwealth Utilities Commission (CUC) to bring the outfalls into compliance, it is not clear when this will happen. The relocation of the Agingan Point outfall to discharge approximately 244 m from shore at a depth of 30 m is planned (Starmer et al. 2008). While the Agingan Sewage Treatment Plant will not be upgraded from secondary to tertiary treatment, the discharge of effluent into offshore ocean currents may assist in diffusing the effluent and moving it away from shore (Starmer et al. 2008). In 2006, the CUC replaced a sewer line that had been chronically overflowing into the lagoon at San Antonio, Saipan (Starmer et al. 2008).

The discharge of hypersaline, nitrate- and phosphate-rich waters from reverse osmosis water purification systems also has the potential to impact nearshore marine habitats. Starmer et al. (2008) reported that in 2005 all major hotels were illegally releasing wastewater from reverse osmosis systems. After action by the U.S. Environmental Protection Agency, the majority of these systems now discharge into deep injection wells. This mitigation action appears to have resulted in a short-term improvement in nearshore water quality, but it is still not known how the injection wells may impact water quality (Starmer et al. 2008).

### 6.5.4 Marine debris

Marine debris, including derelict fishing nets, fishing line, plastics, glass, metal, rubber and other types of discarded or abandoned human-made objects, can enter the marine environment directly from ships or indirectly when washed or blown from land or waterways into nearshore marine waters. Marine debris arriving to the shorelines of the CNMI from offshore can be found along the beaches in the southern islands, but the predominantly rocky, sea cliff-dominated shorelines and limited reef development on the windward exposures results in limited accumulation of marine debris in coral reef habitats. Debris generated by local, land-based activities are of greater concern (Starmer et al. 2008). This debris can impact marine habitats and species including sea turtle and seabird SGCN through breakage, entanglement, abrasion, and ingestion. Still, regular clean ups and outreach campaigns have limited the accumulation of these debris in shoreline and marine habitats and thus is considered only a minor concern in the CNMI.

### 6.5.5 Artificial light

Artificial lighting can impact use and habitat quality of beaches for sea turtle nesting. The presence of lights on or adjacent to nesting beaches alters the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings as they are attracted to light sources and drawn away from the water (Witherington and Bjorndal, 1991; Sella et al. 2006).

Sea turtle nesting in the CNMI is already restricted to a handful of beaches and associated strand that are currently little-influenced by artificial lighting. Additional coastal development could cause increased artificial lighting and therefore degradation of these areas for sea turtle nesting, in addition to other development impacts.

## 6.6 Harvest

The people of the CNMI are entitled to legally harvest and enjoy their fish, game, and other natural resources. The use and collection of åmut is a protected right in the CNMI constitution. We have regulations in place for some species to ensure that these resources will be sustainable, so our children and grandchildren can continue to enjoy these resources. Most harvest is legal, welcome, and not problematic, but there are a few cases where harvest can negatively impact fish and game SGCN.

### 6.6.1 Poaching/Human Persecution

Unpermitted fishing and hunting are on-going threats to SGCN. Illegal fishing and hunting can involve poaching from a no-take area such as a Marine Protected Area, or taking fish, lobster, or ayuyu smaller than the legal size limit. Out-of-season poaching of ayuyu is anecdotally reported as common. Poaching of haggan and fanihi continues to hinder recovery of these two federally threatened species which cannot be legally harvested. In addition to game species being targeted for hunting, some non-game species are harassed or killed for sport or spite - such as the ga’ga’ karisu (Saipan reed-warbler) and åga (Mariana crow).

### 6.6.2 Potentially unsustainable harvest

Many invertebrate SGCN are legally harvested and regulations only call for a permit from DFW, with no catch limits or reporting requirements. We are lacking basic biological information on many of these consumed invertebrates, i.e. we know little of their life history, abundance, distribution, habitat requirements, movements or behavior. We know that CNMI residents are securing permits for harvest, but monitoring efforts are lacking and the extent of legal harvest is unknown. Given these unknowns, harvest could potentially be occurring at an unsustainable level. In this case, the “threat” is a lack of information and monitoring and it is uncertain if harvest represents a “real” threat. Invertebrate SGCN groups for which this threat applies include mangrove crabs, marine snails, octopus, and clams.

### 6.6.3 Trophic effects of fishing

Fishing is a vitally important commercial, recreational, cultural, and subsistence activity across our islands. We have tremendous fisheries resources, but uneven harvest pressure. For example Saipan’s lagoon receives higher fishing pressure than any other prime fishing location in the CNMI accounting for 96,000-160,000 pounds of reef fish extracted each year (Van Ee, 2024). Overall, fish caught in shallow water (reef fish) are the primary source of subsistence fishing in the CNMI. Since access to prime reef fishing is limited to sheltered locations or highly seasonally fished, there is uneven fishing pressure on our reef fish resources. Some locations have abundant resources while other locations are severely depleted of targeted species. Locally depleted sites include the west coast of Saipan (Van Ee 2024, Amesbury et al. 1979; Cuetos-Bueno and Houk 2015; Duenas and Associates, Inc. 1997; Graham 1994; Houk et al. 2012; Starmer 2005; Trianni 1998b). Fisher people report less predictable resources such as seasonal runs of i’i and ti’ao, adult sized lagua and mafuti which are choice food reef fish.

Bottom fishing and pelagic fishing make up the rest of the commercial fish market in the CNMI. These resources are difficult to manage due to the vast depth and distance these species inhabit.

Humans become competitors of large piscivores like the SGCN grey reef shark, which will find less prey available in areas frequently fished by humans. Commercial harvesting of reef fish has been implicated as contributing to coral reef declines elsewhere as some fish targeted for market also serve important roles in reef ecology and local experts align on this subject, that the impacts of reef fish harvest is having a negative effect on our coral reefs ability to recover from other stressors such as bleaching and storm events.

## 6.7 Tourism & Recreation

Tourism is the backbone of the CNMI economy. Most visitors to the CNMI come from Korea, China, and Japan, typically from large urban centers where they may have less opportunity to interact with nature and wildlife at home. This remains a primary reason why tourists visit our islands, to enjoy the natural beauty and wildlife, on land and in the water. However, they are often unaware of the impacts of their activities, especially in the marine environment. CNMI residents participate in many of the same activities that foreign tourists do, but typically have a higher degree of awareness of how their actions can impact resources, at least in the marine environment.

### 6.7.1 Potential marine impacts

Reef sites visited on a regular basis by tourists and other recreational users may be impacted as a result of intentional and accidental physical contact with corals and other benthic organisms, which may result in breakage, tissue damage, and potentially secondary infection of those organisms directly impacted. Over time, these impacts may lead to coral mortality and may reduce the structural complexity and diversity of habitat available for reef fishes and other reef-dependent species. Physical contact with corals and other organisms can occur by individuals engaged in wading, swimming, snorkeling, scuba diving, kayaking, paddle boarding, and other recreational activities, or by anchors or vessels used in recreational activities. Physical impacts may cause long-term changes to the benthic community structure and composition, and ultimately to changes in reef fish communities and other reef-dependent species.

Recreational overuse, which can occur even with informed and conscientious users, can be exacerbated by poor reef etiquette. The most severe instances of recreational overuse and misuse are usually restricted to high-traffic reef sites that are generally somewhat limited in size, although even areas that receive less traffic may still be impacted. While recreational impacts are generally limited in scale when compared to the total reef area of the CNMI, they also are often focused on more accessible, high value areas such as Mañagaha Island. Such impacts jeopardize the long-term viability of reef-centered tourism, and may also affect fishing and other uses of the area.

Better educating visitors can partially address the problem. Tour guides, who are at the front lines of mitigating the recreation impacts on our resources accompany most tourists. However, we also regularly see occurrences of tour guides misusing the resources, i.e. by feeding reef fish to bring them closer for tourists to view. The use of certain foods, such as those high in animal fats, may be directly harmful to fishes by negatively altering their diet. Fish feeding also appears to alter the behavior of fish species, causing some species to become more aggressive, even biting recreational users at sites where fish feeding is commonly practiced.

Another potential concern is the request by hotel operators to remove seagrass beds from designated swim zones (Starmer 2005). Although no action has been taken by the operators to obtain the proper permissions to remove the seagrass or move the swim zones, the requests indicate a need to educate the public about the importance of seagrass beds. Given the lack of sexual reproduction, it can take decades for Saipan's seagrass to recover from a few meters of removal (Derick et al. 2024).

Some small boat owners - typically row boats - will stash their vessels in the mangroves in the bay. To hide their boats, they will cut trails through the mangrove, which damages the plants and reduces habitat resiliency.

### 6.7.2 Potential terrestrial impacts

#### Cave disturbance

Although unquantified, we expect that cave visitation poses the most potential problem on Saipan, with the highest human population and one of only two CNMI islands that hosts the cave-nesting SGCN Mariana swiftlet, a federal and local endangered species. Human disturbance caused by entering swiftlet caves can alter the behavior of nesting swiftlets, and can even cause nest abandonment. Cave visitation is a common recreational activity given the history of their use in ancient Chamorro times and during WWII.

#### Driving on beaches

Vehicle driving on beaches is restricted and relatively uncommon now, but still occasionally occurs, potentially causing compaction of sand and other sediments, direct injury or mortality of wildlife, and reduction in habitat quality. This is of particular concern for those beaches utilized by sea turtles for nesting. Vehicle use in beach strand habitat may cause further habitat degradation by damaging strand vegetation, resulting in increased erosion.

## 6.8 Natural Disaster

### 6.8.1 Typhoons

The CNMI lies within a region of high typhoon activity, with an average of three typhoons passing within 300 nm of Saipan annually since 1970 (Lander 2004) (Figure 58).

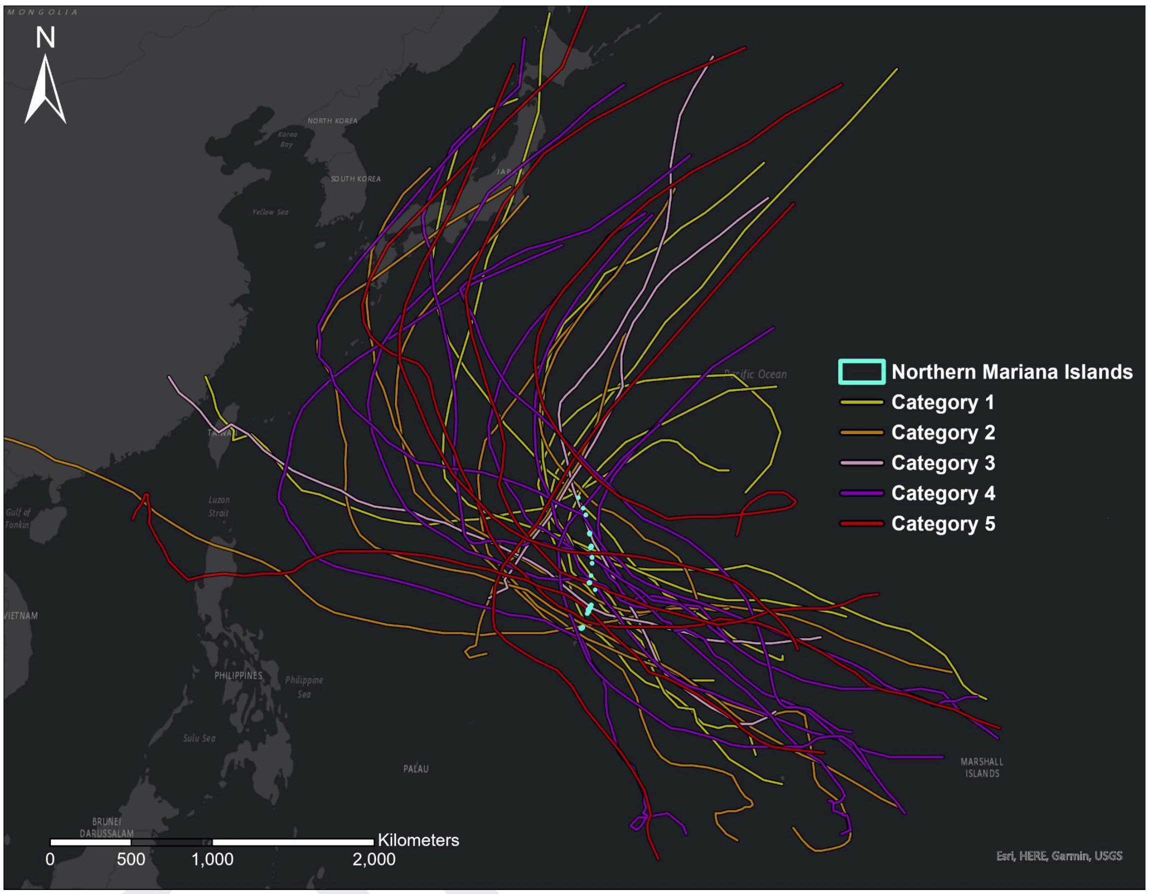


Figure 58. Typhoon events that passed through the Northern Mariana Islands from 2000-2023. Source: United States Naval Research Lab, Monterey, and Joint Typhoon Warning Center 2025.

Strong typhoons have short- and long-term impacts on SGCN. SGCN dependent on forest for food and shelter may find short-term survival challenging. For example, fruit and nectar-eating SGCN such as fanihi, totot, and egigi can starve as most fruits and flowers are stripped from trees. Over the long-term, forest habitat can take years to regrow or several seasons to recover to pre-typhoon conditions, which has long-term population level impacts on forest SGCN particularly if successive typhoon events occur within short time frames (Brewington et al. 2023).

In addition, typhoons create widespread disturbance across forests, often benefiting invasive species. Following typhoons invasive vines grow and spread rapidly by taking advantage of new gaps in the forest canopy.

Severe typhoons are also accompanied by wave action that causes physical damage to coral SGCN, which can take years to be replaced and will have cascading, indirect effects on reef-dependent SGCN. Storm wind-driven waves can cause significant physical damage to shallow coral reef areas, and storm surge and setup can cause coastal erosion and associated reductions in nearshore water quality. The impacts of storm surge on nearshore habitats may be exacerbated where artificial shoreline structures, such as wharves, groins, and jetties occur; these structures reflect rather than attenuate wave energy, resulting in additional movement of sediments. Storm surge can also move loose objects, such as corals, sunken vessels, “permanent buoys”, and other debris, causing additional physical damage to nearby marine habitats (Starmer 2005). Heavy rainfall and runoff associated with storms can cause large influxes of freshwater into the nearshore marine environment. The freshwater runoff can significantly alter the salinity and temperature of nearshore receiving waters, and can contain sediments, nutrients, and other pollutants that with prolonged exposure can stress or even cause mortality in corals and other marine organisms (Jokiel et al. 1993). Heavy rainfall can also cause upland erosion, adding to the load of sediments and organic matter in runoff. Heavy winds and rain can also deposit trash and debris into nearshore waters. The impacts of storm-associated runoff on nearshore marine habitats can be exacerbated by coastal development, poor land use practices, and inadequate stormwater drainage infrastructure. Large volumes of stormwater runoff may also overwhelm wastewater treatment facilities, resulting in the release of untreated or under-treated sewage into nearshore waters. In addition, coral reef ecosystems chronically affected by degraded water quality and with reduced herbivorous fish populations may not be able to recover from storm-associated damage, potentially shifting from a coral-dominated to algae-dominated state.

Although typhoons can be destructive to terrestrial and marine habitats, they are a natural occurrence in the CNMI, and SGCN and their habitats typically recover readily from temporary post-typhoon declines (Brewington et al. 2023). Based on the historical frequency and severity of typhoons, we only consider typhoons a potential threat to very small or range restricted SGCN populations, where any disaster could tip the scales toward extirpation. For example, the Pacific sheath-tailed bat lives only on Aguiguan, with fewer than 500 individuals in a single population. The effects of a severe typhoon hitting Aguiguan could be disastrous for a population in an already precarious position such as this.

However, we cannot assume that the frequency and severity of typhoons will continue according to the historical pattern, so the potential threat of typhoons may change. This was discussed previously in Section 6.3.4.

### 6.8.2 Volcanic activity

While all of the Mariana Islands are volcanic in origin, the northern islands are geologically younger and experience more volcanic activity. Volcanoes on Anatahan, Pagan, and Sarigan are particularly active and could experience an unpredictable eruption at any time. A devastating eruption could extirpate most terrestrial wildlife and vegetation on an island. Ash runoff can have nearly as devastating an effect on nearshore marine habitats, as happened on Anatahan during the 2003-2008 volcanic activity there. The 2003 eruption of Anatahan is believed to have resulted in the extirpation of all landbirds on the island, though there is evidence that several bird species survived the event and/or have started to repopulate the island (DFW 2021).

Underwater volcanic activity in the Northern Islands also plays into coral reef and benthic habitat dynamics. Seamount "ash" plumes can smother coral reefs and alter the landscape of marine habitat around the remote northern islands, oftentimes in ways in which we cannot feasibly monitor or measure. There is a misconception that the Northern Islands are in an untouched pristine landscape, in fact, they are dynamic and unstable landscapes shaped by their unique geologic activity. Populations of species on the Northern Islands should be viewed as bonus populations and not long-term population banks that we can count on for perpetual species preservation.

Again, extirpations from volcanic eruptions are a natural, unavoidable process. On long timescales, these islands would recover and eventually be repopulated, at least by mobile species such as birds. However, many of our endemic SGCN have been greatly reduced from their historical abundance or distribution due to other human-related causes. Potential source populations for repopulation are smaller and fewer, so the process will take much longer, and greatly increases the risk of extinction of narrow-range endemic SGCN. Mariana skink, for example, formerly occurred across the southern islands, but is now known to occur on only 5 northern islands, including Pagan and Sarigan. The loss of any of its island populations would significantly increase the overall risk of extinction.

### 6.8.3 Wildfire

Wildfires are one of the costliest human economic and wildlife disasters in the United States (JEC 2023). Wildfires are increasingly becoming costly for society for their impact on human life, infrastructure, property value, and the environment. In the CNMI, wildfire is very rarely a natural occurrence, but is typically human-caused, both intentionally and unintentionally. Some hunters on Saipan, Tinian, Rota intentionally start fires in grassland areas to attract deer since the species will feed on regenerating vegetation. Wildfires prevent these areas from succeeding to forest and repeated burns provide a constant state of early succession (Bubb 2022). Grassland does not prevent runoff and forest, so heavy rainfall results in increased erosion, with sediments carried into the marine environment and degrading habitats for marine SGCN. Wildfires can transform our forests, which are not fire-adapted, into grassland, or even to bare land with repeated fires. Wildfires have become an almost yearly occurrence on the southern islands and impact large swaths of land where they occur. With increasingly drier dry seasons, wildfires threaten to spread beyond the forest and can impact residential and commercial neighborhoods.

Post World War II reseeding effort in the CNMI included the spread of non-native trees like tangantangan and other fabaceae trees. Tangantangan is particularly susceptible to fire damage as it rarely grows trunks larger than 10 cm in diameter. Tangantangan is a dominant forest species in areas of Saipan and Tinian, and in smaller patches on Rota. When these areas burn repeatedly, the natural succession of forest species is suppressed and forest recovery is delayed. This is particularly problematic on Tinian, where natural forest recovery post WWII has been slow and patchy. In a study of wildfires on Pacific Islands, Tinian had 30% of native forest intersecting with burned areas (Trauernicht et al, 2023). Annual wildfire regimes can delay the recovery of forest plants.

Some wildfires on Saipan have been incidents of suspected arson. There are reports of intentional fires set on properties where development is planned and have yet to be permitted. According to the “The Trash Burning Law of Saipan”, burning trash or green waste on private property is unlawful unless you obtain a permit from the Department of Public Safety. Agricultural burning permits are provided by BECQ. However, unpermitted burns are not enforced.

The Talakhaya Revegetation Project is a great example of collaborative multi-pronged approach to watershed management with a major focus on outreach and arson prevention. The Talakhaya has historically been a popular area for hunters who would annually burn the area. Repeated burning caused severe substrate damage and soil erosion which had downstream effects on the coral reef and fishing area along the coast below the Talakhaya. Local and federal agencies with the help of volunteers worked together to revegetate the area, spread awareness of fire damage, and the importance of watershed protection.

## 6.9 Sea Transportation

Various aspects of sea transport have the potential to negatively impact marine SGCN and their habitats. Commercial shipping activities, due to the larger size of the ships, have greater potential for negative impacts in the form of groundings. For example, the 2014 grounding of the *M/V Paul Russ* near the channel leading into the Port of Saipan impacted more than 3,100m$^2$ of benthic habitat, including an estimated loss of more than 16,000 coral colonies, as well as a significant reduction in reef complexity at the impact site (Johnston et al. 2015). In some instances, in addition to the physical damage to reef habitat and species, vessel grounding can also cause the release of fuel, oil, and other chemicals that may affect marine habitats, including far from the grounding site.

Although very infrequent, dredging is required to maintain commercial shipping lanes. Dredging raises sediment that can smother and kill nearby corals and other organisms. When the Saipan shipping channel was last dredged in the mid-1990's, spinner dolphins became stranded in the Saipan Lagoon, presumably after becoming disoriented by the dredging activities (Trianni and Kessler 2002).

Not restricted to commercial ships, boats of any size can strike and potentially kill or injure large marine animals. Little information is available on vessel strikes in the CNMI, but SGCN spinner dolphin and grey reef shark are seen with what appear to be scars or injuries from strikes (Trianni and Kessler 2002).

# 7 Conservation Plans

We developed goals, objectives, strategies, and actions that we believe will bring about optimal conservation of our fish and wildlife resources based on the best available science, discussions with species and habitat experts, consultation with a diverse set of stakeholders, and public participation. The plans outlined in this section range from landscape-scale broad goals to species specific targets. The following sections of this chapter describe our adaptive monitoring approach, detailing adjustments to conservation plans based on emergent information, current conditions, and capacity.

**Plans** describe the **goals**, **strategies**, **actions**, and potential participants that will be utilized to accomplish our desired **goals.**

**Goals** describe broad primary outcomes or desired conditions, i.e. what condition do we want for the species or island? Clearly articulated goals provide the necessary framework for decision making when conservation resources are limited.

**Strategies** and **actions** are the general approach taken to achieve a **goal**.

This Chapter has four subsections: Landscape-scale Plans, Key Threat Management plans, Participation and Coordination plans, SGCN Conservation plans, Monitoring plans, and Research Needs.

## 7.1 Landscape-Scale Plans

Landscape-scale conservation is the application of conservation measures that take into consideration the interconnected and ecosystem-wide implications of those actions including all species affected by the actions taken. We refer to the overarching challenges and opportunities associated with certain ecosystems by their habitat type but understand that they are connected to the broader landscape of the Mariana archipelago. The goals and strategies will benefit entire ecosystems or suites of SGCN.

The CNMI has committed to the Micronesia Challenge 2030. Many of the conservation strategies described below are aimed at addressing the targets of this agreement, which are as follows:

- To effectively manage 50% of marine resources and 30% of terrestrial resources by 2030 across Micronesia

- Increase the number of community members within each jurisdiction who are deriving livelihoods from sustainably managed natural resources
- Reduce the risks from climate impacts for communities within flood zones and on low-lying islands
- Reduce invasive species and increase restoration of habitats
- Incorporate regional and jurisdictional fisheries management approaches, integrated with MPA's

All other conservation actions and strategies are designed to address the unique conservation needs of our SGCN and their habitats. More detailed species specific conservation plans are provided in Chapter 8 Species of Greatest Conservation Need. (*To be updated in August 2025*)

## *Ridge to Reef Conservation Plans*

| **Native Forest Conservation and Management** | |
|---|---|
| Goal: Protect, enhance, and restore native forest to provide habitat in sufficient quantity and quality for SGCN and other native wildlife. These goals apply to all our islands, but particularly Rota, Tinian, Aguiguan, and Saipan which are most impacted by human activities. | |
| High Priority Actions and Strategies | Support the development of a Comprehensive Forest Management Plan |
| | Identify high-priority forest restoration sites on Saipan and Tinian and develop long-term restoration plans for these sites |
| | Identify sites for ungulate exclusion, removal, or suppression on Rota, Saipan, Tinian, Aguiguan, Pagan, and Alamagan |
| | Promote the management of already established conservation areas by updating their respective management plans as well as monitoring habitat and species |
| Priority Actions and Strategies | Develop or update terrestrial conservation area management plans |
| | Follow guidance from the CNMI Forest Action Plan |

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|---|---|
| | 2020-2030 (and revised editions) |
| | Develop methods for monitoring and preventing the spread of brown root rot (*Phellinus noxius*) |
| | Identify suitable tracts of land for forest restoration - conservation opportunity areas |
| | Investigate native pollinator community ecology: relationships between native plants and pollinators |
| | Conduct baseline assessment of native pollinators in the CNMI |
| | Develop a regional wildfire reduction outreach and education campaign with Guam Forestry |
| | Build capacity within DLNR Forestry for propagating native limestone forest species to supply restoration projects |
| | Identify resilient species and prioritize these plants for restoration projects |
| | Develop broad integrated pest management plan that will benefit SGCN plants and forest health |
| | Develop agroforestry practices that promote an inclusive habitat for native forest-dependent species within agricultural sites |
| | Support new management strategies for deer and other ungulates tailored to the needs of each island |
| | Investigate native forest ecosystem processes to enhance restoration efforts, including soil microorganisms, mycology, native and introduced pollinators, and decomposers |

| **Wetland and Freshwater Habitat Conservation and Management** |
|---|

<table>
<tr><th colspan="2">Goal: Protect, enhance, and restore wetlands and freshwater habitat to benefit wetland dependent SGCN and improve ecosystem services for both animal and urban infrastructure benefit</th></tr>
<tr><td rowspan="5">High Priority Actions and Strategies</td><td>Increase total acreage of functional freshwater and brackishwater habitat</td></tr>
<tr><td>Implement management strategies to restore degraded wetlands around Garapan and Tanapag, Saipan</td></tr>
<tr><td>Implement invasive species control measures in wetland areas</td></tr>
<tr><td>Propose improvements to stream buffer and stream crossing standards for infrastructure projects</td></tr>
<tr><td>Investigate development projects that have violated existing regulations and employ corrective measures to reduce further degradation of habitat</td></tr>
<tr><td rowspan="4">Priority Actions and Strategies</td><td>Establish or expand wetland buffer areas where lacking to mitigate impacts from surrounding land uses. This is especially relevant for the coastal freshwater wetlands along the west side of Saipan that have been cross hatched by roadways</td></tr>
<tr><td>Implement regular wetland monitoring, wetland-specific management plans, and conduct delineation at key critical wetland areas to track changes in extent, condition, and function</td></tr>
<tr><td>Limit and reduce the spread of invasive plant species while implementing control measures in targeted wetland areas of greatest concern.</td></tr>
<tr><td>Enhance public understanding of the ecological and economic value of wetlands in general. Outreach opportunities regarding Susupe Lake, Lake Hagoi, and CK Potholes may prove especially beneficial to long-term SGCN objectives</td></tr>
</table>

| | |
|---|---|
| | Develop and implement wetland-specific management plans for key areas on each island |
| | Engage with landowner, NGOs, and government agencies to promote wetland conservation |
| | Establish wetland buffer areas to mitigate impacts from surrounding land uses |
| | Increase understanding of stream and riparian ecology through localized research |
| | Develop a comprehensive freshwater species inventory for the CNMI |
| | Promote implementation, revision, and development of existing and slated watershed management plans (e.g 2020 Garapan WMP, and 2020 Talakhaya WMP) |
| | Research the possibility of hybrid agricultural and native plant restoration methods for wetlands in areas where community gardens are of interest (taro production) |
| | Support land swap or land acquisition program to allow landowners with wetland or freshwater resources to exchange land for more suitable plots of land |

| **Coastal Habitat** | |
|---|---|
| Goal: Protect, enhance, and restore coastal habitat to improve water quality in the nearshore habitat, improve coastal resilience, and ensure sufficient quantity and quality habitat for coastal dwelling SGCN | |
| High Priority Actions and Strategies | Propose policy to protect mangroves within the CNMI |
| | Propose policy to protect seagrass within the Saipan Lagoon |
| | Conduct feasibility assessment for translocating female phenotype of *Enhalus acoroides* to the Saipan Lagoon to |

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|---|---|
| | support sexual reproduction, gene mixing, and to build up the species resilience |
| Priority Actions and Strategies | Develop beached sea mammal response plan that includes sample/data collection, clean-up, and other needs |
| | Produce educational signage in multiple languages at popular beaches to reduce littering, reduce beach driving, and encourage sustainable enjoyment of beaches and promote endemic wildlife |
| | Install wildlife-safe lighting at all beach walkways and coastal shelters |
| | Identify coastal habitat in need of restoration and utilize appropriate methods to rehabilitate each site including planting native coastal plants, mangroves where appropriate, and other coast stabilizing plants and materials |

| **Coral Reef Restoration and Management** | |
|---|---|
| Goal: Maintain efforts to build and enhance coral reefs as critical infrastructure, especially in response to bleaching events | |
| High Priority Actions and Strategies | Continue to support and develop coral nurseries for propagation, seeding, research and reef restoration, including ESA-listed corals |
| | Support the development and implementation of coral reef management plans, coral bleaching response plans, ship grounding, disease, and acidification |
| | Maintain participation in the US Coral Reef Task Force and All Islands Committee |
| Priority Actions and Strategies | Coordinate with Guam and other regional natural resource managers for capacity building, laboratory |

| | |
|---|---|
| | support, data sharing, and landscape scale coral reef restoration efforts |
| | Prioritize reefs for management, and implement appropriate actions to reduce the impacts of bleaching events |

| **Fishery Management** | |
|---|---|
| Goal: Manage fishery across the archipelago to ensure sustainable harvest, future availability, and equitable access to food resources. | |
| High Priority Actions and Strategies | Propose new fishing regulations that reflect the needs of each island based on the six tools for fisheries management: gear restrictions, spatial and temporal controls, MPAs, catch limits, fishing effort limits, and fish size restrictions |
| | Build capacity by training fisheries managers on Rota and Tinian to support community based fisheries management - coordinate with municipal agencies to support this effort |
| | Produce outreach materials to encourage sustainable fishing practices in multiple languages at popular fishing locations on Saipan, Tinian and Rota |
| Priority Actions and Strategies | Investigate seasonal fisheries across the archipelago including Guam and the  Northern Islands to help understand “source” and “sink” populations of our major food fish species |
| | Identify potential threats to “source” populations to ensure juvenile phase fish are able to reach breeding status or catchable size |
| | Find CREEL reporting solutions for Rota and Tinian to support fishery monitoring needs |

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|---|---|
| | Support education program for sustainable fishing practices |
| | Propose regulations for commercial fishing fleets from Saipan on Northern Islands, Tinian, Aguiguan, and Rota |
| | Promote safe and sustainable spearfishing practices, support the development of a spearfishing safety training course |
| | Develop non-punitive measures to incentivize individuals and companies to comply with and promote fishing regulations and sustainable use of marine resources |

| **Marine Protected Area Management** | |
|---|---|
| Goal: Increase the effectiveness of existing Marine Protected Areas through enhanced monitoring and adaptive management practices | |
| High Priority Actions and Strategies | Develop MPA proposal for Tinian in coordination with Tinian leadership and stakeholders |
| | Demarcate all MPA boundaries with in-water buoys (where feasible) or land markers and install and maintain signage at all MPAs communicating responsible and allowable uses |
| Priority Actions and Strategies | Develop and maintain a long-term sustainable funding stream to support MPA management, restoration, and enforcement |
| | Develop and implement or update management plans for all six MPAs |
| | Develop regulations to further MPA objectives, as outlined in Public Laws and CNMI Administrative Code |
| | Coordinate with Guam natural resource managers to |

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| | develop strategies for cost-saving collaborative opportunities including data sharing, cross training, and shared projects |
| | Monitor for invasive species, pathogens, and habitat degradation |

| **Offshore Marine Habitat** | |
|---|---|
| Goal: Establish baseline data for future management decisions | |
| High Priority Actions and Strategies | Investigate the potential local impacts of deep sea mining in the region |
| | Conduct feasibility study on potential regulations for pelagic and bottom fishing |
| | Coordinate with deep sea exploration teams for data sharing and capacity building opportunities |

## 7.2 Key Threat Management Plans

Threat management strategies and actions are built around finding the most effective tools for reducing or eliminating risks to SGCN and their habitat. Below are detailed actions and strategies for three main categories of threats that impact the most SGCN across broad landscapes. Unique threat management strategies and actions are detailed in each SGCN and SGIN species profile page in Chapter 8.

| **Marine Trash and Toxins Reduction** | |
|---|---|
| Goal: Identify sources and find methods to reduce runoff from land-based sources of trash and toxins | |
| High Priority Actions and Strategies | Encourage continued implementation and adherence to local watershed plans such as the 2020 Garpan WMP, LauLau Bay WMP, and 2020 Talakhaya WMP |
| | Continue to build local capacity for proper pesticide |

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| | and herbicide application |
| | Encourage strict enforcement of imported chemicals to reduce banned chemical usage |
| Priority Actions and Strategies | Develop broad integrated pest management plans developed by local agricultural experts that benefit agricultural operations in the CNMI and reduce chemical pesticide and herbicide use |
| | Map the sources and distribution of pollutants in Saipan Lagoon in relation to trash-sensitive marine SGCN; target actions in locations that can most benefit SGCN |
| | Employ public outreach campaign to encourage safe use of agricultural and household chemicals that have the potential to impact the marine environment |
| | Build local capacity for proper pesticide and herbicide application to help increase local knowledge of safe application of these chemicals |

| **Invasive Species Prevention** | |
|---|---|
| Goals: Prevent introduction of new invasive species to the CNMI through interdiction, early detection, and rapid response; prevent the spread of invasive species among CNMI islands; manage invasive species as needed to protect key areas for SGCN. | |
| High Priority Actions and Strategies | Finalize comprehensive CNMI biosecurity plan |
| | Collaborate with Guam and other relevant stakeholders to develop a regional biosecurity plan and schedule regular updates to the plan |
| | Continue to coordinate with regional partners such as DoD, USFWS, and Guam to secure our borders from invasive species |
| Priority Actions and Strategies | Develop new regulations and enforce biosecurity |

| | |
|---|---|
| | measures for all expeditions to the Northern Islands |
| | Engage with municipal leaders to explore feasibility of ungulate exclosure areas on islands with feral ungulate populations that are an important food resource (Northern Islands and Aguijuan) |
| | Educate boat owners about invasive species and measures to take that prevent the spread of these species |
| | Establish an invasive vine management program on Saipan, Tinian, and Rota to conserve ecological structure and function of important forest areas for SGCN |
| | Develop protocols and capacity for early detection/rapid response to invasive/nuisance species arrivals |
| | Build capacity in the CNMI for the application of biocontrols and pesticide application including identifying funding systems for this effort |
| | Establish  lab partnerships to identify pathogens and pests; Establish channels and partnerships to access the necessary information for effective control, eradication, and management of invasive species |
| | Identify sites for rat, cat and dog suppression for the benefit of wildlife and human health |

| Compliance with Conservation Regulations | |
|---|---|
| Goals: Increase resources for enforcement on all islands; enhance public awareness of conservation regulations through education and awareness campaigns | |
| High Priority Actions and Strategies | Support the development of a comprehensive programmatic Habitat Conservation Plan for the CNMI |

| | |
|---|---|
| | Install and maintain signage at all Conservation Areas and MPAs describing allowable uses |
| | Promote the use and management of any mitigation plans including the Saipan Upland Mitigation Bank |
| | Coordinate with Guam to identify strategic regional funding opportunities for enforcement |
| Priority Actions and Strategies | Publish and promote educational materials for wildlife regulations and sustainable use practices |
| | Complete demarcation of all Conservation Areas and MPA boundaries |
| | Continue and improve the delivery of information about conservation regulations through the DFW, BECQ, and other websites, and through social media networks |
| | Maintain existing funding for conservation enforcement, and seek new sources of funding |
| | Develop non-punitive incentives for regulatory compliance by individuals and companies |
| | Clarify allowable activities under existing hunting, fishing, and gathering regulations |
| | Promote inter-island exchange of enforcement resources and manpower to ensure public compliance with regulations |

## 7.3 Participation and Coordination Plans

The following goals and associated actions and strategies describe how we can formalize public participation in conservation initiatives, build capacity, and promote sustainable use of our natural resources.

| **Public Engagement in Conservation** |
|---|

| Goal: Increase public support for conservation of SGCN and habitats | |
|---|---|
| High Priority Actions and Strategies | Continue and expand on environmental education and outreach efforts by filling vacant Public Information Officer (PIO) positions within agencies |
| | Commit to increased science communication and public engagement |
| | Publish results of research and technical reports in a timely manner to promote adaptive management |
| | Support and encourage community-science grassroots conservation efforts |
| Priority Actions and Strategies | Promote community-science data collection for targeted research needs (SGCN distributions and sightings) |
| | Increase public support for conservation by providing trails, signage, and restoration demonstrations |
| | Promote native forest species by adding native species to public spaces and tourist sites, including Garapan roadside garden beds, popular Tinian beach sidewalk areas, and outdoor community spaces on Rota |
| | Prioritize employing Public Information Officers within agencies to disseminate information about project results to the public |
| | Support the existing youth ranger programs |

| **Educated, Experienced Workforce in Conservation Agencies** |
|---|
| Goals: Increase capacity to carry out conservation initiatives  the educational level of professional and administrative staff working in conservation agencies; reduce turnover of professional staff |

| | |
|---|---|
| Priority Actions and Strategies | Continue to provide financial incentives such as tuition reimbursement for existing employees to pursue degrees or certifications related to their position |
| | Develop an apprenticeship or other program for conservation agencies to hire and train recent college graduates with ties to the Mariana Islands |
| | Continue to provide opportunities for local high school and college students to intern with conservation agencies |
| | Ensure that salaries for conservation agency positions remain competitive compared to other U.S. states and territories |

| Strategic Use of Resources | |
|---|---|
| Goal: Enhance the capability of CNMI conservation agencies and organizations to coordinate on proactive conservation efforts | |
| High Priority Actions and Strategies | Improve communication and cooperation among state and local agencies and organizations to avoid redundant efforts and to partner when interests are shared |
| | Develop island-wide conservation and management plans for all 14 islands in a process that includes stakeholder involvement; include an evaluation of restoration and reintroduction opportunities |
| | Coordinate with partners on Guam for regional conservation priorities |
| | Conduct bio inventories to gather basic information about the abundance, distribution, and habitats of both rare and common native species on all islands; develop a data management system to track information as part of a proactive approach to avoid the need for ESA listings |

| | |
|---|---|
| Priority Actions and Strategies | Update conservation genetics plan as needed |
| | Utilize conservation genetics plan to prioritize species for conservation management |
| | Coordinate with partners on Guam for regional conservation priorities |
| | Coordinate with municipal agencies to help carry out local restoration projects to help build capacity and expand cross jurisdictional cooperation and participation in mutually beneficial projects |

## 7.4 SGCN Conservation Plans by Island

The following summarizes by island the priority actions identified for SGCN in Chapter 8. Additional detailed actions are not included here, but can be found in Chapter 8 (to be updated upon completion of the Species Profile Pages in August 2025).

| **All Islands** | |
|---|---|
| High Priority Actions and Strategies | Update the Mariana Avifauna Conservation Plan (MAC) with stakeholder engagement and consideration of species full range conservation (including Guam) |
| | Employ biosecurity measures on ALL islands to prevent the spread of invasives |
| | Promote sustainable hunting and fishing practices through outreach, education, and enforcement |
| | Develop comprehensive Conservation Action Plans for SGCN |
| | Prioritize resilient species of coral and native plants for restoration projects |
| Priority Actions and Strategies | Establish and publish a standard “State of the Birds” report for the CNMI for public awareness |

| | |
|---|---|
| | Collaborate with Guam natural resource managers to develop seed exchange program to support genetic diversity of shared SGCN plants |
| | Propose incinerator capabilities for each island for biosecurity needs |
| | Conduct baseline surveys for known rare or declining åmut |
| | Identify areas for ungulate control through eradication, suppression, or exclusion fencing |
| | Utilize conservation genetics plan to sort out taxonomic order of species where clarification is needed |
| | Conduct regular bio-blitz style surveys on Saipan, Tinian, and Rota to help identify new introductions and aid in establishing baseline distribution of SGIN |
| | Establish captive propagation program for fanihi conservation |
| | Explore partnerships to establish captive propagation programs for endangered species (fanihi, akaleha, aga, dulalas luta, ko'ko) |



| **Rota** | |
|---|---|
| High Priority Actions and Strategies | Protect and enhance habitat at key tree snail colonies (i.e. ungulate/predator exclosures, rat trapping, and/or vegetation management) |
| | Continue to augment the wild åga population with captive reared birds |

| | |
|---|---|
| | Seek funding for a swift and coordinated control of feral pig populations, incorporate Rota municipal agencies to lead the effort |
| | Move forward with translocation feasibility assessments for nosa Luta and åga |
| | Establish captive propagation program for endangered snails, explore opportunities to collaborate with Guam on this effort |
| Priority Actions and Strategies | Continue existing education, monitoring, and enforcement efforts for fanihi conservation |
| | Continue to conduct outreach and education to build public support or tolerance for åga recovery efforts, and to reduce poaching of fanihi and other SGCN |
| | Reintroduce chachaguak (moving birds from Saipan population) |
| | Address rat and drongo threats to nosa Luta |
| | Determine host plant(s) for the dulalas Luta (Rota blue damselfly, *Ischnura luta*) |
| | Adjust deer population management practices to reflect local population dynamics of deer and deer biology on Rota through population monitoring, appropriate hunting regulations, and enforcement |
| | Ensure long-term protection of key sea turtle nesting areas, discourage beach driving, promote use of wildlife safe lighting systems at public and private beaches |
| | Develop a Rota fishery and coral reef monitoring program by coordinating with municipal natural resource management divisions |

| | |
|---|---|
| | Promote an SGCN plant propagation, protection, and monitoring program |
| | Educate landowners about riparian habitat regulations, allowable uses, and conservation mitigation opportunities to promote sustainable use of streams on private land |
| | Develop citizen science opportunities for akaleha population distribution and mapping |

| **Aguiguan** | |
|---|---|
| High Priority Actions and Strategies | Conduct bio inventory survey on the island to identify population status of SGCN avian, reptile, invertebrate, and plants of the island |
| | Determine impacts of goats on habitat and SGCN distribution across the island |
| Priority Actions and Strategies | Conduct Environmental Assessment (EA) for fanihin liyang translocation |
| | Determine impacts of halitai on sasangat and other SGCN |
| | Implement trash removal/prevention program |
| | Conduct habitat assessment and restoration projects as needed |

| **Tinian** | |
|---|---|
| High Priority Actions and Strategies | Prioritize areas to implement habitat conservation and management for pulattat, chichirikan Tinian, fanihi, haggan, ESA listed snails, fadang, and *heritiera longipediolata* |

| | |
|---|---|
| | Prioritize building up biosecurity capacity on Tinian including but not limited to fumigation and holding facility, additional personnel, & required equipment |
| | Propose marine protected area with the coordination and input from Tinian leadership and the public, for the long-term protection of coral reef and SGCN fishery refugia |
| | Ensure long-term protection of key sea turtle nesting areas, discourage beach driving, promote use of wildlife safe lighting systems at public and private beaches |
| Priority Actions and Strategies | Prevent extirpation of akaleha tree snail colonies using predator/ungulate exclosures, rat trapping, and/or vegetation management |
| | Reintroduce SGCN snails |
| | Conduct outreach and education for preventing fanihi harvest and promote protection of roosting sites |
| | Coordinate with the U.S. Navy on management of akaleha tree snail colonies and pulattat wetlands within the Military Lease Area |
| | Identify site(s) for terrestrial conservation and/or wildlife refuge area outside the MLA |
| | Develop a Tinian fishery and coral reef monitoring program by coordinating with municipal natural resource management divisions |
| | Identify locations for coral reef restoration and explore outplanting and restoration opportunities |
| | Enhance and protect wetland habitats for the pulattat, particularly at Lake Hagoi |

| | |
|---|---|
| | Conduct bio inventory on Tinian |
| | Assess feasibility of reintroducing chachaguak to Tinian |

| **Saipan** | |
|---|---|
| High Priority Actions and Strategies | Ensure compliance with the Saipan Upland Mitigation Bank (SUMB) agreement |
| | Prioritize forest restoration and habitat enhancement efforts that support forest dwelling species such as fanihi, birds, SGCN plants, and akaleha land snails |
| | Continue to support coral nurseries that provide propagation, seeding, restoration, and research for coral reef restoration |
| | Develop seagrass restoration, management, and protection measures to swiftly respond to declining seagrass cover in the Saipan Lagoon |
| Priority Actions and Strategies | Determine major threats to seagrass in the Saipan Lagoon and employ mitigation efforts where feasible |
| | Conduct outreach, education, and enforcement to reduce poaching of haggan, fanihi, and other SGCN |
| | Prevent extirpation of humped tree snail colonies using predator/ungulate exclosures, rat trapping, and/or vegetation management |
| | Reduce disturbance at key swiftlet caves using signage and/or gates |
| | Determine presence, distribution, and abundance of marine SGCN species |
| | Identify priority areas for forest restoration and |

| | |
|---|---|
| | propagate resilient native species for restoration and enhancement projects |
| | Conduct public outreach and education about the importance of SGCN habitats such as seagrass beds and mangrove forests |
| | Place signage in mangrove forest to deter the public from damaging this limited resource |
| | Support mangrove, wetland, and riparian habitat restoration efforts |
| | Educate landowners about riparian habitat regulations, allowable uses, and conservation mitigation opportunities to promote sustainable use of streams on private land |
| | Implement wetland restoration and enhancement projects, particularly in areas important to the Mariana common moorhen and nightingale reed-warbler. |
| | Utilize S.W.A.M.P.S. portfolio as framework for determining future wetlands enhancement/restoration projects on the island |

| **Noos (FDM)** | |
|---|---|
| Priority Actions and Strategies | Coordinate with the U.S. Navy to manage masked booby and other seabird nesting colonies |
| | Induce the U.S. Navy to honor its conservation commitments from the Mariana Islands Range Complex Record of Decision, including rat eradication on Noos |

| **Pagan** | |
|---|---|
| Priority Actions and Strategies | Map and assess the condition of wetland habitats |

| | |
|---|---|
| | Conduct feasibility assessment for habitat restoration and reintroduction of the Pulattat |

| **Anatahan** | |
|---|---|
| Priority Actions and Strategies | Identify, map, and assess the condition of wetland habitats |
| | More extensive bio inventory should be conducted, focused primarily on vegetation and presence of SGCN species |

| **All other Northern Islands** | |
|---|---|
| Priority Actions and Strategies | Promote biosecurity measures for all Northern Island bound vessels |
| | Improve monitoring methods to include automated recording unit deployment and workflow |
| | Develop ungulate exclosure plan on Alamagan to diminish effects of overbrowsing across the island |
| | Assess Agrihan for translocation of key SGCN forest bird species |
| | Assess sasangat population across the northern islands to determine population trends |
| | Follow through with regulations on reporting fisheries catch from the northern islands |
| | Work with NI municipal staff to conduct projects and build capacity |

# 7.5 Monitoring Strategy

## 7.5.1 Status Monitoring

"Status monitoring" is repeated survey methods that allow resource managers to track fluctuations in species and habitat quantity. These long-term data sets eventually show trends that we can infer causation for population fluctuation that help manage the populations or threats to the populations and resources. We measure the status of SGCN populations, habitats, and threats in an ongoing evaluation of status relative to SGCN population and habitat objectives. Status monitoring is also a critical component of adaptive management, as it may lead to changes in prioritization, if, for example, we detect an unexpected SGCN population decline, or an increased threat.

In the CNMI, we do not have access to large-scale regional or continental monitoring programs such as the North American Breeding Bird Survey to support our monitoring strategy and adaptive management. We also do not have sufficient human population to draw from to develop large citizen science monitoring efforts. We therefore are dependent on conservation partners to develop and implement monitoring programs.

We have many long-term, ongoing monitoring programs active in the CNMI. Some began years before the CNMI developed a Wildlife Action Plan in 2005. The purpose of these monitoring programs is rarely directly tied to the Action Plan, but rather was initiated and continues in response to a specific conservation need. The programs described below were designed for different purposes and may track different attributes of species, habitats, or threats, depending on the level and kinds of data needed by wildlife managers. All provide information that can be used for adaptively managing SGCN and their habitats. Many provide specific population or habitat information that we will use to directly measure our progress toward meeting the objectives described in this Plan.

Ongoing monitoring programs are summarized below. The lead or coordinating agency of a monitoring program is indicated in parentheses, but many monitoring programs involve important agency partnerships in implementation.

**Fish**

*Shore-based Creel Program* (DFW): Captures information on nearshore landings for ongoing monitoring of the capacity of the reef fishery to meet subsistence and commercial demand

*Boat-based Creel Program* (DFW): Captures information on vessel landings for ongoing monitoring of the capacity of the reef, pelagic, and bottom fisheries to meet subsistence and commercial demand

*Commercial Purchase Data program* (DFW/WPRFM Council/MES): Captures commercial landing data for all fish species landed on the island of Saipan to inform management decisions

*Exemption Surveys* (DFW): Captures information on net exemption landings for ongoing monitoring of potential impacts on the reef fishery
*Life History Program* (DFW/NOAA): Captures biological information (e.g., reproductive cycle, age at length, age at maturity) on important commercial reef fish species (landed on Saipan) to inform management decisions

*Marine Protected Area Surveys* (DFW): Monitors diversity and abundance of species within MPA's

*Lagoon Surveys* (DFW): Monitors diversity and abundance of species within the Saipan Lagoon

*Bio-Sampling Program* (NOAA): Captures catch and effort information on commercial reef fish and bottomfish catches landed on Saipan to inform management decisions

**Birds**
*Breeding Bird Survey* (DFW): Quarterly bird surveys on Saipan, less frequently Rota and Tinian, which monitor long-term trends of island bird populations, especially forest birds.

*Tropical Monitoring of Avian Productivity and Survivorship* (DFW): Surveys twice annually on Rota to monitor trends in forest bird productivity

*Christmas Bird Count* (DFW): Conducted by DFW staff and volunteers, the Count is conducted annually on Saipan, less frequently on Tinian and Rota, to monitor the presence and population trend of bird species during December/January, including wintering migrants.

*Mariana Swiftlet* (DFW): Cave entrance/exit counts twice annually on Saipan to monitor long-term population trends

*Rota white-eye* (DFW): Surveys twice annually to monitor the long-term population trend of this single-island endemic bird on Rota

*Shorebird, Wader, and Water Bird* (DFW): Quarterly surveys to monitor long-term population trends of wetland-associated birds, including migrants and Mariana Common Moorhens, on Saipan

*Wedge-tailed Shearwater* (DFW): Annual survey of Mañagaha nesting colony to monitor long-term population trend and productivity

*I'Chenchon Seabird* (DFW): Quarterly surveys of the I'Chenchon seabird colony on Rota that monitors the colony occupancy, nesting timing, recruitment rates, and habitat for nesting seabirds

*Mariana Crow* (DFW): Survey to estimate Rota population once every three years; annual survey to monitor population trends; annual nest monitoring; ongoing survival rate and mortality monitoring through radio tracking and band resighting

*Seabirds* (DoN): Quarterly surveys of seabirds on Noos (FDM)

*Mariana Common Moorhen*: Quarterly surveys on Lake Hagoi, Tinian (DoN); annual surveys on Rota and Tinian to monitor long-term population trends (DLNR)

*Micronesian Megapode* (DoN): Five-year surveys to detect presence of megapode on the Tinian MLA

*Island-wide Surveys* (USFWS/DFW): Variable point count surveys conducted on each island every 5-10 years to monitor long-term population trends, especially of forest birds

**Mammals**

*Fanihi* (Mariana Fruit Bat) (DFW): Monthly colony counts and twice annual extra-colonial surveys to monitor long-term population trends on Rota, Saipan, and Tinian

*Cetaceans* (DoN/NOAA): Annual surveys to monitor cetacean presence within the Mariana Island Range Complex, which extends from south of Guam to north of Pagan

**Reptiles**

*Green Sea Turtle*: Monthly surveys for nesting turtle emergencies and nest monitoring on Saipan (DFW) and less frequently on Tinian (non-MLA) and Rota.

**Invertebrates**

*Sea cucumber* (DFW): Occasional monitoring of edible sea cucumber populations on Saipan and Tinian to assess harvest impact

Terrestrial tree snails (DFW, DoD): Monthly colony monitoring on Rota, occasional colony monitoring on Saipan and Tinian

**Plants**
*Endangered Plant Program* (DLNR/DFW/Rota Forestry): Population monitoring, threat mitigation, seed collection, outplanting for endangered plants on Rota

**Habitats/Ecosystems***
*Long-Term Marine Monitoring Program* (BECQ/DLNR): Monitors trends in benthic cover and biological communities including fish, coral, macroalgae, and invertebrates at 50 permanent monitoring sites across Saipan, Tinian, and Rota. Sites encompass forereef, lagoonal reef, and seagrass habitats. Sites are surveyed every two years.

*Water Quality Sampling* (BECQ): Regular collection and analysis of samples from beaches on Rota, Tinian, and Saipan (including Mañagaha) to monitor water quality

*Wetlands Datalayer* (BECQ): a GIS-based inventory of wetland location and type for Saipan, Tinian, and Rota

*Coastal Change Analysis Program* (NOAA): raster-based land cover inventory of each island, including terrestrial and adjacent coastal areas, to monitor changes in habitat

*Mariana Archipelago Reef Assessment and Monitoring Program* (NOAA): Every other year archipelago-wide collection of biological, physical/chemical, and mapping information for long-term coral reef ecosystem monitoring including benthic composition, water quality, and the condition, abundance, diversity and distribution of biological communities, especially fish and macroinvertebrates

*Forest Inventory and Analysis* (USFS): Decadal systematic inventory of the forests of Rota, Tinian, and Saipan to estimate forest area, tree stem volume, biomass, carbon storage, tree damages, and the composition and percentage cover of understory vegetation species

*Talakhaya Watershed Restoration* (Rota DLNR): Long-term restoration and monitoring program designed to restore the degraded Talakhaya watershed on Rota

*Tinian MLA Forest Restoration* (DoD/Tinian DLNR): Experimental forest restoration and monitoring program

*Some of these monitoring programs also address specific taxa, but are listed here to avoid redundancy.

**Threats**

*Brown tree snake* (DFW/USGS/USFWS): Surveys conducted upon confirmation of a credible BTS sighting in the CNMI

*Coconut rhinoceros beetle/Little fire ant* (USDA): Ongoing surveys to detect the spread across Rota and potential introduction of these invasive insects to Saipan and Tinian

## 7.5.2 Monitoring Needs

Existing monitoring programs will meet many, but not all, of our needs for measures of progress toward Plan objectives and information to guide adaptive management. For some SGCN, SGIN, and habitats, baseline information is lacking, and monitoring protocols need to be developed. Collaborating with regional partners to achieve our goals could be a good strategy for finding support on achieving our monitoring goals. Some collaborative initiatives include creating standardized monitoring protocols, training opportunities, and shared funding opportunities. There is a lack of consistent fishery monitoring on Rota and Tinian. We recommend finding opportunities to establish localized fishery monitoring programs on Rota and Tinian (See Landscape-scale Plans: Fishery Management)

**Species of Greatest Information Need Monitoring**

In this version of the Plan we have identified several SGIN that include individual species, families of species, and assemblages of different species, for example native pollinators. The following are a summary of suggested monitoring needs for SGIN:

| | |
|---|---|
| All freshwater SGIN | Develop and conduct riparian species surveys at least once a year on Saipan, Tinian, Rota, and opportunistically in the Northern Islands |
| Marine SGIN | Prioritize collecting baseline data for these species during regularly scheduled marine monitoring efforts. |
| | Utilize community science platforms (e.g. iNaturalist) and encourage the marine recreating community to report species detections |

| | |
|---|---|
| Terrestrial invertebrate SGIN | Develop and implement baseline surveys to identify and describe species (if needed) and determine distribution, range, and abundance across the islands focusing on Saipan, Tinian, and Rota first and surveying the Northern Islands opportunistically |
| Terrestrial plants SGIN | Monitor species within their known range at least once every two years both in the wet and dry seasons to monitor population health, recruitment rates, and presence of pests and pathogens |

**Protected Area Monitoring**
Most protected lands and waters within the CNMI have a management and monitoring plan. These plans need to be updated regularly and we need to improve implantation of these plans. Hiring a dedicated protected area management officer within DLNR would help improve the implantation of these management and monitoring plans.

**Existing Monitoring Improvements**
Many of our species monitoring efforts employ outdated methodologies. We need to conduct a comprehensive assessment of monitoring methods and survey protocols to locate deficiencies and implement new technologies and techniques for species and habitat monitoring. Updating our methodologies will improve species detectability and population estimates. We also need to establish standardized protocols for monitoring species, especially for shared SGCN/SGIN between Guam and the CNMI where regional species population and habitat data will support landscape-scale conservation measures.

Additional SGCN-specific information about monitoring needs is included in the SGCN profiles in Chapter 8.

In some cases, monitoring data can serve multiple purposes, such as both a measure of SGCN status relative to Wildlife Action Plan objectives, and as a measure of effectiveness of a particular action. Some monitoring programs address multiple SGCN, such as bird point count surveys that monitor all forest bird SGCN. Given the limited funding available to create new monitoring programs, we will seek to develop and prioritize programs which can address multiple species or serve multiple purposes. We will also review and modify as needed existing monitoring programs to ensure that they continue to efficiently meet our needs.

## 7.6 Research Needs

For each SGCN, we identified the research required to meet or further refine the objective. These are described under individual SGCN profiles in Chapter 8. In addition, here we identify more general or ecosystem-based research needs that apply to many or all SGCN. We lack the capacity to conduct some research based in the CNMI, to accomplish many of our research objectives we need to establish partnerships with regional or appropriate research institutions that may provide the necessary laboratory facilities to assist with analysis, data and sample repositories, capacity building pipelines, research vessels (boats and submersibles, etc), and other technical assistance. As the global economy and research sectors become more digitized and use of Artificial Intelligence progresses, we need to adapt and adopt new technologies.

**Conservation genetics**

For both marine and terrestrial SGCN, we have incomplete knowledge of the phylogenetic relationships of most of our species. Conducting genetic analyses on populations across our islands would refine our understanding of the taxonomic status including degree of endemism of species and island subpopulations.

**Northern Islands**

Several SGCN avian species have been translocated to the Northern islands in an effort to establish redundant populations (DFW MAC Plan). The next phase of translocations include our ESA listed species. We need to determine the success of our earlier translocation efforts to assess the feasibility of translocating listed species. We also need to understand landscape dynamics in the northern islands **-** typhoons and volcanic activity shape the landscapes, habitat, and subsequent species composition on these islands. Utilizing satellite imagery, lidar, and other spatial ecology technologies, and on the ground habitat assessments, and species distributions; we can analyze landscape dynamics and make inferences about species composition and resilience.

**Marine community ecology**

We need to improve species documentation and reporting. There are many marine species for which we lack species accounts and basic biological information. Understanding relationships between fish and their habitats will aid managers in refining habitat protection, restoration, and management priorities. We need to describe the biogeography and oceanography patterns of the marine landscape - related to the distribution of habitats and species across the islands. Besides basic community ecology, we need to develop a better understanding of marine connectivity. Knowledge of the larval sources and transport pathways of marine fish and invertebrate species, and of migratory pathways of migratory species including sea turtles and cetaceans, guides our conservation approach. Some species needs are best addressed through local conservation actions, while others may require international cooperation and conservation actions outside the CNMI. With improved understanding of the connectivity of marine species among CNMI islands and with island groups outside the CNMI, we can better prioritize our local conservation actions.

**Invasive vine impacts**

Invasive vines including scarlet gourd (Coccinia grandis) continue to spread in forests across the CNMI, but we have limited knowledge of the impacts on forest-dependent SGCN and habitat use. On a short timescale, forest-dependent SGCN may benefit or lose from vine invasion depending on their ecological response, e.g. if fruits of invasive vines are a preferred food source, or if forest stands with high vine abundance are preferred or avoided for nesting. However, we do not know how vine invasion alters forest regeneration. If vine invasion is resulting in permanent conversion of forest to non-forest habitats, then all forest-dependent SGCN are ultimately harmed.

**Human dimensions research**

The human dimensions of conservation is a well known and growing field of ecology research. In the CNMI, human wildlife conflict is a salient issue where ESA regulations have led to negative associations with certain species. We recommend research focused on community perceptions and opinions about conservation, outreach effectiveness, management methods, and other relevant wildlife and natural resource management topics.

# 8 Species of Greatest Conservation Need Profiles and Priorities

A single species example (*Partula lutaensis*) has been included in this draft for public comment. Species profile pages will be included for all SGCN in the final version of the 2025 CNMI SWAP. For additional information please contact Dacia Wiitala - wiitala.dfw@gmail.com

| ***Partula lutaensis*** | |
|---|---|
| Akaleha' <br> *Chamorro* | Akaleha' <br> *Carolinian* |
| Rota Tree Snail <br> *Common Name* | Gastropoda <br> *Class* |
| CNMI Regulations…………Locally Protected | |
| USFWS Status…………….None | |
| IUCN Red List Status……..Not Assessed | |

## Species Description

Conical shell with shell opening on the right. Adults about 1.5 cm in shell height with a flared lip around the shell opening. Varied shell color including white, orange, pink, maroon, dark brown, or multicolored. Body colors include white, tan, gray, and black.

## Species Status, Range, and Distribution

Endemic and only found on Rota Island. Eight known extant colonies/populations. Abount 2,000 individuals. One documented colony/population extirpation in 2022. Because *P. lutaensis* and *P. gibba* are visually similar some of these populations could be mixed communities. Akaleha' were once widespread and abundant on Rota, but their range has severely contracted and fragmented since the mid-twentieth century.

## Preferred Habitat

Broadleaf or mixed broadleaf-coconut forest with well-developed canopy and understory, loamy soils, substantial leaf litter. Prefer to use lada (*Morinda citrifolia*), kafu (*Pandanus tectorius*), Flagellaria indica, and bird's nest fern, but also commonly found on hågon niyok (coconut fronds), puting (*Barringtonia asiatic*), oshal (*Hernandia sonora*), and a variety of other native and introduced plants. Extant populations are in beachside and low-elevation forests, but historical range includes high elevations

## Long-term Objective - Reverse geographic range contraction and fragmentation, increase abundance, and establish new populations within historic range

## Ten-Year Objective

- ❑ Maintain known wild populations
- ❑ Search for additional populations on Rota
- ❑ Develop a captive breeding and reintroduction program on Rota

## Priority Actions

- ❑ Conduct feasibility assessment for captive rear and release program
- ❑ Assess population genetics
- ❑ Determine habitat preferences
- ❑ Control rats and flatworms
- ❑ Develop outreach and education program
- ❑ Develop strict biosecurity measure to prevent additional predator introductions

## Research Needs

- ❑ Identify novel predators
- ❑ Characterize life-history traits and population dynamics
- ❑ Conduct threat analysis and population viability analysis
- ❑ Determine phenotype expressions of genetic variability
- ❑ Map historical geographic range

## Monitoring Needs

- ❑ Conduct quarterly assessment of population and recruitment rates
- ❑ Conduct flatworm, rat, feral ungulate, and slug monitoring

***Partula lutaensis* -** Summary of species resiliency assessment: Based on species specific traits, life history, habitat and projected changes in habitat based on projected future environmental conditions, *Partula lutaensis* is Extremely Vulnerable to environmental shifts and has low resiliency.

| | |
|---|---|
| Climate Exposure (RCP 4.5): | Moderate |
| Climate Exposure (RCP 8.5): | Moderate |
| Adaptive Capacity: | Low |
| Overall CCVI Category (RCP 4.5): | Extremely Vulnerable |
| Overall CCVI Category (RCP 8.5): | Extremely Vulnerable |

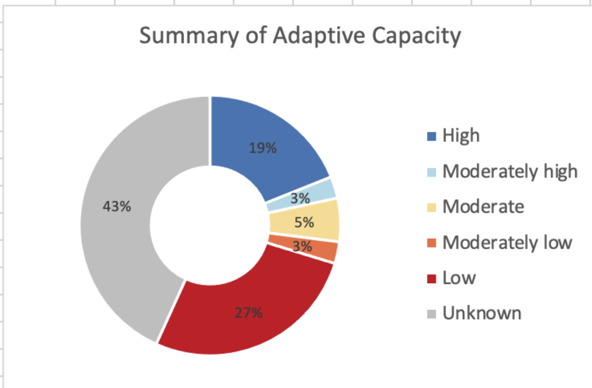



Figure 59. Result of species resiliency assessment for *Partula lutaensis*.

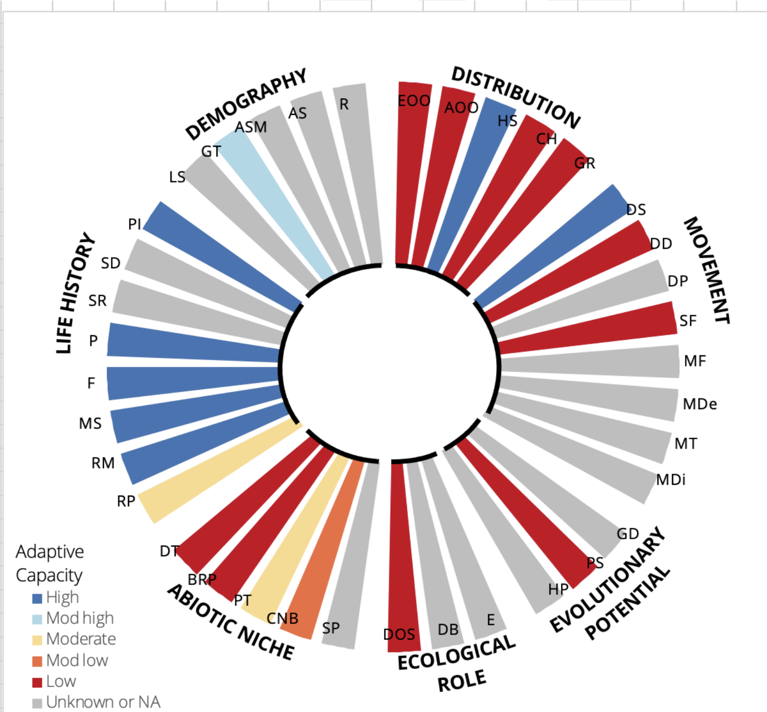



Figure 60. Detailed summary of species resilience assessment based on the seven categories of a species adaptive capacity: Distribution, Movement, Evolutionary Potential, Abiotic Niche, Life History, and Demography.

# 9 Participation

## Purpose

The CNMI Wildlife Action Plan is intended to reflect broad input from the public, resource users, government agencies, non-governmental organizations (NGOs), biological experts, and other stakeholders. Each brings a different perspective on our conservation priorities, threats, and actions that should be taken. We used a variety of approaches to engage each of these stakeholder groups, and incorporated their input into the final Plan.

## 9.1 Methods

### 9.1.1 Public

Starting in April 2024, DFW staff engaged in many one-on-one and small group interviews with individuals, CNMI government agencies, and NGOs about the CNMI's conservation priorities and challenges. DFW staff made a short presentation at each meeting which outlined the purpose of the SWAP, provided background information, and our current list of SGCN. Meeting participants were allowed to ask questions and provide feedback and suggestions for the revised SWAP. A Conservation Planning website was updated during this time to provide information about the current (2015) Wildlife Action Plan, the revision process, and how people can participate in the revision process.

Public meetings were held on Rota on August 13th in the evening. The Northern Marianas College Rota campus generously donated a classroom to use for the presentation and public meeting. There were 11 participants for the Rota meeting. We publicized the meeting through the CNMI DFW facebook page a week prior to the meeting date. The meeting was also published on the Rota Public Information facebook page. There was an article in the Marianas Variety that highlighted the Wildlife Action Plan and our stakeholder engagement process and included the dates for the public meetings on all islands. Printed fliers were posted on all community bulletin boards around Rota. DFW staff also contacted residents through word of mouth, text message, and direct email. .

Public meetings were held on Tinian on August 19th in the evening. We held the meeting at the Tinian Public Library which provided seating, tables, and a projector. There were 15 participants for the Tinian meeting. We publicized the meeting through the CNMI DFW facebook page a week prior to the meeting date. The meeting was also published on the Tinian Mayor's office Facebook page. There was an article in the Marianas Variety that highlighted the Wildlife Action Plan and our stakeholder engagement process and included the dates for the public meetings on all islands. Printed fliers were posted on all community bulletin boards around Tinian. DFW and DLNR staff also contacted residents through word of mouth, text message, and direct email.

Public meetings were held on Saipan on August 28th in the evening. We held the meeting in the auditorium at American Memorial Park. We applied for and received a permit through the National Park Service to use the space weeks before the event. The auditorium space was ample comfortable seating with ADA access and a large screen for presenting. There were 15 attendees

Informational presentations were conducted at the Mariana Islands Conservation Conference (held on Guam, virtual presentation), at the Center for Island Sustainability (held on Guam, virtual presentation), and for attendees at a Basic Grants Management training course (held on Saipan). These presentations were intended to spread the word that the CNMI was in the process of revising the Plan and to encourage audience members to fill out the online survey and participate in public meetings.

The initial public meetings were designed for open-ended discussion about the CNMI's highest conservation priorities. The follow-up sessions were more structured, with an overview of the draft 2015 Wildlife Action Plan and an opportunity for discussion of specific concerns about the Plan. A follow-up meeting was not held on Saipan as the island residents were focused on rebuilding and recovery following Typhoon Soudelor on August 2$^{nd}$.

Only a limited number of people can be reached through interviews or public meetings, and these might not be representative of broad public opinion. We therefore broadened our reach to include residents that might not have interest in participating in a public meeting, but who nonetheless have valuable input to offer regarding conservation issues. On August 8,2024 an online survey was made available on the DLNR Conservation Planning website to collect public opinion about CNMI conservation issues. Participants were asked their opinion about the biggest conservation challenges that the CNMI is facing, and their ideas for actions that should be taken.

### 9.1.2 Government

In April 2024, we invited via letter the island Mayors, various government department heads, and to participate in the planning process. In June and August 2024, DFW staff met with the

Municipal Mayor offices and other CNMI government agencies to gather input on improvements to be made to the Wildlife Action Plan and to spread the word amongst constituents and community members to participate when opportunities became available.

### 9.1.3 Non-Governmental Organizations

While there are few conservation-oriented NGOs active in the CNMI, DFW staff sought and encouraged their participation.
The following groups were interviewed for their input on the Wildlife Action Plan:

- Northern Mariana College (NMC), NMC CREES, NMC students
- Mariana Islands Nature Alliance (MINA)
- Johnston Applied Marine Sciences (JAMS)
- Pacific Coastal Research and Planning (PCRP)
- Ecology of Bird Loss Project (EBL)
- Micronesian Climate Alliance
- University of Washington research programs

### 9.1.4 Formal Comment Period

To be updated at the close of the formal comment period in August 2025.

## 9.1.6 Results

#### Tinian

**Public meeting held at Tinian Public Library**
Feedback from fifteen participants from the August 19, 2024 Public Meeting *These comments are recorded in note form and kept as close to the commenters language as possible:

*Species of Concern*:

- Tataga
- Hangong and hiyok are depleted - we don't want that to happen to the other fish
- Emperor fish
- Big eye scad
- Trevally
- Skip jack
- Parrot fish - they need more regulation because of their unique biology and contributions to reef health
- Solider fish
- Squirrel fish

*Additional threats to highlight:*

- Fires are a major threat on Tinian
- Fires can wipe out threatened and endangered species
- Overfishing - I see photos on social media with hundreds of parrot fish, this is not sustainable
- Parrot fish is not a sustainable fishery because of their breeding cycle
- Deer regulations on Tinian are unclear
- Invasive plants are a big problem on Tinian and could be controlled if we act now and not wait until it looks like Saipan
- Invasive vine control could be manageable on Tinian
- Info on what species that are invasive so that people don't propagate them
- Military buildup on North field - aggregate should be sanitized before coming in - it's not being sanitized.

*Recommended Conservation or Management actions*:

- Fruitbat, sea turtle, parrot fish, coral, såli - we need to monitor all these species
- Some species like rabbit fish and mullet - people are catching the baby fish and we need to monitor and regulate the catching of the baby fish
- More monitoring and size limits including bag limits - not enough research about Tinian fisheries.
- We need an MPA in the water-break area - where the mullet is
- No ti'ao or I'e left in the area, so they catch other fish in the juv state, no size limit for subsistence - no bag limit only for commercial. We need size and bag limit for subsistence fisheries as well as commercial fisheries
- Studies on haguaf to find out when they breed - set a moratorium when the species is more sensitive
- Sea urchin harvest moratoriums
- Some species have no regulations bag limits and no size limits for gill net
- Commercial size limits - open season for atuli and e'e, we need to establish seasons for those species and regulate the harvest of runs
- What happens to the fish that don't get sold - do they go to waste? More public information about the commercial fish market
- Fishing regs for subsistence - not having it regulated is supposed to be for recreation and subsistence but people are making money off of it. Is there a way to regulate and monitor the wildlife being harvested?
- Tangison parrot fish should be protected - Napoleon fish
- Develop non-punitive measures to incentivize following regulations - for example, dive

companies could be rewarded for following regulations - recognition and publicity are a good way to incentivize companies

- Green incentives for good behavior
- Putting more effort into native forest nurseries to outplant native trees
- Regulation for construction companies- relocate the native trees rather than cutting them down - “cut a tree plant a tree program”
- Recover properties that are degraded and reforest and plant native trees
- Monitoring across the islands - there needs to be a bigger effort across islands to determine baselines. Plan should include components that clarify threats for each species
- Specific conservation goals outlined for each island in the SWAP
- There could be more effort in recording what is on each island
- People are a threat
- Outline how agencies can access funds within the Plan
- Identify places that benefit from protection -identify conservation opportunity areas on Tinian
- Funds have to go through the grants management office as the clearing house for the CNMI.
- Do a study on deer presence on Tinian
- We have a sole source of water in Tinian, they are over drawing the water. We are trying to have a cattle industry here, how are we supposed to water the cattle with salinated water?
- Over fishing on Tinian is a problem, in the evening you see more people fishing. There are more people here temporarily and they are over fishing the waters.
- We need size limits and catch limits for all types of fishing activities
- Enforcement. Enforcement. Enforcement.
- Goat island (Aguiguan) is another disaster - that fence there and all the trash - goats get stuck in the fence, it's an animal rights issue.

### Saipan

**Public Meeting**

Feedback from fourteen participants from the August 28, 2024 Public Meeting *The Saipan meeting was more of a question and answer dialog with some suggestions integrated into the conversation. Answers to questions are in italics and are largely paraphrased. These comments are recorded in note form and kept as close to the commenters language as possible:

- To what extent is the SCGN limited by what we can accomplish? *Depends on the state or territory*

- Have we incorporated “keystone species" in the WAP? Disproportionately weighted?
- What are my grandkids going to want, what are their grandkids going to want - interplay between conservation and cultural perpetuation
- Does lumping animals e.g.”food fish” inflate our number of SGCN? Do they count as one species? *The bigger purpose is managing species*
- List nudibranchs as SGCN
- Plants - NMC CREES creates food security for both animals and humans, consider adding plants that will support wildlife (agroforestry)
- It's necessary to get funds right? *SGCNs determine how money gets spent.*
- Can we use it to increase educational materials and opportunities? *It's possible.*
- Large species of seagrass need to be listed as SGCN- there is no genetic diversity and low reproduction rates
- The inclusion of plants sets up a tension between plants as resources for wildlife vs the SGCN that relies on them - *There is no inherent conflict between SGCN for management purposes. We wouldn’t try to remove one SGCN just to benefit the other.*
- Are you looking at defining individual species in native limestone forest and adding them all to the list as SGCNs? This could benefit revegetation projects. *Yes, that is something we are looking into.*
- I see the list of individual species, and I hear that if we keep an individual species approach we create conflict between species. But if we take an ecosystem approach, we include SGCNs in concert and avoid conflict, benefiting all species. *SGCNS are the basis, actions and goals can be at ecosystem level*
- Introduced species- only considered under the social side or also biological side?
- Introduced plants like flame tree are culturally important
- Conservative approach vs binning and including all species?
- Hybrid approach, conservative in some areas but binning and inclusive elsewhere
- This doc not about laws/regs, just a framework/guidance outline for getting funding
- Does the WAP provide guidance for conflicts between HPO and conservation? Marine archeology could disturb the environment/SGCNs (corals and other species).
- Does SGCN designated species give any extra consideration from other agencies
- Could the CNMI protect legally all SGCNs?
- Simply being a unique species is of value, the value of biodiversity
- Middle ground for listing seems best, leave room for growth but don’t leave stuff out/miss opportunities. Cover more than what is actually manageable.
- Dream for the stars but be happy with the moon. No penalty for not delivering on the planned activities, so what is the risk? It could be important to overlist/leave room for growth, but also err on the side of caution to not over plan
- In terms of conservation actions, would like to see interagency projects and public

involvement in implementation
- Constitutional protection of healing resources; include åmut plants. Align with plant protection documents

## Rota

Eleven people attended the August 13th public meeting. Comments are summarized below:

*Species of concern:*
- Ayuyu (coconut crab) on Rota are really depleted

*Additional Threats:*
- Politicians are a threat to our future
- Cuban slugs are a threat
- Ants and mosquitos area a threat
- Coconut rhinoceros beetle is a huge problem
- Deer should be considered a threat to wildlife
- Wildfires are a threat to wildlife
- Cat, dog and rat control should be addressed as they are a major threat to wildlife
- Marine debris is a major problem for wildlife

*Conservation Management Actions:*
- Come up with a law that you cannot export the coconut crab to off island
- There is a lack of honesty in the community and leaders and lawmakers, need to focus on the youth and outreach
- Criminalize poaching in the CNMI - enforcement doesn't have arresting authority
- Everyone should be involved in these discussions - where is our leadership?
- Outplant rare plants to prevent declines
- Collect information on hunting - increase hunting regulations and data collection on hunting
- Hunting - kids are not interested in hunting so there is less pressure on deer and other ungulates. Promote hunting for the youth
- Are there regulations for fishing on Saipan vs Rota? *Yes, some differences in which fishing methods are allowable between islands*
- Public outreach and education should be prioritized
- Education efforts should be focused on certain age groups: the age at which kids are the most engaged is 4th-6th grade

## Government

Over 16 CNMI Government agencies across different jurisdictions were interviewed for input in the SWAP. Concerns and suggestions of CNMI government officials generally mirrored those expressed by the public. In addition to echoing concerns surrounding popular foraged species such as ayuyu and fish, and åmut, public officials also expressed the desire for increased communication and coordination between agencies to ensure our conservation practices are being implemented effectively. Below are some unique highlights from various government meetings.

**Mayor of Tinian Highlights**

- Need to research the impacts of halitai on the sassangat and ayuyu on Tinian and goat island
- Biosecurity on Tinian is a problem and needs to be seriously addressed from the local and federal partners
- We would like to re-establish a marine protected area on Tinian
- We need to incentivize biologists to stay on Tinian and conduct work there
- We need a beached mammal plan for when we get beached sea mammals.
- Food security depletes our natural resources. Conservation area for viewing wildlife and a no-take zone temporarily as a restoration area.
- Forest restoration for animals - addition of fruit trees etc.
- Implement landowner stewardship programs for landowners to manage land for conservation.
- Expenditure of funds needs to be streamlined and procurement streamlined

**Mayor of Saipan Highlights**

- We need to create restoration goals for after typhoons and other natural calamities
- Promote agroforestry and fish farming to increase food security and economic stability which could eliminate some pressure on wildlife populations
- Promote soil and water conservation
- Technical assistance should be extended to the municipality to address biological concerns

**Mayor of Rota Highlights**

- Såli, deer, and fanihi are agricultural pests on Rota, we need mitigation measures to help alleviate cost and damage incurred by landowners
- Increase deer hunting on Rota to help with population control
- Highlight wildlife on Rota for visitors to the islands
- Commercial fishing vessels from Guam and Saipan come and deplete resources on Rota, need to find regulatory mechanism to allow commercial fishing that supports Rota economy

**Mayor of Northern Islands Highlights**

- Need to find ungulate exclosure methods that will help protect agriculture and habitats on Alamagan
- Commercial fishing on the islands near Saipan could be a problem, need to find a way to regulate commercial fishing in the Northern Islands as to not deplete these resources

### Guam

A major revision goal for this version of the Plan was to take a landscape scale approach to conservation planning. Landscape scale conservation entails considering species conservation needs at the life cycle and range wide scale, conserving habitats across broad areas, and considering the conservation of species as they exist on the landscape and not in the context of political and jurisdictional boundaries. To accomplish this mission, we assessed the entire range of our SGCN who exist beyond the borders of the CNMI. We came up with a list of primary regional stakeholders that we could collaborate with to achieve landscape scale conservation initiatives for our shared SGCN. The primary stakeholder for us is Guam, our sister island to the south where the vast majority of our SGCN also occur or have previously occurred.

Collaboration with Guam started in September 2024 with an initial meeting with the Division of Agriculture and key natural resource managers on Guam and the CNMI. We established the shared goal of collaborating to produce a landscape scale conservation framework for Mariana Islands wide conservation goals. Several meetings were held in 2024 and 2025 to produce a set of shared conservation strategies, goals, and actions (detailed in Chapter 7 XXX). We held an Inter-Island SWAP Writing Workshop on Guam in April 2025.

The Inter-Island SWAP workshop was a two-day workshop between CNMI DFW and Wildlife and Guam natural resource managers, including leadership and staff from Guam DAWR and DOAG, and UoG. The purpose of the workshop was to identify opportunities for collaboration between Guam and CNMI natural resource managers that would cause  cost-saving opportunities, regional capacity building, data sharing, and overall improvements to conservation practices for our shared Species of Greatest Conservation Need (SGCN). These identified regional priorities and collaboration opportunities will be incorporated into the Guam and CNMI SWAPs. Including these regional priorities in the SWAPs will provide strategic opportunities for funding and forming a unified effort for conserving shared SGCN.

Day one (April 1st) of the workshop the group focused on what kind of products they wanted to create during the workshop. During the brainstorming session the team highlighted the need to (1) identify priority areas for conservation work (spatial map of important habitat), (2)  identify regionally important species, and (3) identify relevant regional companion plans to the SWAP.

The group broke out into smaller groups to discuss these shared needs in detail. Other shared needs that were identified included:

- Cross-jurisdiction support
- Gap analysis of the species that reside in both Guam and the CNMI but that were identified as SGCN by one but not the other territory
- Finding projects with multispecies benefits – resources and funding
- Establish standard protocol/procedures and data needs for shared SGCN
- Impacts on non-native species on native SGCN (BIOSECURITY!)
- Funding to link monitoring with restoration projects
- List everything that connects us (shared SGCN and conservation goals and objectives)

Identify companion plans:

- Regional wildlife management plans
- Regional biosecurity plan
- Connection with Forest Action Plans
- Coral Reef Resilience Strategy
- Fisheries Management Plan
- Marianas Avifauna Conservation Plan (does not include Guam)

Day two (April 2nd) the group broke into four smaller groups to review the current list of SGCN for both Guam and CNMI to identify the shared species and discuss omissions for each. From these group discussion sessions we came up with a list of regional priority SGCN. Additionally the team discussed conservation priorities and regional strategies for managing and conserving these particular species or groups of species. The regional priority species are:

- Host plants for SGCN (butterflies and damselflies)
- Medicinal plants
- Plants that could benefit from genetic diversity
    - *Serianthes nelsonii, maesa walkeri, tabernaemontana rotensis,* and *heritiera longipetiolata*
- Fanihi (Mariana fruit bat)
- Mariana swiftlet
- Aga (Mariana crow)
- Snails (land snails)
- Slevini skink
- Marine mollusks (Giant clams, Titons trumpet)
- Sea cucumbers

- Sea grasses
- Lobsters (spiny and slipper)
- Freshwater gobies
- Freshwater atyid shrimp

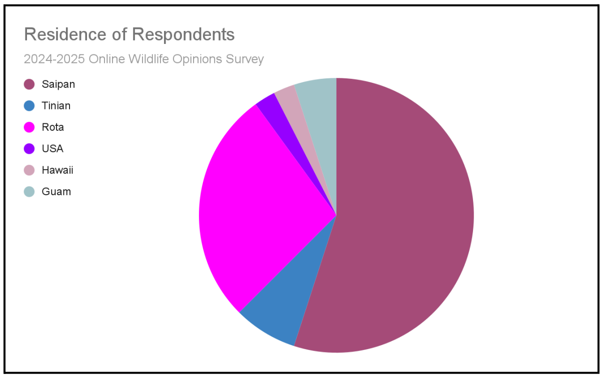
Table 37. Full list of participants in the two day Inter-Island workshop with their role in the workshop followed by their professional title and agency affiliation.

| Name | Workshop role, professional title | Agency |
|---|---|---|
| Dacia Wiitala | Co-host, Conservation Planner | CNMI DFW |
| Else Demeulenaere | Co-host, Associate Director Natural Resources | UoG CIS |
| Caley Chargualaf | Organizer, note taker | UoG CIS |
| Jeremie Charfauros | Note taker | UoG CIS |
| Jeffery Quitugua | Participant, Acting Assistant Chief | Guam DAWR |
| Andrew Kang | Participant, biologist | Guam DAWR |
| Chelsa Muña | Participant, Guam DOAG Director | Guam DOAG |
| Christine Fejeran | Participant, Forestry Division Chief | Guam DOAG |
| Michael Tenorio | Participant, CNMI Fisheries Section Head | CNMI DFW |
| Rosemary Camacho | Participant, CNMI DFW Acting Director | CNMI DFW |
| Ruddy Estoy Jr. | Participant, biologist | Guam DAWR |
| Maurice Jones | Photographer | UOG CIS |
| William Paulino | Participant, biologist | Guam DOAG |

| | | |
|---|---|---|
| Suzanne Medina | Participant, biologist | Guam DAWR |
| Jay Gutierrez | Participant, Wildlife Division Chief | Guam DAWR |
| Carey Demapan | Participant, Endangered Species Section Head | CNMI DFW |
| Christopher Rosario | Participant, biosecurity | Guam DOAG |
| Jennifer Ha | Participant, biologist | Guam DAWR |
| Diane Vice | Participant, Wildlife Section Head | Guam DAWR |
| Henry Fandel | Participant, Wildlife Section Head | CNMI DFW |
| Brent Tibbit | Participant, biologist | Guam DAWR |

## 9.2 Survey Results

We had 41 respondents to the online survey representing Saipan, Tinian, Rota, and CNMI residents living abroad (Figure 61). The survey was designed to determine general attitudes towards natural resources and wildlife management values. There was also a section where respondents could submit general comments about the Wildlife Action Plan. When presented with four different statements that expressed different values on wild animal populations, 70% of respondents indicated that they agreed most with the following statement: Wild animal populations should be managed because they have a right to exist alongside humans. Over half of respondents claimed that they trusted wildlife managers to ensure there are wildlife resources for them, their family and the community. Over half of respondents said their personal views and values are reflected in the current wildlife regulations.



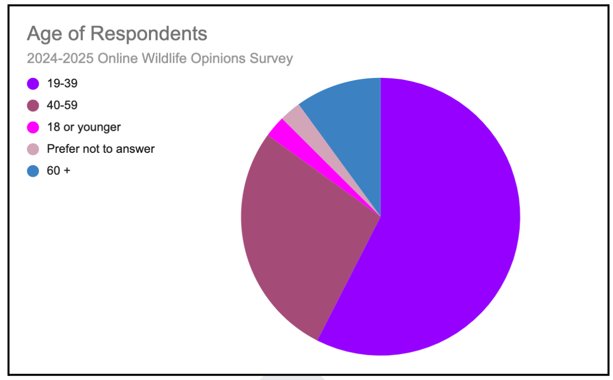




Figure 61. Distribution of respondents across each residence category (Saipan, Tinian, Rota, USA, Hawaii, Guam, Northern Islands had no respondents) and age group (18 or younger, 19-39, 40-59, 60+)

A wide range of issues were brought up in the general comments section of the survey. One respondent from Rota said “Wildlife that are not native to the islands should be managed accordingly. Apparently there is no wildlife management for Sambar Deer which are multiplying in numbers especially on the island of Rota. I have observed that the deer population on Rota has increased 10x because I had observed 12 deer grazing in an open area. The deer have evolved and are a lot smarter because they know how to avoid human detection. When farmers leave their farm, at night the deer would come around and start wrecking havoc on the farmer's plantation. Many farmers have complained to the Fish & Wildlife Conservation Officers but the problem still persists. Another concern is the domestic pigs that have run loose and are now producing offspring in the wild. The pigs need to be eradicated from the wild because they will wreak havoc on the plants. Eradicating the pigs in the early stage will prevent future feral pigs to roam the island of Rota.”

Another respondent from Saipan said “Regulations are only good and effective through EDUCATION and ENFORCEMENT!!! Grass roots participation pertinent to maintain ancestral teaching of taking care of the lands and its contents (wildlife, dirt, soil) good stewardship for generations to come!!!”

Survey participants were asked how often they participate in activities that are associated with natural resources in the CNMI. Not surprisingly, all respondents had participated in beach activities such as barbecues and sand based sports at least once a year. Other popular activities among respondents were oceanic activities such as swimming, rowing, scuba diving, and fishing - underscoring the social and cultural importance of quality marine natural resources.

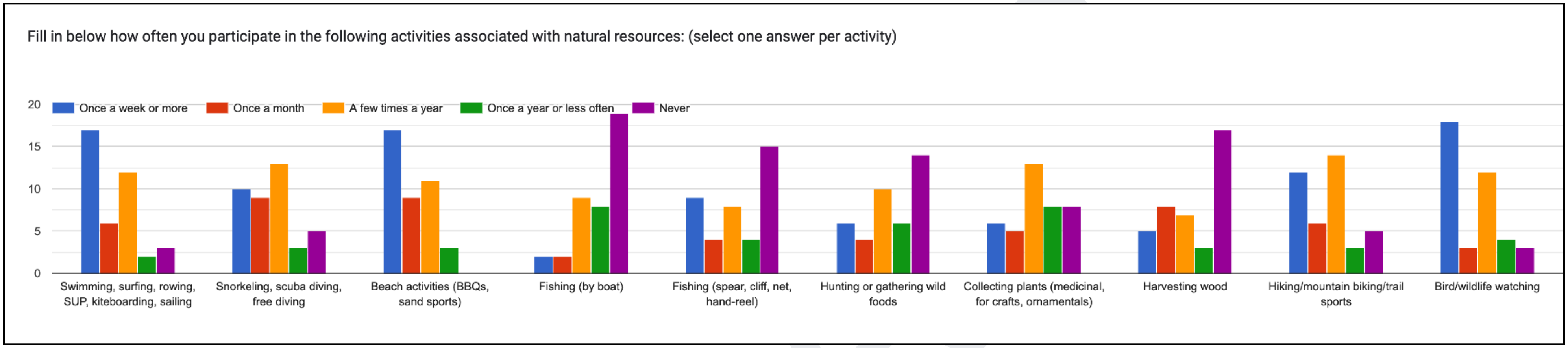



Figure 62. Responses from 2024-2025 Online Wildlife Opinion Survey where respondents replied to the prompt - *How often do you participate in the following activities associated with natural resources:* Swimming, surfing, rowing, SUP, kiteboarding, sailing; Snorkeling, scuba diving, free diving; Beach activities (BBQs and sports); Fishing (by boat); Fishing (spear, cliff, net, hand-reel); Collecting plants (medicinal, for crafts, ornamentals); Harvesting wood; Hiking/mountain biking/trail sports; Bird/wildlife watching

## 9.3 Formal Comments

To be finalized after the formal comment period in August 2025.

## 9.4 Participation Outcomes

### 9.4.1 Social/Cultural SGCN

The participation process was used to identify SGCN of particular social, economic, or cultural importance. Fanihi, haggan, ayuyu, marine mammals, and åmut are SGCN identified as important for conservation by stakeholders. Many species were identified, however, these species or groups of species were mentioned by several groups of people across different meetings and interactions with the Plan author.

Even more frequently than the above species, issues regarding fish and fishing were consistently raised across all islands and in all discussions with the public, NGOs, and government officials. Many different fish species were mentioned, but from the context of discussions, it was clear that individuals were not concerned about a particular fish species, but rather have general concerns that the CNMI continues to support sustainable fisheries. This concern, along with the popularity of fishing as indicated in the public survey, supports the selection of “food fish” as a Species of Greatest Conservation Need. We define “food fish” as any fish species that is harvested for consumption, including but not limited to surgeonfish, jacks, wrasses, emperors, snappers, mullets, goatfish, parrotfish, groupers, and rabbitfish.

### 9.4.2 Actions

Across all islands, public participants repeatedly expressed their desire to see stronger enforcement of conservation regulations, and more environmental education, including integration into the public school system curriculum. These suggestions were integrated into the Plan as general goals, and as species-specific objectives when relevant. Implementation will be challenging as funding for enforcement and education has traditionally been limited.

### 9.4.3 Communication and Coordination

The planning process was a catalyst for DFW staff to initiate discussions with agencies and organizations including Rota and Tinian DLNR, the Division of Forestry, MINA, National Park Service, and others regarding shared conservation goals and interests. The results of these discussions were incorporated into the Plan, but perhaps more importantly, a dialogue was initiated which will greatly facilitate implementation over the next ten years. DFW intends to continue in a coordinating role as we work together to achieve our shared conservation goals.

# 10 Implementation and Monitoring Progress

## 10.1 Implementation Strategy

While DFW is the designated keeper of the Plan, we expect the Plan to be utilized widely and benefit many different agencies and programs. Once the Plan is formalized, DFW will distribute it widely and present the completion of the plan at regional relevant conferences and natural resource management meetings. Implementation will require dedicated staff time to promote use of the plan, integration across jurisdictions and programs.

## 10.2 Adaptive Management

Adaptive management consists of a cycle of planning, implementation, and evaluation of outcomes. To evaluate conservation actions we need regularly published monitoring reports to interpret trends in data and recognize emergent threats. To this end we encourage resource managers to produce interpretable, timely, and actionable outputs. Species monitoring reports and research results should be published in publicly accessible sites such as the Office of Planning and Development website in a timely manner so that management practices can be adjusted appropriately.

In 2030, at the midpoint of the Plan's intended lifespan, DFW will conduct an informal review of outcomes from the first 5 years. We will compile and evaluate monitoring results and new information. We will assess our progress toward Wildlife Action Plan goals and objectives. Depending on the current needs and capacity of wildlife managers in the CNMI, DFW will determine the need for a minor revision to the SWAP. DFW will coordinate with relevant partners to discuss barriers to progress and ways to adapt our approach going forward to 2035.

## 10.3 CNMI and Regional Coordination

DFW staff attending conservation or natural resource management meetings with regional partners can utilize the SWAP as a guidance document to advocate for the conservation of SGCN. DFW will continue to coordinate with regional partners on strategic projects that benefit the CNMI and our natural resources. Specific working groups, steering committees, and other regional natural resource management planning projects should include individuals familiar with the contents of the SWAP to advocate for our SGCN and our priority objectives.

DFW will continue to play a coordinating role in Plan implementation, but working primarily behind the scenes. Our conservation partners and partnerships focus on specific projects and issues, rather than the entire Plan. Conservation partners in the CNMI are undertaking actions outlined in the previous and current Wildlife Action Plan, but their purpose is to accomplish a specific conservation goal, not necessarily to "implement the Wildlife Action Plan". Their priorities and actions were included in the Wildlife Action Plan because of their involvement in Plan development, rather than deriving their priorities from the Plan.

## 10.4 Revision

The CNMI State Wildlife Action Plan will be revised as needed. However, formal plans for a comprehensive revision is scheduled in ten years and should be started no later than 2034. Materials, methods, and resources used to revise the 2005 and 2015 Plans will be organized and made available for the next revision process to use as a road map and to improve upon for each iteration of the planning process. DFW will hire or designate a Wildlife Action Plan revision coordinator. The coordinator will inform conservation partners that DFW is initiating an update to the Wildlife Action Plan and invite their participation. DFW will summarize outcomes from the 2025 Plan, including a summary of met and unmet goals and objectives. DFW will work with partners to compile new information on species, habitats and threats. DFW and partners will broadly advertise the opportunity for the public to provide input in the Wildlife Action Plan revision using agency and organization websites and social media pages, press releases, and formal and informal meetings. The coordinator will seek feedback from all stakeholders including DFW staff, conservation partners, and the public regarding perceived strengths and weaknesses of the Wildlife Action Plan over the last ten years, and recommendations for the Plan update. We anticipate a 2-year process to develop a new, 2035 CNMI Wildlife Action Plan.

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## Appendix A. Regional biological experts that provided input

The degree of input of these individuals varied from answering a few questions related to their area of expertise, to full participation in the planning process from species evaluation through review of the complete draft Plan.

| Name | Affiliation | Taxon |
|---|---|---|
| James Bamba | University of Hawaii | Plants |
| David Benavente | Mariana Islands Nature Alliance | Marine |
| Ilan Bubb | Johnston Applied Marine Sciences | Marine |
| Rodeny Camacho | CNMI Division of Fish and Wildlife | Marine |
| Bronson Curry | U.S. Fish and Wildlife Service | Bats, Snails |
| Carey Demapan | CNMI Division of Fish and Wildlife | Birds, Plants |
| Else Demeulenaere | University of Guam | Plants |
| Trey Dunn | U.S. Fish and Wildlife Service | Marine, BTS |
| Bradley Eichelberger | CNMI Division of Fish and Wildlife | Birds, General Ecology |
| Sarah Faegre | University of Washington | Birds |
| Henry Fandel | CNMI Division of Fish and Wildlife | Birds |
| Wilson Gaul | Northern Mariana College | Invertibrates |
| James Herdon | Northern Mariana College | Invertibrates |
| Lyza Johnston | Johnston Applied Marine Sciences | Marine |
| Rebecca Krasa | CNMI Division of Fish and Wildlife | Birds |
| James Manglona | CNMI DLNR Forestry | Plants |
| Fletcher Moore | University of Washington | Birds, Plants |
| Theresa Rose Osborne | CNMI Division of Fish and Wildlife | Snails |
| Ty Phenis | CNMI Division of Fish and Wildlife | Wetlands |
| Haldre Rogers | Virgina Tech | Birds, Plants |
| Kika Sablan | CNMI Division of Fish and Wildlife | Birds |
| Lee Roy Sablan | CNMI Division of Fish and Wildilfe | Insects, Plants |
| Amanda Santos | CNMI Division of Fish and Wildilfe | Birds |
| Kaeli Swift | University of Washington | Birds |
| Mike Tenorio | CNMI Division of Fish and Wildlife | Marine |
| Brent Tibbatts | Guam Department of Agriculture | Freshwater Species |
| Nathan Van Ee | CNMI Division of Fish and Wildlife | Marine |
| Frank Villagomez | CNMI Division of Fish and Wildlife | Marine |
| Tyler Wilsey | U.S. Fish and Wildlife Service | Birds |

## Appendix B. Species Names Referred to in the Text

| Scientific Name | English | Chamorro | Carolinian |
|---|---|---|---|
| *Acacia confusa* | Formosan Koa | Sosugi Formosa | Serepa |
| *Acanthaster planci* | Crown-of-Thorns Seastar | | |
| *Acanthocybium solandri* | Wahoo | | |
| *Acanthopleura gemmata* | Jewelled Chiton | | |
| *Acanthurus* spp. | Surgeonfish | Hiyok | |
| *Acrocephalus hiwae* | Saipan Reed-warbler | Ga'ga karisu | Litchoghoi bwel |
| *Acropora globiceps* | A stony coral | Kuraling | Yeal |
| *Acropora retusa* | A stony coral | Kuraling | Yeal |
| *Acropora* spp. | Staghorn corals | Kuraling | Yeal |
| *Acrostichum aureum* | Golden Leather Fern | | |
| *Actinopyga mauritiana* | Surf Redfish | Balate | Ppaleppal |
| *Adenanthera pavonina* | Bead Tree | Colales | |
| *Aerodramus bartschi* | Mariana Swiftlet | Chachaguak | Leghe'kiyank |
| *Aglaia mariannensis* | Mapunyao | Mapunyao | |
| *Anous minutus marcusi* | Black Noddy | Fahang dikike' | Rees |
| *Aidia cochinchinensis* | Sumak | Sumak | |
| *Albezia lebbeck* | Siris Tree | Kalaskas | Schepil Kalaskas |
| *Anous stolidus pileatus* | Brown Noddy | Fahang dankolo | She'e'lap |
| *Antigonon leptopus* | Chain-of-love | Cadena de Amor | |
| *Aplonis opaca aeneus* | Micronesian Starling | Sali | Mwii |
| *Aplonis opaca guami* | Micronesian Starling | Sali | Mwii |
| *Ardenna pacifica* | Wedge-tailed Shearwater | Lifa'ru | Lifo'ro |
| *Arothron* spp. | Puffers | | |
| *Artocarpus altilis* | Breadfruit (unseeded) | Lemai | |
| *Astreopora* spp. | Star corals | | |
| *Balanus* spp. | Barnacles | | |
| *Barringtonia asiatica* | Fish-kill tree | Puteng | |
| *Barringtonia racemosa* | Powder-puff Tree | Lagansát | |
| *Birgus latro* | Coconut Crab | Ayuyu | Lyaf |
| *Blechnum orientale* | Centipede Fern | | |
| *Bohadschia* spp. | Sea cucumbers | | |
| *Boiga irregularis* | Brown Tree Snake | Kolepbla | |
| *Bos taurus* | Cow | Baka | |
| *Bruguiera gymnorrhiza* | Mangle | Mangle Machu | |
| *Bryopsis* spp. | Green macroalgae | | |
| *Canavalia* spp. | Jack-beans | | |
| *Canis familiaris* | Dog | Ga’lagu | |
| *Capra hircus* | Goat | Chiba | |
| *Caranx* spp. | Jacks | | |
| *Carcharhinus amblyrhynchos* | Grey Reef Shark | Halu'u | Limwe |

| | | | |
|---|---|---|---|
| *Carcharhinus falciformis* | Silky Shark | | |
| *Carcharhinus galapagensis* | Galapagos Shark | | |
| *Carcharhinus melanopterus* | Blacktip Reef Shark | | |
| *Cardisoma carnifex* | Mangrove Crab | Pang’lao Echung | |
| *Carica papaya* | Papaya | trongkun Papaya | |
| *Carlia ailanpalai* | Curious Skink | Guali’ek Halam Tano | |
| *Cassia fistula* | Golden-shower | Canafistula | |
| *Cassis cornuta* | Horned Helmet | Do'gas prensa | Mwe'ell |
| *Cassytha filiformis* | Love-vine | Agasi | |
| *Casuarina equisetifolia* | Ironwood | Gagu | |
| *Caulerpa* spp. | Seaweeds | | |
| *Cerbera dilatata* | Grey Milkwood | Chuti | |
| *Charonia tritonis* | Triton's Trumpet | Kulu | Sa'wi |
| *Cheilinus undulatus* | Napoleon Wrasse | Tanguisson | Maam |
| *Chelonia mydas* | Green Sea Turtle | Haggan | Wong mool |
| *Chicoreus ramosus* | Branched Murex | Do'gas | Abwel |
| *Chlorodesmis fastigiata* | Turtleweed | | |
| *Chlorurus microrhinos* | Steephead Parrotfish | Laggua | Igan-wosh |
| *Chromolaena odorata* | Bitter Bush | Masigsig | |
| *Chrysopogon aciculatus* | Golden Beardgrass | Inifuk | |
| *Chthamalus* spp. | Barnacles | | |
| *Citrus* spp. | Citruses | trongkun Magsum | |
| *Cleptornis marchei* | Golden White-eye | Canario | Khanooriyo |
| *Coccinia grandis* | Scarlet Gourd | | |
| *Cocos nucifera* | Coconut | niyuk | |
| *Coenobita spp.* | Hermit crabs | Umang | |
| *Corvus kubaryi* | Mariana Crow | Aga | Mwii'lup |
| *Coryphaena hippurus* | Mahi | Dofen | |
| *Crenimugal crenilabis* | Fringelip Mullet | | |
| *Cryptoblepharus poecilopleurus* | Oceanic Snake-eyed Skink | Achi'ak | |
| *Cynometra ramiflora* | Cynometra | Gulos | |
| *Cyperus* spp. | Sedges | | |
| *Dardanus* spp. | Hermit crabs | Umang | |
| *Delonix regia* | Flame Tree | Arbol del Fuego | Nfayarbaw |
| *Desmodium triflorum* | Creeping Tick Trefoil | Agsom | |
| *Diadema savignyi* | Long-spined Urchin | | |
| *Dicranopteris linearis* | Old World Forked Fern | | |
| *Digitaria* spp. | Crabgrasses | Umok | |
| *Discocalyx megacarpa* | | Otot | |
| *Echinometra* spp. | Rock-boring sea urchins | | |
| *Echinostrephus aciculatus* | Needle-spined Urchin | | |
| *Echinothrix diadema* | Blue-black Urchin | | |
| *Egretta sacra* | Pacific Reef-heron | Chuchuko atilong | Ghe're'scho'l |

| | | | |
|---|---|---|---|
| *Eichhornia crassipes* | Water Hyacinth | | |
| *Elaeocarpus joga* | | Joga | |
| *Emballonura semicaudata rotensis* | Pacific Sheath-tailed Bat | Fanihin Liyang | Payesyes/Pai'Scheei |
| *Emoia atrocostata* | Littoral Skink | Achi'ak | |
| *Emoia caeruleocauda* | Pacific Blue-Tail Skink | Achi'ak | |
| *Emoia slevini* | Mariana Skink | Achi'ak | |
| *Enhalus acoroides* | Broadblade Seagrass | | |
| *Eretmochelys imbricata bissa* | Hawksbill Turtle | Haggan karai | Wong maaw |
| *Erythrina variegata* var. *orientalis* | Coral Tree | Gaogao | |
| *Eugenia palumbis* | | Agatelang | |
| *Favia* spp. | Stony corals | Kuraling | Yeal |
| *Favites abdita* | Larger Star Coral | Kuraling | Yeal |
| *Felis catus* | Cat | Katu | |
| *Fregata minor palmerstoni* | Great Frigatebird | Paya'ya | Asaf |
| *Ficus prolixa* | Banyan | Nunu | |
| *Ficus tinctoria* | Dyer’s Fig | Hodda | |
| *Fimbristylis cymosa* | Button Sedge | | |
| *Fimbristylis* spp. | Fimbry Sedges | | |
| *Galeocerda cuvier* | Tiger Shark | | |
| *Gallus gallus* | Red Junglefowl | | |
| *Gafrarium pectinatum* | Pectinate Venus | Tapon/Amsun | Ai'mett/Ghatil |
| *Gallicolumba xanthonura* | White-throated Ground Dove | Paluman kotbata | Apooka |
| *Gallinula chloropus guami* | Mariana Common Moorhen | Pulattat | Gherel Bweel |
| *Gempylus serpens* | Snake Mackerel | | |
| *Globicephala* spp. | Pilot Whales | | |
| *Gonaxis kibweziensis* | | | |
| *Goniastrea retiformis* | Lesser Star Coral | | |
| *Goniopora* spp. | Flowerpot corals | | |
| *Grapsus* spp. | Rock crabs | Agaaf | |
| *Gygis alba candida* | White Tern | Chunge' | Geeghi |
| *Meiogyne cylindrocarpa* | | Paipai | |
| *Guettarda speciosa* | Zebrawood | Panao | |
| *Heliopora coerulea* | Blue Coral | | |
| *Halimeda* spp. | Green macroalgae | | |
| *Halodule uninervis* | Narrowleaf Seagrass | | |
| *Halophila minor* | Hartog Seagrass | | |
| *Halymenia* spp. | Red macroalgae | | |
| *Hemidactylus frenatus* | Common House Gecko | Guali'ek | Galuuf |
| *Heritiera littoralis* | | Hufa | |
| *Hernandia sonora* | Lantern Tree | Nonak | |
| *Heterospathe elata* | Sagisi Palm | Palma Braba | |
| *Talipariti tilliaceum* | Beach Hibiscus | Pago | |
| *Holothuria atra* | Lollyfish | | |

| | | | |
|---|---|---|---|
| *Holothuria leucospilota* | Black Sea Cucumber | | |
| *Holothuria whitmaei* | Black Teatfish | | |
| *Intsia bijuga* | | Ifit | |
| *Ipomoea* spp. | Morning glories | | |
| *Ipomoea pes-caprae* | Beach Morning Glory | Alalak Tasi | |
| *Ischnura luta* | Rota Damselfly | Dulalas Luta | Dulalas Luuta |
| *Isopora palifera* | Catch Bowl Coral | | |
| *Ixobrychus sinensis* | Yellow Bittern | Kakkak | Kakkaak |
| *Katsuwonus pelamis* | Skipjack Tuna | Kachó | |
| *Kyphosus* spp. | Rudderfishes | | |
| *Lambis* | Common Spider Conch | Toro | Li'yang |
| *Lampris guttatus* | Moonfish | | |
| *Lantana camara* | Lantana | | |
| *Leiaster leachi* | Velvety Seastar | | |
| *Lepidodactylus lugubris* | Mourning Gecko | Guali'ek | Galuuf |
| *Leptastrea purpurea* | Crust Coral | | |
| *Leptoria phrygia* | Least Valley Coral | | |
| *Leptoscarus vaigiensis* | Seagrass Parrotfish | Kabara | |
| *Lethrinus* spp. | Emperors | | |
| *Leucaena leucocephala* | Tangantangan | Tangantangan | |
| *Linckia guildingi* | Common Comet Star | | |
| *Liagora* spp. | Red algae | | |
| *Lobophyllia* spp. | Lobed brain corals | | |
| *Lobophytum* spp. | Devil’s hand corals | | |
| *Lutjanus* spp. | Snappers | Mafuté | |
| *Makaira mazara* | Pacific Blue Marlin | | |
| *Mammea odorata* | | Chopak | |
| *Mangifera indica* | Mango | Mangga | |
| *Megapodius laperouse* | Micronesian Megapode | Sasangat | Sasangal |
| *Melanocetus johnsonii* | Deep Sea Anglerfish | | |
| *Melanolepis multiglandulosa* | | Alum | |
| *Merremia tuberosa* | Wood Rose | Alarrak | |
| *Microdictyon* spp. | Green algae | | |
| *Mimosa invisa* | Giant Sensitive Plant | | |
| *Miscanthus floridulus* | Swordgrass | Nette | |
| *Mojarra* spp. | Mojarras | | |
| *Monarcha tatatsukasae* | Tinian Monarch | Chichurikan Tinian | Liteighi'par |
| *Montipora* spp. | Rice corals | | |
| *Morinda citrifolia* | Indian Mulberry | Lada | |
| *Muntingia calabura* | Calabura | Mansanita | |
| *Musa* spp. | Bananas | Chotda | |
| *Myzomela rubratra asuncionis* | Micronesian Honeyeater | Egigi | Tigh'par |
| *Myzomela rubratra saffordi* | Micronesian Honeyeater | Egigi | Tigh'par |

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|---|---|---|---|
| *Nactus pelagicus* | Pacific Slender-toed Gecko | Guali'ek | Galuuf |
| *Naso* spp. | Surgeonfish | Patgon Hugupao | |
| *Neisosperma oppositifolia* | | Fago | |
| *Nephrolepis* spp. | Swordferns | | |
| *Ochrosia mariannensis* | Lipstick Tree | Langiti | |
| *Octopus cyanea* | Day Octopus | Gamson | Ghuus |
| *Ocypode ceratophthalma* | Horned Ghost Crab | Hagu'ui | Arigh |
| *Onychoprion fuscatus oahuensis* | Sooty Tern | Giree'girak | Meshe'gua |
| *Onychoprion lunatus* | Grey-backed Tern | | |
| *Operculina ventricosa* | Paper Rose | Alalag | |
| *Oreochromis mossambica* | Red Tilapia | | |
| *Oryctes rhinoceros* | Coconut Rhinoceros Beetle | | |
| *Pandanus dubius* | Pandanus | Pahong | |
| *Pandanus tectorius* | Pandanus | Kafu | |
| *Panicum* spp. | Panicgrasses | | |
| *Panulirus longipes bispinosus* | Longlegged Spiny Lobster | Mahonggang | Yuurr |
| *Panulirus pencillatus* | Pronghorn Spiny Lobster | Mahonggang | Yuurr |
| *Panulirus* spp. | Spiny lobsters | Mahonggang | Yuurr |
| *Panulirus versicolor* | Painted Spiny Lobster | Mahonggang | Yuurr |
| *Partula gibba* | Humped Tree Snail | Denden | |
| *Partula langfordi* | Langford's Tree Snail | Denden | |
| *Partula* undescribed species | Rota Partulid Snail | Denden | |
| *Patelloida* spp. | Limpets | | |
| *Pavona* spp. | Stony corals | Kuraling | Yeal |
| *Pennisetum* spp. | Fountaingrasses | | |
| *Perochirus ateles* | Micronesian Gecko | Guali'ek | Galuuf |
| *Persea* spp. | Avocados | Alageta | |
| *Phaethon lepturus dorotheae* | White-tailed Tropicbird | Fagpi-apa'ka | Su'ghu'bwesch |
| *Phaethon rubricauda melanorhynchos* | Red-tailed Tropicbird | Fagpi | Su'ghu'bwesch |
| *Phragmites karka* | Tall Reed | Karisu | |
| *Physter microcephalus* | Sperm Whale | | |
| *Pipturus argenteus* | Silvery Pipturus | Amahadyan | |
| *Pisonia grandis* | | Umumu | |
| *Pithecellobium dulce* | Monkeypod | Kamachili | Ghamasiligh |
| *Platydemus manokwari* | New Guinea Flatworm | | |
| *Pocillopora damicornis* | Cauliflower Coral | | |
| *Porites* spp. | Stony corals | Kuraling | Yeal |
| *Porites rus* | Hump Coral | | |
| *Pouteria obovata* | Northern Yellow Boxwood | Lala | |
| *Premna obtusifolia* | False Elder | Åhgåo | |
| *Psammocora* spp. | Stony corals | Kuraling | Yeal |
| *Psychotria mariana* | | Aplokateng | |

| | | | |
|---|---|---|---|
| *Pteropus mariannus* | Mariana Fruit Bat | Fanihi | Pai'Scheei |
| *Ptilinopus roseicapilla* | Mariana Fruit Dove | Paluman totut | Mwee'mwe |
| *Ramphotyphlops braminus* | Brahminy Blindsnake | Ulo'attilong | |
| *Rattus* spp. | Rat | Cha'ka | |
| *Rhipidura rufifrons mariae* | Rufous Fantail | Naabak | Leteghi par |
| *Rhipidura rufifrons saipanensis* | Rufous Fantail | Naabak | Leteghi par |
| *Rusa marianna* | Philippine Deer | Binadu | |
| *Ruvettus pretiosus* | Oilfish | | |
| *Samoana fragilis* | Fragile Tree Snail | Denden | |
| *Sarcophyton* spp. | Toadstool corals | | |
| *Sargassum* spp. | Brown macroalgae | | |
| *Scaevola taccada* | Half Flower | Nanaso | |
| *Seriatopora aculeata* | A stony coral | Kuraling | Yeal |
| *Sida acuta* | Broom Grass | Escobilla | |
| *Siganus* spp. | Rabbitfish | Mañahak | |
| *Sinularia* spp. | Leather corals | | |
| *Spathodea campanulata* | African Tulip Tree | | Apär |
| *Spathoglottis* spp. | Ground orchids | | |
| *Sphyraena* spp. | Barracudas | Alon Laiguan | |
| *Stenella attenuata* | Pantropical Spotted Dolphin | | |
| *Stenella longirostris* | Spinner Dolphin | Toninos | Ghu |
| *Sternula albifrons sinensis* | Little Tern | | |
| *Stichopus chloronotus* | Greenfish | | |
| *Stichopus horrens* | Beche-de-mer | | |
| *Sula dactylatra personata* | Masked Booby | Lu'ao (talisai) | Amwo |
| *Sula leucogaster plotus* | Brown Booby | Lu'ao | O'mwo'o'bwesch |
| *Sula rubripes* | Red-footed Booby | Lu'ao talisai | Amwo |
| *Suncus murinus* | Musk Shrew | Cha'ak | |
| *Sus scrofa* | Pig | Babui | |
| *Synapta maculata* | Spotted Worm Sea Cucumber | | |
| *Taratichthys steindachneri* | Sickle Pomfret | | |
| *Tectus niloticus* | Topshell | | |
| *Terminalia catappa* | Tropical Almond | Talisai | |
| *Thelenota ananas* | Prickly Redfish | | |
| *Thespesia populnea* | Rosewood | Banalo | |
| *Thunnus albacares* | Yellowfin Tuna | Makuró | |
| *Todiramphus albicilla* | Mariana Kingfisher | Sihek | Waaw |
| *Todiramphus albicilla orii* | Mariana Kingfisher | Sihek | Waaw |
| *Todiramphus albicilla owstoni* | Mariana Kingfisher | Sihek | Waaw |
| *Tournefortia argentea* | Velvet Leaf | Hunik | |
| *Trapezia* spp. | Guard crabs | | |
| *Trema orientalis* | Charcoal Tree | Agaunai | Tal Amama |
| *Tridacna maxima* | Small Giant Clam | Hima | Tto |

| | | | |
|---|---|---|---|
| *Tridacna spp.* | Giant clams | Hima | Tto/Shafeshaf |
| *Tridacna squamosa* | Fluted Giant Clam | Hima | Shafeshaf |
| *Tripneustes gratilla* | Collector Urchin | Laun | Larr |
| *Turbinaria* spp. | Brown Algae | | |
| *Turbo argyrostomus* | Silver-mouthed Turban | Aliling pulan | Lifott maram |
| *Turbo petholatus* undescribed subspecies | Tapestry Turban | Aliling pulan | Lifott maram |
| *Turbo setosus* undescribed subspecies | Rough Turban | Aliling pulan | Lifott maram |
| *Turbo spp.* | Turban snails | Aliling pulan | Lifott maram |
| *Vagrans egistina* | Mariana Wandering Butterfly | Ababbang | Libweibwogh |
| *Valonia* spp. | Macroalgae | | |
| *Vigna marina* | Beach Pea | | |
| *Wasmannia auropunctata* | Little Fire Ant | | |
| *Xylocarpus moluccensis* | Cannonball Tree | Lalamyok | |
| *Zosimus aeneus* | A reef crab | | |
| *Zosterops conspicillatus saypani* | Bridled White-eye | Nosa'/Chuchirika | Litchogh |
| *Zosterops rotensis* | Rota White-eye | Nosa' | Litchogh |

## Appendix C. Species Assessed for SGCN/SGIN and final BioScores

*NA means not enough data available to calculated the BioScore for the species for the CNMI.

| Type | FullLatin | CNMI Important Species | IUCN Status | ESA Listing | SGCN 2025 | SGIN 2025 | Common Name | BioScore |
|---|---|---|---|---|---|---|---|---|
| Freshwater | Anguilla bicolor | TRUE | Near Threatened | | TRUE | TRUE | Shortfin eel | NA |
| Freshwater | Anguilla marmorata | TRUE | Least Concern | | TRUE | TRUE | Giant mottled eel | NA |
| Freshwater | Awaous guamensis | TRUE | Near Threatened | | TRUE | TRUE | Freshwater goby | NA |
| Freshwater | Fresh water fish | TRUE | Near Threatened | | TRUE | TRUE | | NA |
| Terrestrial | Ischnura luta | | Endangered | TRUE | TRUE | TRUE | Rota Blue Damselfly | 46 |
| Freshwater | Kuhlia rupestris | TRUE | Near Threatened | | TRUE | TRUE | Jungle perch, rock flagtail | NA |
| Freshwater | Megalops | TRUE | Near | | TRUE | TRUE | Indo-pacifi | NA |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | cyprinoides | | Threatened | | | | c tarpon | |
| Freshwater | Smilosicyopus leprurus | TRUE | Near Threatened | | TRUE | TRUE | Freshwater goby sp. | NA |
| Freshwater | Stiphondon elegans | TRUE | Near Threatened | | TRUE | TRUE | Green riffle goby | NA |
| Freshwater | Stiphondon pelewensis | TRUE | Near Threatened | | TRUE | TRUE | Palauan Riffle Dwarf goby | NA |
| Freshwater | Atyidae | | Near Threatened | | TRUE | TRUE | Atyidae shrimp | NA |
| Freshwater | Caridina typus | | Near Threatened | | TRUE | TRUE | Australian Amano shrimp | NA |
| Freshwater | Caridina variabilis | TRUE | Near Threatened | | TRUE | TRUE | Variable shrimp | NA |
| Freshwater | Macrobrachium lar | TRUE | Near Threatened | | TRUE | TRUE | River prawn | NA |
| Freshwater | Fresh water invertebrates | TRUE | Near Threatened | | TRUE | TRUE | Fresh water invertebrates | NA |
| Marine | Ctenochaetus striatus | TRUE | Least Concern | | TRUE | | Striped Bristletooth | 3 |
| Marine | Acanthuridae | TRUE | | | TRUE | | Surgeonfishes, tangs, and unicornfishes | NA |
| Marine | Acanthurus blochii | TRUE | Least Concern | | TRUE | | Ringtail Surgeonfish | 3 |
| Marine | Acanthurus triostegus | TRUE | Least Concern | | TRUE | | Convict Tang | 2 |
| Marine | Anguilliformes | | | | TRUE | TRUE | Marine Eel Species | NA |
| Marine | Aprion virescens | TRUE | Least Concern | | TRUE | | Green Jobfish | 3 |
| Marine | Beryciforms | TRUE | | | TRUE | | Glass eyes/soldirfish/squirrel fish | NA |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Marine | Blenniiformes | | | | TRUE | TRUE | Blennie species | NA |
| Marine | Bolbometopon muricatum | | Vulnerable | | TRUE | TRUE | Green Humphead Parrotfish | 25 |
| Marine | Bottom fish | TRUE | | | TRUE | | Bottom "Food" Fish | NA |
| Marine | Carangidae | TRUE | | | TRUE | | Trevallies, scads, mackerels, pompanos, jacks | NA |
| Marine | Carangidae | TRUE | | | TRUE | TRUE | Juvenile runs of i'i | NA |
| Marine | Caranx ignobilis | TRUE | Least Concern | | TRUE | | Giant trevally | 3 |
| Marine | Caranx melampygus | TRUE | Least Concern | | TRUE | | Bluefin trevally | |
| Marine | Centropyge flavissima | TRUE | Least Concern | | TRUE | | Lemonpeel angelfish | 2 |
| Marine | Cephalopholis argus | TRUE | Least Concern | | TRUE | | Peacock grouper | 2 |
| Marine | Cetoscarus ocellatus | TRUE | Least Concern | | TRUE | TRUE | Spotted parrotfish | 3 |
| Marine | Chaetodon citrinellus | TRUE | Least Concern | | TRUE | | Speckeled butterfly fish | 2 |
| Marine | Chaetodontidae sp. | TRUE | | | TRUE | | Butterfly fish | NA |
| Marine | Cheilinus trilobatus | TRUE | Least Concern | | TRUE | | Tripple tail wrass | 2 |
| Marine | Cheilinus undulatus | TRUE | Endangered | | TRUE | | Napoleon Wrasse | 22 |
| Marine | Chlorurus microrhinos | TRUE | Least Concern | | TRUE | | Steephead parrotfish | 18 |
| Marine | Chlorurus spilurus | TRUE | Least Concern | | TRUE | | Green parrotfish | 1 |
| Marine | Ellochelon vaigiensis | TRUE | Least Concern | | TRUE | | Squaretail mullet | NA |
| Marine | Epinephelinae sp. | TRUE | | | TRUE | | Grouper fish | NA |
| Marine | Epinephelus | TRUE | Least | | TRUE | | Star | NA |

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|---|---|---|---|---|---|---|---|---|---|
| | hexagonatus | | Concern | | | | spotted grouper | | |
| Marine | Epinephelus lanceolatus | TRUE | Data Deficient | | TRUE | TRUE | Giant grouper | 12 |
| Marine | Etelis coruscans | TRUE | Least Concern | | TRUE | | Onaga | NA |
| Marine | Eviota saipanensis | | Least Concern | | TRUE | TRUE | Saipan dwarf gobie | 2 |
| Marine | Gobiiformes | | | | TRUE | TRUE | Gobies sp. | NA |
| Marine | Haemulidae | TRUE | | | TRUE | | Sweetlips sp. | NA |
| Marine | Heteropriacanthus cruentatus | TRUE | Least Concern | | TRUE | | Glass eye | NA |
| Marine | Hippocampus colemani | TRUE | Data Deficient | | TRUE | TRUE | Coleman's pygmy seahorse | 0 |
| Marine | Kyphosus cinerascens | TRUE | Least Concern | | TRUE | | Guillie, highfin rudderfish | NA |
| Marine | Labridae sp. | TRUE | | | TRUE | | Wrasses | NA |
| Marine | Leptoscarus vaigiensis | TRUE | Least Concern | | TRUE | TRUE | Seagrass Parrotfish | 20 |
| Marine | Lethrinidae | TRUE | | | TRUE | | Emperor fish | NA |
| Marine | Lethrinus harak | TRUE | Least Concern | | TRUE | | Thumbprint emperor | 3 |
| Marine | Lethrinus rubrioperculatus | TRUE | Least Concern | | TRUE | | Red-gill emperor | NA |
| Marine | Lethrinus xanthochilus | TRUE | Least Concern | | TRUE | | Yellowlip emperor | NA |
| Marine | Lutjanidae | TRUE | | | TRUE | | Snappers | NA |
| Marine | Lutjanus fulvus | TRUE | Least Concern | | TRUE | | Flame-tailed snapper | NA |
| Marine | Microphis brachyurus | TRUE | Least Concern | | TRUE | TRUE | Short-tailed pipefish | 2 |
| Marine | Monotaxis grandoculis | TRUE | Least Concern | | TRUE | | Big eye emperor | NA |
| Marine | Mugilidae | TRUE | | | TRUE | | Mullet fish | NA |
| Marine | Mullidae | TRUE | | | TRUE | | Goatfishes | NA |

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|---|---|---|---|---|---|---|---|---|
| Marine | Mullidae Juvenile runs | TRUE | | | TRUE | TRUE | Ti'ao juvenile runs of goatfish (mixed species) | NA |
| Marine | Mulloidichthys flavolineatus | TRUE | Least Concern | | TRUE | | Yellowstripe goatfish | 2 |
| Marine | Myripristis adusta | TRUE | Least Concern | | TRUE | | Shadowfin | NA |
| Marine | Naso unicornis | TRUE | Least Concern | | TRUE | | Bluespine unicornfish | NA |
| Marine | Parupeneus barberinus | TRUE | Least Concern | | TRUE | | Dash dot goatfish | NA |
| Marine | Plectorhinchus albovittatus | TRUE | Least Concern | | TRUE | | Giant sweetlips | NA |
| Marine | Plectorhinchus pictus | TRUE | Least Concern | | TRUE | | Spotted sweetlips | NA |
| Marine | Plectropomus laevis | TRUE | Least Concern | | TRUE | | Blacksaddle grouper | 1 |
| Marine | Pomacanthidae | TRUE | | | TRUE | | Angelfish species | NA |
| Marine | Praealticus poptae | | Least Concern | | TRUE | TRUE | Marianas rock skipper | NA |
| Marine | Sargocentron spiniferum | TRUE | | | TRUE | | Sabre squirrelfish | NA |
| Marine | Scarus schlegeli | TRUE | Least Concern | | TRUE | | Yellow band parrotfish | NA |
| Marine | Scaridae sp. | TRUE | | | TRUE | | Parrot fish sp. | NA |
| Marine | Selar crumenophthalmus | TRUE | Least Concern | | TRUE | | Atulai, Bigeye scad | 2 |
| Marine | Siganidae Juvenile runs | TRUE | | | TRUE | TRUE | Juvenile runs of rabbit fish mixed species | NA |
| Marine | Siganus | TRUE | Least | | TRUE | | Forktail | NA |

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|---|---|---|---|---|---|---|---|---|
| | argenteus | | Concern | | | | rabbit fish | |
| Marine | Thalassoma lutescens | TRUE | Least Concern | | TRUE | | Green moon wrasse | NA |
| Marine | Enhalus acoroides | TRUE | Least Concern | | TRUE | TRUE | Sea grass | 24 |
| Marine | Halodule uninervis | TRUE | Least Concern | | TRUE | TRUE | Sea grass | 22 |
| Marine | Acropora globiceps | TRUE | Endangered | TRUE | TRUE | | Acropora globiceps coral | 23 |
| Marine | Acropora retusa | TRUE | Endangered | TRUE | TRUE | | Acropora retusa coral | 23 |
| Marine | Acropora spp. | TRUE | Endangered | | TRUE | | All Staghorn corals | 23 |
| Marine | All native corals | TRUE | | | TRUE | | Native corals | NA |
| Marine | Seriatopora aculeata | TRUE | Endangered | | TRUE | | Seriatopora aculeata coral | 15 |
| Marine | Gafrarium pectinatum | | | | TRUE | TRUE | Pectinate Venus | 15 |
| Marine | Sand clams intertidal area | | | | TRUE | TRUE | | NA |
| Marine | Tridacna maxima | TRUE | Least Concern | TRUE | TRUE | TRUE | Small Giant Clam | 23 |
| Marine | Tridacna squamosa | TRUE | Least Concern | TRUE | TRUE | | Fluted Giant Clam | 21 |
| Marine | Octopus cyanea | TRUE | Least Concern | | TRUE | TRUE | Day Octopus | 7 |
| Marine | Carcharhinus amblyrhynchos | TRUE | Endangered | | TRUE | TRUE | Grey Reef Shark | 25 |
| Marine | Rhincodon typus | TRUE | Largely Depleted | | TRUE | TRUE | Whale shark | 12 |
| Marine | Sphyrna lewini | TRUE | Critically Endangered | | TRUE | TRUE | Scalloped hammerhead | 10 |
| Marine | Urogymnus | TRUE | Endangered | | TRUE | TRUE | Porcupine | 10 |

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|---|---|---|---|---|---|---|---|---|
| | asperrimus | | | | | | ray | |
| Marine | Tripneustes gratilla | TRUE | | | TRUE | | Collector Urchin | 13 |
| Marine | Cassis cornuta | TRUE | | | TRUE | | Horned Helmet | 23 |
| Marine | Charonia tritonis tritonis | TRUE | | | TRUE | | Triton's Trumpet | 18 |
| Marine | Chicoreus ramosus | TRUE | | | TRUE | | Branched Murex | 16 |
| Marine | Cypraeidae | TRUE | | | TRUE | | Cowrie | NA |
| Marine | Lambis lambis | TRUE | | | TRUE | | Common Spider Conch | 20 |
| Marine | Lambis truncata | TRUE | | | TRUE | | Giant spider conch | NA |
| Marine | Mollusca sp. | TRUE | | | TRUE | | Sea slugs, sea snails, limpets, nudibranch | NA |
| Marine | Rochia nilotica | TRUE | | | TRUE | | Trocus | NA |
| Marine | Turbo argyrostomu s | TRUE | | | TRUE | | Silver-mou thed Turban | 18 |
| Marine | Turbo petholatus undescribed subspecies | TRUE | | | TRUE | | Tapestry Turban | 28 |
| Marine | Turbo setosus undescribed subspecies | TRUE | | | TRUE | | Rough Turban | 28 |
| Marine | Actinopyga mauritiana | | Vulnerable | | TRUE | | Surf Redfish | 15 |
| Marine | Actinopyga variens | | Data Deficient | | TRUE | | Sea cucumber | NA |
| Marine | Holothuria whitmaei | | Endangered | | TRUE | | Black Teatfish, sea cucumber | 17 |
| Marine | Cardisoma | TRUE | | | TRUE | TRUE | Mangrove | 23 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | carnifex | | | | | | Crab | |
| Marine | Coenobita spp. | | | | | | Land Hermit Crab spp | 13 |
| Marine | Grapsus tenuicrustatus | TRUE | | | | | Rock Crab, Hagauf | 10 |
| Marine | Ocypode ceratophthalma | | | | | | Horned Ghost Crab | 15 |
| Marine | Palaemon concinnus | | | | TRUE | TRUE | Mangrove prawn | NA |
| Marine | Panulirus longipes bispinosus | TRUE | | | TRUE | TRUE | Longlegged Spiny Lobster | 18 |
| Marine | Panulirus pencillatus | TRUE | | | TRUE | TRUE | Pronghorn Spiny Lobster | 16 |
| Marine | Panulirus versicolor | TRUE | | | TRUE | TRUE | Painted Spiny Lobster | 12 |
| Marine | Scyllaridae | TRUE | | | TRUE | TRUE | Slipper lobsters | NA |
| Marine | Globicephala macrorhynchus | | Least Concern | | | | Shortfinned pilot whale | 12 |
| Marine | Kogia breviceps | | Least Concern | | | | Pygmy spermwhale | 10 |
| Marine | Megaptera novaeangliae | TRUE | Least Concern | | TRUE | | Humpback Whales | 8 |
| Marine | Peponocephala electra | | Least Concern | | | | Melon-headed whale | 10 |
| Marine | Physeter macrocephalus | | Vulnerable | | TRUE | | Sperm whale | 20 |
| Marine | Pseudorca crassidens | | Near Threatened | | TRUE | | False killer whale | 12 |
| Marine | Stenella longirostris longirostris | | Least Concern | | TRUE | | Spinner Dolphin | 18 |

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|---|---|---|---|---|---|---|---|---|
| Marine | Ziphius cavirostris | | Least Concern | | | | Cuvier's Beaked Whale | 8 |
| Marine | Sargassum | | | | | TRUE | Sargassum macroalgae | 0 |
| Marine | Chelonia mydas | TRUE | Endangered | TRUE | TRUE | | Green Sea Turtle | 46 |
| Marine | Eretmochelys imbricata bissa | TRUE | Critically Endangered | TRUE | TRUE | | Hawksbill Turtle | 38 |
| Terrestrial | Arachnids | | Least Concern | | TRUE | TRUE | spiders, scorpions | NA |
| Terrestrial | Acrocephalus hiwae | TRUE | Endangered | TRUE | TRUE | | Saipan Reed-warbler | 40 |
| Terrestrial | Aerodramus bartschi | TRUE | Vulnerable | TRUE | TRUE | | Mariana Swiftlet | 30 |
| Terrestrial | Anous minutus marcusi | | Least Concern | | | | Black Noddy | 16 |
| Terrestrial | Anous stolidus pileatus | | Least Concern | | | | Brown Noddy | 8 |
| Terrestrial | Acrocephalus hiwae | | Endangered | TRUE | TRUE | | Nightingale Reed-warbler | 6 |
| Terrestrial | Aerodramus bartschi | | Critically Endangered | | TRUE | | Mariana Swiftlet | 4 |
| Terrestrial | Aplonis opaca aeneus | | Least Concern | | TRUE | | Micronesian Starling | 17 |
| Terrestrial | Aplonis opaca guami | | Least Concern | | TRUE | | Micronesian Starling | 13 |
| Terrestrial | Ardenna pacifica | | Least Concern | | TRUE | | Wedge-tailed Shearwater | 18 |
| Terrestrial | Cleptornis marchei | | Endangered | | TRUE | | Golden White-eye | 27 |
| Terrestrial | Corvus kubaryi | | Critically Endangered | TRUE | TRUE | | Mariana Crow | 38 |
| Terrestrial | Egretta | | Least | | | | Pacific | 5 |

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|---|---|---|---|---|---|---|---|---|
| | sacra sacra | | Concern | | | | Reef-heron | |
| Terrestrial | Fregata minor palmerstoni | | Least Concern | | TRUE | | Great Frigatebird | 20 |
| Terrestrial | Gallicolumba xanthonura | | Near Threatened | | TRUE | | White-throated Ground Dove | 25 |
| Terrestrial | Gallinula chloropus guami | | Least Concern | TRUE | TRUE | | Mariana Common Moorhen | 34 |
| Terrestrial | Gygis alba candida | | Least Concern | | | | White Tern | 10 |
| Terrestrial | Ixobrychus sinensis | | Least Concern | | | | Yellow Bittern | 12 |
| Terrestrial | Megapodius laperouse laperouse | | Near Threatened | TRUE | TRUE | | Micronesian Megapode | 27 |
| Terrestrial | Monarcha tatatsukasae | | Near Threatened | | TRUE | | Tinian Monarch | 23 |
| Terrestrial | Myzomela rubratra asuncionis | | Least Concern | | TRUE | | Micronesian Myzomela | 17 |
| Terrestrial | Myzomela rubratra saffordi | | Least Concern | | TRUE | | Micronesian myzomela ssp. saffordi | 27 |
| Terrestrial | Onychoprion fuscatus oahuensis | | Least Concern | | | | Sooty Tern | 16 |
| Terrestrial | Onychoprion lunatus | | Least Concern | | | | Grey-backed Tern | 18 |
| Terrestrial | Phaethon lepturus dorotheae | | Least Concern | | TRUE | | White-tailed Tropicbird | 16 |
| Terrestrial | Phaethon rubricauda melanorhynchos | | Least Concern | | TRUE | | Red-tailed Tropicbird | 17 |
| Terrestrial | Ptilinopus roseicapilla | | Near Threatened | | TRUE | | Mariana Fruit Dove | 27 |
| Terrestrial | Megapodius | | Endangered | TRUE | TRUE | | Micronesia | 2 |

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|---|---|---|---|---|---|---|---|---|
| | laperouse laperouse | | | | | | n Megapode | |
| Terrestrial | Monarcha tatatsukasae | | Near Threatened | | TRUE | | Tinian Monarch | 2 |
| Terrestrial | Rhipidura versicolor mariae | | Least Concern | | TRUE | | Rufous Fantail ssp. mariae | 25 |
| Terrestrial | Rhipidura versicolor saipanensis | | Least Concern | | TRUE | | Rufous Fantail ssp. saipanensi s | 27 |
| Terrestrial | Sternula albifrons sinensis | | Least Concern | | | | Little Tern | 14 |
| Terrestrial | Zosterops rotensis | | Critically Endangered | TRUE | TRUE | | Rota White-eye | 2 |
| Terrestrial | Sula dactylatra personata | | Least Concern | | TRUE | | Masked Booby | 20 |
| Terrestrial | Sula Leucogaster plotus | TRUE | Least Concern | | TRUE | | Brown Booby | 14 |
| Terrestrial | Sula sula rubripes | TRUE | Least Concern | | TRUE | | Red-footed Booby | 16 |
| Terrestrial | Todiramphu s albicilla albicilla | | Least Concern | | TRUE | | Mariana Kingfisher ssp. albicilla | 23 |
| Terrestrial | Todiramphu s albicilla orii | | Least Concern | | TRUE | | Mariana Kingfisher ssp. orii | 37 |
| Terrestrial | Todiramphu s albicilla owstoni | | Least Concern | | TRUE | | Mariana Kingfisher ssp. owstoni | 19 |
| Terrestrial | Zosterops conspicillatu s saypani | | Least Concern | | TRUE | | Bridled White-eye | 19 |
| Terrestrial | Zosterops rotensis | | Critically Endangered | TRUE | TRUE | | Rota White-eye | 31 |
| Terrestrial | Myzomela rubratra asuncionis | TRUE | Near Threatened | | TRUE | | Micronesia n Myzomela | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Terrestrial | Myzomela rubratra saffordi | | Near Threatened | | TRUE | | Micronesian myzomela ssp. saffordi | 0 |
| Terrestrial | Native/endemic terrestrial snails | | | | TRUE | TRUE | | NA |
| Terrestrial | Partula gibba | | Endangered | TRUE | TRUE | | Humped Tree Snail | 34 |
| Terrestrial | Partula langfordi | | Endangered | TRUE | TRUE | | Langford's Tree Snail | 46 |
| Terrestrial | Partula lutensis | | | | TRUE | TRUE | Rota Partulid Snail | 40 |
| Terrestrial | Samoana fragilis | | Endangered | TRUE | TRUE | | Fragile Tree Snail | 40 |
| Terrestrial | Acanthograeffea denticulata | | | | TRUE | TRUE | Denticulated Stick Insect | 18 |
| Terrestrial | Camponotis marianensis | | | | TRUE | TRUE | Carpenter ants | 20 |
| Terrestrial | Vagrans egistina | | Endangered | TRUE | TRUE | | Mariana Wandering Butterfly | 50 |
| Terrestrial | Birgus latro | | Least Concern | | TRUE | | Coconut Crab | 20 |
| Terrestrial | Discoplax michalis | | Least Concern | | TRUE | TRUE | Guam Long-legged land crab | 16 |
| Terrestrial | Emballonura semicaudata rotensis | | Endangered | | TRUE | | Pacific Sheath-tailed Bat | 50 |
| Terrestrial | Pteropus mariannus mariannus | | Endangered | | TRUE | | Mariana Fruit Bat | 26 |
| Terrestrial | Cryptoblepharus poecilopleurus | | Least Concern | | | | Oceanic Snake-eyed Skink | 7 |
| Terrestrial | Emoia atrocostata | | Least Concern | | TRUE | | Littoral Skink | 17 |

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|---|---|---|---|---|---|---|---|---|
| Terrestrial | Emoia slevini | | Critically Endangered | | TRUE | | Mariana Skink | 25 |
| Terrestrial | Nactus pelagicus | | Least Concern | | | | Pacific Slender-toed Gecko | 7 |
| Terrestrial | Perochirus ateles | | Least Concern | | TRUE | | Micronesian Gecko | 13 |
| Terrestrial | Ramphotyphlops braminus | | Least Concern | | | | Brahminy Blindsnake | 3 |
| Terrestrial | Varanus indicus | | Least Concern | | | | Halitai, Monitor Lizard | 3 |
| Terrestrial | Native pollinators | | Least Concern | | TRUE | TRUE | bees, wasps, flies, butterflies and moths, beetles | NA |
| Terrestrial Plant | Bulbophyllum guamense | | | TRUE | TRUE | TRUE | Siboya halumtånu' | 36 |
| Terrestrial Plant | Cyathea aramaganensis | | | | TRUE | | Tree fern | |
| Terrestrial Plant | Dendrobium guamense | | | TRUE | TRUE | TRUE | No common name | 36 |
| Terrestrial Plant | Heritiera longipetiolata | | Vulnerable | TRUE | TRUE | | Hufa halumtånu | 30 |
| Terrestrial Plant | Maesa walkeri | | | TRUE | TRUE | | No common name | 26 |
| Terrestrial Plant | Medicinal Plants | TRUE | | | TRUE | TRUE | All native plants used in traditional healing | 8 |
| Terrestrial Plant | Nervilia jacksoniae | | | TRUE | TRUE | TRUE | No common name | 46 |
| Terrestrial | Nesogenes | | | TRUE | TRUE | | No | 55 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Plant | rotensis | | | | | | common name | |
| Terrestrial Plant | Osmoxylon mariannense | | Critically Endangered | TRUE | TRUE | | No common name | 55 |
| Terrestrial Plant | Erythrina variegata | | | TRUE | TRUE | TRUE | Gaogao, catclaw tree | NA |
| Terrestrial Plant | Serianthes nelsonii | TRUE | Critically Endangered | TRUE | TRUE | | Trongkun guafi | 60 |
| Terrestrial Plant | Peperomia mariannensis | TRUE | | | TRUE | TRUE | Potpuput | NA |
| Terrestrial Plant | Procris pedunculata | TRUE | | | TRUE | TRUE | | NA |
| Terrestrial Plant | Merilliodendron megacarpum | | | | TRUE | TRUE | | NA |
| Terrestrial Plant | Elatostema calcareum | TRUE | | | TRUE | TRUE | Tapun ayuyu | NA |
| Terrestrial Plant | Intsia bijuga | TRUE | Near Threatened | | TRUE | TRUE | Ifik | NA |
| Terrestrial Plant | Bikkia tetrandra | TRUE | | | TRUE | TRUE | Gausali | NA |
| Terrestrial Plant | Grewia crenata | | | | TRUE | TRUE | Angilao | NA |
| Terrestrial Plant | Claoxylon marianum | | | TRUE | TRUE | TRUE | Cator, panao, mwesor | NA |
| Terrestrial Plant | Ficus prolixa | TRUE | | | TRUE | TRUE | nunu | NA |
| Terrestrial Plant | Coastal/mangrove species | | | | TRUE | TRUE | Mångli | NA |
| Terrestrial Plant | Tabernaemontana rotensis | | | TRUE | TRUE | | | 44 |
| Terrestrial Plant | Tuberolabium guamense | | | TRUE | TRUE | | No common name | 36 |
| Terrestrial Plant | Wetland plants | TRUE | | | TRUE | TRUE | Wetland associated | NA |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | plants | |
| Terrestrial Plant | Cycas micronesica | TRUE | Critically Endangered | TRUE | TRUE | | Fadang | 28 |
| Terrestrial Plant | Native limestone forest species | TRUE | | | TRUE | | | NA |
| Terrestrial Plant | Lycopodium phlemaria var. longifolium | | | | TRUE | TRUE | | NA |