NOAA Technical Memorandum CRCP 54

National Coral Reef Monitoring Program Socioeconomic Monitoring Component

Summary Findings for the Commonwealth of the Northern Mariana Islands, 2024

NOAA Coral Reef Conservation Program
Silver Spring, MD

August 2025

United States Department of Commerce	National Oceanic and Atmospheric Administration	National Ocean Service
Howard Lutnick Secretary	Laura Grimm, Chief of Staff, Acting Under Secretary	Nicole LeBoeuf Assistant Administrator

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About this Document

The mission of the National Oceanic and Atmospheric Administration (NOAA) is to understand and predict changes in the environment, weather, ocean, and coasts; to share that knowledge and information with others; and to conserve and manage coastal and marine ecosystems. As a line office of NOAA, the National Ocean Service (NOS) conducts or sponsors research and monitoring programs to improve the scientific basis for conservation and management decisions. The NOS strives to make information about the purpose, methods, and results of its scientific studies widely available. Coral Reef Conservation Program (CRCP) along with the National Centers for Coastal Ocean Science (NCCOS) use the NOAA Technical Memorandum NOS series to achieve timely dissemination of scientific and technical information.

This **NOAA Technical Memorandum** may be cited using the following format:
M.E. Allen, A.T. Alva, S. Siegel, C.S. Fleming, S.B. Gonyo, and E.K. Towle. 2025. National Coral Reef Monitoring Program Socioeconomic Monitoring Component: Summary Findings for the Commonwealth of the Northern Mariana Islands, 2024. U.S. Dep. Commerce, NOAA Tech. Memo., NOAA-TM-NOS-CRCP-54, 44 pp. + Appendices. https://doi.org/10.25923/dz7d-k819

The report cover photo was provided by Caroline Donovan.

Authorship Credit**:** Supervision: M.A.; Project Administration: M.A., C.F.; Writing-Original Draft: M.A., S.S., A.A.; Validation: S.S.; Data Curation: A.A.; Formal Analysis: A.A., S.S.; Software: A.A.; Visualization: A.A., S.S.; Methodology: S.G., A.A.; Writing-Review & Editing: C.F., S.G., E.T.; Funding Acquisition: E.T.

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Acknowledgments

This project was funded under the NOAA Coral Reef Conservation Program project #743. The project investigators would like to extend our appreciation to many individuals and groups that made this work possible. They include: Eastern Research Group (ERG), the Logit Group, and Pacific Coastal Research & Planning (PCRP) for implementing the sampling design and conducting the data collection; NOAA Coral Reef Management Liaison, Janice Castro; and the many dedicated representatives of federal and territory agencies, non-governmental organizations, academic institutions, and stakeholder groups who provided input and feedback during the initial survey development and subsequent revisions. We would also like to thank our anonymous reviewers for their time and valuable comments to improve this report, and the resident population of CNMI for participating in the survey. Finally, the NCRMP Socioeconomic Team wishes to extend our appreciation to all of our colleagues we have worked with along the way—for their support, ideas, and efforts toward the greater goal of long-term socioeconomic monitoring of our nation's coral reef states and territories.

Interviewers preparing for socioeconomic data collection in CNMI. Photo credit: Deven Sablan.

Executive Summary

The Socioeconomic Component of the National Coral Reef Monitoring Program (NCRMP) collects socioeconomic data across all United States (U.S.) coral reef territories and jurisdictions to inform human dimensions indicators. These indicators fall under the broad categories of population demographics, human use of coral reef resources, and knowledge, attitudes, and perceptions of coral reefs and coral reef management. The overall goal of this endeavor is to understand the status and trends of each jurisdiction's population, social and economic structure, interactions with coral reef resources, and responses to local coral reef management. The National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Conservation Program (CRCP) uses this information to help address coral reef issues at local, regional, and national levels, as well as to inform continuing research and communication products. NOAA CRCP staff, along with educators and managers in the jurisdictions, use this information to monitor changes in coral reef–dependent communities and jurisdictions and ensure outreach programs are designed to achieve their goals.

This report presents primary data collected for the second socioeconomic monitoring cycle in the Commonwealth of the Northern Mariana Islands (CNMI) (the first monitoring cycle was completed in 2016). The household survey was conducted in person from February to March 2024. Results are representative of the CNMI resident population as a whole and island strata of Saipan, Tinian, and Rota. Key highlights from the results include:

- **Activity Participation:** Over 70% of CNMI residents participated in beach recreation and swimming/wading in both 2016 and 2024, and participation in most activities increased from 2016 to 2024.
- **Seafood:** Nearly all (98%) residents consumed seafood in at least some of their meals on average, and 84% of those residents ate seafood from local coral reefs.
- **Importance of Coral Reefs:** Over 80% of residents believed that CNMI's coral reefs were extremely important for coastal protection, food, and human health. Two-thirds of residents also believed that coral reefs were important for cultural events (such as fiestas and ceremonies) and for establishing or maintaining social relationships and family ties.
- **Perceived Resource Conditions:** At least 50% of residents believed ocean water quality and the amount of fish in CNMI were good, but residents were generally split on whether these conditions will worsen or improve over the next 10 years.
- **Threats to Coral Reefs:** Residents were generally more familiar with a variety of threats to coral reefs in 2024 than they were in 2016. In 2024, the highest increase in familiarity was with coral bleaching. Between 46-49% identified coral bleaching, marine litter, pollution, and ocean acidification as severe threats to coral reefs.
- **Support for Management Strategies:** At least 80% of residents supported active coral reef restoration, community participation in marine resource management, new requirements for improved wastewater treatment, and increased restrictions on coastal

construction practices to prevent soil and stormwater runoff. From 2016 to 2024, support level for various management strategies generally decreased but was still high overall.

- **Marine Protected Areas:** The majority of residents were aware of existing marine protected areas (MPAs) or marine preserves in CNMI. Over 70% of residents believed that MPAs have led to improved coral reef protection, and 64% believed that MPAs have improved the amount and size of fish. Perceptions of most MPA impacts were more negative in 2024 than they were in 2016, but residents were more likely to perceive positive impacts to fishermen livelihoods than in 2016.
- **Conservation Behaviors:** Over 80% of residents believed that it was extremely important for CNMI residents to engage in activities that help protect coral reefs. Most residents generally engaged in routine conservation-oriented behaviors such as reducing household electricity or water use or using fewer single-use plastics. Less than 50% of residents had taken longer-term actions such as maintaining or upgrading septic or sewer systems. Commonly stated barriers to action were lack of opportunity, lack of knowledge, and lack of permission.
- **Awareness of Coral Reef Rules and Regulations:** Nearly 90% of residents believed it was unacceptable to leave trash on the beach, and 60% believed it was unacceptable to anchor a boat on coral or remove coastal vegetation. Opinions were mixed about the acceptability of touching corals, operating a boat in shallow reef areas, having fires on the beach, and feeding fish, birds, or mammals, suggesting a potential need for more outreach to improve compliance through increased awareness of rules and regulations.

Overall, the results indicate that CNMI's residents are active marine resource users who have integral connections with coral reefs and rely on these ecosystems for a variety of social, economic, and cultural benefits. Results also show that residents are increasingly aware of coral reef issues, such as coral bleaching and ocean acidification, and suggest that residents strongly support management strategies such as active coral reef restoration, efforts to mitigate threats to coral reefs (e.g., restrict sources of pollution), and actions to prevent resource conditions (e.g., ocean water quality) from becoming worse.

The findings on resident perceptions of resource conditions and threats to coral reefs can be used to 1) assess the effectiveness of current management efforts and determine if those efforts need modification; 2) design new management approaches that are readily understood and therefore more likely to be accepted and followed by resource users; or 3) adjust outreach and education strategies per changing local observations about threats to the local marine environment.

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1. Introduction

Coral reefs are among the most valuable ecosystems on Earth, providing food, protection from storms, tourism, recreation, and other ecosystem services or benefits to adjacent coastal communities (Brander and van Beukering, 2013; Eastern Research Group, 2019). When coral reefs are threatened by changing ocean conditions, fishing impacts, and land-based sources of pollution, nearby human communities are also threatened. In 2013, the National Oceanic and Atmospheric Administration's (NOAA) Coral Reef Conservation Program (CRCP) created the National Coral Reef Monitoring Program (NCRMP) to establish an integrated and focused long-term monitoring program of biological, environmental, and socioeconomic indicators for all United States (U.S.) states and territories where coral reefs are present. The incorporation of a socioeconomic monitoring component to the NCRMP represents a holistic, interdisciplinary approach for the CRCP. More information about all components of the NCRMP can be explored in the "NOAA Coral Reef Conservation Program: National Coral Reef Monitoring Plan" (NOAA CRCP, 2021).[1]

1.1 Socioeconomic component of NCRMP

The Socioeconomic Component of the NCRMP collects and monitors socioeconomic information, including human use of coral reef resources, knowledge, attitudes, and perceptions of coral reefs and coral reef management, and demographics of the populations living in coral reef areas. The overall goal of the socioeconomic monitoring component is to track relevant information on each jurisdiction's population, social and economic structure, the benefits of coral reefs and related habitats, the perceived impacts of society on coral reefs, and the impacts of coral management on communities. NOAA's CRCP uses the information to improve programs designed to protect coral reefs at local, regional, and national levels, as well as to inform continuing research and communication products.

The Socioeconomic Component uses a suite of 13 survey indicators to measure the relationship between coral reefs and their adjacent communities (Lovelace and Dillard, 2012).[2] Indicators enable researchers to track changes over time by simplifying intellectually complex concepts into smaller and more measurable parts (Schirnding, 2002). Primary and secondary data streams inform the indicators for each of the seven inhabited U.S. coral reef jurisdictions: South Florida, the U.S. Virgin Islands, Puerto Rico, Hawai'i, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands (CNMI) (Table 1). A detailed description of the 13 indicators can be found in the team's indicator development report (Abt Associates, 2019).[3]

[1] https://www.coris.noaa.gov/activities/NCRMP_Plan_2021/welcome.html
[2] https://coastalscience.noaa.gov/data_reports/developing-social-and-economic-indicators-for-monitoring-the-u-s-coral-reef-jurisdictions-report-from-a-scientific-workshop-to-support-the-national-coral-reef-monitoring-program-hollings-marine-lab/
[3] https://doi.org/10.25923/ww0p-q586

A socioeconomic survey is implemented in each inhabited jurisdiction once every 5–7 years to inform 7 of the 13 indicators:

- Participation in coral reef activities (including snorkeling, diving, fishing, harvesting)
- Cultural importance of coral reefs
- Perceived resource condition
- Awareness and knowledge of coral reefs
- Attitudes towards coral reef management strategies
- Awareness of coral reef rules and regulations
- Participation in behaviors that may improve coral health

The survey includes a standard set of questions for all jurisdictions as well as a subset of jurisdiction-specific questions relevant to local management needs. All survey questions are periodically approved for use by the Office of Management and Budget (OMB) under OMB #0648-0646. Surveys from the first socioeconomic monitoring cycle occurred from 2014 to 2018 (Gorstein et al., 2019a; Gorstein et al., 2019b; Gorstein et al., 2018a; Gorstein et al., 2018b; Gorstein et al., 2017; Gorstein et al., 2016; Levine et al., 2016), and the second monitoring cycle began in 2019 and is presently ongoing (Allen et al., 2021; Allen et al., 2022; Allen et al., 2023; Allen et al., 2024a; Allen et al., 2024b). After each monitoring cycle, scores for all 13 socioeconomic indicators are calculated. More information on NCRMP's Socioeconomic Component can be found at the project website: https://www.coris.noaa.gov/monitoring/socioeconomic.html

Table 1. Geographic scope of current NCRMP Socioeconomic Monitoring.

Location	Inhabited Islands/Counties
American Samoa	Islands of Tutuila, Taʻū, Olosega, Ofu, Aunuʻu
South Florida	Martin, Palm Beach, Broward, Miami-Dade, and Monroe Counties
Hawaiʻi	Islands of Kauaʻi, Maui, Molokaʻi, Oʻahu, Hawaiʻi, Lānaʻi
Puerto Rico	Islands of Puerto Rico, Vieques, and Culebra
Commonwealth of the Northern Mariana Islands	Islands of Saipan, Tinian, and Rota
Guam	Entire island of Guam
U.S. Virgin Islands	Islands of St. Croix, St. Thomas, and St. John

1.2 Purpose of this report

This technical memorandum presents the findings from the second CNMI NCRMP socioeconomic data collection. The report is organized into six remaining sections. Section 2 provides an overview of CNMI, section 3 details the methodology used in data collection and

analysis, sections 4 through 5 provide descriptive statistics, advanced analysis, and trend analysis between the first (2016) and second (2024) rounds of monitoring, and section 6 delivers discussion and conclusions. All data presented in this report support indicator development efforts accomplished at the completion of each monitoring cycle (Abt Associates, 2019). Discussions of secondary data are omitted from this report, but an overview of data sources and secondary data–derived indicators are provided in the first CNMI data collection report (Gorstein et al., 2019b) and the first cycle's complete indicator report (Abt Associates, 2019).

2. Jurisdiction description

CNMI is a commonwealth of the U.S. and has been under territorial control by the U.S. since the end of World War II. CNMI consists of 14 islands in the northwestern Pacific Ocean, with a total land area of 183.5 square miles (NOAA CRCP, 2016). The vast majority of the population resides in the islands of Saipan, Tinian, and Rota, whereas Pagan and Alamagan are more sparsely populated. Saipan is the largest island and capital of the Northern Mariana Islands, with a population of 43,385 (U.S. Census Bureau, 2020); the administrative center is Capitol Hill, a village in northwestern Saipan. The Northern Mariana Islands (Figure 1), together with Guam to the south, compose the Mariana Islands archipelago. The southern islands of CNMI are made of limestone and have the oldest and most developed reefs in CNMI, which are predominantly located along the western (leeward) side. The northern islands are volcanic, with active volcanoes on several islands, including Anatahan, Pagan, and Agrihan (NOAA CRCP, 2016). Within the Mariana Islands archipelago, the most notable broadscale reef-community zonation pattern exists between the northern volcanically active islands and the southern raised limestone islands (Starmer et al., 2008). CNMI lies relatively close to the Indo-Pacific center of coral reef biodiversity (Veron, 2000) and possesses one of the most species-rich marine ecosystems among U.S. jurisdictions.

CNMI's most diverse reefs are found near the island of Saipan (NOAA CRCP, 2016). The western sides of Saipan hold the most assemblages of seagrass, branching corals, and the last mangroves in CNMI. Tinian is located directly south of Saipan, and its western waters contain the most developed reef system around the island. Rota, the southernmost island in the CNMI, is surrounded by fringing reefs with significant reef development in the northwest (Starmer et al., 2008). CNMI's coral reef ecosystems are relatively healthy compared to others managed by the U.S. but face multiple stressors such as land-based pollution, direct damage from heavy visitor use, warming ocean temperatures, and the invasive crown of thorns starfish (NOAA CRCP, 2018). Presently, the cross-agency CNMI Coral Reef Initiative is the pinnacle of coral reef ecosystem education, preservation, and management in CNMI. This organization is made up of key members from NOAA CRCP, the Division of Coastal Resources management, the Division of Environmental Quality, and the Division of Fish and Wildlife (DCRM, 2018).

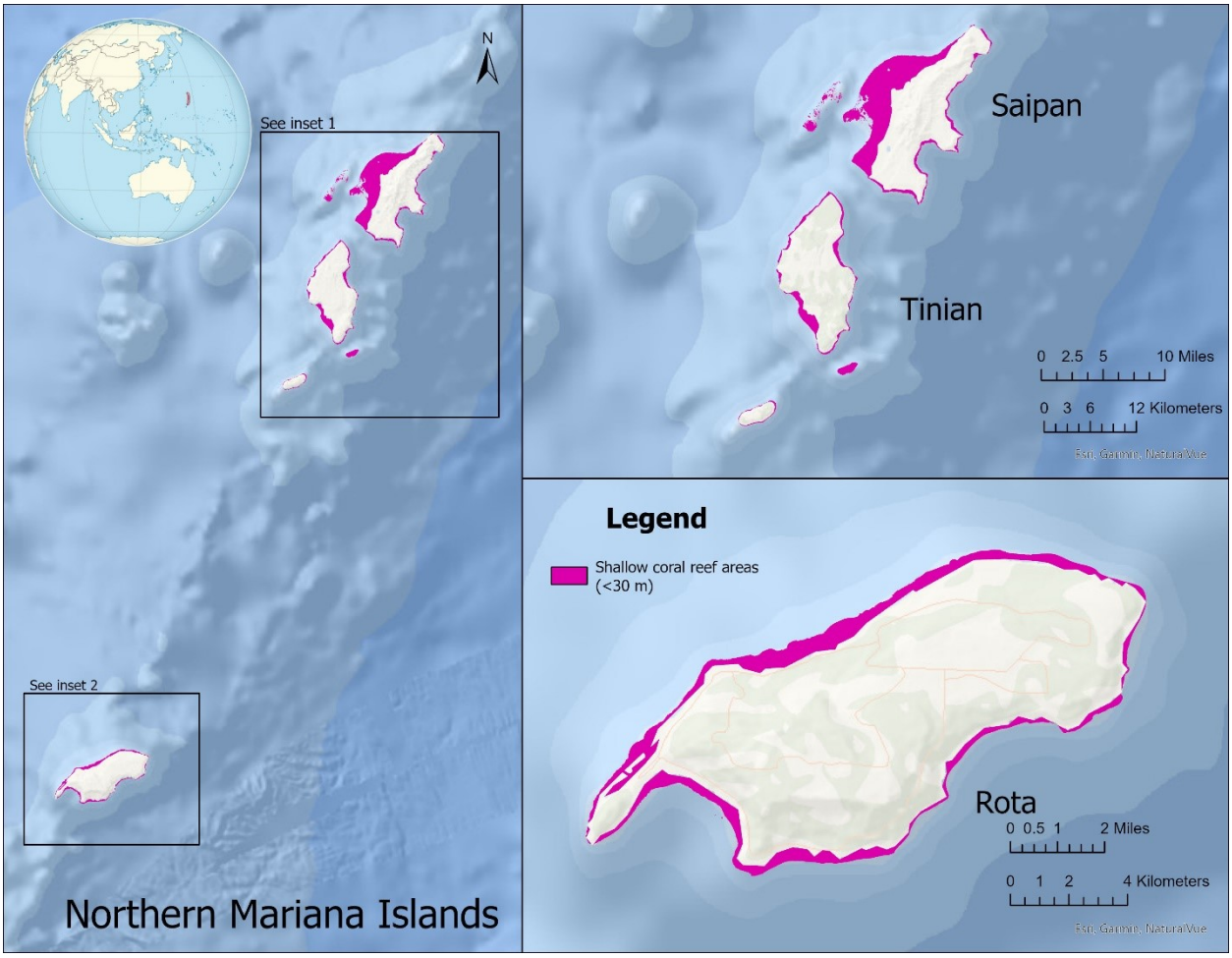

Figure 1. Map of the CNMI islands of Saipan, Tinian, and Rota, and coral reef areas.

CNMI's climate is classified as equatorial (Kottek et al., 2006) and is moderated by seasonal northeast trade winds, with little seasonal temperature variation. The primary ocean current that influences this region is the North Equatorial Current, flowing east to west in the tropical Pacific Ocean. CNMI is hot and humid, with a mean annual temperature of 28°C (83°F) and a mean annual rainfall of approximately 213 cm (84 in) (Starmer et al., 2008). The dry season runs from December to June; the rainy season runs from July to November and can include typhoons. Although typhoons are more frequent during these rainy months, the threat of typhoons is a year-round reality for residents of CNMI due to its location in "Typhoon Alley." CNMI lies within an El Niño–Southern Oscillation core region, which experiences interannual variations of rainfall and drought-like conditions in years following El Niño events.

CNMI has a rich cultural history rooted in maritime traditions, with the Chamorro people arriving around 1500 BC and practicing diverse fishing techniques. Spanish contact in the 1500s led to the Spanish–Chamorro Wars and eventual relocation of Chamorros to Guam, leaving Saipan uninhabited from 1700 to 1815. Meanwhile, the Refaluwasch (Carolinian) people, who had historically visited the Marianas, resettled Saipan after a typhoon in 1815, founding the

village of Arabwal (later Garapan). Chamorros began returning around 1865, forming the unique dual-indigenous culture that CNMI has today. Fishing and harvesting persisted as main sources of livelihood throughout the colonial period of Spanish occupation and continues to this day. A key difference in modern times, however, is that revenue for fishermen is now more closely tied to tourism in CNMI, as tourists provide a significant source of demand for seafood (Allen and Amesbury, 2012).

CNMI's gross domestic product (GDP) is estimated to be $1.1 billion (World Bank Group, 2022), with tourism and recreation being the largest ocean industry (NOAA OCM, 2024). CNMI is a frequently visited tourist destination for Japanese, Korean, Chinese, and U.S. travelers alike (MVA, 2023). Tourism is an integral aspect of CNMI's economy, and on average, approximately 29.6% of tourists travel to Saipan for marine-related tourism. This form of tourism provides millions of dollars per year in associated economic value (van Beukering et al., 2006).

Between the first and second NCRMP socioeconomic monitoring cycles in 2016 and 2024, CNMI's tourism economy faced some challenges. In October of 2018, Typhoon Yutu made direct landfall on Tinian and southern Saipan, bringing devastation to communities and property in CNMI and in major population centers on Saipan. With maximum sustained winds of approximately 180 miles per hour at landfall, the typhoon was one of the strongest tropical cyclones ever recorded. In 2020, the COVID-19 pandemic compounded tourism impacts. From an annual peak of 653,200 visitors in 2017, there was a low of 12,700 visitors in 2021 (a decrease of 98%). Visitor arrivals have bounced back in the years since, with 160,600 visitors in the first three quarters of 2023 (CNMI DOC, 2023). As a result, coral reef ecosystems continue to provide a variety of ecosystem services to both visitors and nearby communities but also face pressures from high rates of tourism and higher coastal population density.

View of Bird Island, Saipan. Photo credit: Caroline Donovan.

3. Methodology

An in-person survey of household residents (ages 18 years and older) who live in CNMI at least three months per year was conducted from February to March 2024 in English, Chamorro, Carolinian, and Tagalog languages[4]. The survey instrument is included in Appendix A. A three-stage stratified cluster sampling design was implemented in three island strata (Saipan, Rota, and Tinian) (Figure 2). The first stage of sampling randomly selected 30 clusters from Saipan; given the small number of households in Tinian and Rota, each island was worked as a single cluster, and all households on each island were visited. Second, after randomly selecting a starting point, interviewers followed walking rules to selected households from within each of the selected clusters. For the third stage, one adult from within each selected household was randomly selected following the last-birthday method. Local field surveyors visited each of the selected resident households up to two times to invite them to participate in the survey, and left behind a postcard if they were not home or preferred to take the survey online.

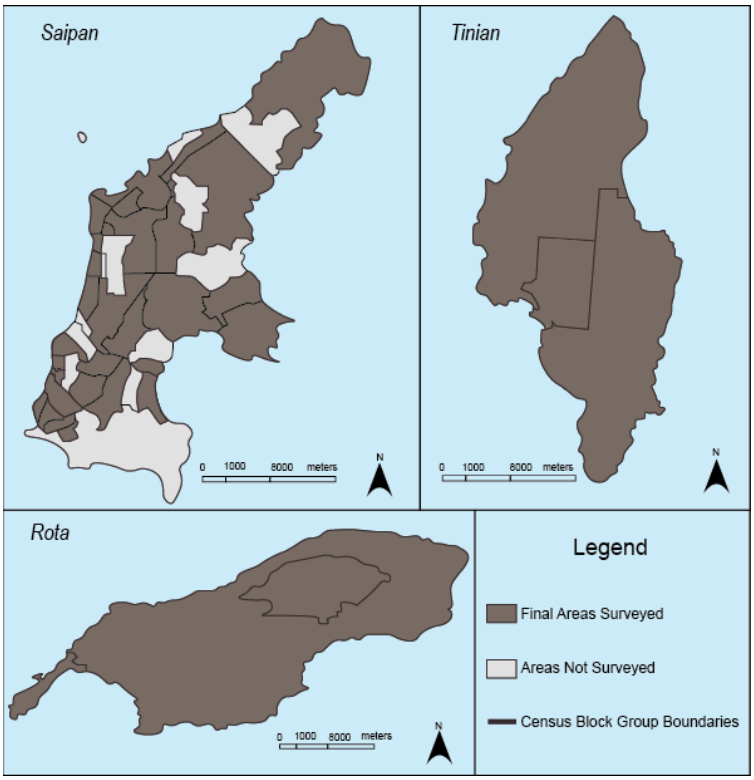

Figure 2. Map of survey sampling areas in CNMI.

A total of 709 surveys were completed, yielding an overall response rate of 24.3%[5]. Ninety-four percent of surveys were completed in English, 4% in Chamorro, 2% in Tagalog, and less than 1% in Carolinian. Survey results were weighted to be representative of the territory as a whole as well as for each of the three islands, effectively adjusting for the sample design and to address potential nonresponse bias. Please see Appendix B.1 for more information on data collection procedures and Appendix B.2 for data weighting and trimming protocols.

[4] All data are publicly archived with the National Center for Environmental Information (NCEI Accession 0299676) at https://www.ncei.noaa.gov/archive/accession/0299676

[5] The response rate was calculated based on the total number of sufficient surveys divided by the total number of households visited, excluding ineligible households where an interview attempt could not be made (abandoned building, demolished building, or household skipped for safety reasons) (709/2923 = 24.3%). This is the equivalent of AAPOR RR6 with the assumption that there are no eligible cases among the cases of unknown eligibility (AAPOR, 2023). This assumption is a limitation in the response rate calculation.

4. Results: Summary findings

Approximately 33% of CNMI residents identified as Chamorro, and 31% identified as Filipino (Table 2). The majority of residents completed some college or less, and had a household income of under $50,000.[6] Though over 80% of residents have lived in CNMI for more than 10 years, approximately half were native born to the islands. Approximately 50% of residents were employed full- or part-time, and 35% were either currently employed or last employed in a marine occupation (considered commercial fishing or related to outdoor recreation and tourism).

Table 2. Weighted estimates of key demographics for CNMI residents for the 2024 survey (n = 709).

Demographic Variables		Percent
Island Strata of Residence	Saipan	90.6
	Tinian	4.9
	Rota	4.5
Sex	Female	51.8
	Male	48.2
Race/Ethnicity*	Chamorro	32.5
	Filipino	31.3
	Carolinian	12.2
	Asian	8.1
	Other Hawaiian/Pacific Islander	8.0
	Palauan	7.3
	White	5.1
	Other	4.7
Age	18–34	29.5
	35–44	19.7
	45–54	22.7
	55–64	20.3
	65+	7.8
Education	Less than high school	14.7
	High school degree or GED	42.1
	Technical/trade school certification	13.0
	Some college	14.8
	College degree or higher	15.4
Household Income	Under $25,000	27.1
	$25,000–$49,999	18.7
	$50,000–$99,999	14.2
	$100,000 or higher	4.4
	Opted to skip	35.6
Residential Tenure	1 year or less	3.0
	2–5 years	6.0
	6–10 years	9.1

[6] These findings align with the Island Areas Census in 2020 that found the median household income was $31,362 and the poverty rate for all people for whom poverty status was determined was 38.0% (U.S. Census Bureau, 2020).

	More than 10 years	81.9
Native Born	Yes	49.5
	No	50.5
Employment Status*	Employed full-time	44.8
	Employed part-time	5.7
	Unemployed	35.1
	Retired	10.7
Employment in Marine Occupation	Yes	35.0
	No	65.0
**These questions requested "select all that apply" and may not add up to 100%*		

4.1 Participation in coral reef activities

Residents were most likely to participate in beach recreation (74% at least once in the past 12 months), followed by swimming/wading (71%) (Figure 3). The least frequented activities were scuba diving (12%), gathering of marine resources (16.2%), and board sports (stand-up paddleboarding, kiteboarding, surfing, windsurfing) (18.6%). Across the three islands, residents of Rota had participation patterns similar to residents of Saipan but had the highest participation in spearfishing (31.1% at least once in the past 12 months), boat-based fishing (35.5%), and gathering of marine resources (27.9%) (see Table C1). Residents of Tinian generally had higher participation in beach recreation (86.1%), swimming/wading (80.4%), and snorkeling (52.6%) but lower participation in board sports (6.3%) and scuba diving (4.4%).

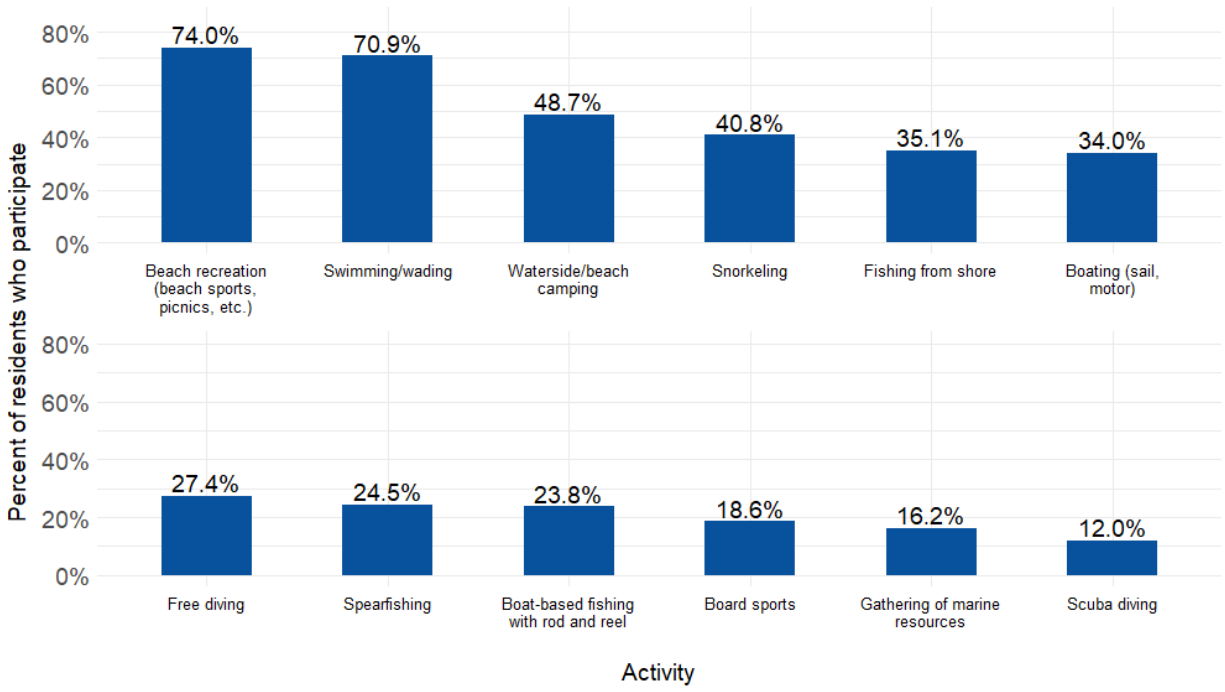

Figure 3. Percentage of CNMI residents who participated in a coral reef activity at least once in the last 12 months.

Residents also indicated the geographic zone where they most often participated in activities (Figure 4). Although zones A–F are used similarly in both locations, Rota's geographic locations are different from Tinian and Saipan. Overall, the majority of Saipan residents participated in Zone C, while the majority of Tinian residents participated in Zone F off the coast of Tinian (Figure 4a). In Rota, participation was spread around the island for different activities (Figure 4b).

While Zone C was the most preferred area for activity participation in Saipan, scuba diving mostly occurred in Zone A (Figure 4a). This zone includes the entire shoreline of Laolao Bay, home to one of the most popular dive sites on Saipan year-round.[7] The second most frequented place for scuba diving off the coast of Saipan was still Zone C, highlighting the importance of that zone for Saipan's resident recreation. Similar to the residents of Saipan, most Tinian residents who participated in scuba diving indicated that Zone A on the island of Saipan was where they participated in scuba diving the most. See Table C2 for the distribution of activities across zones for all three islands.

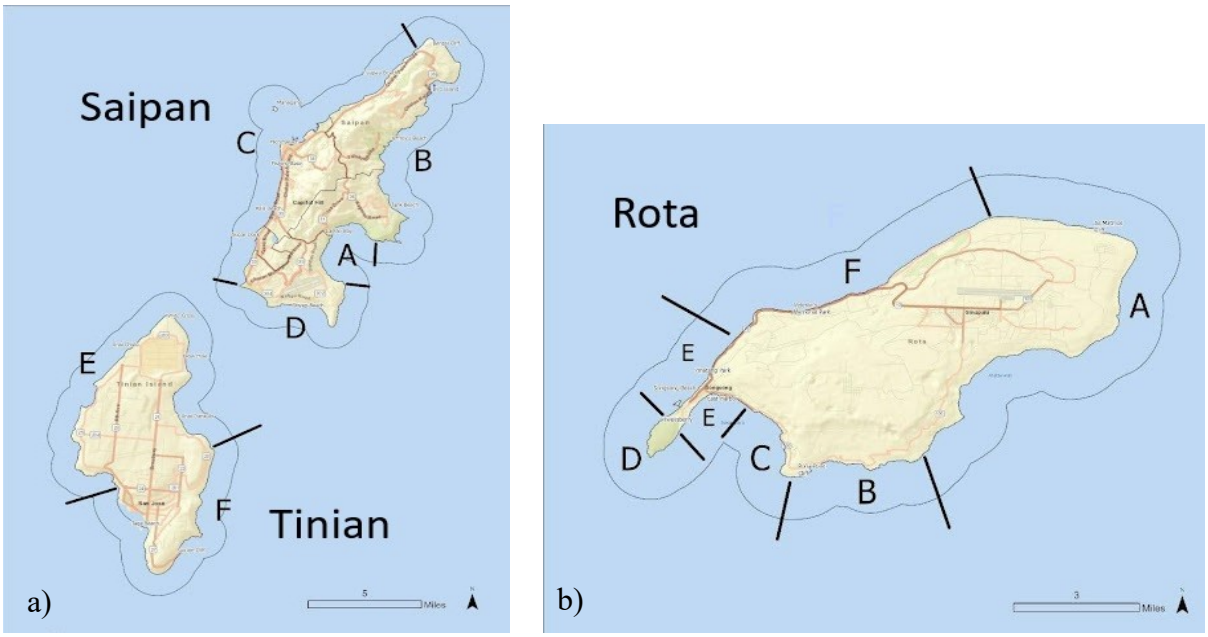

Figure 4. Map of geographic zones for activity participation used in the survey administered in a) Saipan and Tinian and b) Rota.

The majority (55.6%) of residents fished and/or gathered marine resources for subsistence purposes, followed by recreational motivations (31.6%). Cultural (10.9%) and commercial (1.9%) purposes were the lowest motivators. The three islands were relatively similar with the

[7] https://www.ncei.noaa.gov/data/oceans/coris/library/NOAA/CRCP/NOS/OCM/Projects/198/NatureConservancy2017s_Laolao.pdf

exception that Saipan fishers and gatherers were more likely to be motivated by cultural purposes (12.1%) than fishers and gatherers in Rota and Tinian (under 3%) (Table C3).

4.2 Cultural importance of reefs and reef reliance

4.2.1 Seafood consumption

Nearly all (97.9%) resident households consumed seafood in at least some of their meals on average, and of those residents, 84.9% consumed seafood from local coral reefs (Figure 5).

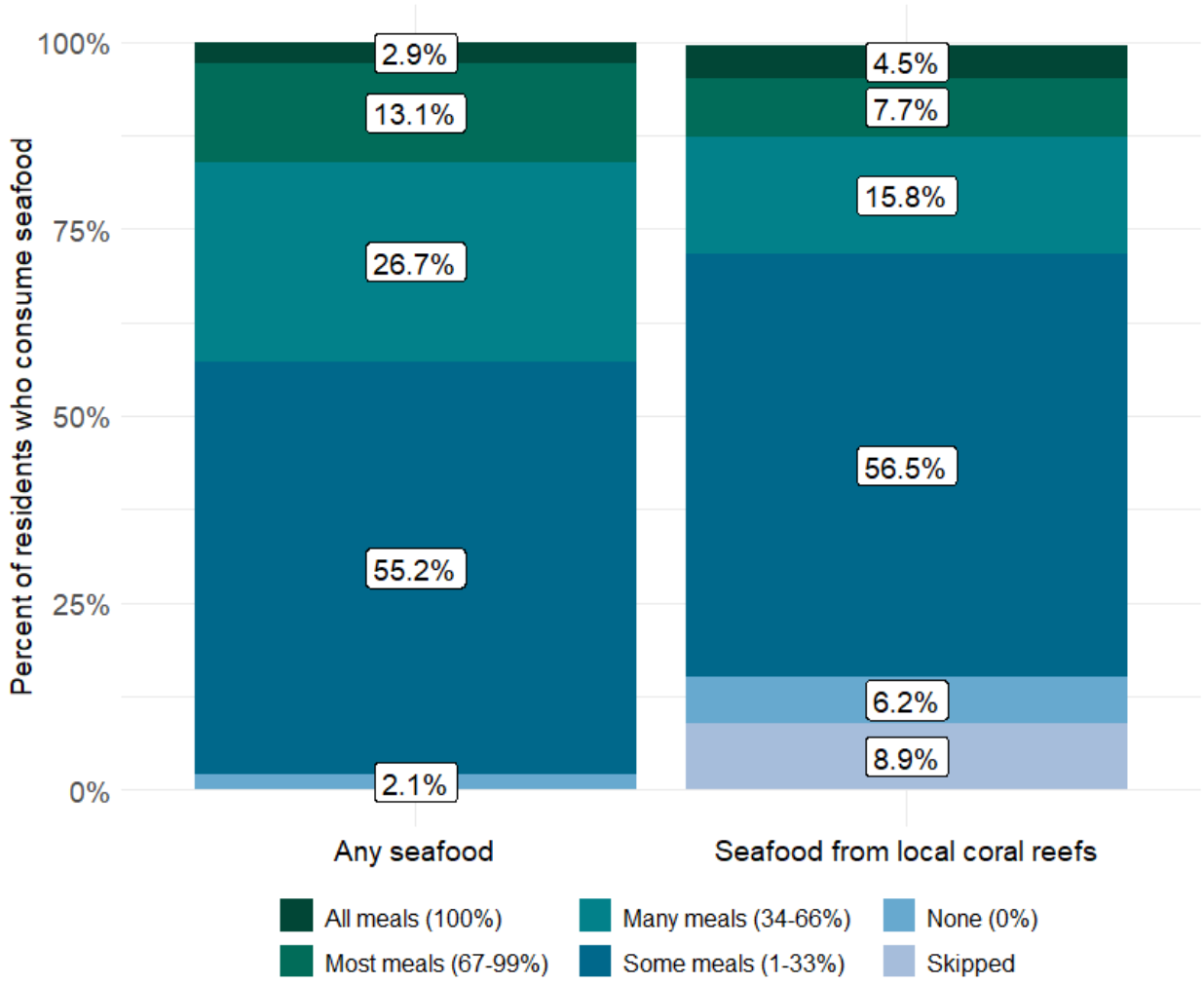

Figure 5. Frequency of general and local coral reef seafood consumption.

4.2.2 Cultural importance

A majority of residents believed that coral reefs were very important to each aspect of culture (Figure 6). Culturally important events (such as fiestas and ceremonies) and establishing and

maintaining cultural and familial ties were rated with the highest percentages of "very important." Religious practices had the highest percentage of residents expressing they were not sure about its importance in relation to coral reefs. Tinian residents placed higher importance on all aspects of culture, with the exception of religious practices, compared to Rota and Saipan. There was also a lower percentage of Tinian residents who were not sure about the importance of coral reefs to culture (Table C6).

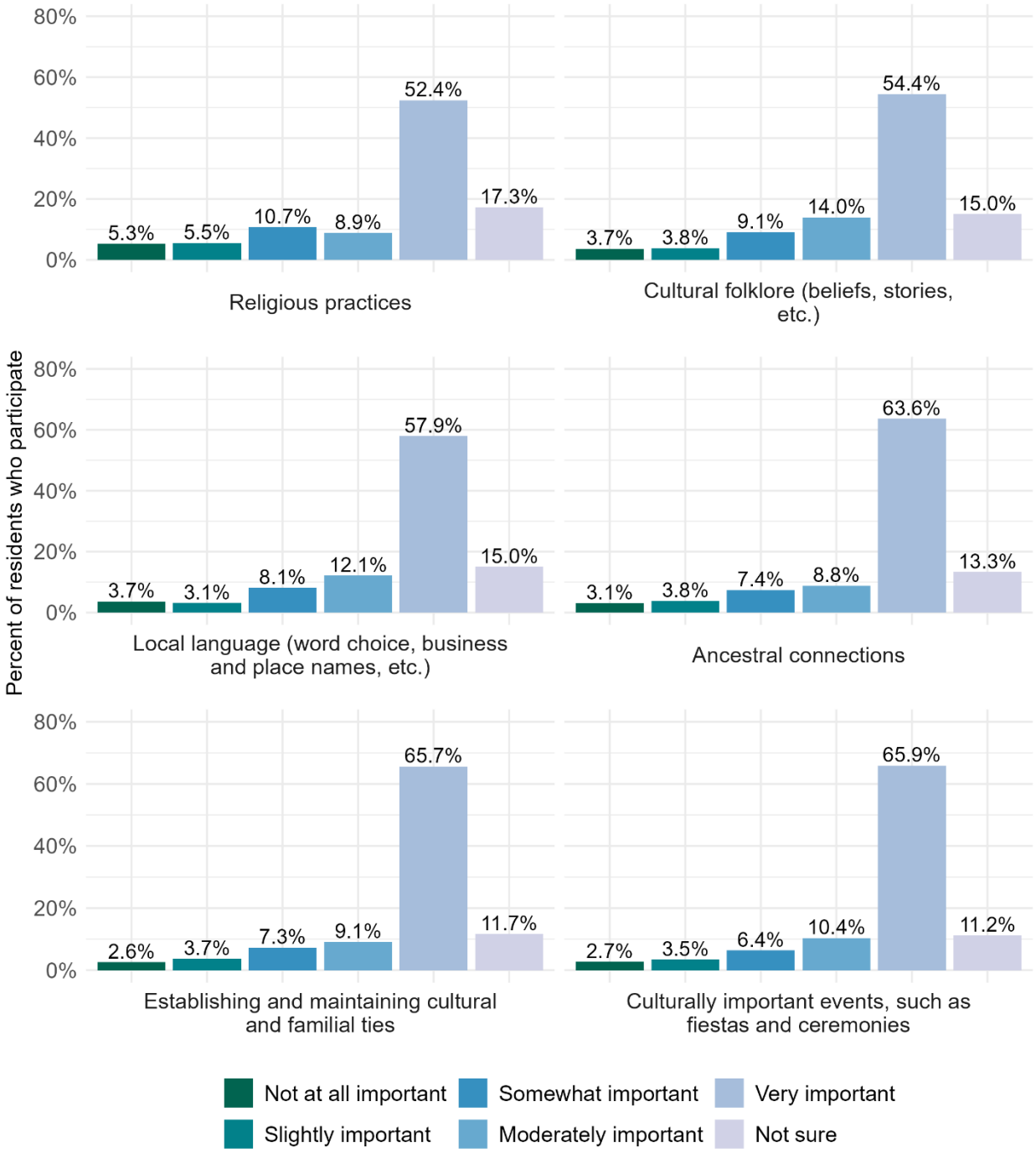

Figure 6. Cultural importance of coral reefs.

4.3 Marine resource importance and perceived conditions

4.3.1 Importance to quality of life

The majority of residents believed that all five marine resources were very important to their quality of life (Figure 7). Most (84%) residents believed ocean water quality was very important, and 62% believed the amount of trochus (*aliling*) was very important to their quality of life.

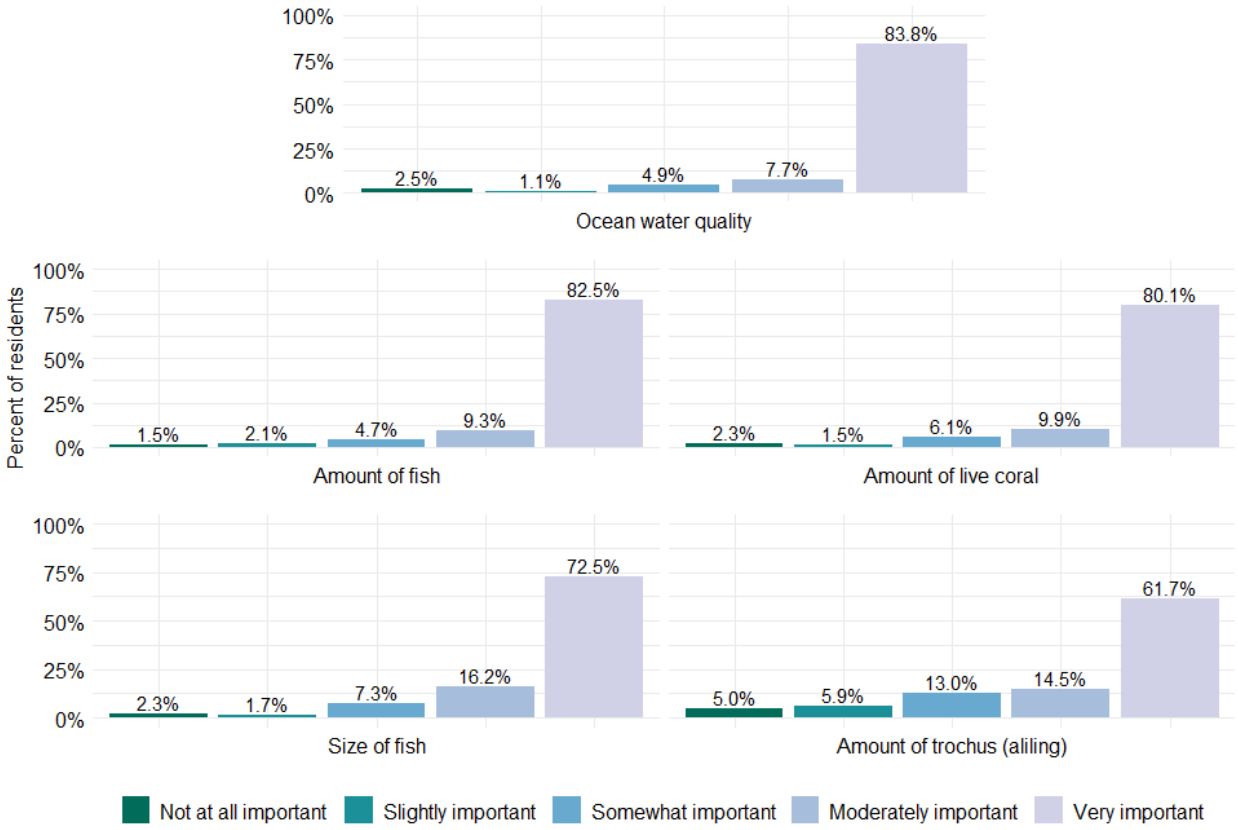

Figure 7. Marine resource importance to quality of life.

4.3.2 Perceived resource conditions

The perceived current condition of marine resources in CNMI was generally positive (Figure 8). The majority of residents believed ocean water quality and the amount of fish were in good condition. The amount of trochus (*aliling*) had the highest responses for "bad condition" (18.3%) and "not sure" (31.8%). Rota and Tinian both had more positive perceptions on most resources than Saipan (Table C8).

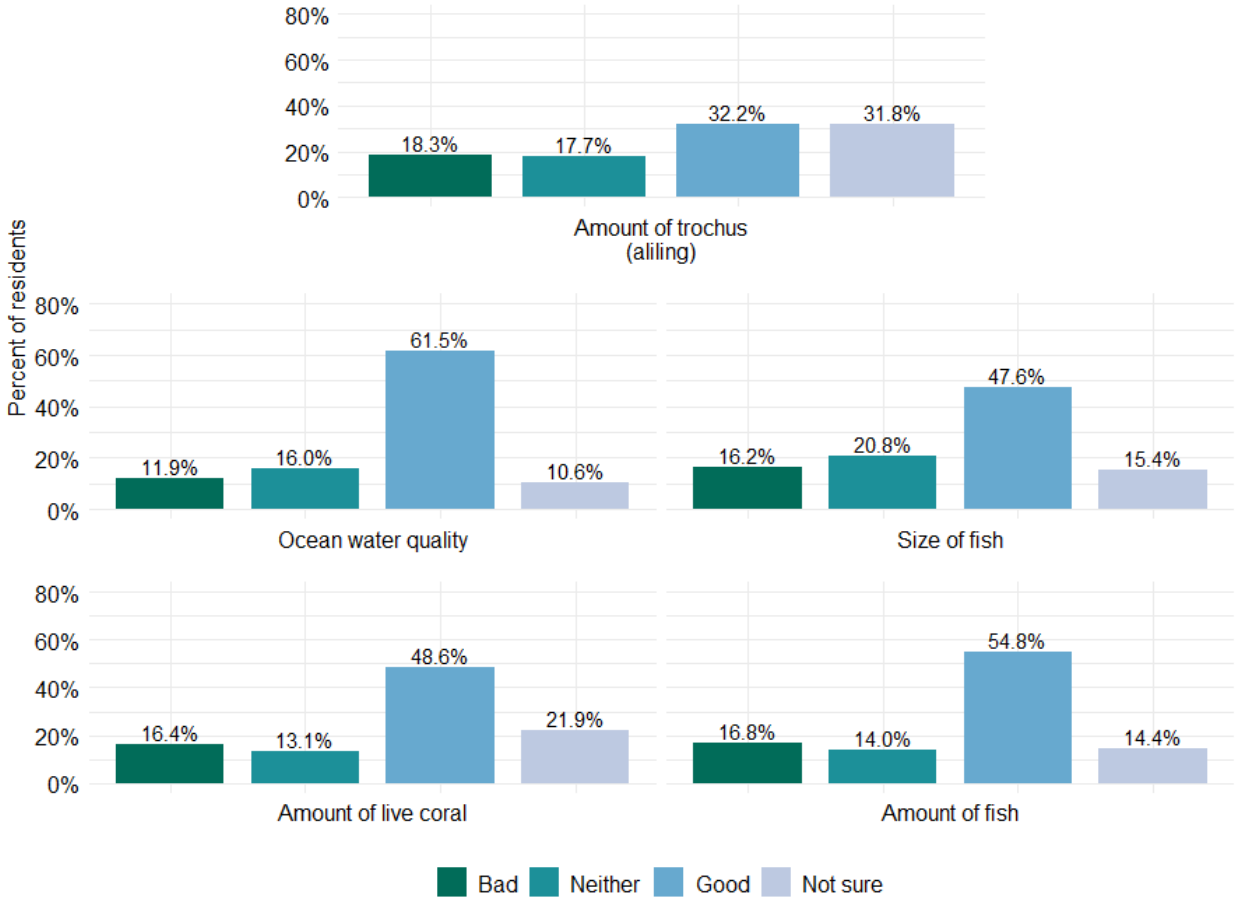

Figure 8. Perceived current resource conditions.

A fisherman walks along the shoreline where he throws his net to catch small fish in shallow waters. Photo credit: Caroline Donovan.

Residents were asked to predict the changes in resource conditions over the next 10 years. For each of the resources except for amount of trochus (*aliling*), more residents believed conditions would worsen over the next 10 years than other options. For amount of trochus (*aliling*), 35% of residents were not sure, consistent with the response to the previous question. Few residents believed there would be no change in the resources (Figure 9Figure 9).

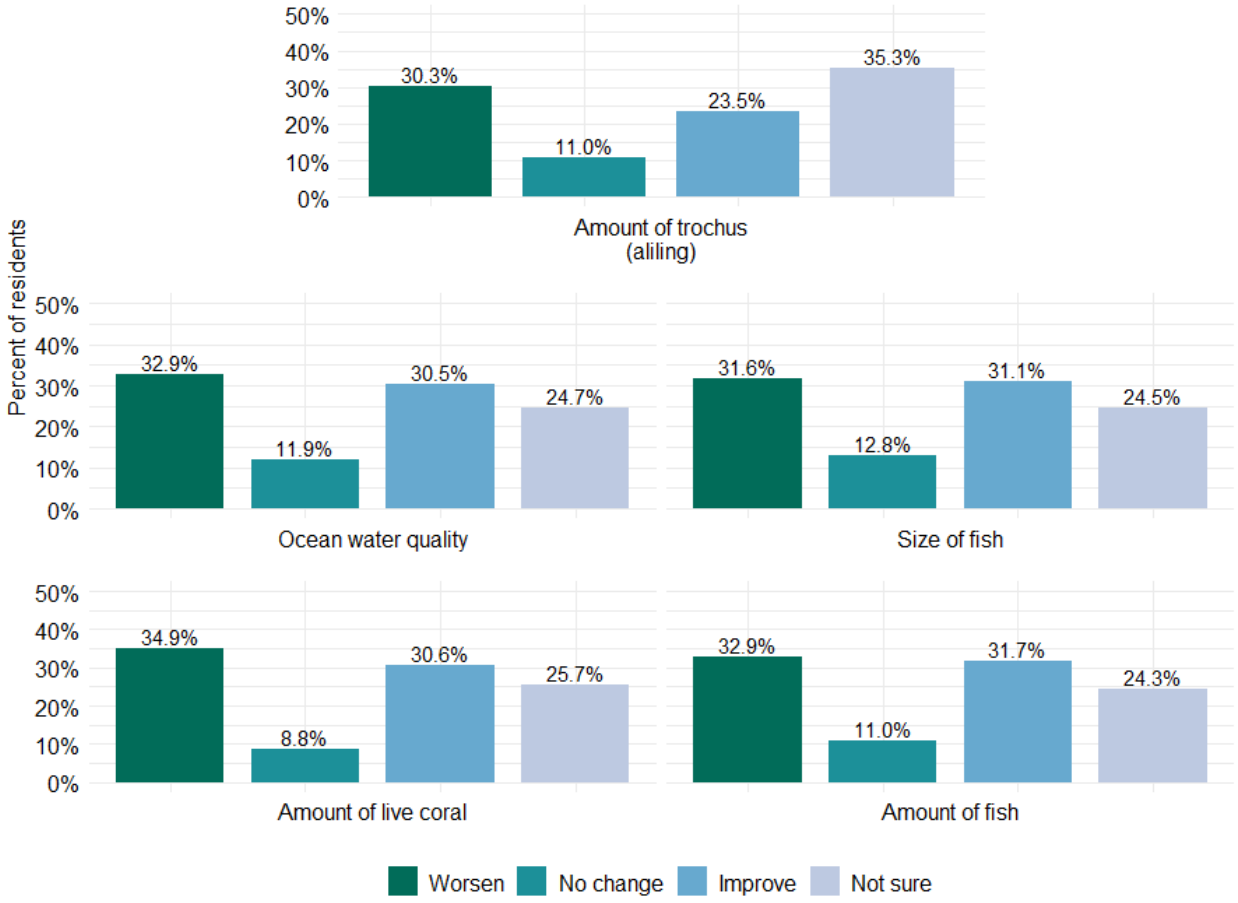

Figure 9. Perceived projected resource conditions (next 10 years).

Figure 10 highlights the relationship between current and projected resource condition responses for amount of live coral. The width of the relationships is proportional to the quantity of responses to both questions, while the color corresponds to different ratings of the current resource condition. Out of the 48.6% of residents who believed the current resource condition was good, 47.5% of them believed the amount of live coral would improve over the next 10 years (23% of all residents). Out of the 29.5% of residents who answered the current amount of live coral is either neutral or bad, the majority (56.9%) believed the resource will worsen over the next 10 years (16.8% of all residents). These relationships are similar across the other

resources, and similar diagrams can be found in Appendix D.

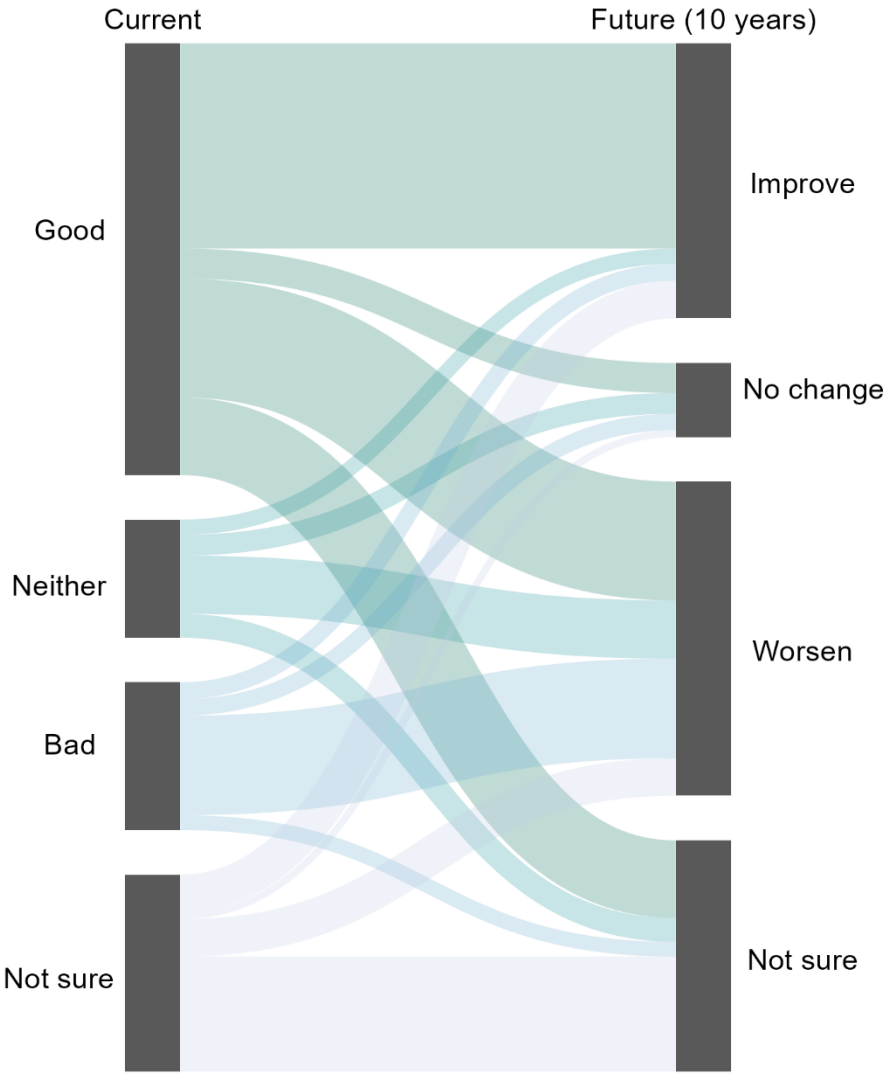

Figure 10. Relationship between current and future perceived amounts of live coral. The Sankey Diagram highlights the flow of responses from ratings of "current resource condition" to ratings of "future resource condition (10 years)."

4.4 Awareness and knowledge of coral reefs

Over 70% of residents believed coral reefs are very important to each of the listed ecosystem services (Figure 11). Residents were most likely to find coral reefs very important for protection from natural disasters.

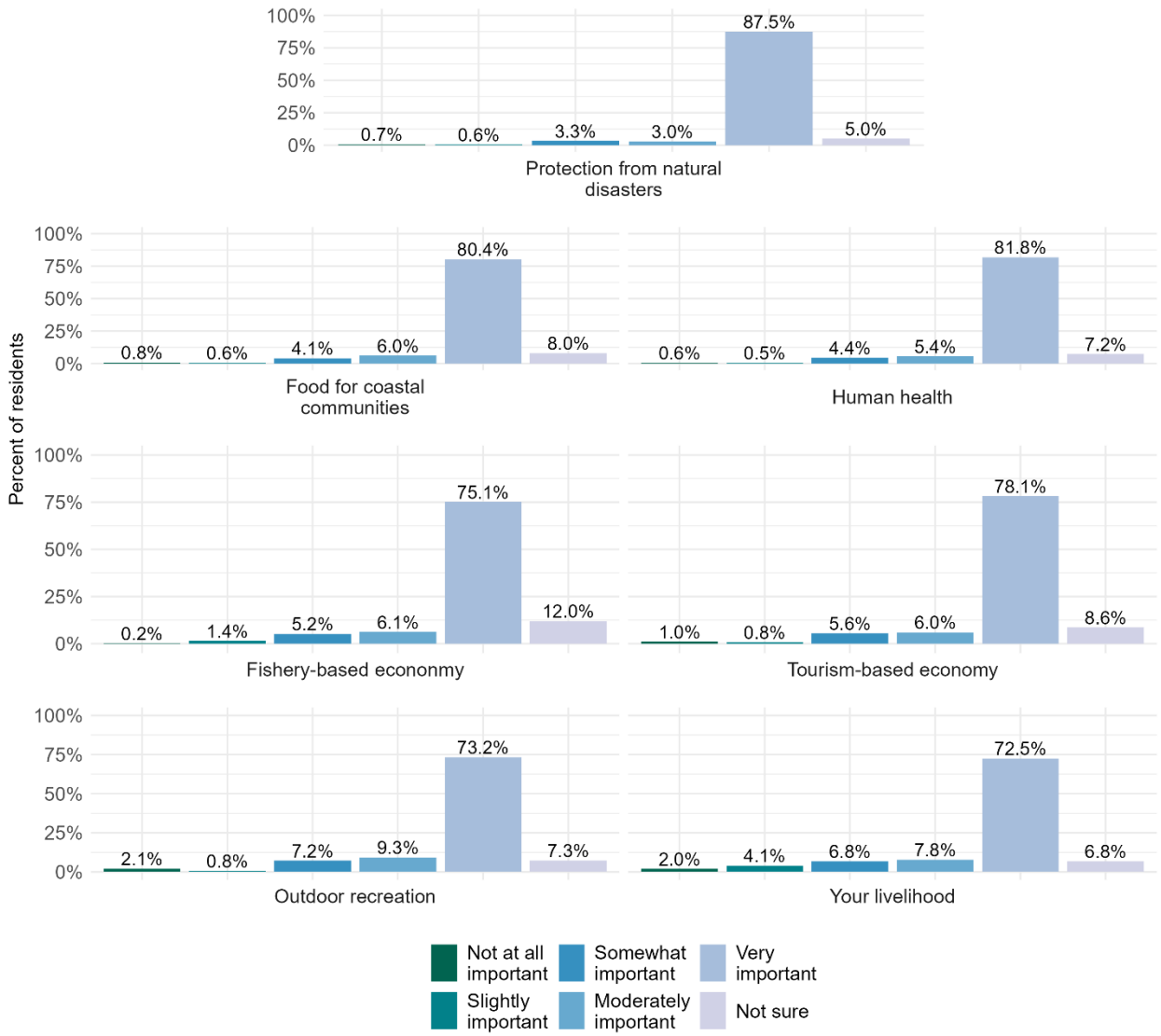

Figure 11. Importance of coral reefs for providing ecosystem services.

Most residents were familiar with the following threats to coral reefs (Figure 12). Tangible threats such as marine litter, pollution, and overfishing and overgathering all had the smallest percentage of residents who were not familiar with the threat. Similarly, those three categories had the greatest consensus that those were threats to coral reefs. Invasive species, ocean acidification, and divers and snorkelers had the highest unfamiliarity with over 20% of residents not being familiar with those threats. Whether divers and snorkelers pose a threat to coral reefs had the greatest disagreement among residents with 37.0% believing they do not versus 35.1% answering that they do pose a threat.

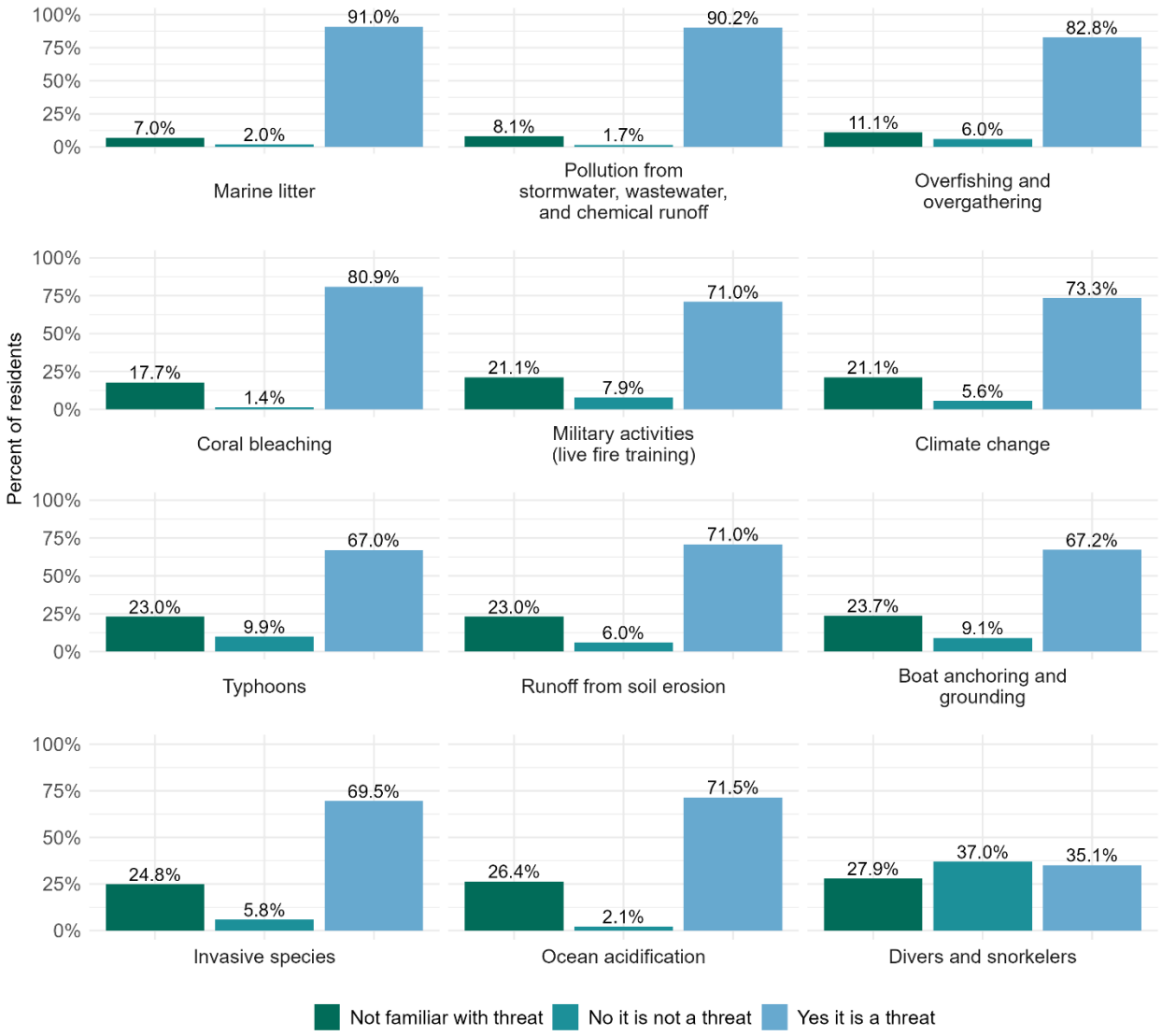

Figure 12. Familiarity of threats to coral reefs.

Residents who answered "yes, it is a threat to coral reefs" were also asked to rate the threat's severity (Figure 13). A majority of residents identified all of the listed threats as either a major or severe threat. Although the familiarity of threats to coral reefs were generally similar across the three stratum (Table C11), residents of Tinian generally assessed the threat impacts to be more severe than the other islands (Table C12).

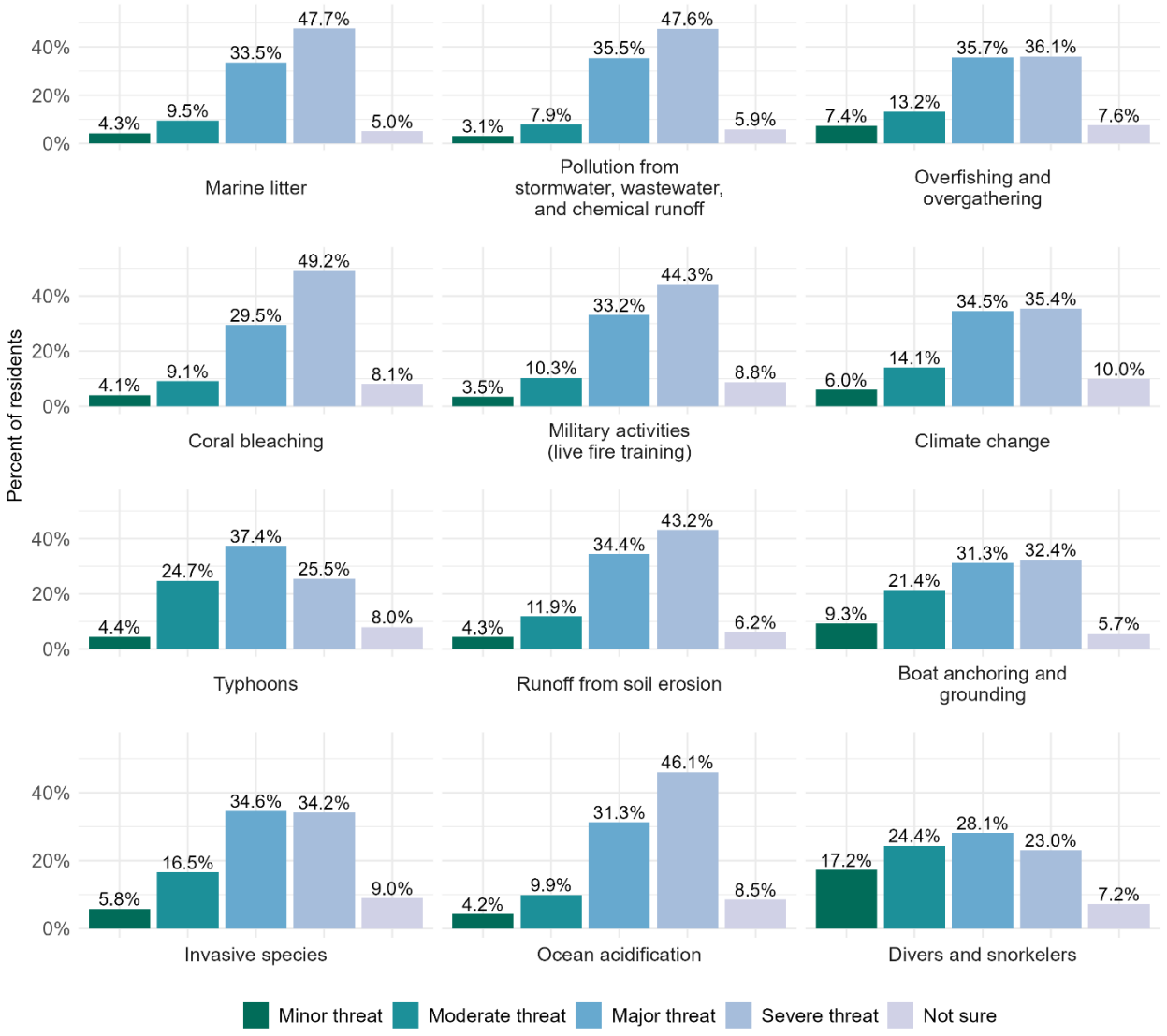

Figure 13. Perceived severity of threats to coral reefs.

4.5 Attitudes towards coral reef management strategies

4.5.1 Marine protected areas

The survey defined a marine protected area (MPA) or marine preserve as "an area of the ocean where particular human activities are limited to protect living, non-living, cultural, and/or historic resources" (Appendix A). Prior to taking the survey, 69.3% of residents were aware of existing MPAs or marine preserves in CNMI. This had larger variation in the three islands, with 85.7% of residents in Rota who were familiar, 69.2% of Saipan residents, and only 54.8% of Tinian residents (Table C13). Out of residents who were familiar, a majority believed that MPAs improved different components of the ecosystem and economy (Figure 14).

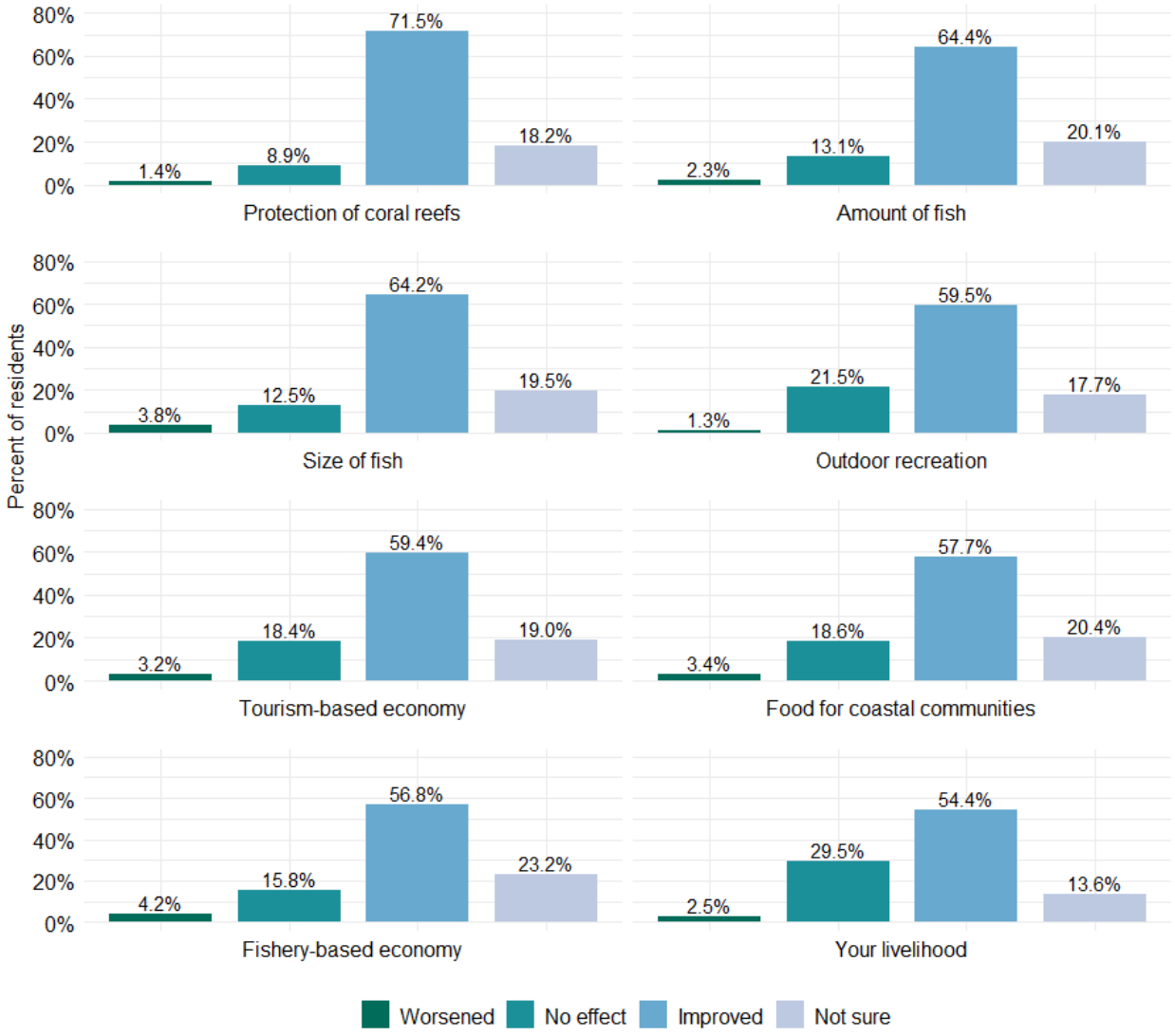

Figure 14. Perceived impacts from marine protected areas.

4.5.2 Support for management strategies

A majority of residents indicated support for each of the management strategies (Figure 15), and levels of support were generally consistent across the three islands (Table C15). Actively restoring coral reef habitats had the most support from residents at 84.2%, while the strategy with the least support was establishing limits on the number of tourism operators able to conduct business within locally managed MPAs (65.4%).

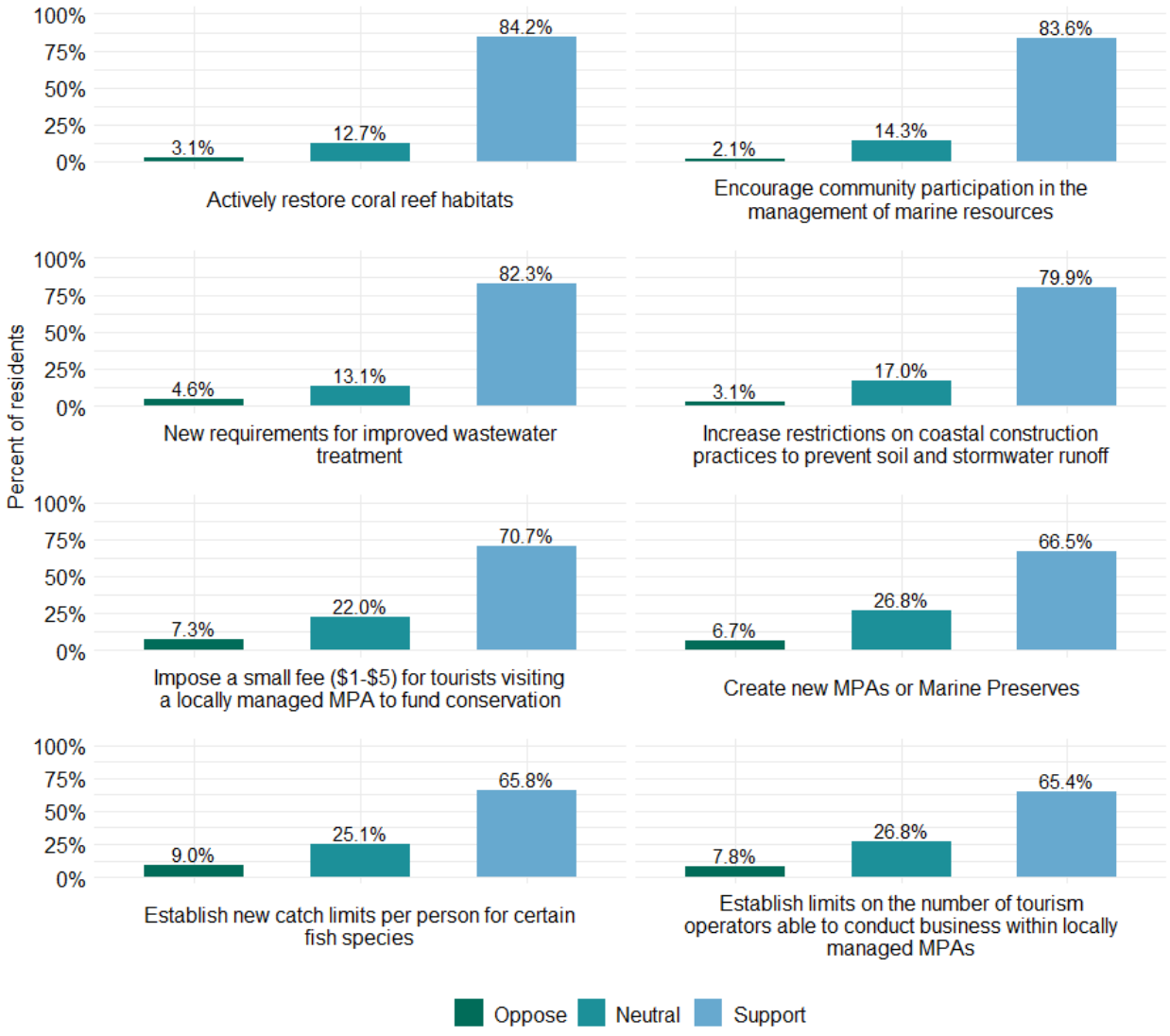

Figure 15. Support for coral reef management strategies.

4.6 Participation in behaviors that may improve coral reef health

4.6.1 Routine behaviors

Almost 80% of residents believed that it is very important for CNMI residents to engage in activities that help to protect coral reefs, and less than 1% did not believe it is important at all (Table C16). Approximately three-fourths of residents reported engaging in routine pro-environmental behaviors (Figure 16). Residents were less likely to compost or use reef-safe forms of sun protection (at around 66%). Residents were most likely to reduce household electricity use and promote environmentally responsible practices with friends or family (both

above 90%). Tinian had slightly lower participation than Rota or Saipan, and Rota had higher participation in composting (82.3% vs. 67.7% in Saipan; and 53.6% on Tinian) (Table C17).

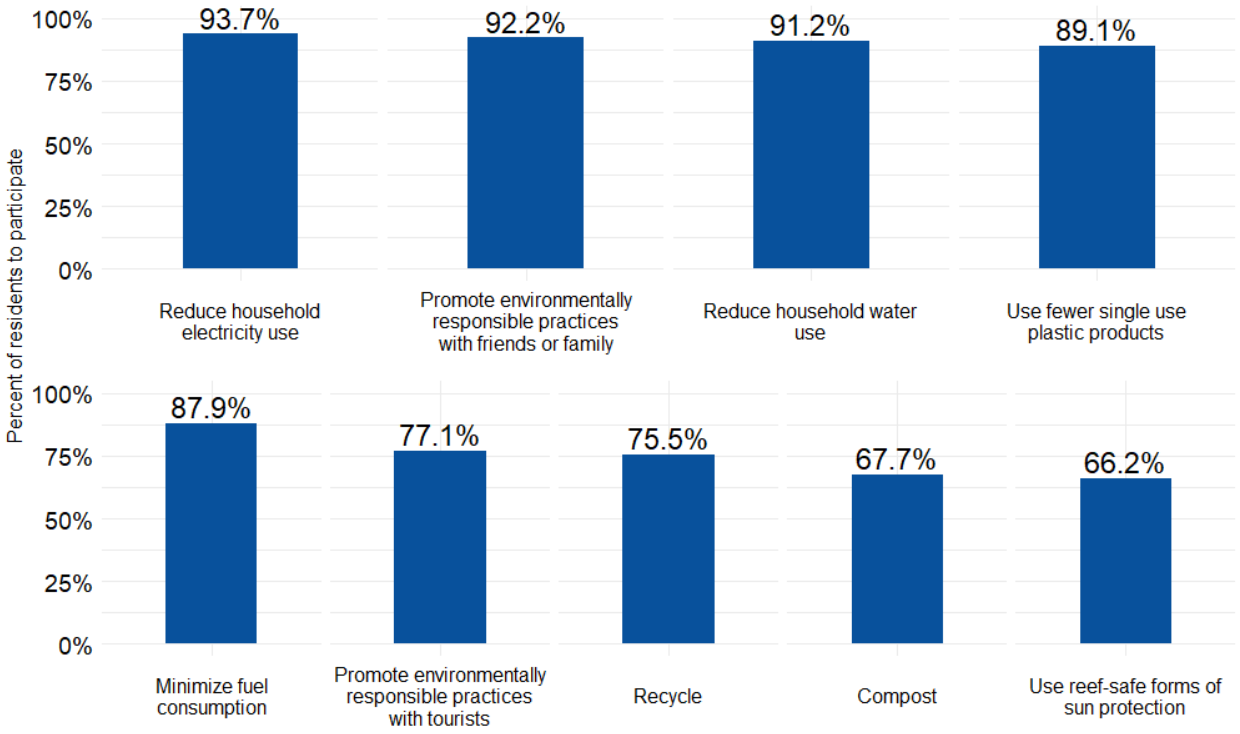

Figure 16. Participation in routine pro-environmental behaviors.

Residents were also asked why they had not participated in routine pro-environmental behaviors. Lack of opportunity was the most frequent reason provided for not composting, not using reef-safe forms of sun protection, and not promoting environmentally responsible practices with friends, family, or tourists (Figure 17). Inconvenience was also a barrier to environmentally friendly household practices specifically, such as composting, recycling, and reducing electricity and water usage. The responses across the three islands varied greatly (Table C18).

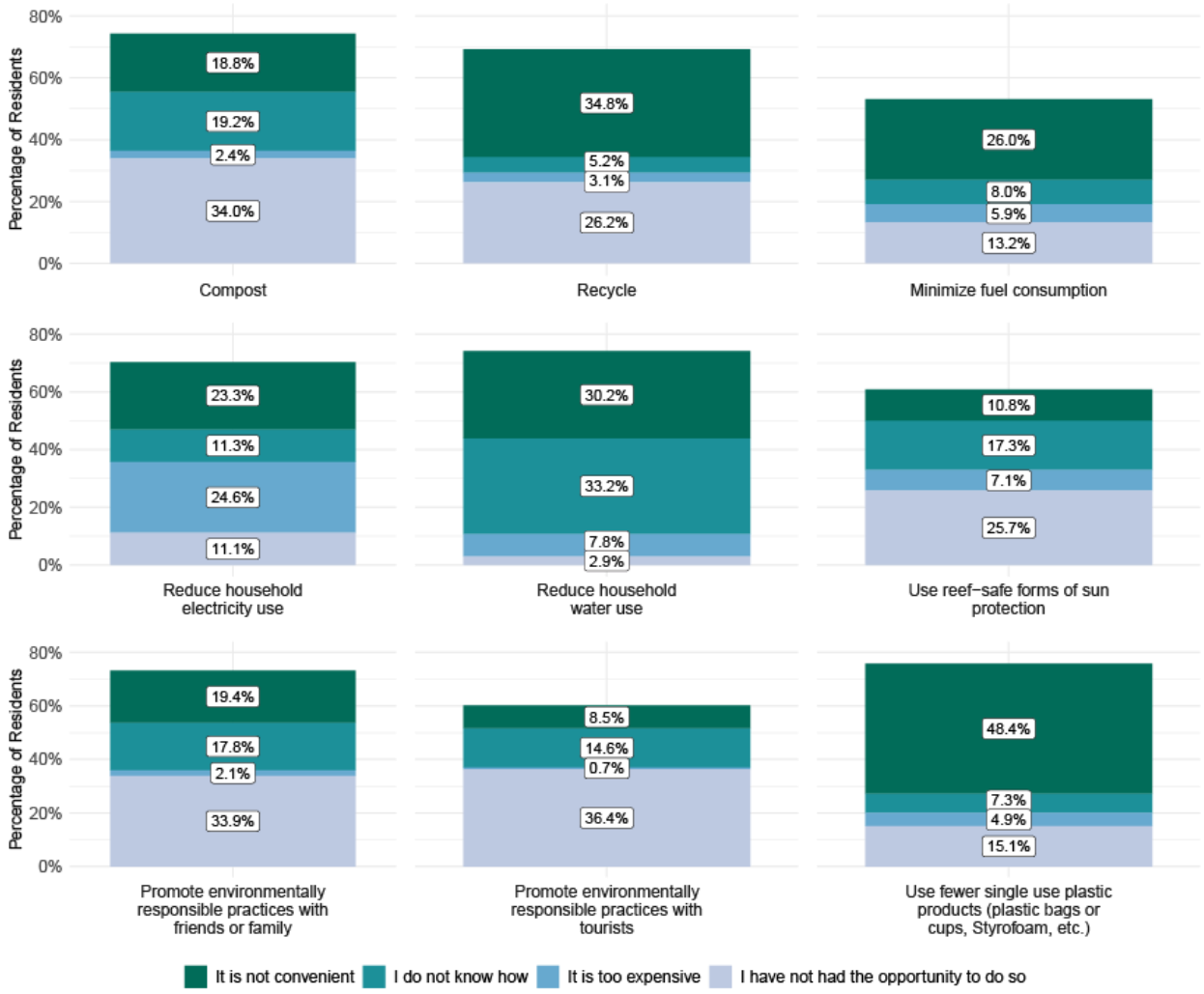

Figure 17. Reasons for not engaging in routine pro-environmental behaviors.

4.6.2 Annual behaviors

About half of residents participated in a beach clean-up, citizen science effort, or other environmental effort, and there was higher participation in Rota and Tinian than in Saipan (Table C19). Nearly a third of residents (30.2%) donated to an environmental cause, 13.9% participated in active coral restoration, and 13.5% joined or renewed a membership in a conservation organization (Figure 18).

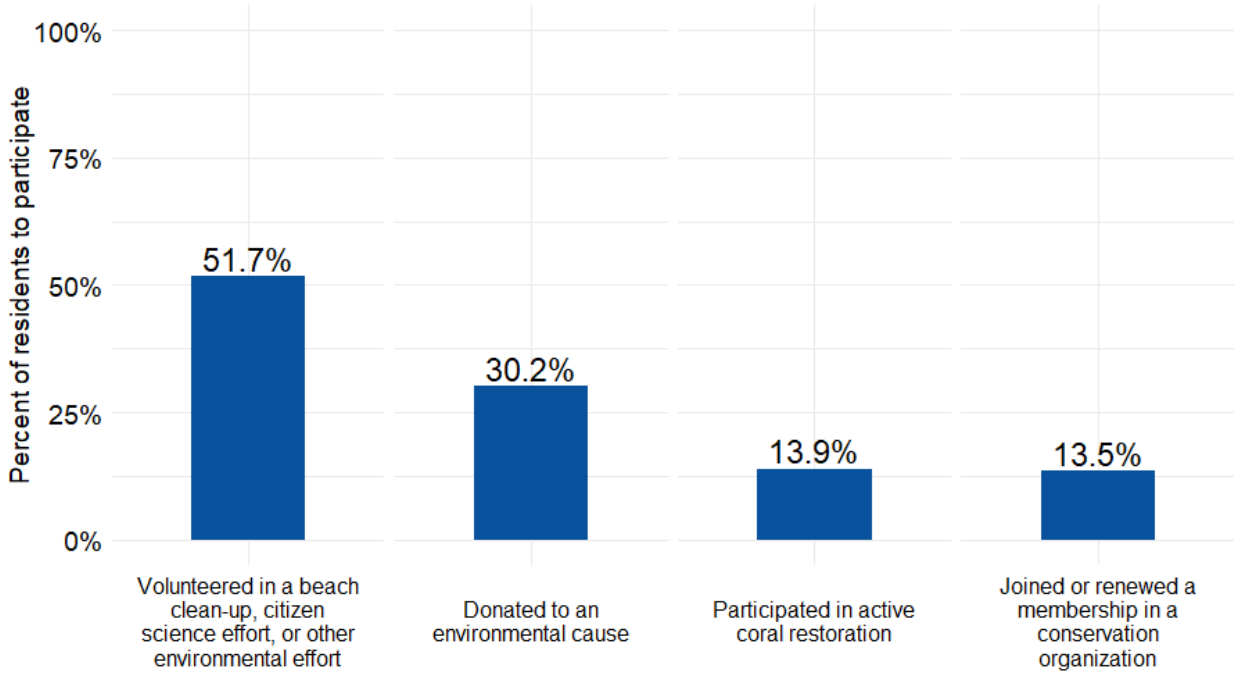

Figure 18. Participation in annual pro-environmental behaviors.

The most common reason for not participating in annual pro-environmental behaviors was a lack of opportunity, which could be attributed to a lack of knowledge on causes or organizations related to coral reefs to support, or limited ability or access to when or where volunteer events occur (Figure 19).

Information sign about sea turtle protection and beaches. Photo credit: Caroline Donovan.

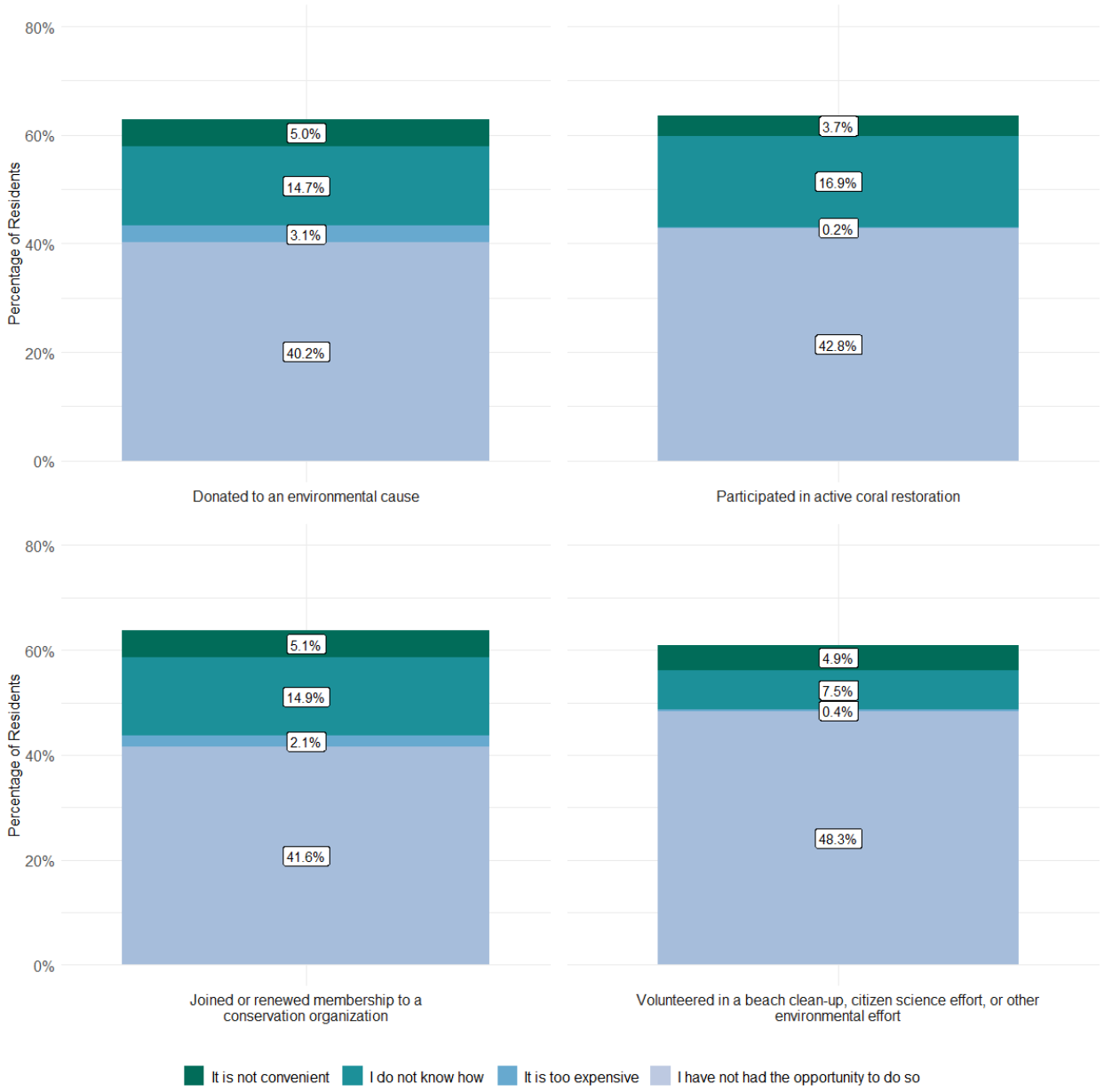

Figure 19. Reasons for not participating in annual pro-environmental behaviors.

4.6.3 Longer-term behaviors

Nearly half of residents had installed a water storage system in the past 5 years (Figure 20). A little over a third had performed maintenance on the septic or sewer system on their property, and 28.9% hade upgraded the septic or sewer system on their property. Saipan had higher participation than either Rota or Tinian (Table C21).

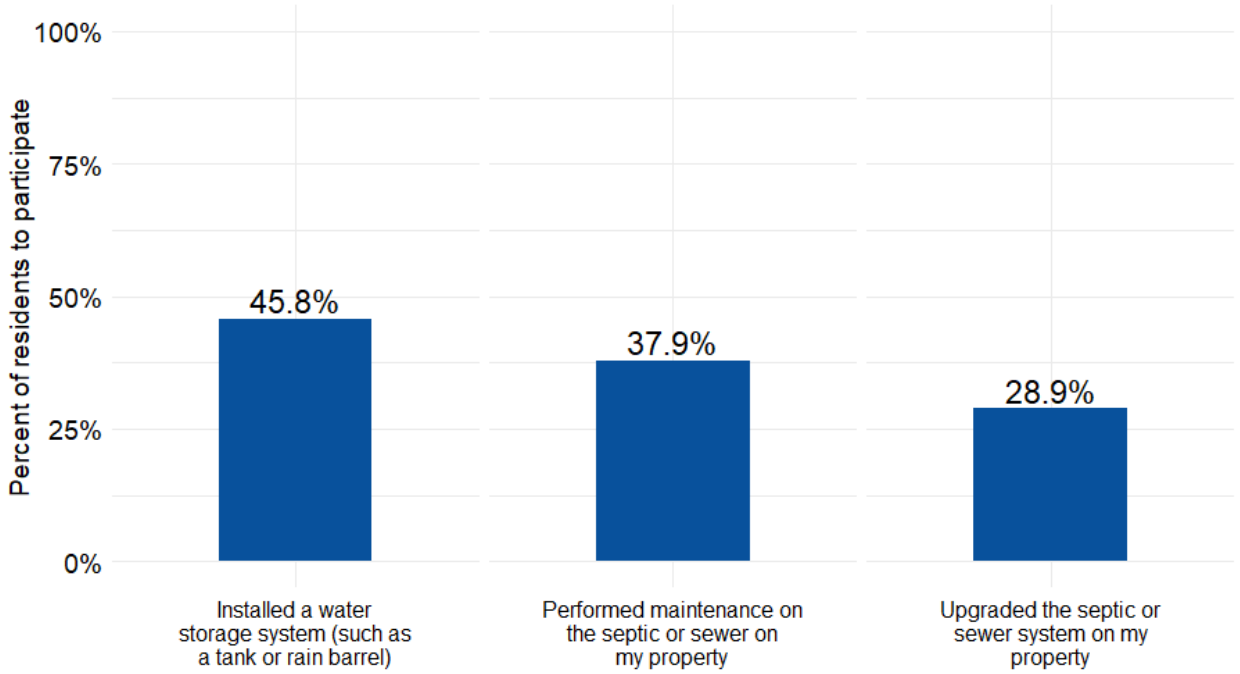

Figure 20. Participation in longer-term pro-environmental behaviors (in the last 5 years).

Reasons for not participating in these longer-term behaviors varied among residents (Figure 21). Barriers were related to lack of awareness, opportunity, or expenses to make long-term changes to residential properties.

Field team conducting surveys at resident households in CNMI. Photo credit: Deven Sablan.

Figure 21. Reasons for not participating in longer-term pro-environmental behaviors.

4.7 Awareness of coral reef rules and regulations

The majority of residents believed that most of the listed coral reef behaviors were unacceptable; however, residents were more ambivalent towards having fires on the beach and feeding fish, birds, or marine animals (Figure 22). Alternatively, most residents (86.9%) felt that leaving trash on the beach was very unacceptable. The results were largely consistent across the three islands (Table C23).

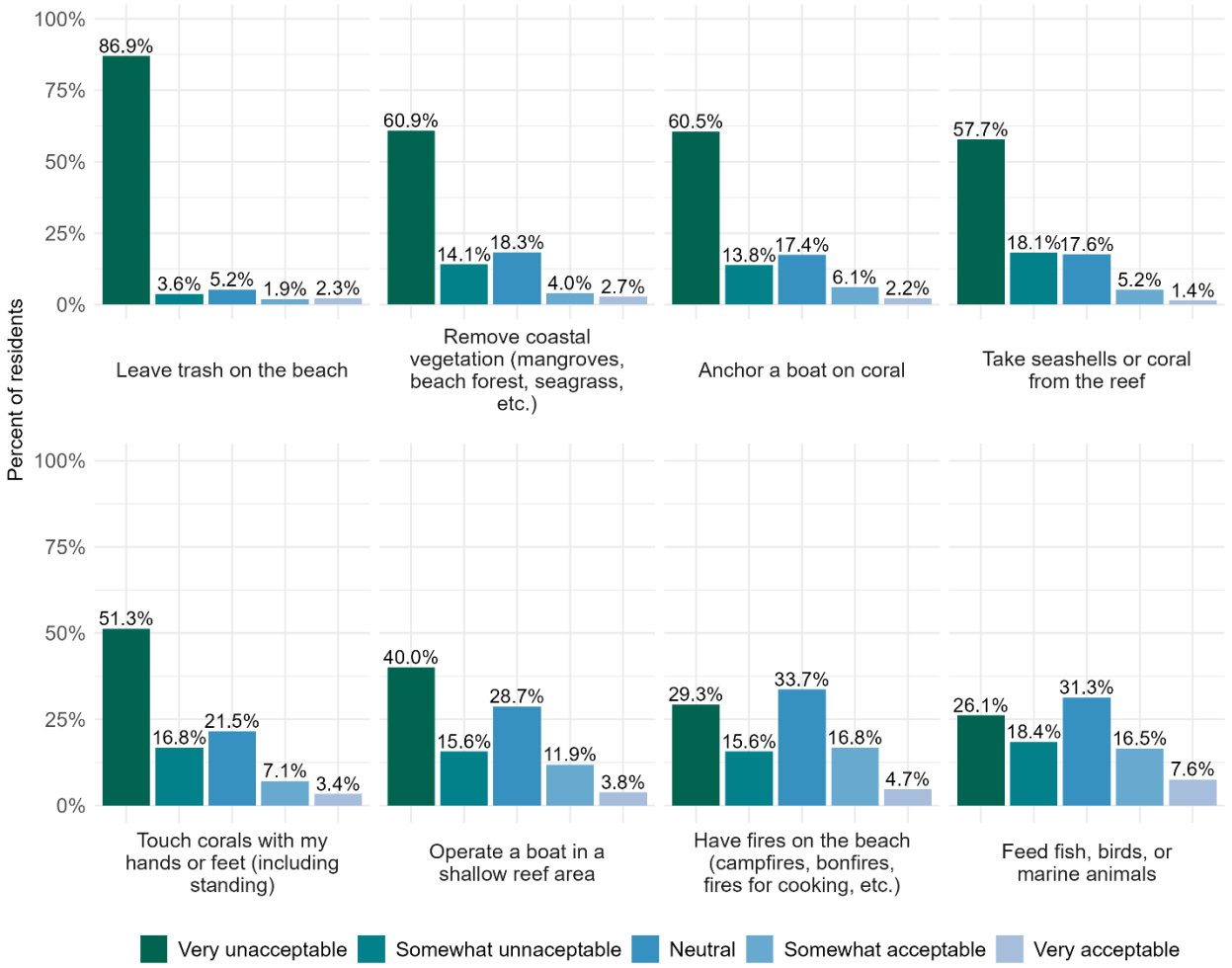

Figure 22. Acceptability of coral reef behaviors.

5. Results: Trend analysis for 2016 to 2024

With two monitoring cycles of survey data from 2016 and 2024, NCRMP is able to start tracking how the human dimensions of coral reefs may be changing over time, where data are available. The 2016 cycle surveyed CNMI residents via telephone (n = 702 surveys; 97%) and face-to-face (n = 20 surveys; 3%) (Gorstein et al., 2019b). The 2024 cycle improved the methodology with a more complex sampling design and weighted results that adjusted for sampling and potential nonresponse bias (Appendix B). Some improvements were also made to the 2024 survey instrument (Appendix A). *T*-tests compared similar questions from both surveys, testing for significant differences in mean response percentages between 2016 and 2024 residents.[8]

[8] Due to slight differences in measurement scales, statistical comparisons were not done for the results presented on motivations for fishing and gathering, seafood consumption, perceived importance of coral reefs, or perceived impacts of marine protected areas.

5.1 Participation in coral reef activities

Between 2016 and 2024, there was an increase in resident participation in all activities except for swimming/wading, beach recreation, and gathering marine resources, which remained relatively stable (Figure 23). The largest percent increase was for all types of fishing (fishing from shore, fishing from a boat/kayak, or spearfishing), with 21% more participation in 2024.

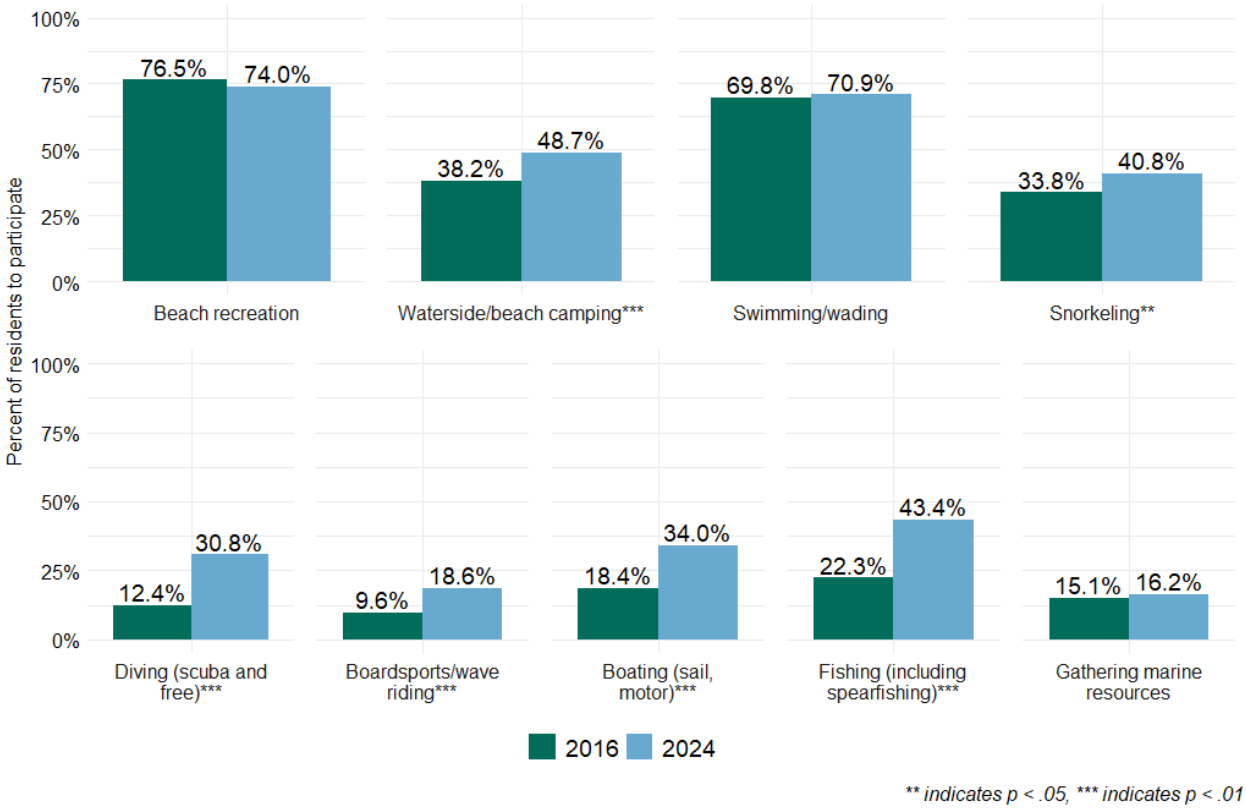

Figure 23. Resident participation in coral reef activities during 2016 and 2024.

Reasons for fishing in 2016 and 2024 were also examined, but statistical differences were not tested due to differences in the way this question was asked between surveys. In general, residents in CNMI were more likely to fish or gather marine resources for subsistence purposes in both survey years, followed by recreational reasons.

5.2 Seafood consumption

Frequency of seafood consumption in 2016 and 2024 was examined, but no statistical comparisons were tested due to differences in scales (Figure 24). Overall, the percentage of residents who consumed seafood often (a few times a week or every day) decreased for general seafood consumption. Most residents consuming seafood from local coral reefs included it in some of their meals in 2016 and 2024. The percent of residents who never ate seafood in general or seafood caught from local coral reefs decreased in 2024.

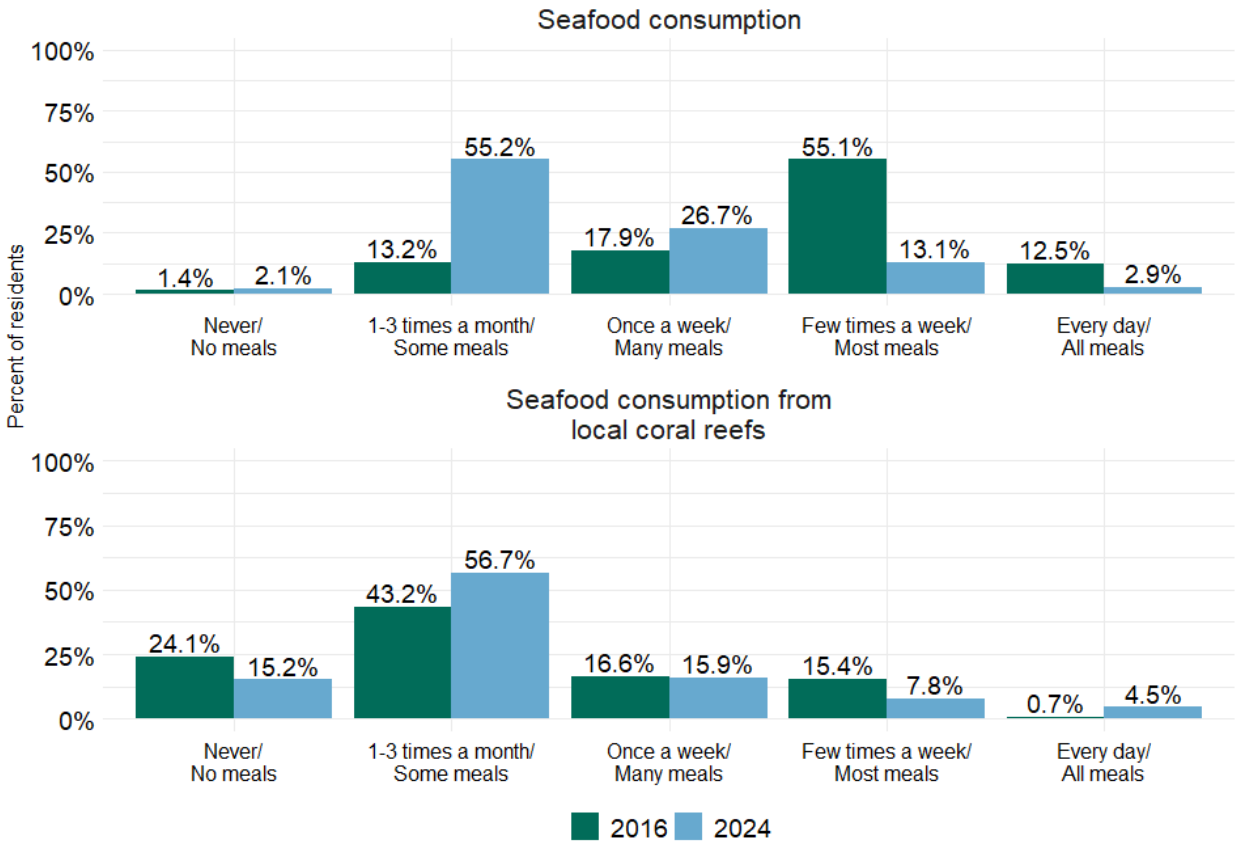

Figure 24. Frequency of resident seafood consumption in general and from local coral reefs in 2016 and 2024.

5.3 Importance of coral reefs

Two statements rated by residents in 2016 and 2024 on the importance of coral reefs were examined, but no statistical comparisons were made due to differences in scales (Figure 25). In 2016, the majority of residents agreed or strongly agreed that coral reefs protect CNMI from erosion and natural disasters and are important for providing food for coastal communities. In 2024, the majority of residents rated these two statements as being slightly to very important.

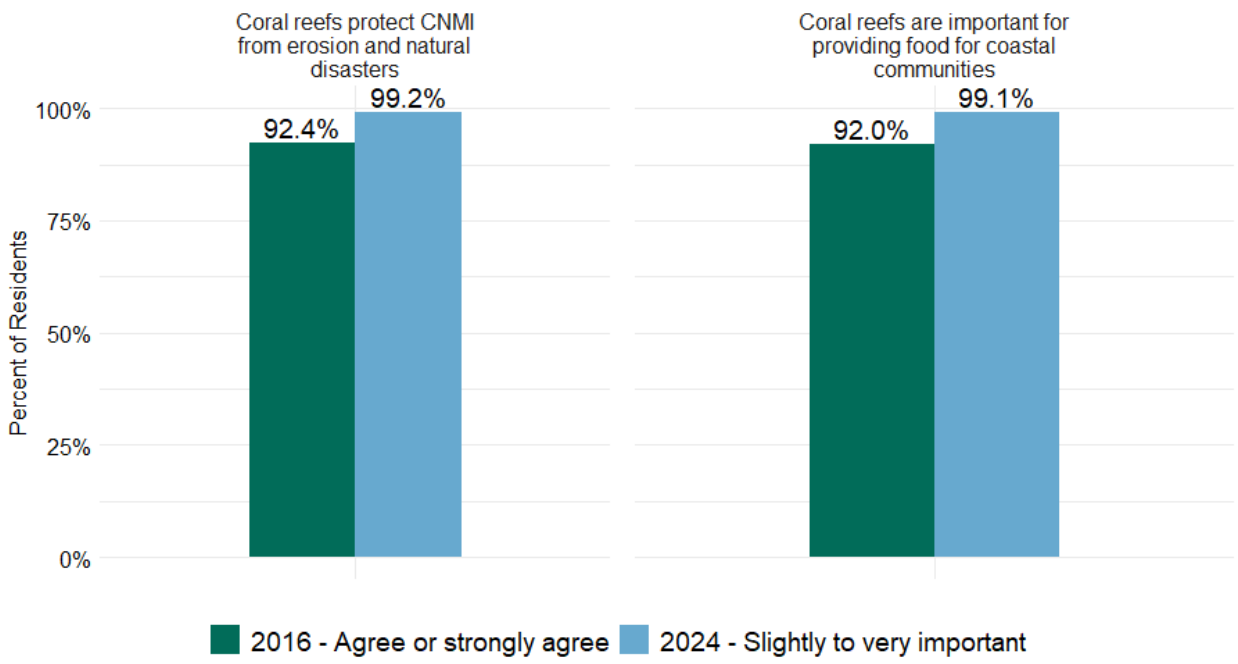

Figure 25. Residents' perceived importance of coral reefs in 2016 and 2024.

5.4 Perceived resource conditions and threats

Both the 2016 and 2024 surveys asked about the current condition of four marine resources: ocean water quality, amount of live coral, amount of fish, and amount of trochus (*aliling*). In 2024, CNMI residents were more likely to perceive all four marine resources as being in "very good" condition. For ocean water quality, there was also an increase in the percentage of residents who were "not sure" about its condition (Figure 26).

Residents' familiarity of potential threats to coral reefs in 2016 and 2024 were also examined (Figure 27).[9] Residents were generally more familiar with threats to coral reefs in 2024 than they were in 2016; although, their familiarity with pollution as a threat to coral reefs remained relatively the same, and their familiarity with typhoons as a threat to coral reefs decreased. The highest increase (32.9%) in familiarity was with coral bleaching.

[9] Due to slight differences between the scales used in the 2016 and 2024 surveys, responses were consolidated into "not familiar" and "familiar" categories for purposes of analysis and visualization.

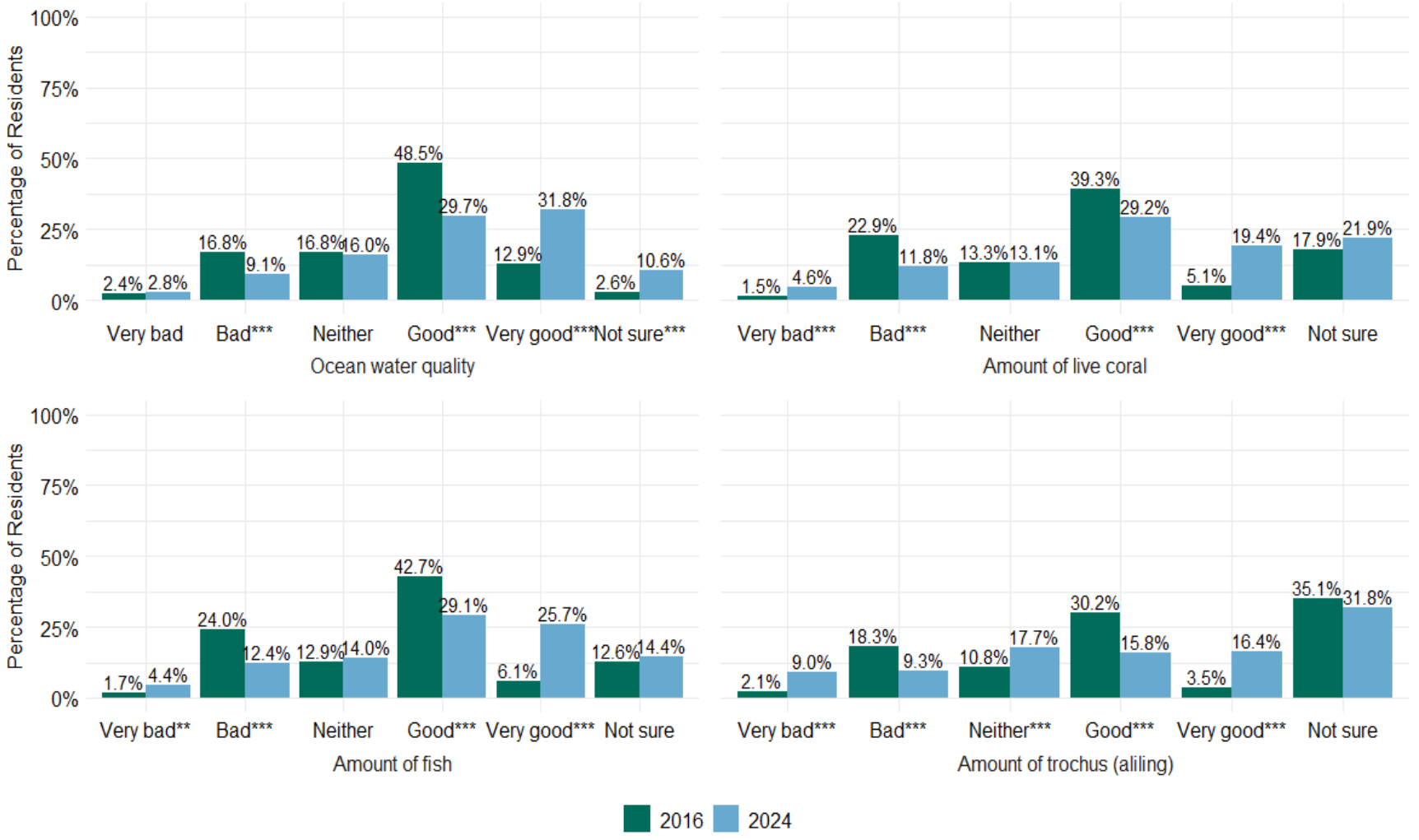

Figure 26. Resident perceptions of current resource conditions in 2016 and 2024.

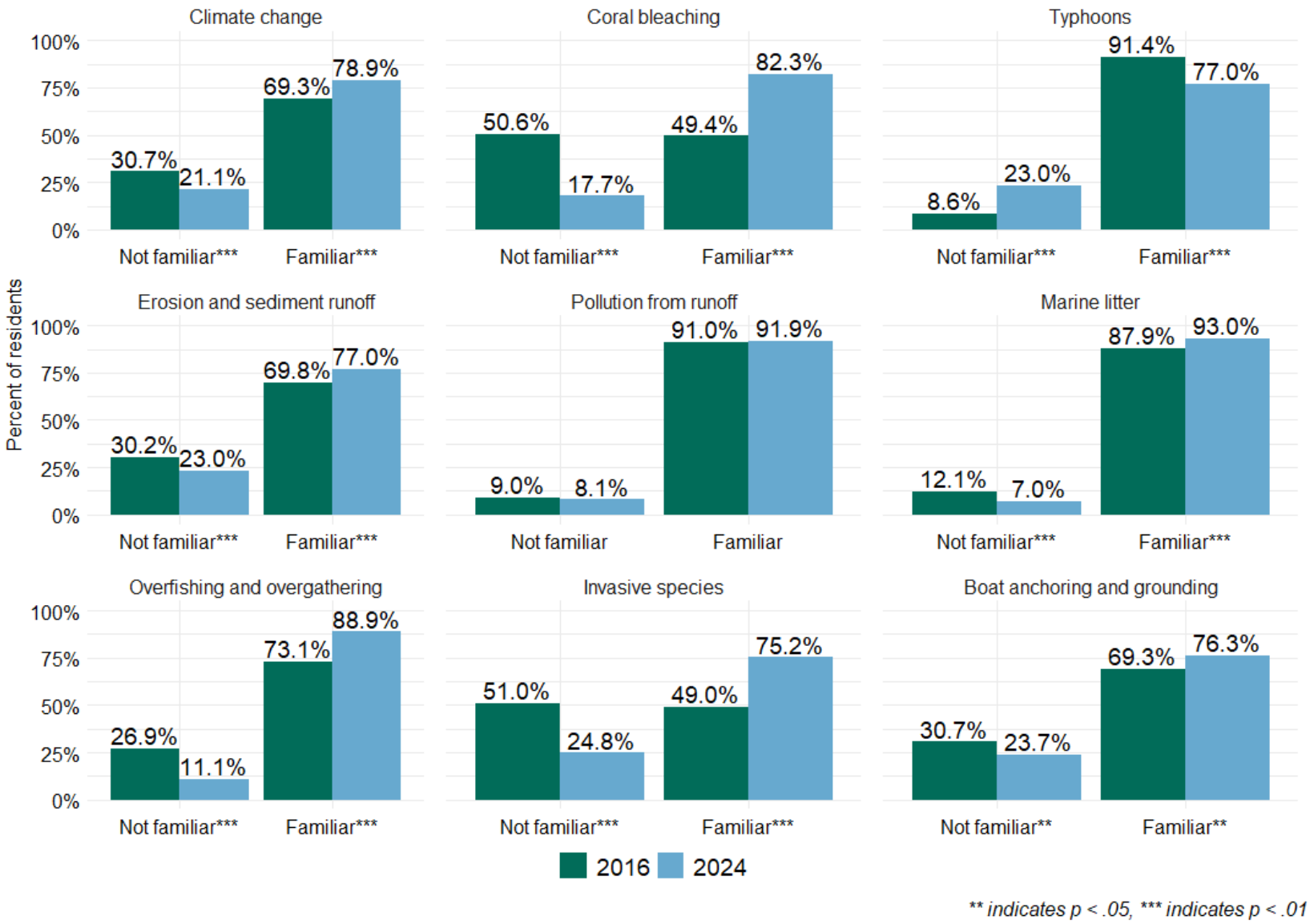

Figure 27. Residents' familiarity of coral reef threats in 2016 and 2024.

5.5 Attitudes toward coral reef management strategies

Between 2016 and 2024, the percentage of residents who were familiar with MPAs in CNMI increased by 7.5% (Figure 28).

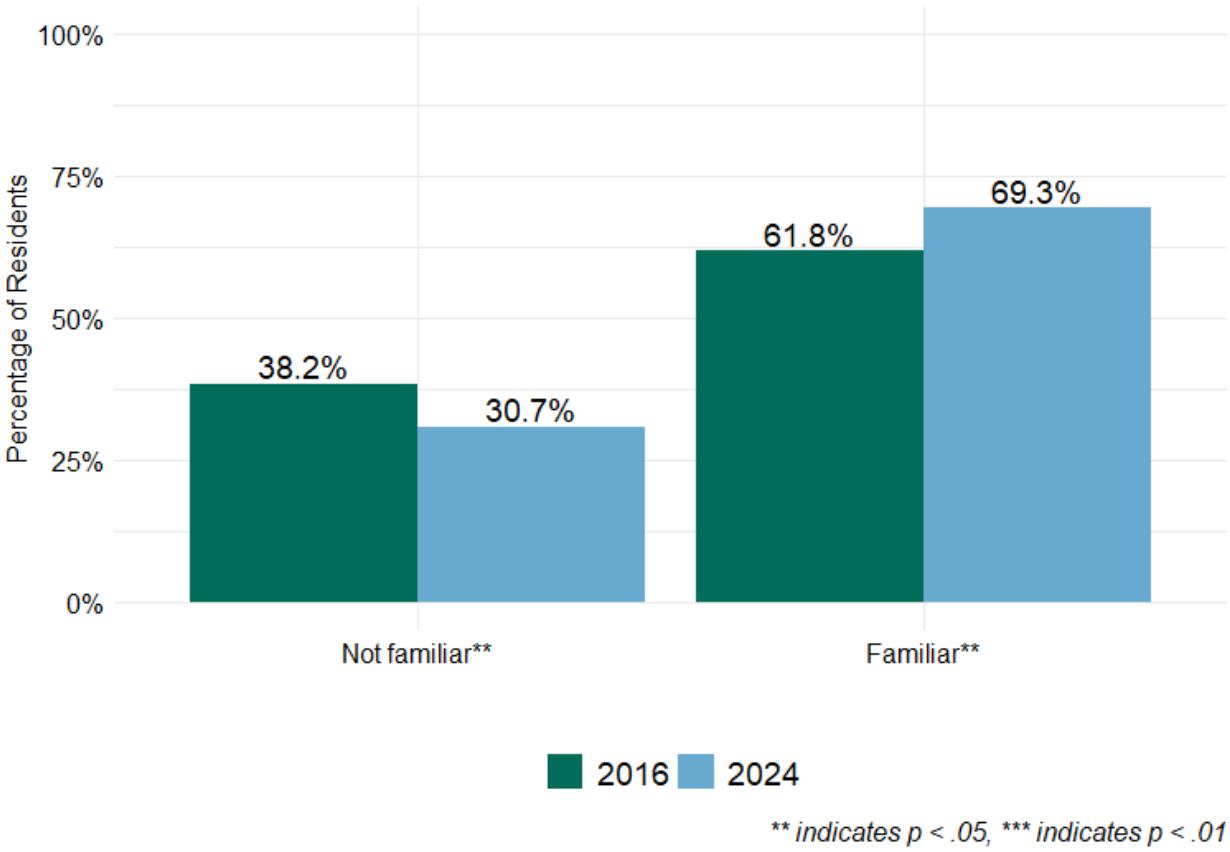

Figure 28. Residents' familiarity of marine protected areas in 2016 and 2024.

Four statements rated by residents in 2016 and 2024 on the impacts of MPAs were examined, but no statistical comparisons were made due to differences in survey questions and scales (Figure 29). In both survey years, the majority of residents believed that MPAs protected coral reefs and increased the number of fish in the jurisdiction. While perceptions of these two impacts were generally positive, fewer residents believed MPAs were providing these two benefits in 2024. There was also less agreement that MPAs had a positive impact on tourism. Opinions about the impacts of MPAs on fishermen's livelihoods and the fishery-based economy were more positive in 2024.

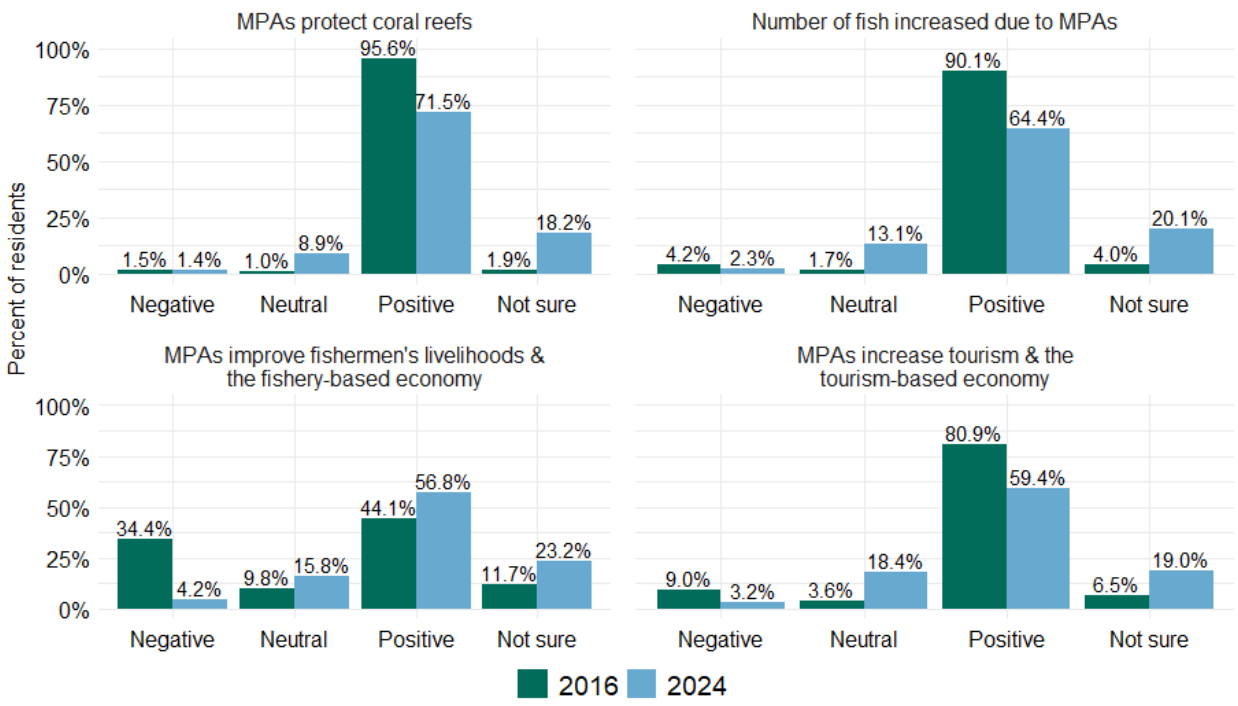

Figure 29. Residents' perceptions of marine protected area impacts in 2016 and 2024.

Residents' attitudes toward five different management strategies in 2016 and 2024 were examined (Figure 30). While the majority of residents supported all five management strategies in both years, the amount of support decreased in 2024. There was also a significant increase in the percentage of residents who neither opposed nor supported all five strategies in 2024.

Coral reef ecosystem in CNMI. Photo credit: CNMI Coral Reef Initiative.

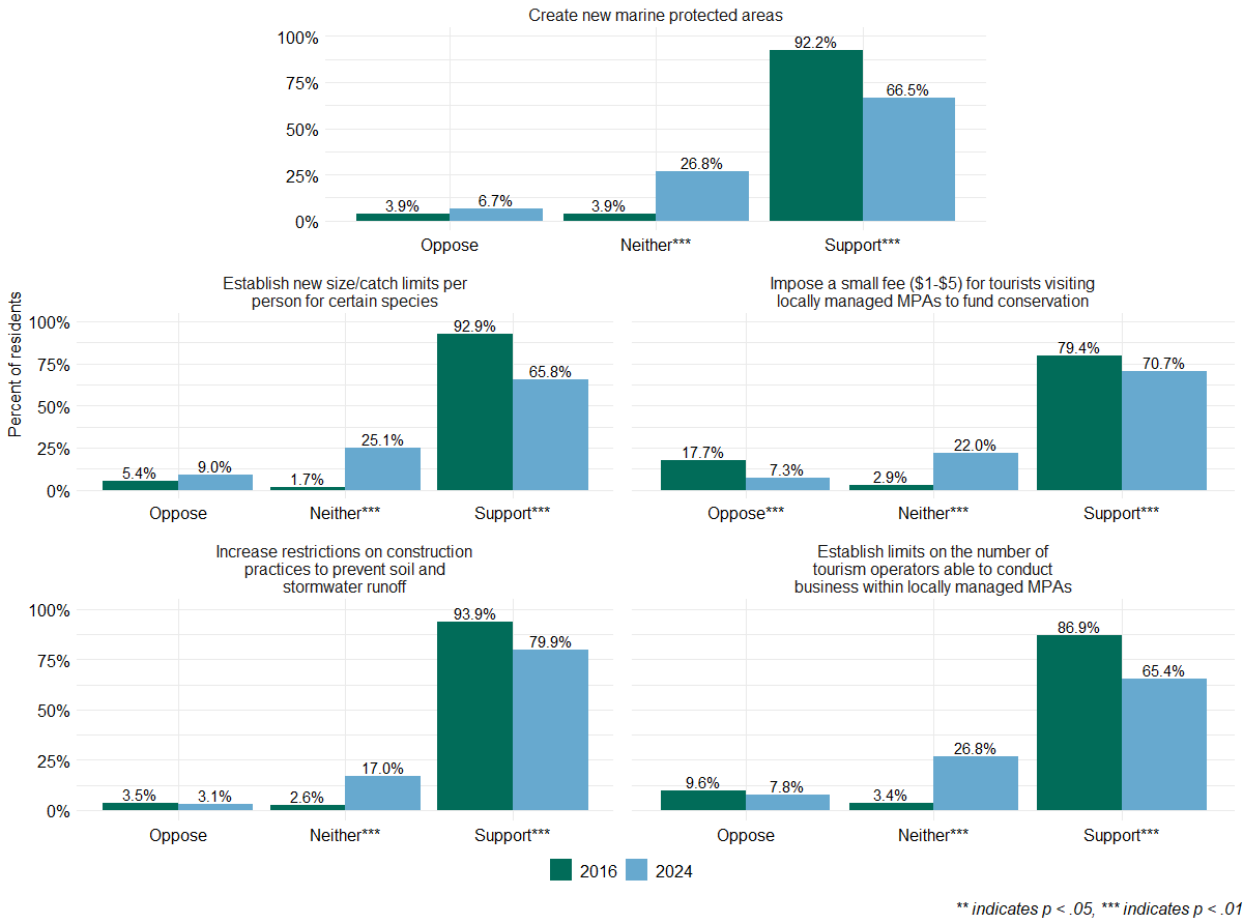

Figure 30. Residents' support for management strategies in 2016 and 2024.

6. Discussion

The results from the 2024 NCRMP socioeconomic survey can inform management decisions on the perceptions, beliefs, and attitudes that are held by residents in CNMI. Based on the survey findings, some general inferences about the population of CNMI in 2024 and their interactions with coral reefs are evident. There are also some notable changes or similarities between 2016 and 2024 that may be informative for the effectiveness of management and outreach strategies.

Participation in coral reef activities

Beach recreation and swimming/wading were primary activities for CNMI residents in both 2016 and 2024, and the frequency of participation in most activities increased in 2024.

Snorkeling and shore-based fishing were more common coral reef activities, whereas participation in board sports or scuba diving was less prevalent. Variation in activity participation may be influenced by the costs associated with the activity and equipment, skills, interests, motivations, or other socioeconomic or environmental factors. Spatial variation in activity participation may be influenced by differences in environmental attributes, management

regulations, or MPAs that exist across Saipan, Tinian, and Rota. Sustained access to activities and the quality of those experiences are linked to ecosystem conditions and perceptions of resource quality (Manning, 1999). Beach recreation, for instance, is linked to coral reefs through the protection of beaches from erosion due to storm events (Shivlani et al., 2003). Swimming and wading depend on clean ocean water quality for public health and safety but may also impact the health of corals by introducing toxic sunscreen residues or other transferable chemicals.

Importance of coral reefs

The majority of residents recognized that coral reefs provide a variety of ecosystem services (or benefits) to CNMI communities. There was general consensus that coral reefs are very important for coastal protection, human health, food, tourism- and fisheries-based economies, outdoor recreation, and fishermen livelihoods. These benefits are connected to social values, beliefs, and the ways in which people interact with the coastal-marine environment. With beach recreation being a top activity for 77% of CNMI residents, 99% of residents also believe that coral reefs are important for protecting beaches from erosion due to storm events. This highlights some of the benefits coral reefs provide and shows that residents recognize their value.

Residents also believed that ***coral reefs are important to local culture, most notably to culturally important events (such as fiestas and ceremonies) and to establishing and maintaining relationships, familial ties, and ancestral connections.*** There are many local practices to build and maintain cultural and familial ties such as elders teaching children the basis for *Ina'dahi,* or caring for each other and natural resources, and how to repair fishing nets (House of Chamorros, n.d.; Robie, 2024). Culturally important events related to coral reefs include international fishing tournaments built around important pelagic species that begin their lives in CNMI's coral reefs as well as the Flame Tree Arts Festival that showcases important cultural aspects tied to coral reefs (Micronesia Tour, n.d.; National Assembly of State Arts Agencies, n.d.).

Some cultural traditions are closely linked to fishing. For example, the social practice of sharing one's fish catch with family and the local community is particularly important among CNMI residents for maintaining long-standing sociocultural traditions (Allen and Amesbury, 2012). Coral reef fisheries also have a role in local food systems. This survey found that most residents consumed seafood regularly and that residents ***most often fished for subsistence***. These findings demonstrate the integral role of marine resources in food security, cultural perpetuation, and social solidarity for many CNMI residents, and underscore the need for sustainable management of coral reef ecosystems.

Perceived resource conditions

Residents were more likely to believe that ***ocean water quality and the amount of fish were in good condition, but there were mixed perceptions of the amount of trochus (aliling).*** About one-third of residents were unsure about the status of trochus, and this may be due to the CNMI-wide moratorium on trochus harvest that has been in effect since 1981 (CNMI DLNR, 2024).

Residents were generally split on whether the condition of marine resources will worsen or improve over the next 10 years.

Ocean water quality, fish, and corals were rated as being extremely important to residents' quality of life, which is not surprising given residents' activity participation and reliance on seafood. These findings on perceptions can be further understood in conjunction with actual biophysical conditions being observed. For instance, NCRMP biological monitoring data indicates the condition of reef fish populations in CNMI were "impaired" as of 2018 (NOAA CRCP, 2018), but this observation is not necessarily consistent with residents' perceptions in 2016 or 2024. ***The discrepancy between biological and social observations may suggest a need for targeted outreach with residents or more engagement with communities in managing reef fisheries.*** Furthermore, residents' concern about the status of ocean water quality may have important implications for public health and safety messaging considering swimming/wading and beach recreation were primary activities for residents. Poor water quality also has an adverse effect on coral condition and the availability of fishery and marine resources that residents rely on for subsistence or cultural purposes. Perceptions of resource conditions can be further understood by awareness of threats to coral reefs.

Awareness of threats to coral reefs

CNMI residents were generally more familiar with threats to coral reefs in 2024 and believed ***coral bleaching, marine litter, and pollution (from stormwater, wastewater, and chemical runoff) were the most severe issues.*** The list of threats to coral reefs span those that can be addressed at the jurisdiction level via human behavior (such as marine litter and runoff from soil erosion) and those that are climate related (such as typhoons and ocean acidification). Familiarity among residents did not differentiate between the two types of threats. Ocean acidification was among the least familiar threats; but a majority of residents still recognized it was an issue, and nearly 50% believed it was severe. This is a relatively high percentage compared to awareness levels reported by residents in other U.S. coral reef jurisdictions (Allen et al., 2021, 2022, 2023, 2024a, 2024b). Considering that the CNMI is located near the volcanic island of Maug, a unique area where underwater vents seep carbon dioxide, allowing a "natural laboratory" for ocean acidification research, there is opportunity for public engagement on this topic (NOAA AOML, 2014). Continued outreach can help enhance public awareness of the effects of changing ocean conditions and how these changes affect not only coral reefs but also the ecosystem services that people depend on in CNMI.

Attitudes toward coral reef management strategies

The majority of residents were aware of existing MPAs or marine preserves in CNMI. Most residents generally believed that ***MPAs in CNMI have improved protection of coral reefs, the amount and size of fish, recreation, and tourism.*** These findings suggest that residents recognize there are several positive effects associated with MPAs in CNMI, but perceptions became more neutral in 2024. Differences in MPA perceptions across islands may be influenced by proximity to MPA locations and how long MPAs have been active. The island-level results of

familiarity with existing MPAs or marine preserves are consistent with MPA locations on the islands. Rota, whose residents had the highest familiarity with MPAs, has the oldest MPA, while Tinian, whose residents had the lowest familiarity, has not had an active MPA since 2010 (CNMI DLNR, 2024).

Residents were less sure if MPAs have had an effect on food for coastal communities, the fishery-based economy, or fishermen's livelihoods, except in 2024, when perceptions of the latter were slightly more positive. This is a particularly important finding considering residents' high dependency on seafood and subsistence fishing. Varying perceptions may be related to the types of fishing practices residents engage in or activities that are allowed within MPAs. For example, since residents were less likely to fish for commercial reasons, they may have been less certain of MPA impacts to fishery-based economies.

Information on residents' attitudes can provide managers and decision-makers with a better understanding of which resource management strategies are most likely to be supported by residents. This survey found ***strong support for active coral reef restoration, community participation in marine resource management, new requirements for improved wastewater treatment, and other management strategies.*** Community participation is particularly critical to fostering trust in management and ensuring fair decision-making processes and outcomes (Bennett et al., 2019). Support for these management strategies is also consistent with residents' values and perceptions of resource conditions and threats to reefs. New requirements for wastewater treatment could help address residents' concern about pollution as a threat to coral reefs and perception that ocean water quality may get worse in the future. Also, considering the prevalence of marine-based tourism in CNMI and its importance to the economy, promoting stewardship and responsible coral reef behaviors among visitors and tourists is critical to outreach and communication messaging. Making use of volunteers and citizen science can help teach communities and tourists about environmentally responsible behaviors while directly involving them in coral reef conservation.

Conservation behaviors

About 80% of residents believed that it is very important for CNMI residents to engage in activities that help protect coral reefs. Residents indicated several conservation-oriented actions they are taking, such as reducing household electricity and water use, promoting environmentally responsible practices with friends or family, using fewer single-use products, and minimizing fuel consumption. Most residents had not installed a water storage system or maintained or upgraded their property's septic system within the last five years. There was no clear consensus on the main barriers behind these actions, and it may be likely that implementing any changes are out of homeowners' control or require government support. Improving access and opportunities could help residents be able to implement more conservation practices at home.

Residents provided their perceptions on whether they believed following rules and regulations adjacent to coral reef ecosystems were acceptable or unacceptable. Most residents believed it

was unacceptable to leave trash on the beach, remove coastal vegetation, or anchor a boat on coral. This suggests that residents are aware of appropriate coral reef conduct that is consistent with the rules and regulations established by the CNMI Department of Lands and Natural Resources (CNMI DLNR, 2024). Residents were more ambivalent about whether or not it was acceptable to have fires on the beach or feed fish, birds, or marine animals, which are also established regulations in the territory. Targeted outreach may be needed to increase awareness about these behaviors and their role in conservation.

6.1 Future research and monitoring

There were a few lessons learned from the second NCRMP socioeconomic data collection in CNMI related to the sampling design, data collection, and analysis. The 2024 data collection was able to achieve higher sample sizes in all three islands of Saipan, Tinian, and Rota, allowing for data to be representative of CNMI as a whole and its three island strata. The survey was also administered via a mixed-mode approach of in-person and online surveys, making use of both traditional and modern survey resources (as opposed to telephone surveys, which have experienced low response rates). Future monitoring may consider offering the survey in additional languages or further increasing the sampling resolution in order to better understand different subpopulations and spatial patterns in CNMI and expand how NCRMP socioeconomic data can be used to inform management decisions. It is also important that nonresponse data are collected to determine more accurate response rates and representation of the data. This was a limitation of the first and second cycles of data collection.

As NCRMP is a national monitoring program with the goal of measuring 13 socioeconomic indicators over time, there is limited ability to change the survey instrument. However, improvements were made to some of the 2024 survey questions for better measurement validity, accuracy, and reliability of the indicators. Future complementary research could ask about the impacts of coral reef threats on particular resource conditions, and further analysis could examine the links between residents' awareness of threats and their perceptions of resource change. Related, additional studies could further examine ocean literacy, social risks of ecosystem issues, and behavior change. Additional analyses or studies could also examine how level of support and perceived benefits of MPAs vary by activity group (such as those who fish), as well as the preferences of those groups for different management actions and policies. This could inform the trade-offs between resource protection and use and has implications for fair and effective governance processes and the success of marine conservation management actions.

Finally, interdisciplinary collaboration and efforts to integrate and model social and biophysical data are still needed. NCRMP's Socioeconomic Component continues to work with the biological and environmental NCRMP teams and partners for a holistic approach to understanding socioeconomic and biophysical data and to inform coral reef management and monitoring across all jurisdictions. Comparing perceived coral reef resource conditions to biophysical data may reveal gaps between residents' perceptions of resources and patterns

observed in fisheries, benthic, and environmental data. Future analyses could examine questions such as how differing perceptions of coral reef health by region may correlate with differences in biophysical conditions. Nevertheless, integration of socioeconomic, biological, and environmental NCRMP data provides a more holistic understanding of the human-ecological interactions and implications of the indicators that NCRMP is monitoring. This supports communication of complex data in a way that facilitates better science-based resource management decision-making.

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Appendix A: 2024 CNMI survey instrument

NOAA CORAL REEF CONSERVATION PROGRAM
NATIONAL CORAL REEF MONITORING PROGRAM (NCRMP)
RESIDENT CORAL REEF SURVEY:
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS (CNMI)
OMB CONTROL NUMBER 0648-0646

Survey administered in: English or Chamorro or Carolinian or Tagalog

Hafa adai, my name is _____, and I am working on behalf of the National Oceanic and Atmospheric Administration (NOAA). NOAA's National Coral Reef Monitoring Program is conducting surveys with residents of {*jurisdiction*} to learn how people interact with coral reefs and how perceptions of coral reef conditions in {jurisdiction} are changing over time. The information collected will be used to help management better serve local communities. Your household was randomly selected to participate in this survey.

S1. Just one person is needed to complete this survey. May I please speak to the person 18 or older in your household who has had the most recent birthday? (Note: If selected person is not available, choose the next eligible person available).

- The person who answered the door is eligible → *Continue to SCRIPT 2*
- New individual comes to the door → *Re-read SCRIPT 1 with new individual, then proceed to SCRIPT 2*
- No eligible persons available → *Proceed with "not available" protocol, thank the current individual, and end survey*
- The person declines → *Proceed with NR1*

The survey should take no more than 20 minutes to complete. Your participation is voluntary, but is very important to the success of this study. You may skip any of the questions or stop the survey at any time. All information you provide is confidential. Your name and address will never be identified or associated with the results.

S2. Are you willing to participate in this survey?

- Yes (person agreed to be interviewed) → *Continue to S3*
- No (person did not agree to be interviewed) → *Proceed with nonresponse question NR1*

S3: Do you live in [jurisdiction] at least three months of the year?

- Yes (the person lives here for at least 3 months a year) → *Start survey*
- No (the person does not live here for at least 3 months a year) → *End survey*

NR1. Are there any particular reasons why you would prefer not to participate in the survey that you would be willing to share?

- Yes → *Allow respondent to comment and record reasons in NR2*
- No → *Thank the individual and end survey*

NR2. [For Interviewer] Did the respondent make any of the following comments, whether or not these exact words were used? (Check all that apply)

- I'm TOO BUSY/I don't have time {*If this is a reason, ask for a convenient time to interview*}
- I DO NOT LIKE surveys
- I am NOT INTERESTED
- Surveys are a WASTE OF TIME

- I DON'T TRUST surveys
- Surveys are an INVASION OF PRIVACY
- Unfavorable PAST EXPERIENCE with surveys
- Other reason

NR3. [For Interviewer] Please record the following observations during your interaction with the respondent.

a. Sex of respondent: ____Male ____Female
b. Age: ____18-29 ____30-49 ____50-69 ____70+
c. Race:
d. Presence of children in household

—BEGINNING OF SURVEY—

PARTICIPATION IN REEF ACTIVITIES

[SCRIPT] In this first section, we would like to understand your coastal and marine-based activities in CNMI.

1. In the past 12 months, approximately how often did you participate in each of the following activities in CNMI? *{supports 'participation in reef activities' indicator}*

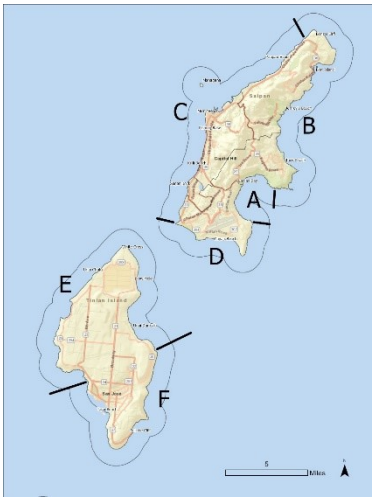
	Never	Once a month or less	2-3 times a month	4 times a month or more
Swimming or wading	1	2	3	4
Snorkeling	1	2	3	4
Scuba diving	1	2	3	4
Free diving	1	2	3	4
Waterside/beach camping	1	2	3	4
Beach recreation (beach sports, picnics, etc.)	1	2	3	4
Boating (sail, motor)	1	2	3	4
Board sports (SUP, kiteboarding, surfing, windsurfing)	1	2	3	4
Spearfishing	1	2	3	4
Boat-based fishing with rod and reel (excluding spearfishing)	1	2	3	4
Fishing from shore (excluding spearfishing)	1	2	3	4
Gathering of marine resources (seaweed, trochus, sea cucumber, octopus, clams, mollusks)	1	2	3	4

SKIP LOGIC: IF RESPONDENT DID NOT PARTICIPATE IN ANY ACTIVITIES (NEVER FOR ALL), SKIP TO Q4.

2. Please look at the map of CNMI and the boundaries of each zone. For each activity, in which zone did you most often participate? *{supports 'participation in reef activities' indicator}*
(SHOW RESPONDENT APPROPRIATE MAP)

SKIP LOGIC: IF RESPONDENT DID NOT PARTICIPATE IN 'FISHING' OR 'GATHERING', SKIP TO Q4.

	Zone A	Zone B	Zone C	Zone D	Zone E	Zone F	Check here if did not participate
[ASK IF POSITIVE VALUE IN Q1] Swimming or wading							
[ASK IF POSITIVE VALUE IN Q1] Snorkeling							
[ASK IF POSITIVE VALUE IN Q1] Scuba diving							
[ASK IF POSITIVE VALUE IN Q1] Free diving							
[ASK IF POSITIVE VALUE IN Q1] Waterside/beach camping							
[ASK IF POSITIVE VALUE IN Q1] Beach recreation (beach sports, picnics, etc.)							
[ASK IF POSITIVE VALUE IN Q1] Boating (sail, motor)							
[ASK IF POSITIVE VALUE IN Q1] Board sports (SUP, kiteboarding, surfing, windsurfing)							
Spearfishing							
[ASK IF POSITIVE VALUE IN Q1] Boat-based fishing *with rod and reel (excluding spearfishing)*							
[ASK IF POSITIVE VALUE IN Q1] Fishing *from shore (excluding spearfishing)*							
[ASK IF POSITIVE VALUE IN Q1] Gathering of marine resources *(seaweed, trochus, sea cucumber, octopus, clams, mollusks)*							



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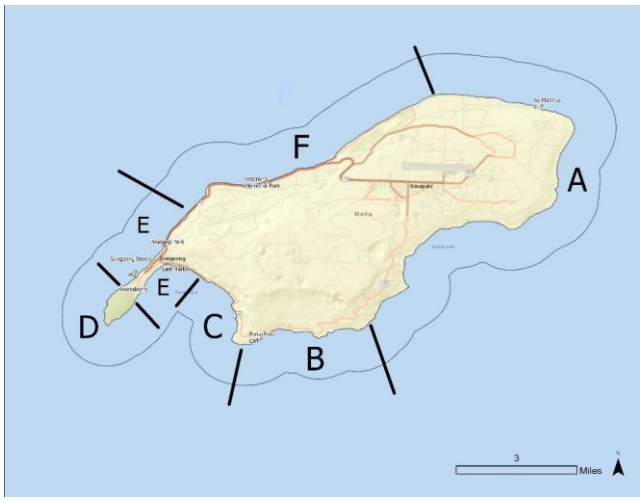

Depending on island of residence

3. **Which of the following best describes your most common motivation for fishing and gathering? (Choose one). *{supports 'participation in reef activities' indicator}***
   1. Recreational: I fish primarily for sport or pleasure, but may also sell a few fish.
   2. Subsistence: I fish primarily to catch fish to feed myself, my family, and/or my community.
   3. Commercial: I fish primarily for some or all of the money I make in one year.
   4. Cultural: I fish primarily to keep traditional practices alive.

IMPORTANCE OF CORAL REEFS

[SCRIPT] For the next several questions, we would like to understand your household's reliance on seafood and the cultural importance of coral reefs in CNMI.

4. **On average, how many of the meals eaten by you or members of your household contain seafood? –INTERVIEWER STATES SCALE *{supports 'cultural importance of reefs' indicator}***

None of the meals (0%)	Some of the meals **(1-33%)**	Many of the meals **(34-66%)**	Most of the meals **(67-99%)**	**All of the meals (100%)**
1	2	3	4	5

SKIP LOGIC: IF 'NONE OF THE MEALS', SKIP TO Q6.

5. **On average, how many of the meals eaten by you or members of your household contain seafood from local coral reefs in CNMI? (Examples include reef fish such as parrotfish and goatfish, bottomfish such as snappers and groupers, and other shellfish and marine life that depend on coral reefs such as octopus and clams. This does not include pelagic fish such as wahoo and rainbow runner.) *{supports 'cultural importance of reefs' indicator}***

None of the meals (0%)	Some of the meals **(1-33%)**	Many of the meals **(34-66%)**	Most of the meals **(67-99%)**	**All of the meals (100%)**	**Not Sure**
1	2	3	4	5	NS

6. How important are coral reefs to each of the following in CNMI? – INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'cultural importance of reefs' indicator}*

	Not at all important	Slightly important	Somewhat important	Moderately important	Very Important	Not Sure
Culturally important events, such as feasts and ceremonies	1	2	3	4	5	NS
Establishing and maintaining cultural and familial ties	1	2	3	4	5	NS
Ancestral connections	1	2	3	4	5	NS
Religious practices	1	2	3	4	5	NS
Local language (word choice, business and place names, etc.)	1	2	3	4	5	NS
Cultural folklore (beliefs, stories, etc.)	1	2	3	4	5	NS

PERCEIVED RESOURCE CONDITION

[SCRIPT] In the next few questions, you will be presented with a series of marine resources, and will be asked to rate how important they are to you, as well as their current conditions and how you think those conditions may change in the future.

7. How important are each of the following marine resources to your quality of life? – INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'perceived resource condition' indicator}*

	Not at all important	Slightly important	Somewhat important	Moderately important	Very Important
Ocean water quality	1	2	3	4	5
Amount of live coral	1	2	3	4	5
Amount of fish	1	2	3	4	5
Size of fish	1	2	3	4	5
Amount of trochus (*aliling*)	1	2	3	4	5

8. **How would you rate the <u>current condition</u> of each of the following marine resources in CNMI? – INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'perceived resource condition' indicator}***

	Very Bad	Somewhat Bad	Neither Bad nor Good	Somewhat Good	Very Good	Not Sure
Ocean water quality	1	2	3	4	5	NS
Amount of live coral	1	2	3	4	5	NS
Amount of fish	1	2	3	4	5	NS
Size of fish	1	2	3	4	5	NS
Amount of trochus (*aliling*)	1	2	3	4	5	NS

9. **<u>Over the next 10 years</u>, how do you think the condition of each of those same marine resources will change in CNMI? – INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'perceived resource condition' indicator}***

	Worsen Greatly	Worsen Somewhat	No Change	Improve Somewhat	Improve Greatly	Not Sure
Ocean water quality	1	2	3	4	5	NS
Amount of live coral	1	2	3	4	5	NS
Amount of fish	1	2	3	4	5	NS
Size of fish	1	2	3	4	5	NS
Amount of trochus (*aliling*)	1	2	3	4	5	NS

<u>AWARENESS AND KNOWLEDGE OF REEFS AND REEF THREATS</u>

[SCRIPT] This next section will ask about reef awareness and importance in CNMI.

10. **How important are coral reefs in CNMI to each of the following? -INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'awareness and knowledge of reefs' indicator}***

	Not at all important	Slightly important	Somewhat important	Moderately important	Very Important	Not Sure
Protection from natural disasters	1	2	3	4	5	NS
Outdoor recreation	1	2	3	4	5	NS
Food for coastal communities	1	2	3	4	5	NS
Tourism-based economy	1	2	3	4	5	NS
Fishery-based economy	1	2	3	4	5	NS
Your livelihood	1	2	3	4	5	NS
Human health	1	2	3	4	5	NS

11. Which of the following do you believe are threats <u>to coral reefs</u> in CNMI? Please indicate:

YES – this is a threat to coral reefs;
NO – this is not a threat to coral reefs;
NOT SURE – I have heard of this, but I am not sure if it is a threat to coral reefs; or
NOT FAMILIAR – I have never heard of this term.

	Yes	No	Not Sure	Not Familiar
Climate change	1	2	NS	NF
Coral bleaching	1	2	NS	NF
Typhoons	1	2	NS	NF
Pollution from stormwater, wastewater, and chemical runoff	1	2	NS	NF
Marine litter	1	2	NS	NF
Invasive species	1	2	NS	NF
Overfishing and overgathering	1	2	NS	NF
Boat anchoring and grounding	1	2	NS	NF
Ocean acidification	1	2	NS	NF
Divers and snorkelers	1	2	NS	NF
Runoff from soil erosion	1	2	NS	NF
Military activities (live fire training)	1	2	NS	NF

SKIP LOGIC: IF 'YES' TO ANY ITEM, ASK ABOUT EACH ITEM IN Q12. IF 'NO', 'NOT SURE', OR 'NOT FAMILIAR' WITH ALL ITEMS, SKIP TO Q13

12. How severe are each of the following threats to coral reefs in CNMI? –INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'awareness and knowledge of reefs' indicator}*

	Minor Threat	Moderate Threat	Major Threat	Severe Threat	Not Sure
[ASK IF 'YES' IN Q11] Climate change	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Coral bleaching	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Typhoons	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Pollution from stormwater, wastewater, and chemical runoff	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Marine litter	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Invasive species	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Overfishing and overgathering	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Boat anchoring and grounding	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Ocean acidification	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Divers and snorkelers	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Runoff from soil erosion	2	3	4	5	NS
[ASK IF 'YES' IN Q11] Military activities (live fire training)	2	3	4	5	NS

ATTITUDES TOWARD CORAL REEF MANAGEMENT STRATEGIES

[SCRIPT] There are many different management strategies for protecting coral reefs in CNMI. In the next few questions, we are interested in your opinions on some of these strategies.

13. A Marine Protected Area (MPA) is an area of the ocean, such as conservation areas and sanctuaries, where particular human activities are managed to protect living, non-living, cultural, and/or historic resources. Before today, were you aware of existing MPAs in CNMI? *{supports 'awareness of reef regulations' indicator}*

Yes (*IF YES, GO TO Q14*)
No (*IF NO, SKIP TO Q15*)

14. How do you think the establishment of MPAs impacted the following in CNMI? – INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'attitudes toward reef management strategies' indicator}*

	Worsened Greatly	Worsened Somewhat	No Impact	Improved Somewhat	Improved Greatly	Not Sure
Protection of coral reefs	1	2	3	4	5	NS
Amount of fish	1	2	3	4	5	NS
Size of fish	1	2	3	4	5	NS
Tourism-based economy	1	2	3	4	5	NS
Fishery-based economy	1	2	3	4	5	NS
Your livelihood	1	2	3	4	5	NS
Outdoor recreation	1	2	3	4	5	NS
Food for coastal communities	1	2	3	4	5	NS

15. Next, how much do you oppose or support each of the following management strategies to protect coral reefs in CNMI? – INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'attitudes toward reef management strategies' indicator}*

	Strongly Oppose	Somewhat Oppose	Neutral	Somewhat Support	Strongly Support
Establish new catch limits per person for certain fish species	1	2	3	4	5
Create new MPAs	1	2	3	4	5
Establish new requirements for improved wastewater treatment	1	2	3	4	5
Encourage community participation in the management of marine resources	1	2	3	4	5
Increase restrictions on coastal construction practices to prevent soil and stormwater runoff	1	2	3	4	5
Establish limits on the number of tourism operators able to conduct business within locally managed MPAs	1	2	3	4	5
Impose a small fee ($1-$5) for tourists visiting a locally managed MPA to fund conservation	1	2	3	4	5
Actively restore coral reef habitats	1	2	3	4	5

PARTICIPATION IN BEHAVIORS THAT MAY IMPROVE CORAL HEALTH

[SCRIPT] Now, we'll talk about some activities that can help protect coral reef ecosystems in CNMI.

16. How important is it for CNMI residents to engage in activities that help to protect coral reefs? ***{supports 'pro-environmental behaviors' indicator}***

Not at all Important	Slightly Important	Somewhat Important	Moderately Important	Very Important
1	2	3	4	5

17. Which of the following do you do routinely (whenever possible)? (Check all that apply). ***{supports 'pro-environmental behaviors' indicator}***

	Yes	No
Reduce household water use		
Reduce household electricity use		
Compost		
Recycle		
Use reef-safe forms of sun protection		
Promote environmentally responsible practices with friends or family		
Promote environmentally responsible practices with tourists		
Minimize fuel consumption		
Use fewer single use products (plastic bags or cups, Styrofoam, etc…)		

SKIP PATTERN: IF 'YES' FOR ALL ITEMS, SKIP TO Q19. IF 'NO' FOR ANY ITEM, ASK ABOUT EACH ITEM IN Q18.

18. Which of the following are reasons why you do not engage in those activities routinely? (Check all that apply). *{supports 'pro-environmental behaviors' indicator}*

	I do not know how	It is not convenient	It is too expensive	I have not had the opportunity to do so	None of these reasons
[ASK IF 'NO' IN Q17] Reduce household water use					
[ASK IF 'NO' IN Q17] Reduce household electricity use					
[ASK IF 'NO' IN Q17] Compost					
[ASK IF 'NO' IN Q17] Recycle					
[ASK IF 'NO' IN Q17] Use reef-safe forms of sun protection					
[ASK IF 'NO' IN Q17] Promote environmentally responsible practices with friends or family					
[ASK IF 'NO' IN Q17] Promote environmentally responsible practices with tourists					
[ASK IF 'NO' IN Q17] Minimize fuel consumption					
[ASK IF 'NO' IN Q17] Use fewer single use products (plastic bags or straws, Styrofoam, etc.)					

19. In the past 12 months, have you done any of the following activities? *{supports 'pro-environmental behaviors' indicator}*

	Yes	No
Donated to an environmental cause (including education or outreach)		
Volunteered in a beach clean-up or other environmental effort		
Joined or renewed a membership in a conservation organization		
Participated in active coral restoration		

SKIP PATTERN: IF 'YES' FOR ALL ITEMS, SKIP TO Q21. IF 'NO" FOR ANY ITEM, ASK ABOUT EACH ITEM IN Q20.

20. Which of the following are reasons why you have not engaged in any of those activities in the past 12 months? (Check all that apply) *{supports 'pro-environmental behaviors' indicator}*

	I do not know how	It is not convenient	It is too expensive	I have not had the opportunity to do so	None of these reasons
[ASK IF 'NO' IN Q19] Donated to an environmental cause (including education or outreach)					
[ASK IF 'NO' IN Q19] Volunteered in a beach clean-up or other environmental effort					
[ASK IF 'NO' IN Q19] Joined or renewed a membership in a conservation organization					
[ASK IF 'NO' IN Q19] Participated in active coral restoration					

21. <u>In the past 5 years</u>, have you done any of the following? *{supports 'pro-environmental behaviors' indicator}*

	Yes	No
Upgraded the septic or sewer system on my property		
Performed maintenance on the septic or sewer system on my property		
Installed water storage system (such as a tank or rain barrel)		

<u>SKIP PATTERN</u>: IF 'YES' FOR ALL ITEMS, SKIP TO Q23. IF 'NO' FOR ANY ITEM, ASK ABOUT EACH ITEM IN Q22.

22. Which of the following are reasons why you have not engaged in those activities? (Check all that apply). *{supports 'pro-environmental behaviors' indicator}*

	I do not know how	It is not convenient	It is too expensive	My system is already up to date	I am not allowed to	None of these reasons
[ASK IF 'NO' IN Q21] Updated the septic or sewer system on my property						
[ASK IF 'NO' IN Q21] Performed maintenance on the septic or sewer system on my property						
[ASK IF 'NO' IN Q21] Installed water storage system (such as a tank or rain barrel)						

23. The rules and regulations surrounding coral reefs are sometimes misunderstood. How unacceptable or acceptable are each of the following practices in CNMI?– INTERVIEWER REPEATS SCALE AS NEEDED *{supports 'awareness of reef regulations' indicator}*

	Very Unacceptable	Somewhat Unacceptable	Neutral	Somewhat Acceptable	Very Acceptable
Operate a jet ski or similar watercraft in a shallow reef area	1	2	3	4	5
Leave trash on the beach	1	2	3	4	5
Anchor a boat on coral	1	2	3	4	5
Feed marine animals (mammals, fish, sea birds, etc.)	1	2	3	4	5
Touch corals with my hands or feet (including standing)	1	2	3	4	5
Take seashells or coral from the reef	1	2	3	4	5
Remove coastal vegetation (mangroves, beach forest, seagrass, etc.)	1	2	3	4	5
Have fires on the beach (campfires, bonfires, fires for cooking, etc.)	1	2	3	4	5

DEMOGRAPHICS

[SCRIPT] I just have a few more questions that will help us to interpret our results. As a reminder, the information you provide will remain strictly confidential.

24. Do you identify as any of the following?

□ Male
□ Female
□ Other
□ No response

25. In what year were you born? _____

26. Were you born in CNMI?

□ Yes □ No

27. How many years have you lived in CNMI? _____ Years

28. What race/ethnicity do you consider yourself? (Check all that apply).

- Carolinian
- Chamorro
- Chuukese
- Palauan
- Other Hawaiian / Pacific Islander
- Bangladeshi
- Chinese
- Filipino
- Japanese
- Korean
- Other Asian
- American Indian or Alaska Native
- Black
- White
- Hispanic or Latino
- Other
- No response

29. Including your primary language, which of the following can you comfortably read?

- English
- Spanish
- Chinese Mandarin
- Chinese Cantonese
- Japanese
- Korean
- Tagalog/ Filipino
- Chamorro
- Carolinian
- Other
- No response

30. What is the highest level of education you have completed? (Choose one)

- 8th Grade or Less
- Some high school
- High School Graduate, GED
- Technical/trade school certification
- Some college or community college
- Associate's degree
- College Graduate
- Graduate School, Law School, Medical School

31. What is your current employment status? (Check all that apply).

- Unemployed
- Employed full time
- Employed part time
- Retired

32. Is your current or most recent occupation related to one or more of the following? (Check all that apply). ***{demographic question for variable weighting and livelihood contextualization in Q10}***

- Commercial fishing
- Outdoor recreation
- Tourism
- Not related to any of the above

33. How many adults aged 18 years or older live in your household, including yourself? _____

34. What is your annual household income?

- Less than $10,000
- $10,000-$14,999
- $15,000-$24,999
- $25,000 -$49,999
- $50,000-$74,999
- $75,000-$99,999
- $100,000-$124,999
- $125,000 or more
- No Response

Thank you for your time and contribution to this research!

Appendix B: Data collection protocols and weighting efforts

B.1 Data collection

Sample design

CNMI was stratified into three strata: Saipan, Tinian, and Rota. The sample design for this survey effort involved three stages.

In stage one, Census Block Groups were chosen using a systematic, proportionate-to-size technique to identify the target clusters. There was a random selection of 30 primary clusters in Saipan from the 42 available, while Tinian and Rota were each worked as a single cluster with all of their Census Block Groups included (shown in Table B1). In Tinian and Rota, it was anticipated that all households would need to be surveyed to achieve a 16% response rate, while a 20% response rate was assumed for Saipan.

Table B1. CNMI island strata and sample sizes (2020 data from the U.S. Census). CI = confidence interval.

Stratum	Substrata	20+ Population	Households	Expected Completes	Adjusted Sample Size	Margin of Error (95% CI)	First-Stage Cluster Selection	Required Completion Rate
Saipan	District 1	9,116	4,003	90	500	5.6	9	18%
	District 2	3,816	1,655	40	222		4	18%
	District 3	9,785	4,586	100	556		10	18%
	District 4	2,354	920	30	167		3	18%
	District 5	4,452	1,810	40	222		4	18%
Tinian	District 6	1,378	609	100	609	8.97	1	16%
Rota	District 7	1,282	645	100	625	8.99	1	16%
Total		32,186	14,208	500	2,901	4.32	32	17%

In stage two (after review of stage 1 but before field work), households were systematically chosen within each cluster for interview attempts by randomly selecting starting points (and alternate starting points) within each cluster. Further, a separate group of alternate clusters were selected by reviewing Census Block population data and inspecting satellite maps to provide a backup for each of the 30 primary clusters on Saipan. The randomly assigned starting points were adjusted slightly as needed in order to ensure that the starting point represented an intersection or street location that could be reliably located via Google search/GPS and was not in an inaccessible location (wooded area, etc.). The goal was to collect approximately 10 responses in 32 clusters across the three strata.

In stage three (during data collection), one adult (aged 18+) from each selected household was randomly selected using the last birthday method to ensure a random selection from all eligible individuals within the household. Households were randomly selected by following detailed

walking rules, including a) starting with the closest dwelling unit, b) attempting the survey and dispatching leave-behind postcards, and c) repeating these two steps by working away from the starting point in a systematic manner.

Response rate achievement plan

The goal of data collection was to achieve 500 survey responses. Surveyors made up to two attempts to have respondents complete the survey. We implemented an adaptive/responsive survey design based on lessons learned from initial cluster visits. Initial cluster visits served as a pilot testing phase to determine the response rate and to assess if we needed to increase (or decrease) the number of eligible households visited during the first visit and to assess the successfulness of the second visit. We began by visiting approximately 65 eligible houses (i.e., excluding vacant or destroyed) per cluster in Saipan and visited all households in Tinian and Rota. Second visits were conducted in clusters with 11 or fewer completed surveys and they occurred on either a different time of day (morning vs. late afternoon/evening) or a different part of the week (weekday vs. weekend) from the first visit to the cluster.

Data collection methods and data processing methods

Field teams conducted in-person surveys with household respondents and dispatched postcards that provided the household with a unique code should they want to complete the survey online. Field teams visited eligible houses up to two times and used ArcGIS Field Maps to document household visitation and status. Possible statuses are shown in Figure B1.

Language accommodation

Surveyors approached each household with a postcard that introduced the survey project in English, Chamorro, Carolinian, and Tagalog. Though multilingual surveyors were employed, it was uncommon for each surveyor to speak all included survey languages, and additional languages are spoken across CNMI. If surveyors determined a language barrier, they presented the translated postcard. They then offered a self-administered table option to the respondent. If the respondent declined, surveyors made a note that the household faced a language barrier for the first survey attempt.

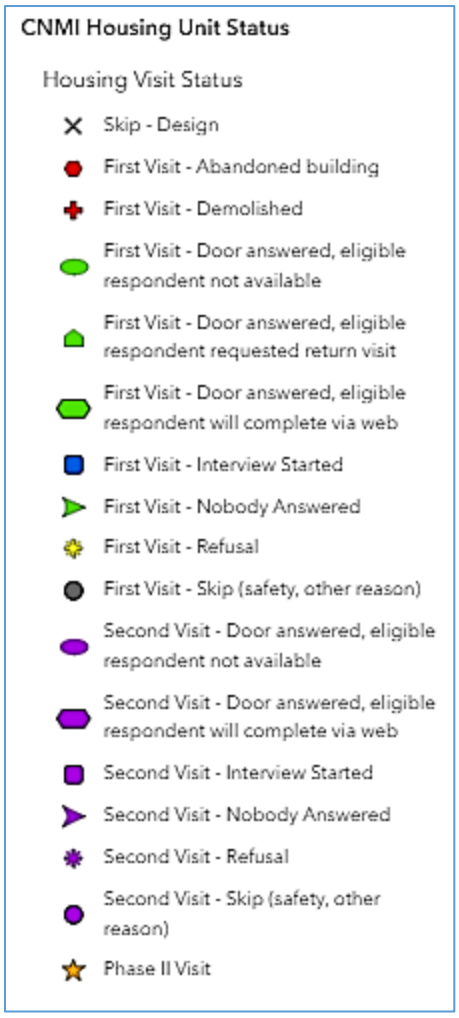

Figure B1. Housing status options.

Dates of data collection

Data collection began on February 27, 2024 and continued until March 23, 2024. Surveyors were hired by the survey vendor and subcontractor in early February 2024. They worked up to 30 hours a week on Saipan, and local surveyors were additionally hired to support surveying on Rota and Tinian. Surveyor training consisted of a recorded project introduction from the NCRMP team, a project description and review of expectations, a presentation on logistics and how to get ready for data collection, a presentation and activity on field operations and a recorded software demo, and a presentation and discussion of interview procedures and techniques.

Determining sufficient survey responses

In total, 4,066 households were visited during the data collection effort. Of all households visited, 11% were abandoned, 35% did not answer the door, and 1% refused. Out of the 4,066 households, 730 initiated a survey. Six formally refused to continue with the survey after having started, one did not meet the initial screening criteria (age and residency thresholds), and 14 did not meet sufficiency rules (surveys with completion rates under 50% and those with duration times below the first percentile of 5.86 minutes).

A total of 709 sufficient surveys were received (460 in Saipan, 125 in Tinian, and 120 in Rota). The results section of this report presents results based on the 709 sufficient surveys. Tables B2 and B3 presents the percentage of sufficient surveys by strata, language, and survey mode. Tables B4 and B5 present the number of attempts required to obtain the sufficient surveys and response rate percentages by mode and stratum, respectively. Each column may not exactly sum to 100.0% due to rounding. The overall response rate across the three strata and both survey modes was calculated to be 24.3%.

Table B2. Language of administered survey.

Language	Rota	Saipan	Tinian	Total
Chamorro	1.6% (2/124)	4.6% (21/460)	3.2% (4/125)	3.8% (27/709)
Carolinian	0.0% (0/124)	0.7% (3/460)	0.8% (1/125)	0.6% (4/709)
Tagalog	1.6% (2/124)	1.3% (6/460)	4.0% (5/125)	1.8% (13/709)
English	96.8% (120/124)	93.5% (430/460)	92.0% (115/125)	93.8% (665/709)

Table B3. Mode of survey completion (online/in-person).

Mode	Rota	Saipan	Tinian	Total
In-person	72.6% (90/124)	62.6% (288/460)	40.0% (50/125)	60.4% (428/709)
Online	25.8% (32/124)	36.5% (168/460)	60.0% (75/125)	38.8% (275/709)
No Response	1.6% (2/124)	0.9% (4/460)	0.0% (0/125)	0.8% (6/709)

Table B4. Number of survey attempts.

Number of Attempts	Rota	Saipan	Tinian	Total
One Attempt	100.0% (124/124)	89.8% (413/460)	100.0% (125/125)	93.4% (662/709)
Two Attempts	0.0% (0/124)	9.8% (45/460)	0.0% (0/125)	6.3% (45/709)
No Data	0.0% (0/124)	0.4% (2/460)	0.0% (0/125)	0.3% (2/709)

Table B5. Response rate percentages and the values used to calculate response rates.

Mode	Rota	Saipan	Tinian	Total
In-Person	16.9% (90/533)	15.1% (288/1911)	10.4% (50/479)	14.6% (428/2923)
Online	6.0% (32/533)	8.8% (168/1911)	15.7% (75/479)	9.4% (275/2923)
Unknown	0.0% (2/533)	0.0% (4/1911)	0.0% (0/479)	0.0% (6/2923)
Total Response Rate	23.3% (124/533)	24.1% (460/1911)	26.1% (125/479)	24.3% (709/2923)

B.2 Weighting

Data were weighted to account for sample design and nonresponse, and then calibrated based on key variables (age category, gender, education, race, and household income) within each stratum to ensure data were representative of the adult population of CNMI. This was accomplished through iterative proportional fitting, a method commonly referred to as "raking." Iterative proportional fitting creates a weight for each survey respondent to help the sample become more representative of true population characteristics. In this analysis, base weights were computed as the product of three stages of random selection that included (1) random selection of clusters within each of two strata, (2) random selection of households within selected clusters, and (3) random selection of adults within selected households. The sampling design for this survey effort reflected a complex, multistage process. Therefore, a base weight was calculated and applied in order to correct for the unequal probabilities of selection at each of the three stages of the sampling. The base weights were computed as the inverse of the overall probability of selection that reflected each of the three stages of sampling.

To account for nonresponse caused by both survey-related factors (i.e., field period, incentives, survey topic/sponsor, and survey mode) as well as various other survey unit factors (i.e., demographics, sampled unit's experience with surveys and/or the topic, or in this case, household level indicators such as region or rental status), a nonresponse adjustment was made in order to account and correct for nonresponses among surveyed households.

These weights were then calibrated to match six of the survey sample's demographic data to the true demographic characteristics of the CNMI population: gender (male, female), age group (18–24, 25–34, 35–44, 45–54, 55–64, 65 or older), education level (less than high school, high school or GED, some college or Associates degree, college degree or more), median household income

(less than $15,000, $15,000–$24,999, $25,000–$49,999, $50,000 or higher, unknown), race/ethnicity (Chamorro, Filipino, two or more races, all other races), and current employment status (employed, not employed). These population controls were from the 2020 U.S. Census.

Finally, weights were trimmed to ensure no single final weight dominated the distribution. A 5% trim was ultimately implemented because it was found to balance the bias and variance of the weights the best. After the trimming was performed, the final weights were derived by computing a final post-stratification adjustment that multiplied the trimmed weights by a fixed constant of 1.11534 to ensure that the final weights summed to the target population value of 33,711. A comparison between the demographics in the weighted sample is presented in Table B6.

Table B6. Demographics of true population and weighted respondents.

Demographic Variables		Population	Weighted Respondents
Location of Residence	Rota	4.0	4.5
	Saipan	91.7	90.6
	Tinian	4.3	4.9
Gender	Male	53.0	48.3
	Female/other	47.0	51.7
Age	18–24	13.1	10.7
	25–34	18.1	18.1
	35–44	19.5	20.1
	45–54	23.8	23.2
	55–64	17.3	18.8
	65+	8.2	9.2
Education	Less than high school	14.3	14.5
	High school or GED	40.2	42.4
	Some college/Associates degree	24.4	23.1
	College degree or more	21.1	20.0
Household Income	Under $15,000	14.0	15.4
	$15,000–$24,999	12.0	10.8
	$25,000-$49,999	19.0	18.2
	$50,000 or higher	19.0	18.0
	Unknown	36.0	37.6
Race/Ethnicity Group	Chamorro	25.4	27.3
	Filipino	32.7	30.1
	Two or More Races	7.3	8.2
	All Other Races	34.6	34.4
Current Employment	Not Employed	47.0	47.5
	Employed	53.0	52.5

Appendix C: CNMI and island strata results for 2024

Table C1. Proportion of participation in activities by stratum.

Activity	Rota	Saipan	Tinian	Total
Swimming/wading	67.2%	70.6%	80.4%	70.9%
Snorkeling	39.1%	40.3%	52.6%	40.8%
Scuba diving	13.1%	12.3%	4.4%	12.0%
Free diving	30.2%	27.1%	29.2%	27.4%
Waterside/beach camping	49.7%	48.5%	51.8%	48.7%
Beach recreation	66.5%	73.7%	86.1%	74.0%
Boating	31.6%	34.1%	34.5%	34.0%
Board sports	19.8%	19.1%	6.3%	18.6%
Spearfishing	31.1%	24.2%	25.1%	24.5%
Fishing from shore	37.9%	34.1%	50.8%	35.1%
Boat-based fishing with rod and reel	35.5%	22.7%	32.2%	23.8%
Gathering of marine resources	27.9%	15.3%	22.9%	16.2%

Table C2. Zone of activity participation; answered only by those who participated in question 1.

Activity	Tinian and Saipan Zones	Tinian*	Saipan	Rota Zones	Rota
Swimming/wading	A	5.7%	7.2%	A	11.0%
	B	0.0%	7.6%	B	0.9%
	C	0.0%	79.2%	C	1.6%
	D	0.0%	5.4%	D	0.0%
	E	15.6%	0.2%	E	34.6%
	F	78.7%	0.4%	F	51.9%
Snorkeling	A	6.2%	10.6%	A	6.4%
	B	0.5%	8.3%	B	16.9%
	C	0.0%	70.7%	C	14.4%
	D	0.0%	8.3%	D	2.6%
	E	9.5%	0.5%	E	34.9%
	F	83.8%	1.6%	F	24.8%
Scuba diving	A	44.1%	41.5%	A	2.2%
	B	0.0%	10.4%	B	0.0%
	C	0.0%	37.6%	C	36.5%
	D	0.0%	10.5%	D	0.0%
	E	29.4%	0.0%	E	61.3%
	F	26.5%	0.0%	F	0.0%
Free diving	A	2.9%	15.4%	A	1.0%
	B	0.0%	13.7%	B	2.3%

Activity	Tinian and Saipan Zones	Tinian*	Saipan	Rota Zones	Rota
	C	0.0%	61.4%	C	0.0%
	D	0.0%	6.9%	D	5.5%
	E	28.2%	0.3%	E	59.2%
	F	68.9%	2.3%	F	32.0%
Waterside/beach camping	A	6.7%	7.9%	A	12.0%
	B	0.5%	7.4%	B	2.0%
	C	3.6%	74.9%	C	1.7%
	D	2.1%	8.8%	D	1.6%
	E	15.6%	0.2%	E	12.7%
	F	71.4%	0.8%	F	70.0%
Beach recreation	A	5.2%	6.2%	A	4.0%
	B	0.0%	5.3%	B	0.4%
	C	0.7%	81.5%	C	5.2%
	D	0.3%	5.3%	D	0.4%
	E	16.0%	0.5%	E	19.2%
	F	77.8%	1.2%	F	70.7%
Boating (sail, motor)	A	0.0%	5.6%	A	19.0%
	B	0.0%	7.3%	B	1.7%
	C	2.8%	81.9%	C	3.0%
	D	0.0%	2.8%	D	20.3%
	E	24.2%	0.2%	E	33.3%
	F	73.0%	2.1%	F	22.8%
Board sports (stand-up paddleboarding, kiteboarding, surfing, windsurfing)	A	0.0%	3.0%	A	1.6%
	B	0.0%	4.5%	B	15.2%
	C	0.0%	89.9%	C	0.0%
	D	0.0%	2.1%	D	6.4%
	E	20.9%	0.5%	E	54.9%
	F	79.1%	0.0%	F	21.9%
Spearfishing	A	3.5%	16.2%	A	13.6%
	B	0.0%	6.9%	B	24.2%
	C	0.0%	64.8%	C	1.6%
	D	0.0%	10.5%	D	3.0%
	E	25.2%	0.3%	E	33.1%
	F	71.3%	1.1%	F	24.6%
Fishing from shore	A	1.8%	7.9%	A	5.6%
	B	0.5%	12.0%	B	7.7%
	C	0.0%	74.7%	C	1.2%
	D	0.0%	5.1%	D	11.3%
	E	16.4%	0.2%	E	27.9%
	F	81.3%	0.0%	F	46.4%
Boat-based fishing with rod and reel	A	3.4%	6.2%	A	15.3%
	B	0.0%	10.8%	B	2.9%
	C	0.0%	78.6%	C	1.4%
	D	0.0%	2.3%	D	24.6%
	E	35.9%	0.8%	E	34.6%
	F	60.7%	1.3%	F	21.2%
Gathering of marine resources	A	1.0%	11.6%	A	14.0%
	B	0.0%	10.3%	B	0.0%
	C	3.3%	64.8%	C	4.4%
	D	0.0%	8.4%	D	0.0%
	E	24.0%	1.1%	E	12.8%
	F	71.7%	3.8%	F	68.8%

*Note: Rota's geographic references, even though A–F are used similarly, are different from Tinian and Saipan as shown in Figure 4. Geographic comparisons between activity participation in Tinian/Saipan and Rota are not possible.

Table C3. Primary motivation for fishing and gathering by stratum.

Note: Asked only for those who fished and/or gathered at least 1 day per year.

Motive	Rota	Saipan	Tinian	Total
Recreational	32.0%	31.2%	36.0%	31.6%
Subsistence	61.1%	55.0%	58.4%	55.6%
Commercial	4.6%	1.7%	2.9%	1.9%
Cultural	2.2%	12.1%	2.6%	10.9%

Table C4. Percent of meals eaten within household containing seafood by stratum.

Percent	Rota	Saipan	Tinian	Total
None (0%)	2.7%	2.0%	1.9%	2.1%
Some meals (1%–33%)	58.7%	54.7%	60.2%	55.2%
Many meals (34%–66%)	24.4%	26.8%	28.1%	26.7%
Most meals (67%–99%)	10.6%	13.5%	9.3%	13.1%
All meals (100%)	3.6%	3.0%	0.5%	2.9%

Table C5. Percent of meals eaten within household containing seafood from local coral reefs in CNMI by stratum.

Note: Asked only to respondents who ate seafood for at least some meals.

Percent	Rota	Saipan	Tinian	Total
None (0%)	1.8%	6.4%	6.4%	6.2%
Some meals (1%–33%)	60.2%	56.7%	49.5%	56.5%
Many meals (34%–66%)	17.8%	15.5%	19.8%	15.8%
Most meals (67%–99%)	4.0%	7.9%	8.7%	7.7%
All meals (100%)	9.5%	4.4%	1.8%	4.5%
Not sure	0.5%	0.3%	1.3%	0.4%

Table C6. Importance of coral reefs to culture.

Resource	Importance	Rota	Saipan	Tinian	Total
Ancestral connections	Not at all	2.4%	3.2%	1.9%	3.1%
	Slightly	3.2%	4.0%	0.4%	3.8%
	Somewhat	8.9%	7.2%	9.7%	7.4%
	Moderately	9.0%	8.7%	10.4%	8.8%
	Very	60.4%	63.3%	72.4%	63.6%
	Not sure	16.2%	13.6%	5.2%	13.3%
Cultural folklore (beliefs, stories, etc.)	Not at all	2.4%	3.8%	1.6%	3.7%
	Slightly	3.6%	3.9%	1.4%	3.8%
	Somewhat	17.8%	8.4%	14.4%	9.1%
	Moderately	7.3%	14.6%	8.6%	14.0%
	Very	56.6%	53.7%	66.8%	54.4%
	Not sure	12.5%	15.6%	7.1%	15.0%
Culturally important events, such as feasts and ceremonies	Not at all	3.0%	2.8%	1.6%	2.7%
	Slightly	1.8%	3.7%	0.0%	3.5%
	Somewhat	12.9%	6.0%	7.0%	6.4%
	Moderately	4.5%	10.7%	10.2%	10.4%
	Very	67.2%	65.3%	75.8%	65.9%
	Not sure	10.7%	11.5%	5.3%	11.2%
Establishing and maintaining cultural and familial ties	Not at all	3.2%	2.7%	0.0%	2.6%
	Slightly	3.1%	3.8%	1.9%	3.7%
	Somewhat	6.0%	7.3%	8.1%	7.3%
	Moderately	4.0%	9.4%	8.5%	9.1%
	Very	72.5%	64.6%	79.3%	65.7%
	Not sure	11.3%	12.3%	2.2%	11.7%
Local language (word choice, business and place names, etc.)	Not at all	2.7%	3.6%	4.9%	3.7%
	Slightly	4.4%	3.0%	3.9%	3.1%
	Somewhat	16.2%	7.7%	9.2%	8.1%
	Moderately	6.1%	11.9%	21.5%	12.1%
	Very	59.9%	58.2%	51.6%	57.9%
	Not sure	10.8%	15.6%	9.0%	15.0%
Religious practices	Not at all	10.4%	5.1%	3.3%	5.3%
	Slightly	3.8%	5.7%	3.8%	5.5%
	Somewhat	13.1%	10.7%	8.2%	10.7%
	Moderately	5.8%	8.6%	15.9%	8.9%
	Very	49.8%	52.5%	52.1%	52.4%
	Not sure	17.2%	17.3%	16.7%	17.3%

Table C7. Perceptions of marine resource importance to quality of life.

Resource	Importance	Rota	Saipan	Tinian	Total
Ocean water quality	Not at all	1.8%	2.7%	0.0%	2.5%
	Slightly	2.5%	1.1%	0.0%	1.1%
	Somewhat	5.1%	5.1%	0.9%	4.9%
	Moderately	5.0%	7.7%	9.7%	7.7%
	Very	85.5%	83.4%	89.4%	83.8%
Amount of live coral	Not at all	1.1%	2.4%	1.6%	2.3%
	Slightly	3.0%	1.5%	0.0%	1.5%
	Somewhat	6.2%	6.3%	1.6%	6.1%
	Moderately	4.9%	10.1%	12.0%	9.9%
	Very	84.8%	79.7%	84.8%	80.1%
Amount of fish	Not at all	0.2%	1.6%	0.0%	1.5%
	Slightly	0.0%	2.2%	1.6%	2.1%
	Somewhat	5.4%	4.8%	1.4%	4.7%
	Moderately	5.7%	9.1%	15.2%	9.3%
	Very	88.7%	82.2%	81.8%	82.5%
Size of fish	Not at all	4.6%	2.3%	0.0%	2.3%
	Slightly	3.7%	1.6%	2.2%	1.7%
	Somewhat	7.8%	7.3%	7.5%	7.3%
	Moderately	9.1%	16.6%	15.6%	16.2%
	Very	74.8%	72.3%	74.6%	72.5%
Amount of trochus (*aliling*)	Not at all	4.0%	4.8%	9.1%	5.0%
	Slightly	5.6%	6.0%	5.0%	5.9%
	Somewhat	7.5%	13.4%	10.5%	13.0%
	Moderately	12.3%	14.6%	14.4%	14.5%
	Very	70.6%	61.3%	60.9%	61.7%

Table C8. Perceptions of marine resource current condition by stratum.

Resource	Current condition	Rota	Saipan	Tinian	Total
Ocean water quality	Very bad	0.0%	3.1%	0.0%	2.8%
	Somewhat bad	8.1%	9.5%	1.0%	9.1%
	Neither bad nor good	5.4%	17.0%	7.5%	16.0%
	Somewhat good	21.5%	30.0%	31.5%	29.7%
	Very good	58.5%	29.3%	53.0%	31.8%
	Not sure	6.5%	11.0%	7.0%	10.6%
Amount of live coral	Very bad	0.6%	5.0%	1.5%	4.6%
	Somewhat bad	9.9%	12.2%	7.2%	11.8%
	Neither bad nor good	6.8%	13.8%	6.2%	13.1%
	Somewhat good	25.0%	29.0%	37.4%	29.2%
	Very good	40.4%	17.6%	32.4%	19.4%
	Not sure	17.3%	22.5%	15.3%	21.9%
Amount of fish	Very bad	3.5%	4.6%	1.6%	4.4%
	Somewhat bad	14.0%	12.4%	10.5%	12.4%
	Neither bad nor good	5.7%	14.8%	6.6%	14.0%
	Somewhat good	20.7%	29.3%	33.4%	29.1%
	Very good	49.3%	24.0%	35.9%	25.7%
	Not sure	6.9%	14.9%	12.0%	14.4%
Size of fish	Very bad	3.2%	2.7%	2.3%	2.7%
	Somewhat bad	10.0%	14.1%	6.2%	13.5%
	Neither bad nor good	11.4%	21.4%	19.5%	20.8%
	Somewhat good	16.2%	26.2%	25.5%	25.7%
	Very good	49.2%	19.9%	31.6%	21.9%
	Not sure	10.0%	15.7%	15.0%	15.5%
Amount of trochus (*aliling*)	Very bad	0.6%	9.6%	6.7%	9.0%
	Somewhat bad	9.4%	9.3%	10.2%	9.3%
	Neither bad nor good	10.9%	18.0%	18.0%	17.7%
	Somewhat good	18.4%	15.1%	25.0%	15.8%
	Very good	40.8%	15.2%	14.7%	16.4%
	Not sure	19.9%	32.8%	25.5%	31.8%

Table C9. Perceived change in resource conditions over the next 10 years by stratum.

Resource	Change in condition	Rota	Saipan	Tinian	Total
Ocean water quality	Worsen greatly	3.2%	9.7%	5.5%	9.2%
	Worsen somewhat	24.4%	23.4%	27.0%	23.7%
	No change	15.1%	12.0%	7.1%	11.9%
	Improve somewhat	12.7%	18.3%	27.3%	18.5%
	Improve greatly	15.9%	11.7%	12.4%	12.0%
	Not sure	28.7%	24.7%	20.7%	24.7%
Amount of live coral	Worsen greatly	3.0%	12.3%	5.5%	11.5%
	Worsen somewhat	24.3%	23.0%	29.6%	23.4%
	No change	10.1%	9.0%	3.7%	8.8%
	Improve somewhat	13.7%	17.7%	26.5%	18.0%
	Improve greatly	16.3%	12.5%	12.3%	12.6%
	Not sure	32.5%	25.5%	22.4%	25.7%
Amount of fish	Worsen greatly	3.5%	11.5%	4.6%	10.8%
	Worsen somewhat	21.6%	21.6%	31.2%	22.1%
	No change	14.5%	11.3%	2.6%	11.0%
	Improve somewhat	7.7%	18.5%	28.3%	18.5%
	Improve greatly	20.9%	12.9%	11.9%	13.3%
	Not sure	31.7%	24.1%	21.5%	24.3%
Size of fish	Worsen greatly	4.4%	11.0%	5.0%	10.4%
	Worsen somewhat	20.1%	21.1%	25.4%	21.3%
	No change	12.2%	13.3%	4.0%	12.8%
	Improve somewhat	13.8%	19.2%	28.4%	19.4%
	Improve greatly	18.6%	11.4%	12.2%	11.7%
	Not sure	31.0%	24.1%	25.0%	24.5%
Amount of trochus (*aliling*)	Worsen greatly	5.0%	15.7%	5.7%	14.7%
	Worsen somewhat	17.2%	14.9%	26.8%	15.6%
	No change	12.5%	11.1%	6.0%	11.0%
	Improve somewhat	13.7%	14.4%	23.3%	14.8%
	Improve greatly	13.0%	8.6%	7.0%	8.7%
	Not sure	38.6%	35.3%	31.2%	35.3%

Table C10. Importance of coral reefs to various ecosystem services by stratum.

Value	Importance	Rota	Saipan	Tinian	Total
Protection from natural disasters	Not at all	1.9%	0.7%	0.0%	0.7%
	Slightly	3.4%	0.5%	0.0%	0.6%
	Somewhat	0.8%	3.4%	2.7%	3.3%
	Moderately	3.2%	2.7%	7.2%	3.0%
	Very	85.1%	87.6%	87.2%	87.5%
	Not sure	5.7%	5.1%	2.9%	5.0%
Outdoor recreation	Not at all	4.6%	2.1%	0.0%	2.1%
	Slightly	3.5%	0.5%	2.2%	0.8%
	Somewhat	4.3%	7.4%	6.2%	7.2%
	Moderately	10.6%	9.2%	11.1%	9.3%
	Very	67.6%	73.6%	71.7%	73.2%
	Not sure	9.5%	7.2%	8.7%	7.3%
Tourism-based industry	Not at all	1.9%	1.0%	0.0%	1.0%
	Slightly	2.6%	0.7%	0.5%	0.8%
	Somewhat	3.4%	5.7%	3.9%	5.6%
	Moderately	3.2%	6.0%	8.4%	6.0%
	Very	81.9%	77.6%	84.0%	78.1%
	Not sure	7.1%	8.9%	3.3%	8.6%
Fishery-based industry	Not at all	2.3%	0.1%	0.0%	0.2%
	Slightly	1.4%	1.4%	0.6%	1.4%
	Somewhat	2.4%	5.3%	6.1%	5.2%
	Moderately	2.9%	5.9%	12.7%	6.1%
	Very	74.8%	75.0%	76.1%	75.1%
	Not sure	16.3%	12.2%	4.6%	12.0%
Food for coastal communities	Not at all	1.9%	0.8%	0.0%	0.8%
	Slightly	0.0%	0.7%	0.0%	0.6%
	Somewhat	5.0%	3.8%	7.9%	4.1%
	Moderately	7.3%	5.7%	11.4%	6.0%
	Very	77.7%	80.8%	75.9%	80.4%
	Not sure	8.1%	8.2%	4.8%	8.0%
Human health	Not at all	0.6%	0.7%	0.0%	0.6%
	Slightly	0.0%	0.6%	0.6%	0.5%
	Somewhat	2.5%	4.5%	3.8%	4.4%
	Moderately	9.1%	5.4%	3.8%	5.4%
	Very	83.1%	81.5%	86.3%	81.8%
	Not sure	4.8%	7.4%	5.6%	7.2%
Your livelihood	Not at all	3.7%	1.9%	2.3%	2.0%
	Slightly	7.1%	3.9%	3.5%	4.1%
	Somewhat	3.2%	7.0%	6.9%	6.8%
	Moderately	10.1%	7.3%	15.2%	7.8%
	Very	70.6%	72.9%	66.8%	72.5%
	Not sure	5.2%	7.0%	5.3%	6.8%

Table C11. Threat familiarity by stratum.

Threat	Familiarity	Rota	Saipan	Tinian	Total
Climate change	Not familiar / not sure	19.8%	21.2%	20.5%	21.1%
	Not a threat	4.3%	5.7%	3.2%	5.6%
	Yes, it is a threat	75.9%	73.1%	76.3%	73.3%
Coral bleaching	Not familiar / not sure	24.2%	17.3%	19.6%	17.7%
	Not a threat	2.7%	1.2%	2.7%	1.4%
	Yes, it is a threat	73.2%	81.4%	77.7%	80.9%
Typhoons	Not familiar / not sure	18.0%	23.6%	17.3%	23.0%
	Not a threat	7.9%	10.2%	6.0%	9.9%
	Yes, it is a threat	74.0%	66.2%	76.7%	67.0%
Pollution from stormwater, wastewater, and chemical runoff	Not familiar / not sure	7.5%	8.4%	3.7%	8.1%
	Not a threat	3.2%	1.4%	5.7%	1.7%
	Yes, it is a threat	89.3%	90.2%	90.6%	90.2%
Marine litter	Not familiar / not sure	3.9%	7.4%	2.7%	7.0%
	Not a threat	1.6%	1.8%	6.3%	2.0%
	Yes, it is a threat	94.5%	90.8%	91.0%	91.0%
Invasive species	Not familiar / not sure	25.7%	24.9%	20.9%	24.8%
	Not a threat	2.1%	5.7%	9.7%	5.8%
	Yes, it is a threat	72.2%	69.3%	69.4%	69.5%
Overfishing and overgathering	Not familiar / not sure	13.6%	11.4%	3.9%	11.1%
	Not a threat	8.3%	5.8%	7.7%	6.0%
	Yes, it is a threat	78.1%	82.8%	88.4%	82.8%
Boat anchoring and grounding	Not familiar / not sure	23.0%	23.9%	21.4%	23.7%
	Not a threat	10.2%	9.3%	5.4%	9.1%
	Yes, it is a threat	66.8%	66.9%	73.2%	67.2%
Divers and snorkelers	Not familiar / not sure	22.1%	27.6%	38.4%	27.9%
	Not a threat	52.2%	36.6%	30.3%	37.0%
	Yes, it is a threat	25.6%	35.8%	31.3%	35.1%
Ocean acidification	Not familiar / not sure	21.7%	26.9%	20.0%	26.4%
	Not a threat	4.8%	1.8%	5.4%	2.1%
	Yes, it is a threat	73.5%	71.2%	74.6%	71.5%
Soil runoff into the ocean from fires and off-roading	Not familiar / not sure	19.9%	23.6%	15.9%	23.0%
	Not a threat	6.5%	5.7%	10.9%	6.0%
	Yes, it is a threat	73.6%	70.7%	73.3%	71.0%
Military activities (live fire training)	Not familiar / not sure	13.5%	21.0%	28.2%	21.1%
	Not a threat	9.6%	8.1%	3.4%	7.9%
	Yes, it is a threat	76.9%	70.9%	68.3%	71.0%

Table C12. Threat impact perception by stratum.

Threat	Threat level	Rota	Saipan	Tinian	Total
Climate change	Minor	5.3%	6.2%	3.6%	6.0%
	Moderate	26.3%	13.4%	15.9%	14.1%
	Major	33.3%	34.8%	29.8%	34.5%
	Severe	24.4%	35.2%	47.9%	35.4%
	Not sure	10.8%	10.3%	2.8%	10.0%
Coral bleaching	Minor	10.6%	3.8%	5.4%	4.1%
	Moderate	3.9%	9.6%	4.2%	9.1%
	Major	49.2%	28.9%	24.4%	29.5%
	Severe	32.8%	49.3%	59.4%	49.2%
	Not sure	3.5%	8.4%	6.6%	8.1%
Typhoons	Minor	6.0%	4.2%	6.2%	4.4%
	Moderate	35.3%	24.2%	24.7%	24.7%
	Major	25.2%	39.0%	22.4%	37.4%
	Severe	24.6%	24.3%	43.9%	25.5%
	Not sure	9.0%	8.2%	2.9%	8.0%
Pollution from stormwater, wastewater, and chemical runoff	Minor	3.4%	3.1%	3.3%	3.1%
	Moderate	14.2%	7.4%	12.4%	7.9%
	Major	35.2%	35.7%	31.0%	35.5%
	Severe	43.5%	47.5%	51.7%	47.6%
	Not sure	3.7%	6.2%	1.6%	5.9%
Marine litter	Minor	7.9%	4.2%	2.8%	4.3%
	Moderate	5.4%	9.7%	10.0%	9.5%
	Major	32.2%	33.8%	29.9%	33.5%
	Severe	50.1%	47.1%	56.0%	57.7%
	Not sure	4.5%	5.3%	1.3%	5.0%
Invasive species	Minor	12.2%	5.5%	5.1%	5.8%
	Moderate	17.0%	16.3%	19.8%	16.5%
	Major	32.4%	35.3%	22.7%	34.6%
	Severe	29.3%	33.6%	48.6%	34.2%
	Not sure	9.1%	9.2%	3.8%	9.0%
Overfishing and overgathering	Minor	4.3%	7.5%	6.8%	7.4%
	Moderate	12.8%	12.9%	19.2%	13.2%
	Major	41.5%	36.1%	23.2%	35.7%
	Severe	39.8%	35.4%	46.1%	36.1%
	Not sure	1.5%	8.1%	4.7%	7.6%
Boat anchoring and grounding	Minor	10.4%	9.3%	8.7%	9.3%
	Moderate	22.1%	21.6%	16.9%	21.4%
	Major	30.7%	31.8%	21.7%	31.3%
	Severe	28.9%	31.6%	48.4%	32.4%
	Not sure	7.8%	5.6%	4.2%	5.7%
Divers and snorkelers	Minor	19.6%	17.1%	18.6%	17.2%
	Moderate	32.3%	24.3%	21.9%	24.4%
	Major	15.2%	28.9%	19.7%	28.1%
	Severe	31.7%	22.0%	39.8%	23.0%
	Not sure	1.2%	7.7%	0.0%	7.2%
Ocean acidification	Minor	7.2%	4.0%	5.0%	4.2%
	Moderate	7.8%	10.3%	5.3%	9.9%
	Major	33.6%	31.1%	33.5%	31.3%
	Severe	45.9%	45.6%	53.8%	46.1%
	Not sure	5.6%	8.9%	2.4%	8.5%
Soil runoff into the ocean from fires and off-roading	Minor	12.9%	3.7%	8.9%	4.3%
	Moderate	8.3%	12.0%	13.4%	11.9%
	Major	39.2%	34.4%	30.5%	34.4%

	Severe	37.0%	43.3%	46.0%	43.2%
	Not sure	2.6%	6.7%	1.2%	6.2%
Military activities (live fire training)	Minor	2.9%	3.5%	3.2%	3.5%
	Moderate	5.5%	10.3%	14.4%	10.3%
	Major	41.2%	32.9%	29.7%	33.2%
	Severe	43.0%	44.6%	39.3%	44.3%
	Not sure	7.4%	8.6%	13.4%	8.8%

Table C13. Familiarity with marine protected areas by stratum.

Familiarity	Rota	Saipan	Tinian	Total
No	14.3%	30.8%	45.2%	30.7%
Yes	85.7%	69.2%	54.8%	69.3%

Table C14. Perceived impacts of marine protected areas by stratum.

Note: Answered only by those who answered “yes” in Table C13 (they are familiar with MPAs).

Statement	Change in condition	Rota	Saipan	Tinian	Total
Protection of coral reefs	Worsened greatly	0.0%	0.1%	0.0%	0.1%
	Worsened somewhat	6.0%	1.0%	1.9%	1.3%
	No change	10.9%	9.1%	0.0%	8.9%
	Improved somewhat	26.5%	43.4%	32.1%	42.1%
	Improved greatly	36.7%	28.0%	56.0%	29.4%
	Not sure	19.8%	18.4%	10.0%	18.2%
Amount of fish	Worsened greatly	0.8%	0.1%	0.0%	0.1%
	Worsened somewhat	5.4%	2.0%	0.8%	2.2%
	No change	10.8%	13.5%	8.3%	13.1%
	Improved somewhat	24.6%	37.3%	21.6%	36.0%
	Improved greatly	34.4%	26.8%	59.4%	28.4%
	Not sure	24.0%	20.3%	9.9%	20.1%
Tourism-based industry	Worsened greatly	5.9%	0.6%	0.0%	0.9%
	Worsened somewhat	6.7%	2.0%	4.2%	2.3%
	No change	26.0%	18.1%	12.0%	18.4%
	Improved somewhat	11.1%	39.5%	19.7%	37.2%
	Improved greatly	23.1%	20.9%	54.7%	22.2%
	Not sure	27.2%	18.9%	9.4%	19.0%
Fishery-based industry	Worsened greatly	5.3%	1.3%	0.0%	1.5%
	Worsened somewhat	5.0%	2.5%	4.8%	2.7%
	No change	24.8%	15.5%	8.1%	15.8%
	Improved somewhat	15.5%	37.0%	18.0%	35.1%
	Improved greatly	20.3%	20.7%	51.4%	21.7%
	Not sure	29.0%	23.0%	17.8%	23.2%
Your livelihood	Worsened greatly	1.7%	1.2%	0.0%	1.2%
	Worsened somewhat	5.5%	1.0%	3.1%	1.3%
	No change	26.2%	30.0%	20.8%	29.5%
	Improved somewhat	20.9%	33.0%	16.9%	31.7%
	Improved greatly	28.4%	21.4%	46.6%	22.7%
	Not sure	17.4%	13.4%	12.6%	13.6%
Outdoor recreation	Worsened greatly	0.0%	0.1%	0.0%	0.1%
	Worsened somewhat	3.8%	0.8%	6.5%	1.2%
	No change	33.0%	21.2%	12.8%	21.5%
	Improved somewhat	16.0%	37.8%	22.0%	36.0%
	Improved greatly	22.7%	22.5%	48.2%	23.5%
	Not sure	24.5%	17.6%	10.5%	17.7%
Food for coastal communities	Worsened greatly	1.2%	1.6%	0.0%	1.6%
	Worsened somewhat	6.7%	1.6%	0.8%	1.8%
	No change	23.2%	18.6%	10.9%	18.6%
	Improved somewhat	15.4%	36.5%	22.7%	34.9%
	Improved greatly	25.3%	21.7%	47.3%	22.8%
	Not sure	28.3%	20.0%	18.3%	20.4%
Size of fish	Worsened greatly	0.8%	0.1%	0.0%	0.2%
	Worsened somewhat	3.3%	3.8%	0.0%	3.6%
	No change	14.6%	12.8%	1.8%	12.5%
	Improved somewhat	24.3%	38.2%	23.9%	36.8%
	Improved greatly	32.1%	25.7%	60.9%	27.4%
	Not sure	24.9%	19.4%	13.4%	19.5%

Table C15. Support for coral reef management strategies by stratum.

Strategy	Support	Rota	Saipan	Tinian	Total
Establish new catch limits per person for certain fish species	Strongly oppose	5.3%	4.2%	0.9%	4.0%
	Somewhat oppose	1.2%	5.3%	1.8%	5.0%
	Neutral	22.8%	25.0%	29.7%	25.1%
	Somewhat support	20.4%	24.2%	27.0%	24.2%
	Strongly support	50.2%	41.3%	40.6%	41.6%
Create new MPAs or natural reserves	Strongly oppose	3.2%	5.0%	0.7%	4.8%
	Somewhat oppose	0.8%	2.0%	1.0%	1.9%
	Neutral	21.0%	27.4%	21.9%	26.8%
	Somewhat support	19.7%	22.7%	18.8%	22.4%
	Strongly support	55.3%	42.9%	57.6%	44.1%
Establish new requirements for improved wastewater treatment	Strongly oppose	2.7%	3.8%	0.7%	3.6%
	Somewhat oppose	0.0%	1.1%	0.0%	1.0%
	Neutral	11.8%	13.3%	10.0%	13.1%
	Somewhat support	13.2%	21.2%	21.3%	20.8%
	Strongly support	72.4%	60.6%	68.0%	64.5%
Encourage community participation in the management of marine resources	Strongly oppose	0.6%	1.4%	0.0%	1.3%
	Somewhat oppose	1.3%	0.8%	0.0%	0.8%
	Neutral	13.7%	14.4%	13.6%	14.3%
	Somewhat support	10.0%	24.1%	11.6%	22.9%
	Strongly support	74.5%	59.3%	74.8%	60.7%
Increase restrictions on coastal construction practices to prevent soil and stormwater runoff	Strongly oppose	1.3%	2.2%	0.2%	2.1%
	Somewhat oppose	2.5%	1.0%	0.0%	1.0%
	Neutral	15.5%	17.2%	13.7%	17.0%
	Somewhat support	15.8%	21.8%	19.5%	21.5%
	Strongly support	64.8%	57.7%	66.6%	58.4%
Establish limits on the number of tourism operators able to conduct business within locally managed MPAs	Strongly oppose	4.0%	4.1%	0.9%	4.0%
	Somewhat oppose	1.6%	3.8%	6.7%	3.8%
	Neutral	23.9%	26.9%	27.3%	26.8%
	Somewhat support	20.0%	25.7%	21.8%	25.3%
	Strongly support	50.5%	39.5%	43.2%	40.1%
Impose a small fee ($1–$5) for tourists visiting a locally managed MPA to fund conservation	Strongly oppose	2.2%	2.2%	1.3%	2.3%
	Somewhat oppose	5.0%	5.3%	2.6%	5.0%
	Neutral	20.5%	21.8%	26.1%	22.0%
	Somewhat support	15.7%	20.2%	24.0%	20.2%
	Strongly support	56.6%	50.4%	45.9%	50.5%
Actively restore coral reef habitats	Strongly oppose	0.5%	2.4%	0.0%	2.2%
	Somewhat oppose	2.5%	0.9%	0.0%	0.9%
	Neutral	11.7%	12.9%	8.8%	12.7%
	Somewhat support	7.6%	15.8%	10.8%	15.2%
	Strongly support	77.6%	68.0%	80.4%	69.0%

Table C16. Importance of CNMI residents to engage in activities to protect coral reefs by stratum.

Importance	Rota	Saipan	Tinian	Total
Not at all	0.0%	0.6%	0.0%	0.6%
Slightly	1.3%	0.5%	0.0%	0.5%
Somewhat	8.3%	5.8%	5.0%	5.9%
Moderately	7.5%	15.0%	9.8%	14.4%
Very	82.9%	78.1%	85.2%	76.6%

Table C17. Participation in routine pro-environmental behaviors by stratum.

Behavior	Rota	Saipan	Tinian	Total
Reduce household water use	88.4%	91.6%	85.0%	91.2%
Reduce household electricity use	90.9%	94.0%	90.4%	93.7%
Compost	82.3%	67.7%	53.6%	67.7%
Recycle	78.5%	75.8%	65.9%	75.5%
Use reef-safe forms of sun protection	75.0%	66.5%	51.3%	66.2%
Promote environmentally responsible practices with friends and family	94.2%	92.2%	89.4%	92.2%
Promote environmentally responsible practices with tourists	89.4%	76.2%	82.4%	77.1%
Minimize fuel consumption	87.4%	88.3%	81.7%	87.9%
Use fewer single-use products (plastic bags or cups, Styrofoam, etc.)	83.1%	89.9%	79.3%	89.1%

Table C18. Reasons for not participating in routine pro-environmental behaviors by stratum.

Note: Answered only by those who did not participate in the behavior.

Behavior	Reason	Rota	Saipan	Tinian	Total
Reduce household water use	I don't know how	0.0%	37.2%	13.0%	33.2%
	It is not convenient	7.9%	31.9%	27.2%	30.2%
	It is too expensive	0.0%	8.9%	1.6%	7.8%
	I have not had the opportunity to do so	2.3%	0.2%	32.2%	2.9%
	None of these reasons	89.8%	21.8%	31.8%	25.9%
Reduce household electricity use	I don't know how	0.0%	11.3%	20.1%	11.3%
	It is not convenient	6.2%	24.0%	28.7%	23.3%
	It is too expensive	7.2%	27.1%	10.8%	24.6%
	I have not had the opportunity to do so	3.1%	10.3%	26.0%	11.1%
	None of these reasons	83.5%	27.3%	16.9%	29.7%
Compost	I don't know how	17.4%	18.9%	24.7%	19.2%
	It is not convenient	13.7%	19.0%	19.0%	18.8%
	It is too expensive	16.3%	2.1%	0.6%	2.4%
	I have not had the opportunity to do so	31.7%	33.0%	49.4%	34.0%
	None of these reasons	37.2%	30.8%	15.5%	25.6%
Recycle	I don't know how	7.0%	5.2%	4.8%	5.2%
	It is not convenient	25.3%	36.2%	20.6%	34.8%
	It is too expensive	1.4%	3.0%	5.3%	3.1%
	I have not had the opportunity to do so	27.0%	23.4%	65.8%	26.2%
	None of these reasons	51.0%	38.2%	18.6%	30.7%
Use reef-safe forms of sun protection	I don't know how	4.1%	17.8%	15.8%	17.3%
	It is not convenient	4.5%	10.0%	25.1%	10.8%
	It is too expensive	3.1%	7.1%	9.5%	7.1%
	I have not had the opportunity to do so	32.8%	25.6%	24.0%	25.7%
	None of these reasons	62.2%	43.4%	40.0%	39.1%
Promote environmentally responsible practices with friends and family	I don't know how	0.0%	19.0%	10.3%	17.8%
	It is not convenient	0.0%	20.2%	18.0%	19.4%
	It is too expensive	45.9%	0.0%	8.6%	2.1%
	I have not had the opportunity to do so	76.0%	30.9%	54.0%	33.9%
	None of these reasons	24.0%	33.2%	33.6%	26.8%
Promote environmentally responsible practices with tourists	I don't know how	9.6%	14.4%	22.6%	14.6%
	It is not convenient	24.2%	8.4%	1.4%	8.5%
	It is too expensive	31.1%	0.0%	0.0%	0.7%
	I have not had the opportunity to do so	30.5%	35.2%	68.9%	36.4%
	None of these reasons	28.7%	43.0%	20.6%	48.3%
Minimize fuel consumption	I don't know how	0.0%	9.2%	0.0%	8.0%
	It is not convenient	27.0%	25.7%	28.8%	26.0%
	It is too expensive	20.2%	5.2%	4.7%	5.9%
	I have not had the opportunity to do so	22.2%	13.8%	0.0%	13.2%
	None of these reasons	50.8%	55.7%	66.6%	46.9%
Use fewer single-use products (plastic bags or cups, Styrofoam, etc.)	I don't know how	13.7%	7.2%	4.4%	7.3%
	It is not convenient	53.8%	46.8%	59.7%	48.4%
	It is too expensive	0.0%	5.7%	1.2%	4.9%
	I have not had the opportunity to do so	4.0%	15.0%	23.1%	15.1%

	None of these reasons	28.5%	25.3%	16.9%	24.3%

Table C19. Participation in annual pro-environmental behaviors by stratum.

Behavior	Rota	Saipan	Tinian	Total
Donate to an environmental cause	34.2%	30.4%	21.7%	30.2%
Volunteered in a beach clean-up, citizen science effort, or other environmental effort	64.1%	50.8%	57.6%	51.7%
Joined or renewed a membership in a conservation organization	16.9%	13.3%	14.5%	13.5%
Participated in active coral reef restoration activities	18.6%	13.8%	11.8%	13.9%

Table C20. Reasons for not participating in annual pro-environmental behaviors by stratum.

Note: Answered only by those who did not participate in the behavior.

Behavior	Reason	Rota	Saipan	Tinian	Total
Donated to an environmental cause	I don't know how	10.5%	14.6%	19.2%	14.7%
	It is not convenient	3.4%	4.9%	6.8%	5.0%
	It is too expensive	0.4%	3.3%	1.4%	3.1%
	I have not had the opportunity to do so	47.0%	39.1%	54.7%	40.2%
	None of these reasons	41.6%	44.4%	23.3%	37.0%
Volunteered in a beach clean-up, citizen science effort, or other environmental effort	I don't know how	9.8%	7.1%	14.4%	7.5%
	It is not convenient	16.1%	4.2%	11.0%	4.9%
	It is too expensive	0.0%	0.4%	0.0%	0.4%
	I have not had the opportunity to do so	29.1%	48.8%	51.7%	48.3%
	None of these reasons	56.2%	45.0%	30.9%	48.9%
Joined or renewed a membership in a conservation organization	I don't know how	11.6%	14.9%	19.3%	14.9%
	It is not convenient	2.8%	5.1%	8.5%	5.1%
	It is too expensive	0.0%	2.3%	0.0%	2.1%
	I have not had the opportunity to do so	42.3%	40.9%	55.3%	41.6%
	None of these reasons	44.6%	43.0%	27.8%	36.3%
Participated in active coral reef restoration activities	I don't know how	8.8%	17.1%	19.9%	16.9%
	It is not convenient	2.4%	3.6%	6.8%	3.7%
	It is too expensive	0.0%	0.1%	1.0%	0.2%
	I have not had the opportunity to do so	44.2%	42.1%	54.6%	42.8%
	None of these reasons	45.8%	42.1%	24.3%	36.4%

Table C21. Participation in long-term pro-environmental behaviors by stratum.

Behavior	Rota	Saipan	Tinian	Total
Upgraded the septic or sewer system on my property	27.7%	29.5%	18.9%	28.9%
Performed maintenance on the septic or sewer system on my property	26.4%	38.9%	28.4%	37.9%
Installed a water storage system (such as a tank or rain barrel)	21.9%	47.5%	32.2%	45.8%

Table C22. Reasons for not participating in long-term pro-environmental behaviors by stratum.

Note: Answered only by those who did not participate in the behavior.

Behavior	Reason	Rota	Saipan	Tinian	Total
Upgraded the septic or sewer system on my property	I don't know how	7.9%	12.9%	15.1%	12.7%
	It is not convenient	3.8%	3.3%	8.1%	3.6%
	It is too expensive	20.0%	11.5%	12.7%	11.9%
	I have not had the opportunity to do so	18.1%	17.6%	13.6%	17.5%
	I am not allowed to	10.2%	13.8%	12.2%	13.6%
	None of these reasons	49.3%	47.5%	43.8%	40.7%
Performed maintenance on the septic or sewer system on my property	I don't know how	11.1%	13.3%	10.0%	13.0%
	It is not convenient	2.1%	3.0%	7.6%	3.2%
	It is too expensive	11.3%	10.0%	9.3%	10.0%
	I have not had the opportunity to do so	13.9%	14.6%	8.2%	14.2%
	I am not allowed to	14.3%	15.0%	17.4%	15.1%
	None of these reasons	51.8%	49.8%	54.1%	44.5%
Installed a water storage system (such as a tank or rain barrel)	I don't know how	6.7%	10.9%	16.2%	11.0%
	It is not convenient	5.3%	3.9%	14.7%	4.6%
	It is too expensive	10.7%	12.5%	9.8%	12.3%
	I have not had the opportunity to do so	9.5%	9.4%	6.5%	9.2%
	I am not allowed to	7.2%	13.5%	6.4%	12.8%
	None of these reasons	61.2%	54.1%	51.9%	50.1%

Table C23. Perceptions of acceptability of regulations to protect coral reefs by stratum.

Behavior	Perception	Rota	Saipan	Tinian	Total
Operating a boat in a shallow reef area	Very unacceptable	47.6%	40.2%	29.0%	40.0%
	Somewhat unacceptable	8.8%	15.7%	20.4%	15.6%
	Neutral	22.0%	28.6%	35.6%	28.7%
	Somewhat acceptable	17.9%	11.5%	13.7%	11.9%
	Very acceptable	3.6%	3.9%	1.3%	3.8%
Leaving trash on the beach	Very unacceptable	89.9%	86.8%	87.8%	86.9%
	Somewhat unacceptable	3.5%	3.7%	2.9%	3.6%
	Neutral	3.3%	5.3%	6.7%	5.2%
	Somewhat acceptable	0.0%	2.1%	0.0%	1.9%
	Very acceptable	3.2%	2.2%	2.6%	2.3%
Anchoring a boat on coral	Very unacceptable	63.7%	60.2%	63.4%	60.5%
	Somewhat unacceptable	21.0%	13.4%	14.1%	13.8%
	Neutral	13.8%	17.6%	17.4%	17.4%
	Somewhat acceptable	0.0%	6.6%	1.2%	6.1%
	Very acceptable	1.5%	2.2%	3.9%	2.2%
Feeding fish, birds, or marine animals	Very unacceptable	28.1%	26.6%	15.6%	26.1%
	Somewhat unacceptable	20.0%	18.5%	14.9%	18.4%
	Neutral	31.9%	31.3%	31.2%	31.3%
	Somewhat acceptable	10.1%	16.3%	27.1%	16.5%
	Very acceptable	9.8%	7.3%	11.2%	7.6%
Touching corals with my hands or feet (including standing)	Very unacceptable	54.0%	51.0%	53.6%	51.3%
	Somewhat unacceptable	15.9%	17.0%	13.4%	16.8%
	Neutral	17.3%	21.6%	23.4%	21.5%
	Somewhat acceptable	8.5%	7.0%	7.1%	7.1%
	Very acceptable	4.3%	3.4%	2.6%	3.4%
Taking seashells from the reef	Very unacceptable	43.8%	59.1%	44.8%	57.7%
	Somewhat unacceptable	32.5%	16.9%	27.8%	18.1%
	Neutral	18.9%	17.4%	20.2%	17.6%
	Somewhat acceptable	4.9%	5.3%	3.6%	5.2%
	Very acceptable	0.0%	1.4%	3.6%	1.4%
Removing coastal vegetation (mangroves, beach forest, seagrass, etc.)	Very unacceptable	60.9%	60.9%	61.4%	60.9%
	Somewhat unacceptable	20.5%	13.8%	13.4%	14.1%
	Neutral	14.3%	18.6%	15.9%	18.3%
	Somewhat acceptable	3.4%	3.9%	7.1%	4.0%
	Very acceptable	0.8%	2.8%	2.2%	2.7%
Having fires on the beach (campfires, bonfires, fires for cooking, etc.)	Very unacceptable	25.3%	29.5%	29.3%	29.3%
	Somewhat unacceptable	17.7%	15.9%	7.5%	15.6%
	Neutral	40.5%	33.6%	28.8%	33.7%
	Somewhat acceptable	14.0%	16.4%	25.7%	16.8%
	Very acceptable	2.4%	4.6%	8.7%	4.7%

Appendix D: Additional figures of results

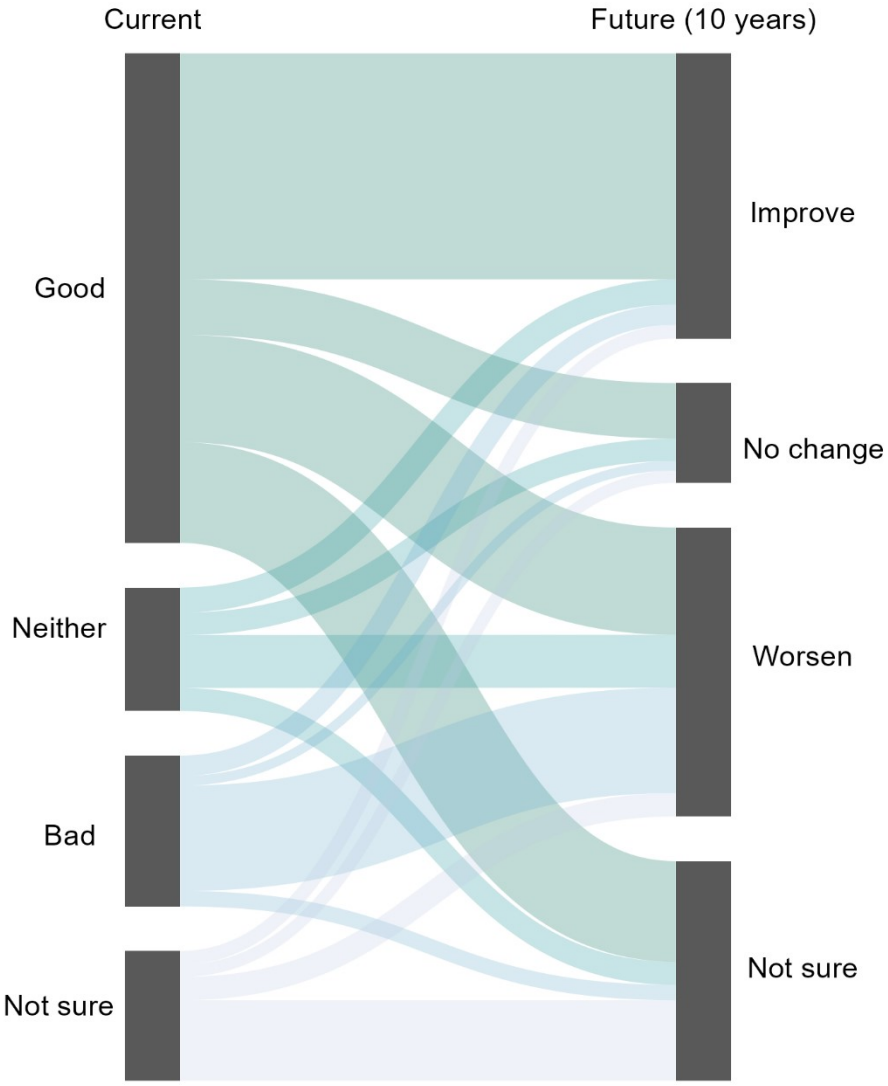

Figure D1. Relationship between current and future perceived amounts of fish in CNMI.

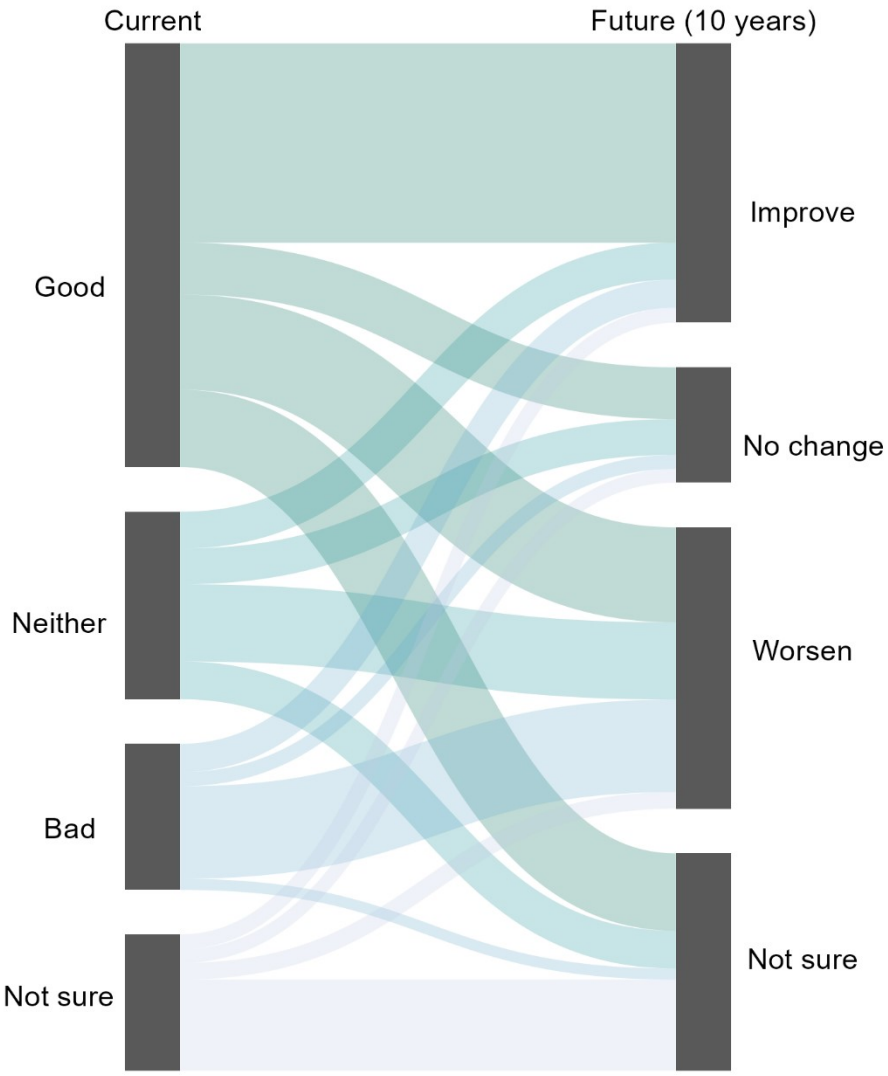

Figure D2. Relationship between current and future perceived size of fish in CNMI.

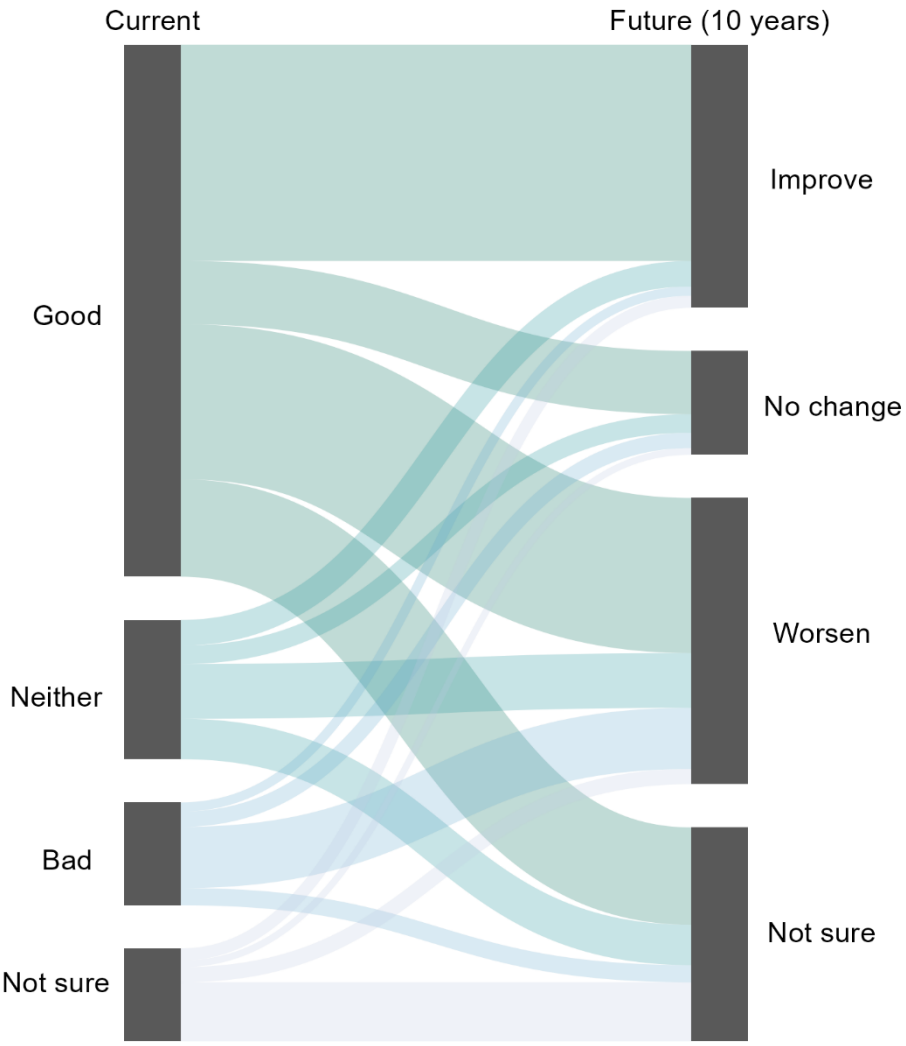

Figure D3. Relationship between current and future perceived ocean water quality in CNMI.

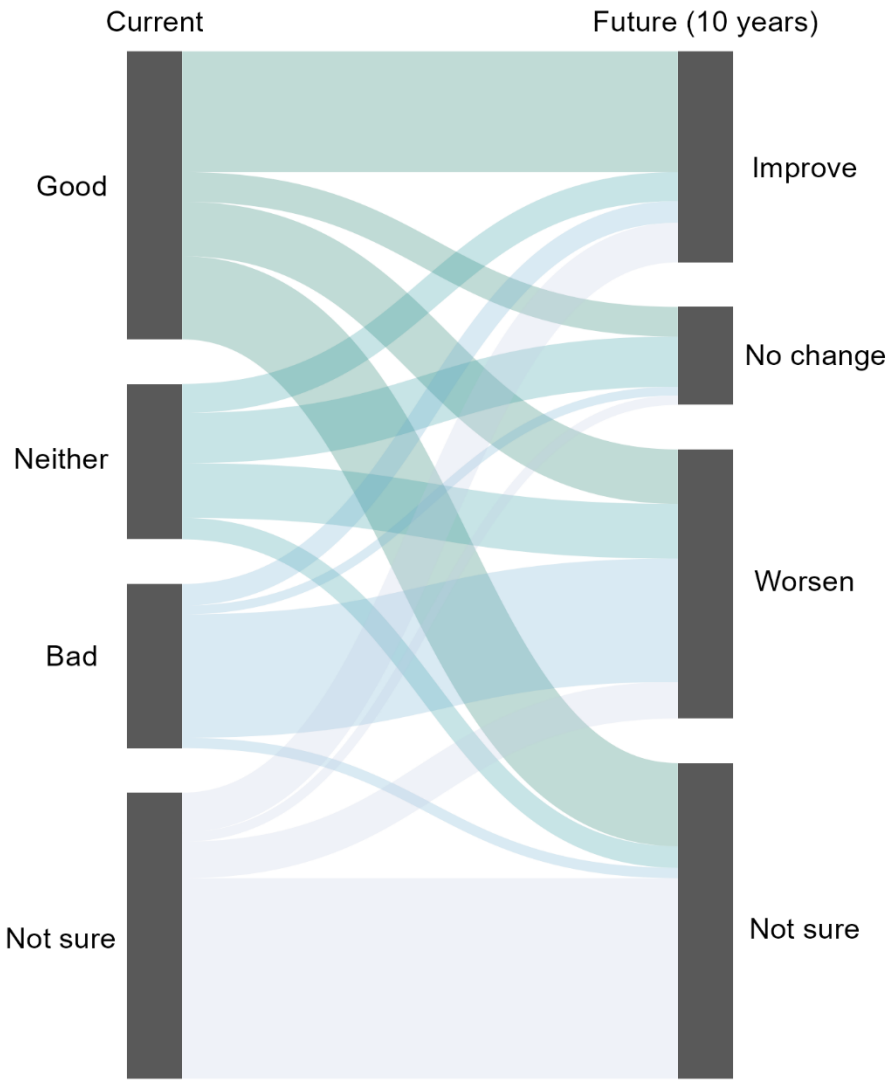

Figure D4. Relationship between current and future perceived amounts of trochus (*aliling*) in CNMI.

Howard Lutnick, Secretary
United States Department of Commerce

Laura Grimm, Chief of Staff and Acting Under Secretary
National Oceanic and Atmospheric Administration

Nicole R. LeBoeuf, Assistant Administrator
National Ocean Service