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## GUAM'S COASTAL FISHERIES MANAGEMENT PLAN 2025

*"We do not inherit the earth from our ancestors; we borrow it  
from our children."  
- Oscar Wilde*



Prepared by the University of Guam  
Center for Island Sustainability  
& Sea Grant



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## EXECUTIVE SUMMARY

The reefs surrounding Guam, though limited in area, support a vibrant fishing community that has sustained the Chamorro people for millennia. Reef fishing is deeply woven into the cultural fabric, serving as a means of sustenance and a reflection of shared values, such as *ina'famaolek*—the practice of cooperation and mutual respect. Traditional fishing methods continue to be passed down through generations, preserving both cultural heritage and ecological knowledge. However, over the past few decades, Guam's reef fish populations have declined by approximately 60%, signaling an urgent need for action. While overfishing remains the primary cause of this decline, other contributing factors include:

- 1) erosion and sedimentation from urban expansion, off-road activities, and wildfires;
- 2) the growth of the tourism industry;
- 3) climate change;
- 4) increased availability of advanced fishing technologies; and
- 5) nutrient pollution.

This concerning trend underscores the need for comprehensive management, which has led to the creation of Guam's Coastal Fisheries Management Plan. In partnership with the fishing community and marine scientists, the Guam Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR) is committed to assessing the health of Guam's fisheries and exploring innovative management solutions. **The overarching goal of this plan is to restore fish populations, enhance reef ecosystems to support long-term sustainable use of marine resources, and secure a sustainable future for Guam's fisheries.** To achieve this, the plan focuses on the following key strategies:

- 1) introducing fishing licenses to distinguish between commercial and non-commercial fishing activities;
- 2) establishing size limits to protect immature fish;
- 3) restricting commercial nighttime spearfishing;
- 4) strengthening enforcement effort; and
- 5) embracing a flexible management approach that allows for adjustments to strategies and measures through time in response to evolving conditions and objectives.

By adopting these strategies, the plan aims to balance the needs of the community with the preservation of Guam's vital marine resources.



## A. INTRODUCTION

### 1. Problem Statement

Guam’s limited reef habitat, spanning approximately 1,200 km<sup>2</sup>, supports thousands of commercial and non-commercial fishers who rely on its rich biodiversity. These reefs host over 150 species of reef fish and 50 species of corals, forming the foundation of an ecosystem that is critical to the island’s food security, economy, and cultural heritage. Fishing within these reef ecosystems not only provides sustenance and livelihoods but also plays a key role in maintaining social ties and perpetuating long-standing cultural traditions. As tourism continues to grow, the economic value of Guam’s coral reef fisheries also increases, contributing substantially to local revenues.

Despite these benefits, Guam’s coral reef ecosystems—and the communities that depend on them—are increasingly at risk. Over the decades, Guam has undergone significant development, driven by western colonization and the expansion of its economy as a small island. This development has introduced numerous environmental stressors that have contributed to the degradation of its fragile reef fisheries. These drivers include:

- 1) erosion, sedimentation, and nutrient enrichment caused by urban development, off-roading, and wildfires;
- 2) the rise of tourism, which places additional pressure on natural resources;
- 3) climate change, with warming seas and more intense storms impacting reef health; and
- 4) fishing pressure, exacerbated by a lack of comprehensive policies and enforcement and the availability of advanced and efficient fishing gear.

Among these threats, overfishing remains the most significant and persistent driver of decline in Guam. Long-term data collected by the Guam Department of Agriculture’s Division of Aquatic and Wildlife Resources (DAWR) through creel surveys since the early 1980s reveal alarming trends. Fisheries-dependent data show a 63% decline in total landings over a 25-year period, alongside a notable decrease in key target species. The composition of catches has shifted as large-bodied species—such as parrotfish, surgeonfish, groupers, and snappers—have dwindled, replaced by smaller species in their respective families. Large, slow-growing species like *tanguison* (Napoleon wrasse) and *atuhong* (bumphead parrotfish), which have longer maturation periods, have become particularly vulnerable to fishing pressure and are now scarce in many areas.

This shift in species composition has affected the broader fishing community, which now expends greater effort to achieve smaller and less profitable harvests compared to historical catch rates. What was once a thriving

fishery dominated by large-bodied species has become a reefscape filled with smaller fish, reducing the overall function and cultural value of the fishery.

Recognizing the urgency of restoring Guam’s fish stocks to support both ecological sustainability and the needs of its diverse communities, DAWR initiated the development of a comprehensive Coastal Fisheries Management Plan in 2021. This plan seeks to address the ongoing challenges and reverse the decline in fish populations through science-based management strategies and through collaborative discussions with the Guam fishing community.

## 2. Policy Context

In response to escalating concerns about the health of its fisheries, Guam's political leadership has strengthened partnerships with natural resource management agencies. In 1997, Public Law No. 24-21 established five marine preserve areas (MPAs) to safeguard vital habitats and reef ecosystems from fishing pressure. These MPAs—Tumon Bay, Piti Bomb Holes, Pati Point, Sasa Bay, and Achang Reef Flat—protect approximately 16% of Guam's nearshore waters. Although fishing regulations differ among these preserves, spearfishing is prohibited across all MPAs. Some MPAs allow seasonal fishing with a permit, while others are designated as no-take zones year-round. A 2012 study by Williams et al. found that Guam’s MPAs support a higher overall abundance of fish compared to non-MPAs lacking fishing regulations.

In March 2020, the passing of Public Law 35-78 marked a significant milestone by banning SCUBA spearfishing—an issue that had sparked contentious debate for over 30 years due to its detrimental impact on viable reef fish populations. SCUBA spearfishing was predominantly employed in the commercial sector, enabling fishers to harvest larger quantities of fish with less effort compared to traditional spearfishing. This practice primarily targeted vulnerable, slow-growing species such as large parrotfish, Napoleon wrasse, and sizable groupers, which have seen a decline over the years.

Despite the establishment of MPAs and the ban on SCUBA spearfishing, there remains an urgent need for more comprehensive management strategies. In 2021, the Guam Department of Agriculture’s Division of Aquatic and Wildlife Resources (DAWR) initiated the fisheries management planning process, bringing together stakeholders including the University of Guam Marine Lab, UOG Center for Island Sustainability & Sea Grant, NOAA Fisheries, and the local fishing community. This collaborative effort aims to:

- Assess the current status of Guam’s most commonly caught species through detailed analyses,
- Develop a sustainable fisheries management program,
- Establish monitoring, surveillance, and enforcement mechanisms, and
- Empower fishers and the broader community to actively participate in fisheries management.

Through these efforts, Guam seeks to enhance its fisheries management framework, ensuring the sustainability of its marine resources for generations to come.

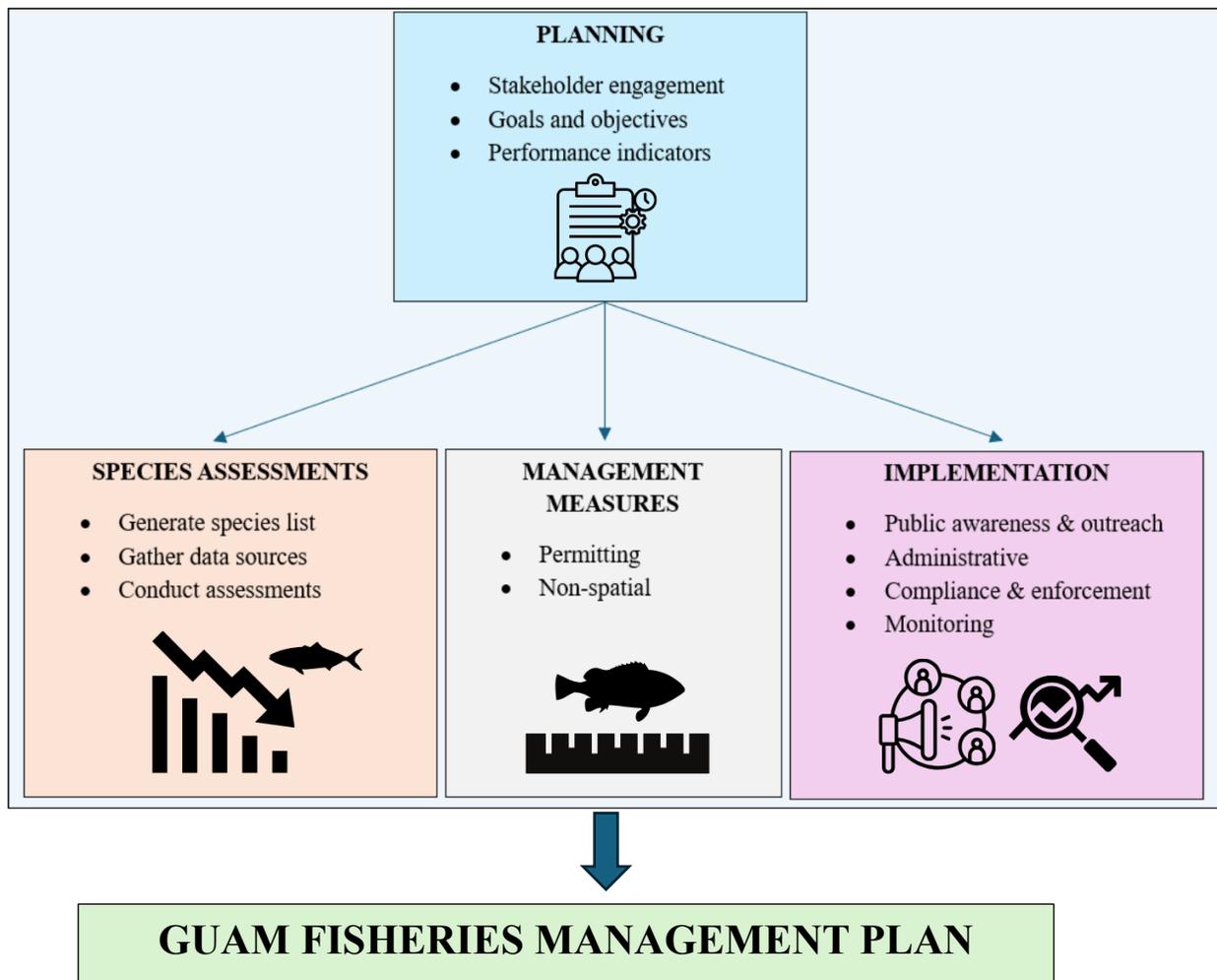
## 3. Fisheries Management Program

The fisheries management program encompasses a comprehensive suite of activities aimed at the planning, implementation, and adaptive management of fisheries resources. Key components of this program include:

- *Setting Clear Objectives*: establishing species management goals tailored to the unique needs and characteristics of Guam’s fisheries.
- *Developing a Fisheries Profile*: conducting thorough assessments of key fish stocks and examining the ecological context to understand the dynamics of the fishery.
- *Identifying Suitable Management Measures*: determining the most effective spatial and/or non-spatial management strategies that align with the established goals and the specific context of each fishery.
- *Implementation of Management Strategies*: building capacity within the community, enhancing awareness of fishery goals and the current status of resources, and creating robust monitoring, surveillance, and enforcement frameworks.
- *Monitoring Progress*: regularly evaluating biological and socioeconomic indicators to assess whether the management goals are being achieved.
- *Adaptive Management*: embracing a flexible management approach that allows for adjustments to strategies and measures in response to evolving conditions and objectives.

Through these elements, Guam’s fisheries management program aims to foster sustainable use of marine resources, ensuring the resilience of its fisheries and the communities that depend on them. The planning approach is summarized below, while the remaining elements of the FMP are described in following chapters.

**Figure 1. ELEMENTS OF THE GUAM FISHERIES MANAGEMENT PROGRAM**





#### 4. Goals and Objectives of the Guam Fisheries Management Plan (FMP)

The goals of the Guam Government, stakeholders, and the fishing community are to:

- 1) rebuild fish populations and improve ecosystem health to support long-term sustainable use of the resources, and
- 2) ensure that the people of Guam have access to the resources they need and benefit directly from long-term stewardship.

The objectives of the management plan are to:

- 1) improve capacity for implementation of management,
- 2) sustain awareness and support from the communities for management,
- 3) ensure inclusive participating by capturing diverse community voices to reflect the full range of perspectives in management decisions;
- 4) provide data to inform adaptive management, and
- 5) provide access for thriving fisheries to support community needs and livelihoods.

This Fisheries Management Plan (FMP) is intended to serve as a living document that provides a framework for the sustainable use and conservation of our fisheries resources. Because fisheries are dynamic and continually influenced by environmental, social, and economic changes, this plan is designed as a living document that will evolve over time. It integrates existing knowledge from both scientific research and the fishing community to present a set of initial policies and strategies. As new information, technologies, and community perspectives emerge, these goals and policies will be revisited and refined to ensure they remain relevant, effective, and responsive to the evolving needs of Guam’s fisheries and the people who depend on them.

It is important to note that while this FMP guides management, it is not in itself a law. Specific measures identified in the plan – such as size limits, species bans, or gear restrictions – may be formally adopted through the regulatory or legislative process, at which point they become legally enforceable. Until then, the plan serves as a roadmap for informed decision-making, adaptive management, and ongoing collaboration among managers, fishers, and the community.

## B. GUAM REEF FISHERIES PROFILE

### 1. Geographic Context of Guam's Reefs

Guam's coastal waters encompass approximately 42 square miles of shallow coral reefs, along with an additional 43 square miles of deeper reefs located at least 3 nautical miles offshore. The southern region of the island features a lagoon ecosystem that extends beyond Cocos Island, providing vital habitat for a variety of marine life.

The windward coast of Guam is characterized by strong winds and high seas for most of the year, making its reefs largely inaccessible. In contrast, the leeward coast boasts the most accessible reefs, with all boat ramps situated here, alongside numerous access points for shore-based fishing. This region includes four main fishing ports and boat ramps: Agana Boat Basin, Agat Marina, Umatac boat ramp, and Merizo Pier. Due to this accessibility, the leeward coast experiences the highest levels of fishing pressure annually.

Several Marine Protected Areas (MPAs) are located along the leeward coast, including Sasa Bay, Piti Bomb Holes, and Tumon Bay. These MPAs benefit from high visibility and community engagement, facilitating easier enforcement of fishing regulations. In contrast, the Pati Point MPA and Achang Bay MPA, located along the northern and southern reefs respectively, face more significant management challenges due to their lower visibility and accessibility. Overall, the geographic features of Guam's reefs play a critical role in shaping both the ecological dynamics of these marine environments and the patterns of fishing activity, influencing the effectiveness of conservation efforts and the sustainability of fish stocks.

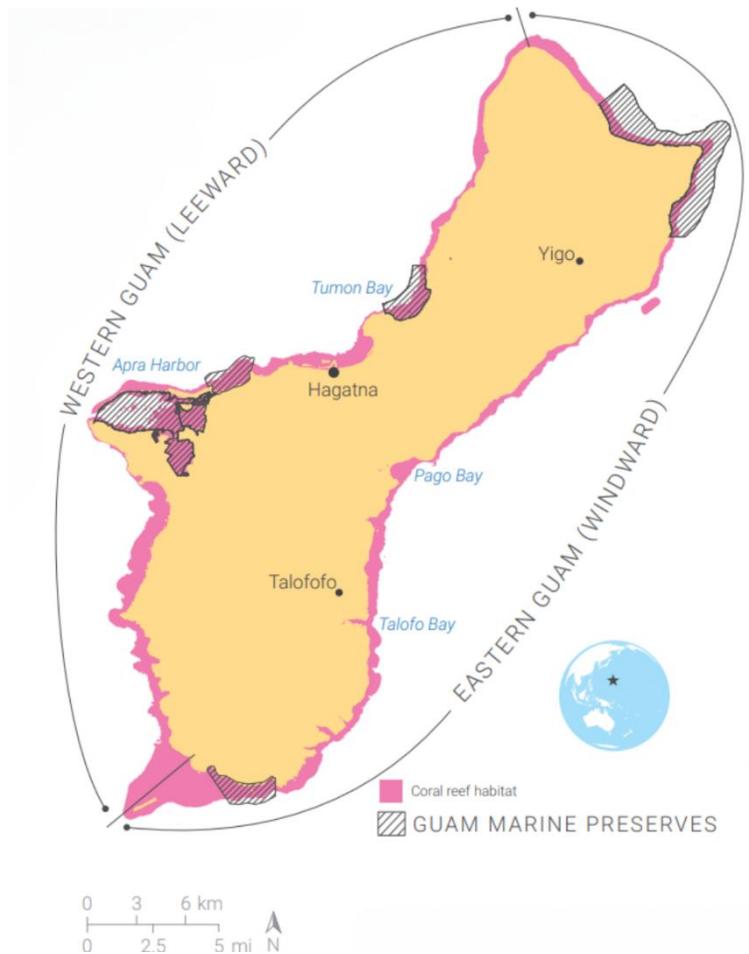


FIGURE 2. Map of Guam, displaying respective reefs and MPAs. Photo by Guam Coral Reef Initiative.

### 2. Guam's Reef Fisheries

Guam's fishing community is a vibrant tapestry of diverse ethnicities and fishing practices, each contributing to the island's rich cultural heritage. Traditional harvesting methods continue to be practiced, including *talaya* (cast net), *tekken* (gill net), and *chenchulu* (surround net). These techniques not only reflect the cultural significance of fishing in Guam but also demonstrate the community's deep understanding of local marine ecosystems. According

to the Guam DAWR, recent participation counts highlight the variety of fishing methods employed by local fishers, showcasing the intricate relationship between traditional fishing practices and sustainable resource management.

Table 1: Guam’s top fishing methods within its reef-associated fisheries, from 2024-2025.

Method	% Contribution
Hook-and-line	69
Spearfishing	13
Talaya (cast net)	11
Tekken (gill net)	5
Other methods	2

While Guam boasts some of the highest fish biodiversity in the Pacific, certain families of food fish are more heavily targeted in reef fisheries. Notable among these are the Acanthuridae (surgeonfishes), Scaridae (parrotfishes), Lutjanidae (snappers), Carangidae (trevallies), and Lethrinidae (emperors). These species are not only vital for local diets but also play crucial roles in maintaining the health and balance of reef ecosystems. A comprehensive, one-year fisheries-dependent data collection effort led by Leilani Sablan Naden provided valuable insights into the top species harvested through various fishing methods within Guam’s reef-associated fisheries from 2021-2022 (Figure 3). This intensive study not only underscored the economic importance of these species to the fishing community but also highlights the need for ongoing monitoring and management to ensure the sustainability of these vital resources (Sablan et al., 2025).

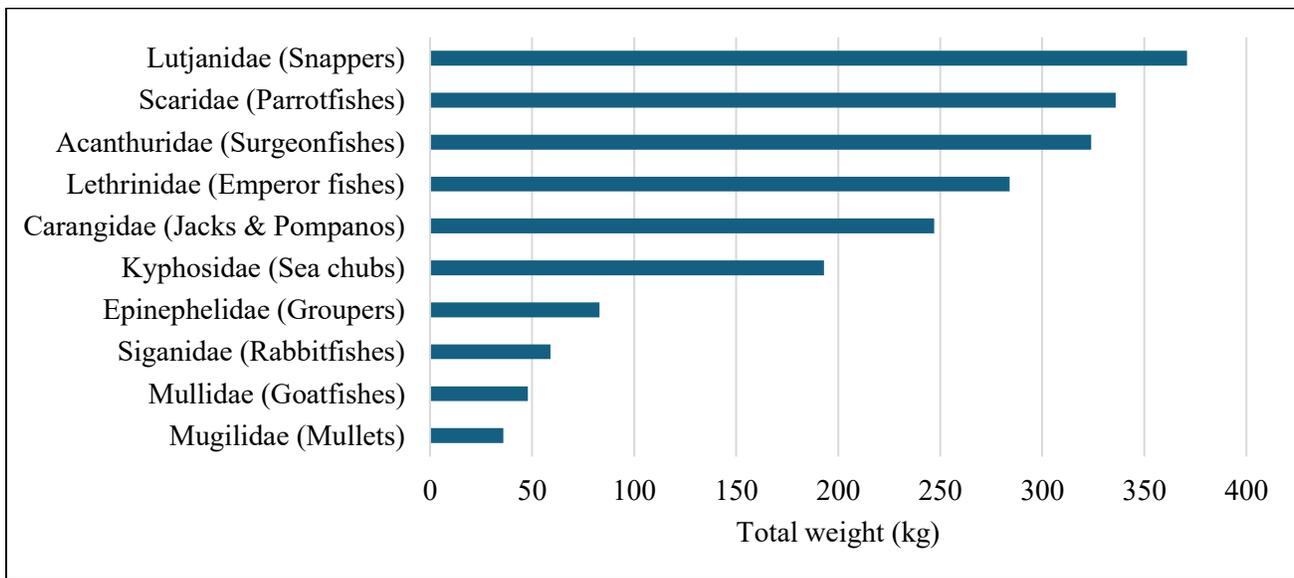


FIGURE 3. Guam’s top ten harvested fish families within reef-associated fisheries.

As Guam’s reef fisheries continue to face challenges such as overfishing and environmental changes, understanding the dynamics of these fisheries and their contribution to both the local culture and economy is

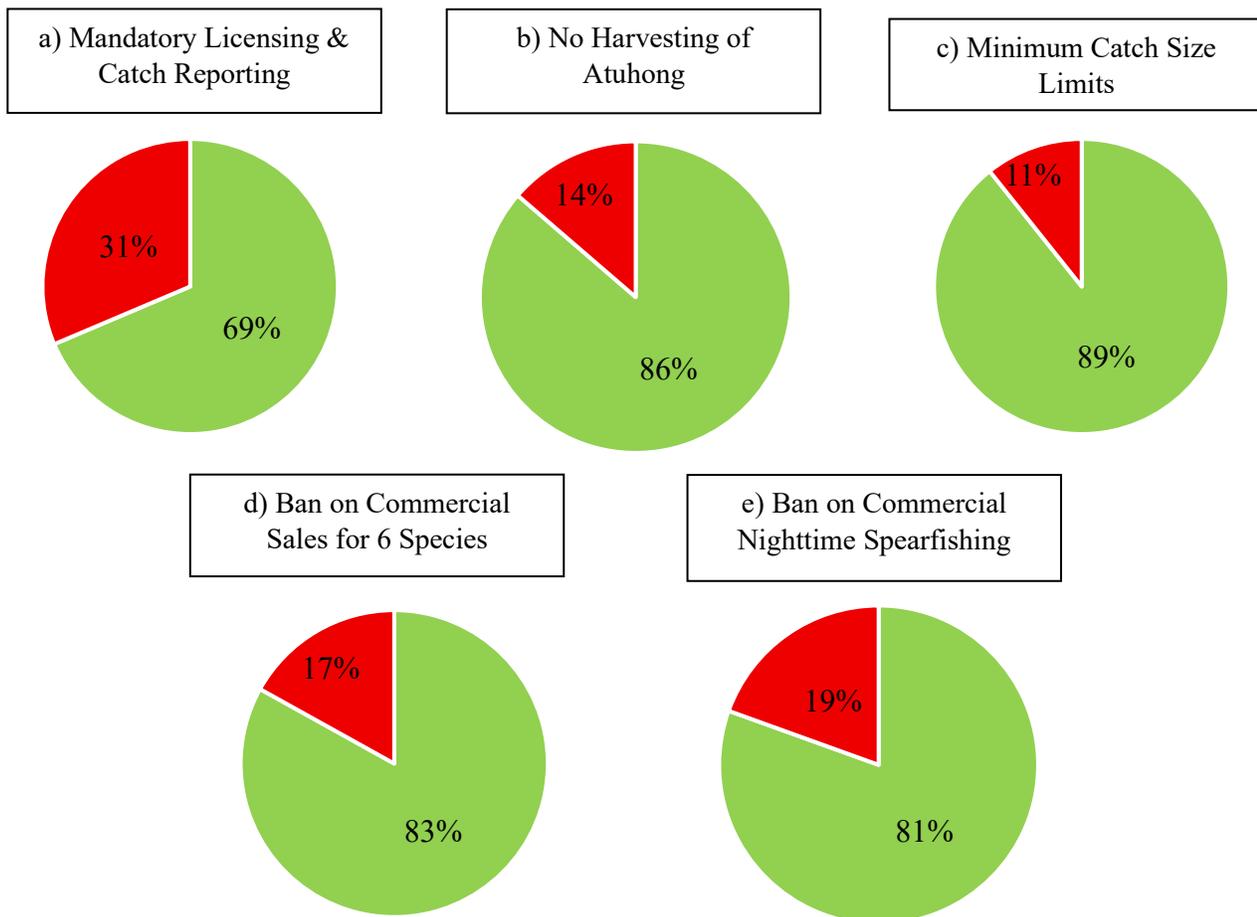
essential. Efforts to promote sustainable practices and integrate traditional knowledge into modern fisheries management will be crucial in preserving Guam’s rich marine heritage for future generations.

### 3. Community Perceptions on Fisheries Management

While science guides this plan, community voices highlight the urgency to act now. Generations of fishers have observed declines in abundance, noting that areas once rich with fish are now struggling to recover. This plan responds to both science and community concerns.

As part of the process, DAWR hosted four townhall meetings attended by over 220 fishers and community members throughout the summer of 2025. Participants shared perspectives on proposed management measures, following a presentation and open comment period. An activity then gathered individual feedback on each measure. These proposals were developed from earlier surveys and townhalls held in 2021.

The following graphs illustrate the support received by those in attendance for proposed measures of the management plan. This feedback guided DAWR’s decisions on what measures would advance as part of the management plan.



Figures 4a-e: Support (green) versus opposition (red) received by townhall attendees for proposed fisheries measures.

## 4. Fisheries Science Context

### *Maximum sustainable yield / Overfishing*

Fishery management aims to maintain fish populations at sustainable levels, thereby minimizing the risk of stock collapse. This approach also prioritizes the preservation of marine ecosystems and seeks to optimize economic benefits from fisheries while recognizing the rights and needs of local fishing communities and stakeholders. Achieving these goals requires regulations that effectively limit or reduce fishing pressure on fish stocks.

The sustainability of any fish stock hinges on its ability to reproduce effectively, which is influenced by the rates of fishing mortality (F) and natural mortality (M). Fishing mortality refers to the percentage of a fish population removed through fishing activities over a specified time frame. It is a vital metric in fisheries management, providing insight into the intensity of fishing pressure faced by a stock. *Maximum sustainable yield* (MSY) is the maximum amount of fish that can be harvested sustainably from a fishery over the long term without depleting the population. This balance is crucial; when fishing occurs at rates above the MSY, it can result in *overfishing*. This situation arises when the removal of individuals from a stock exceeds the population's natural capacity to replenish itself. A stock is deemed *overfished* when its recruitment – the influx of new individuals – is significantly compromised due to excessive fishing pressure. Furthermore, *ecosystem overfishing* is a broader concern that occurs when the removal of one or more key species undermines the ecosystem's ability to sustain essential functions, jeopardizing its overall health. This can lead to disruptions in food webs and habitat structures, with potentially severe consequences for marine biodiversity.

To navigate these complexities, effective fisheries management relies on a deep understanding of these dynamics, promoting sustainable practices that ensure long-term viability of fish stocks and the ecosystems they inhabit. By prioritizing these principles, fisheries management can support the resilience of both marine environments and the communities that depend on them.

Length frequency distributions taken from fishery dependent or independent surveys can provide valuable insight into the status of the fish stock and fishing pressure. A length frequency distribution represents the summation of individual length measurements at every size-category measured. *Spawning potential ratio* (SPR) is a measure of the sustainability of fishing pressure. SPR is defined as the reproductive output of a fished cohort relative to the reproductive output of that same cohort of fish in an unfished state. SPR can be estimated through interpreting the size structure of the stock as well as basic biological information such as the length at reproductive maturity. The size structure of the catch is directly related to the SPR of the stock, assuming the data are non-biased and representative of the entire stock.

### *Life history information and its use in fisheries assessments (written by Dr. Brett Taylor)*

Life-history information refers to the biological characteristics of a species, including growth rates, age at sexual maturity, reproductive output, and lifespan. This information is critical in understanding how species interact with their environment and how they respond to fishing pressure. Local life-history data is especially important for stock assessments and fisheries management because it provides context-specific insights into the biology of harvested species. For example, species in tropical coastal ecosystems often exhibit significant variation in life-history traits depending on the environmental conditions, fishing pressure, and habitat type. The growth rate for *Chlorurus microrhinos* in Guam, for example, may be entirely different from *C. microrhinos* in Palau. Accurate local data helps managers create more tailored strategies that reflect the specific conditions and challenges of the fishery in question, as opposed to relying on generalized data from other regions, which may

lead to ineffective or even harmful management decisions. Having precise, location-specific life-history information is essential for creating sustainable fisheries that can adapt to changing environmental and socioeconomic conditions.

Even for species with existing location-specific collections, concerns about the accuracy of life-history data persist, particularly when long-term harvesting has altered key biological metrics. Metrics such as age at maturity, asymptotic length, and growth coefficients are critical inputs for population models, and fishing pressure can shift these traits. However, tropical ecosystems are highly dynamic, with life-history traits varying across environments and spatial scales. Therefore, a single "true" value for a biological trait is often an oversimplification. What is most important is developing a realistic reflection of species biology that best represents the ecosystem being studied. To achieve this, it is necessary to understand the drivers of biological traits, both analytically and mechanistically, in order to better inform management practices.

### *Mechanisms to Maintain Sustainable Fishing*

To ensure sustainable fishing practices and promote the long-term health of fish populations and ecosystems, a variety of regulatory mechanisms can be implemented. In the Guam Fisheries Management Plan, several key approaches are adopted to maintain sustainability:

- **Minimum size limits:** These limits establish the smallest legal size at which fish can be harvested, ensuring that individuals have the opportunity to mature and spawn at least once before being subject to fishing pressure. Size limits are often based on biological data, such as growth rates and reproductive maturity. In some cases, they are set to maintain a predetermined level of spawning potential, referred to as Spawning Potential Ratio (SPR), which measures the proportion of reproductive capacity remaining in the population relative to its unfished state.
- **Species bans:** A species ban is a complete fishing restriction for a particular species. Such bans are implemented when there is reason to believe that the stock is overfished and requires considerable rebuilding before it is capable of providing surplus production to a fishery without compromising the sustainability of the stock.
- **Gear-based regulations:** These regulations control the types of fishing gear that can be used. Limiting or banning certain gear types reduces habitat destruction, bycatch (the unintentional capture of non-target species), and the overharvesting of vulnerable species. For example, prohibiting destructive gear like large gill nets, or banning SCUBA-assisted spearfishing, helps protect large-bodied, slow-growing species that are easily targeted by advanced fishing methods. Regulating gear types also encourages more selective fishing practices, which can minimize damage to the ecosystem while maximizing the sustainable yield of target species.

These mechanisms work together to maintain sustainable fishing by balancing the needs of fishers with the imperative to conserve marine resources for future generations. Each approach is adapted to fit the unique ecological and cultural context of Guam, ensuring that fisheries management is responsive to both environmental challenges and community needs.

### *Fishery Management Reference Points and Harvest Control Rules*

Effective fishery management requires regular evaluation of information and periodic adjustments to ensure that management targets and objectives – whether social, economic, or biological – are being achieved. A structured and logical way to make such adjustments is through the use of **harvest control rules**. These rules provide an objective decision-making framework that guides management actions. They do so by interpreting the status of measurable indicators, such as stock size or fishing pressure, relative to established reference points. Based on

this comparison, adjustments are made to management measures in response to how the indicator aligns with, exceeds, or falls short of the reference point (Figure 5).

The indicators crucial for effective fisheries management are outlined in Table 2. These indicators may include estimates, spawning potential ratio (SPR) metrics, catch rates, total landings, and others. Based on these indicators, management measures may be adjusted to sustain fish populations. Possible adjustments could include modifying size limits, extending or reducing species-specific bans, altering seasonal closure periods, adjusting the number of permits issued, or capping the total allowable catch for individual fishers or the entire fishery. The selection of the appropriate management measure and the extent of the adjustment will depend on several factors, such as the biology of the target species, the likelihood of compliance, the social and political acceptability of the action, enforcement capacity, and data availability.

To ensure effective implementation and higher compliance, it is essential for stakeholders and managers to agree on harvest control rules before any new management decisions are needed. This collaborative approach promotes consistency, transparency, and objective responses to changing fishery conditions, fostering better long-term outcomes for both the fish populations and the communities that rely on them.

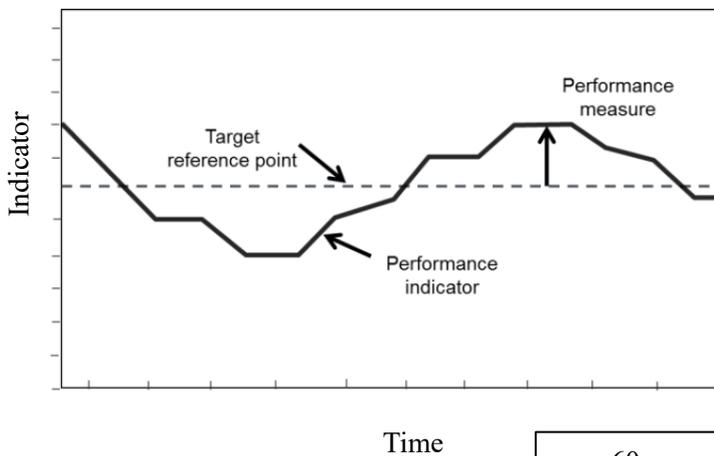


Figure 5: The relationship between an indicator and its reference point, known as a performance measure, informs management adjustments. This decision-making framework is called a harvest control rule.

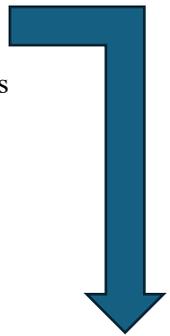
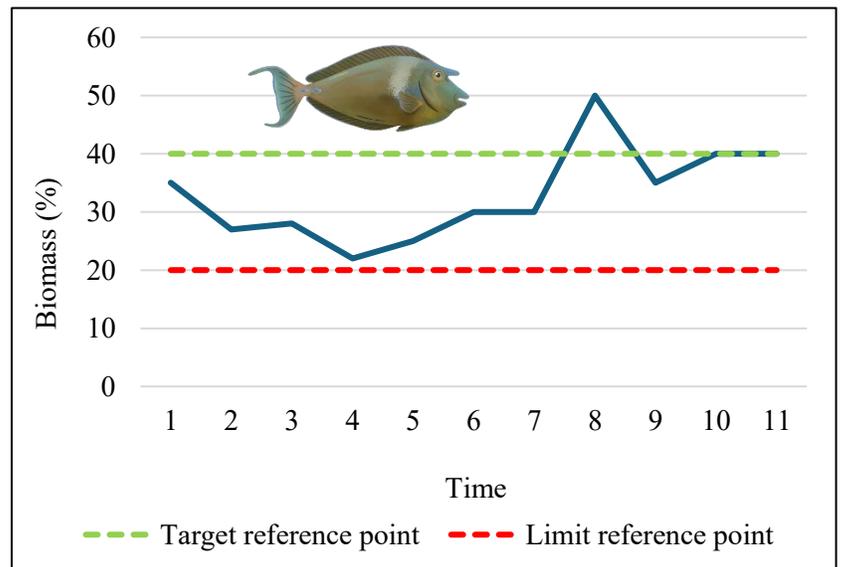


Figure 6: An example graph illustrating a harvest control rule for *Naso unicornis* (tataga') based on fished biomass over time. The graph shows how biomass fluctuates around the target reference (green) and limit reference (red) and reflects adjustments in management based on those fluctuations.



Types of Indicators	Reference Points
Spawning potential ratio (SPR)	SPR 20%, SPR 30%
% of catch > size of maturity	100%
Total landings	Historical average, predetermined amount
Catch per unit effort (CPUE)	Fraction of historical maximum; Average over a selected period of time
Transect density/abundance estimates	Baseline averages; Baseline minimum or maximums
Types of Management Measures to Adjust	
<ul style="list-style-type: none"> <li>✓ Size limits</li> <li>✓ Species bans</li> <li>✓ Prohibition of commercial nighttime spearfishing</li> <li>✓ Licensing measures</li> </ul>	

Table 2. Types of indicators and management measures that could be considered for a harvest control rule.

## 5. Existing Monitoring Data

### *Fisheries-dependent datasets*

Since the 1980s, Guam's Department of Agriculture (DoAg) Division of Aquatic and Wildlife Resources (DAWR) has maintained a fisheries-dependent monitoring program, a rarity among small-scale coastal fisheries. This program monitors both commercial and recreational fishers through a creel survey approach. Interviews are conducted by intercepting fishers during both shore-based and boat-based trips. Surveys are scheduled regularly, covering weekdays, weekends, and evening shifts, and are conducted eight days per month. During each survey, fish fork-lengths are measured, and fishers are asked standardized questions about their fishing locations, methods, and other relevant details. The species-specific data collected are entered into a standardized database, which can be requested from Guam DoAg DAWR. Despite the program's temporal consistency, interception rates remain low, resulting in relatively small sample sizes each year.

In addition to its creel surveys, Guam DoAg DAWR conducted five bottom-fishing trips to three remote banks in the fall of 1998 and spring of 1999: Galvez Bank, White Tuna Bank, and Bank A. Each bank, differing in distance from Guam, was visited for 3 to 5 days per trip. The surveys aimed to assess bottom-fishing resources at these remote locations, where distance from Guam was seen as a proxy for accessibility and fishing pressure. Standardized fishing was conducted with fishers randomly assigned to different boat positions. All landed fish were measured, and their weights were recorded.

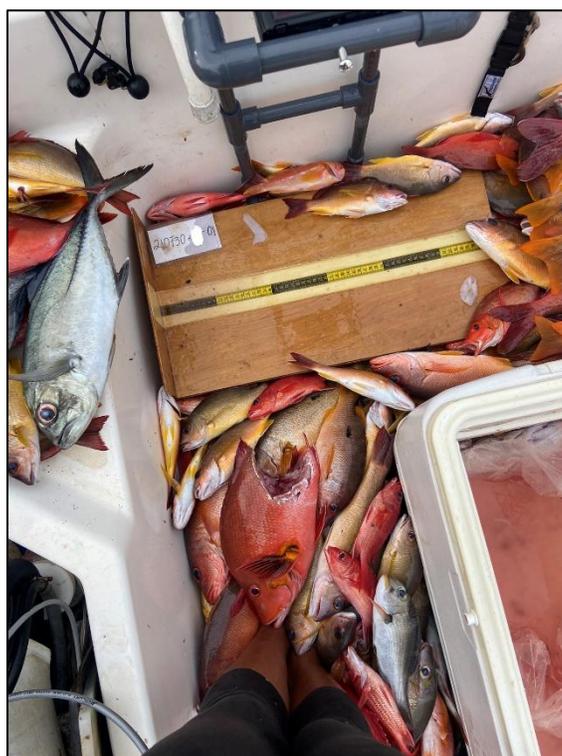


Image 1. A standard fish measuring board utilized in fisheries-dependent survey efforts across Guam and Micronesia.

Over the past decade, fisheries-dependent data have been collected through collaborative efforts across Micronesia, including Guam, the Commonwealth of the Northern Mariana Islands (Saipan and Tinian), Yap,

Pohnpei, Chuuk, Kosrae, the Republic of Palau, and the Republic of the Marshall Islands (Majuro and Arno atolls). The data sets used in the species assessments in section B6 were derived from standardized, intensive data collection efforts, typically spanning one year or across major fishing seasons in some cases. These efforts provided representative snapshots of nearshore spearfishing, net, and bottom fisheries. Regular visits were made to key fish markets or prominent fishers, where fishers were interviewed, and each landed fish was photographed on a measuring board. Fork lengths were generated from the photographs, and daily or seasonal trends were analyzed by combining length data with interview information to approximate fishing locations. For Guam, comparative data were sourced from Guam DoAg DAWR creel surveys over the past decade, along with size data from a recent University of Guam Marine Lab thesis by Leilani Sablan Naden.

### *Fisheries-independent datasets*

From 2020 to 2022, coral, benthic, and fish assemblage data were collected on reefs adjacent to 26 southern Guam watersheds as part of a ridge-to-reef study. The objective was to explore potential linkages between watersheds, fishing access, and the condition of ecological assemblages, using key metrics of coral, benthic, and fish populations (Houk et al. 2022). Fish assemblage data were specifically used for species assessments conducted for this fisheries management plan. Survey locations were situated at the southern end of each channel associated with watershed discharge. Five 50-meter transects were deployed along the 8–10 m reef slope contour, following protocols from previous studies aimed at ensuring sufficient statistical power for site-level resolution (Houk and Van Woesik 2013, Houk et al. 2015). Food-fish populations were assessed using 12 stationary-point counts (SPC) at ~20 m intervals along each transect. During each SPC, a trained observer identified and recorded the species and size of all food-fish within a 5–6 m radius over a 3-minute period. Food-fish were defined as species from the following families: acanthurids, scarines, labrids, serranids, siganids, carangids, lethrinids, lutjanids, balistids, kyphosids, mullids, holocentrids, and sharks. Fish fork lengths were converted to biomass using coefficients derived from regional fishery-dependent data when available, or from FishBase when not ([www.fishbase.org](http://www.fishbase.org)). Species assessments based on these data included examining spatial trends in both biomass and size structure for target species across MPAs and different geographic regions.

NOAA's Pacific Islands Fisheries Science Center (PIFSC) Ecosystem Sciences Division conducts a national coral reef monitoring program across all U.S.-affiliated Pacific Islands and territories. Sites are selected around each island based on major habitat and depth strata. For Guam, strata included geographic regions (west versus east) and Marine Protected Area (MPA) status. Between 30 and 100 sites were surveyed in each of the three monitoring years (2011, 2014, and 2017), ensuring consistent sampling effort across strata and years. All sites were surveyed using a modified Stationary Point Count (SPC) method, where pairs of divers conducted simultaneous fish counts within adjacent cylindrical plots (15-meter diameter) extending from the substrate to the limit of vertical visibility. Before each SPC began, a 30-meter line was laid across the seafloor to assist divers with maintaining survey boundaries. Each survey had two components: first, a 5-minute species enumeration period where the diver recorded all species observed within their cylinder. Afterward, the tallying phase began, during which the divers systematically counted each species recorded, estimating the number of individuals and measuring their total length (TL) to the nearest centimeter. The divers performed rapid visual sweeps of the area for each species, one group at a time, while remaining at the center of their cylinder as much as possible. If a species was observed during the enumeration period but was not present during the tallying phase, divers recorded their best estimate of size and number from the first encounter, marking it as 'non-instantaneous.' For use in species assessments within the Guam Fisheries Management Plan, biomass and size data were aggregated to the site level, then averaged across the island to produce annual means for each target species. Pairwise testing was used to analyze data across years, treating each year as a discrete factor to account for the high variability and statistical uncertainty observed within MPAs and geographic strata. This approach ensured consistent comparisons, given that site selection was proportional across strata for each survey year.

The Guam long-term coral reef monitoring program complements NOAA's National Coral Reef Monitoring Program (NCRMP), with the primary difference being the survey design, although the protocols remain identical (Burdick 2023). The Guam program also conducted two resilience-based snapshot surveys during the 2015-2017 El Niño Southern Oscillation events. In each time frame, 20 sites were selected around the island at shallow (3 m) and intermediate (8 m) depths. At each site, 3 x 50 m transect lines were laid out, and six replicate SPC (Stationary Point Count) surveys were conducted, focusing exclusively on herbivores and mobile predators. The SPC protocols were similar to those used in the national program. This dataset allowed for comparisons between east and west geographic regions, as well as between Marine Protected Areas (MPAs) and reference (non-MPA) sites, providing valuable insights into MPA efficacy over time. Between 20 and 35 sites were monitored in both MPA and reference locations during each survey year. The monitoring program began in 2010, with current data covering Tumon (five years), Piti (three years), and Achang (two years).

In addition to the aforementioned FI-datasets, stereo-video surveys of Guam reef fishes were completed by the UOG Marine Lab. These surveys represent repeat assessments of reef fish assemblages on the outer reef slopes of Guam during two time periods a decade apart (2011/2012 and 2021) and the most recent surveys conducted in 2024. Currently, only parrotfishes have been annotated for the 2021 survey period, and annotations for all relevant species are still underway for the 2024 surveys. The aim was to examine the effects of fishing pressure, habitat variability, and time on fish composition, size structure, and ecological functions, such as the grazing potential of parrotfishes. Surveys were conducted using diver-operated stereo video at 17 fixed sites around Guam, with timed swims of 24 minutes (2011/12) or 30 minutes (2021, 2024) at two depth ranges (6-10 m and 18-20 m). The area covered per site averaged 1.1 hectares, with distance measured by GPS using a surface buoy. Fish within 8 m ahead and 2.5 m on either side of the camera were identified to species level, color phase (for species like parrotfish and humphead wrasse, where color phase is linked to sex), and measured to the nearest millimeter fork length. These 17 sites span multiple Marine Protected Areas (MPAs) and encompass a range of environmental and anthropogenic factors, such as exposure, benthic substrate, fishing pressure, and adjacent habitats, all incorporated into the dataset. The extensive survey area at each site allows for detailed size structure analysis of common species, with over 15,000 total fish observations. Previous studies have used this dataset to assess changes in parrotfish biomass, species composition, and size structure across gradients of fishing pressure over time, as well as to examine how life-history traits affect species' vulnerability to overexploitation.

Overall, the existing fisheries data for Guam was robust enough to support the species assessments necessary for the Guam Fisheries Management Plan. Data gathered from ongoing monitoring programs—such as DAWR's creel surveys, long-term coral reef monitoring, and stereo-video surveys—provided essential insights into fish population dynamics, species composition, and habitat conditions. These programs are critical for tracking key biological indicators, such as biomass, size structure, and species abundance, which are fundamental for assessing the health of Guam's fisheries. As the Guam Fisheries Management Plan moves forward, data derived from ongoing monitoring programs will continue to play a pivotal role in evaluating the effectiveness of management measures and informing adaptive management strategies. The consistent monitoring of biological indicators will be invaluable for applying harvest control rules, ensuring that the fisheries are sustainably managed in response to changing environmental conditions and fishing pressures. Long-term, these programs will help maintain a balance between sustainable harvests and the conservation of Guam's vital marine resources.

## 6. Current Understanding of Guam's Fish Stocks

Guam's reef fish stocks have experienced significant changes over the past few decades, influenced by a combination of intense fishing pressure, environmental degradation, and shifting ecosystem dynamics. As outlined by Weijerman et al. (2016), Guam's reef fisheries, exploited since the 1960s, have shown widespread signs of depletion. Overfishing has led to a reduction in the biomass of key species, with herbivores and predators—essential for maintaining ecosystem health—among the most affected. Populations of large, slow-growing species have declined, giving way to smaller, faster-growing species as fishers target what remains accessible. This shift has led to reduced ecosystem resilience and a weakened ability to withstand environmental disturbances.

In their 2018 study, Houk et al. expanded on these findings by providing a detailed analysis of the changing dynamics of Guam's fisheries over 25 years of exploitation. The study emphasized that density dependence—the relationship between fish population density and growth rates—has varied significantly across species and fishing zones. Houk et al. observed a "restructuring" of Guam's coral reef fisheries, where fishing pressure has led to a decline in high-trophic-level predators, such as groupers and snappers, and a relative increase in herbivorous species like parrotfish and surgeonfish in certain areas. This restructuring is particularly concerning because the removal of top predators can destabilize the reef food web, resulting in cascading effects on coral reef health. Houk et al. also pointed to

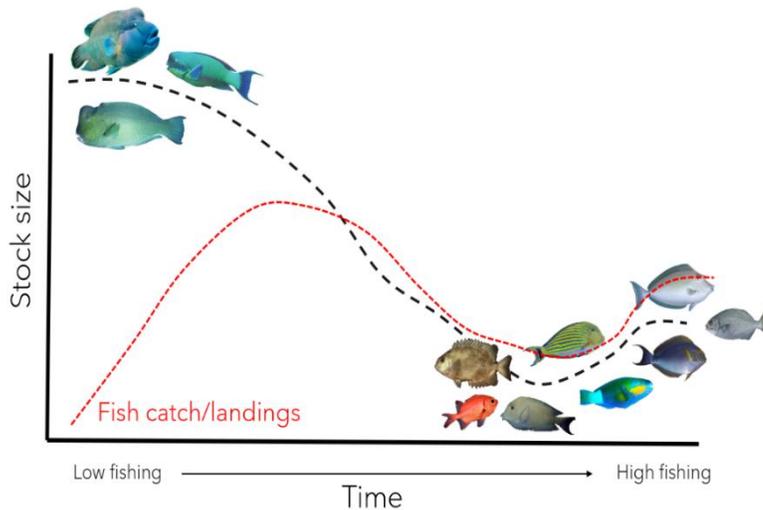


Figure 8. Representation of the catch composition shift over time with increasing fishing pressure. Graph courtesy of P. Houk.

understanding species-specific responses to fishing and habitat pressures in guiding management decisions. They also highlighted the need for more refined, spatially explicit management approaches that consider the heterogeneous nature of fishing impacts across Guam's reefs.

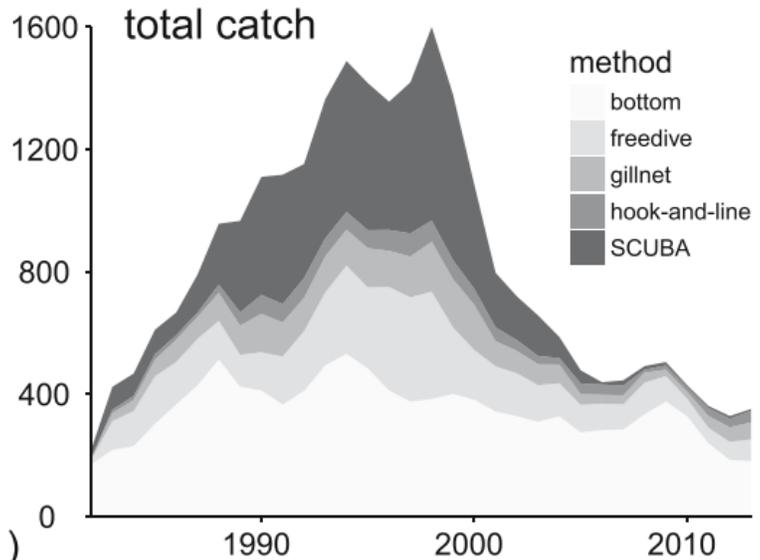


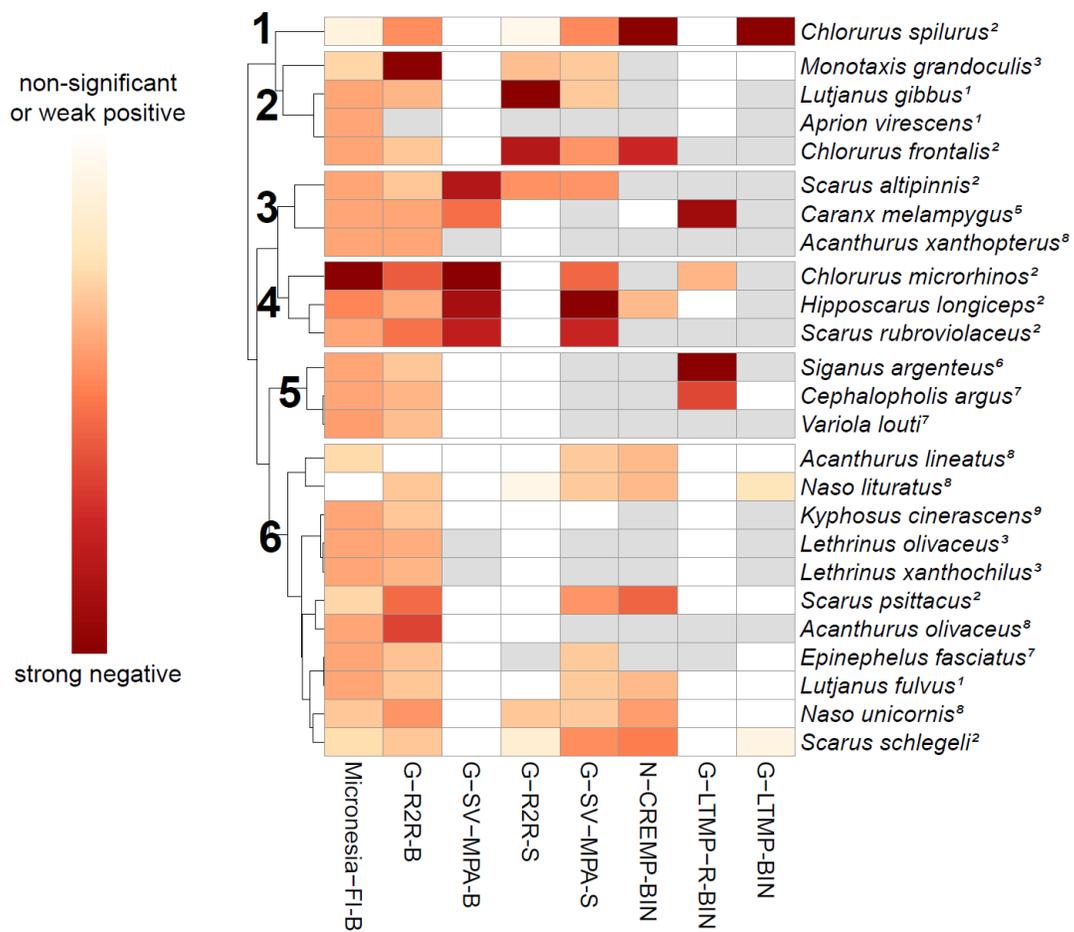
Figure 7. Reported landings from the creel data collection program. (from Houk et al., 2018)

spatial variability in fishing intensity, with some areas, particularly closer to population centers, showing more pronounced depletion than more remote or less accessible zones. Their work indicated that fishing pressure was the primary driver of these changes, though habitat degradation from factors like land-based pollution and coral bleaching events exacerbated the issue.

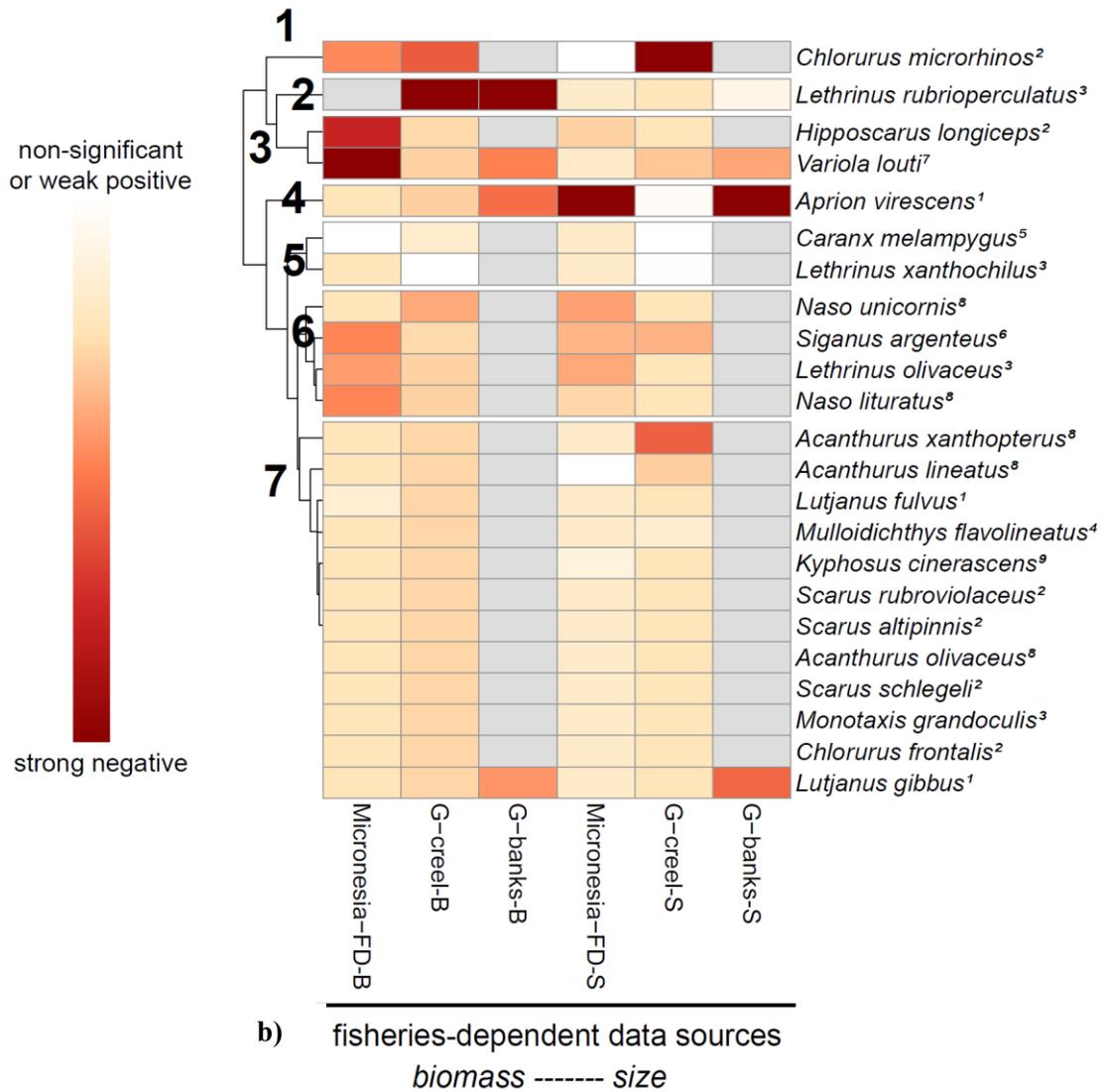
Both Weijerman et al. (2016) and Houk et al. (2018) suggest that while Guam's fish stocks have been compromised, the situation is not irreversible. The establishment of marine protected areas (MPAs), alongside adaptive fisheries management strategies, offers hope for recovery. Houk et al. stressed the importance of

*Population assessments conducted for top species*

In 2023, Dr. Peter Houk and Dr. Brett Taylor of the University of Guam Marine Laboratory published a comprehensive assessment of top species that comprise more than 70% of the landings in Guam, using the monitoring data detailed in section B5. The culmination of nine unique fisheries-dependent and fisheries-independent datasets provided a consensus assessment for each species and revealed how each species may respond to fishing pressure gradients. Houk and Taylor reported declining biomass and/or size trends for most species with sufficient FI or FD data for examinations, comprised of mainly large-bodied species in their respective families (Figures 9a-b). These findings generally agree with studies over the past decade reporting: 1) declines in many target species sizes and biomass on Guam (Taylor et al. 2014, Houk et al. 2018, Taylor et al. 2022), 2) regionally low, often lowest, fish biomass for many species and overall fish biomass on Guam compared to other Pacific islands (Williams et al. 2012, MacNeil et al. 2015, Houk et al. 2021), and 3) significantly lower catch success and observed biomass on Guam’s leeward, more accessible reefs compared to windward, wave-exposed reefs (Houk et al. 2022, Taylor et al. 2022, Sablan et al. 2025).



a) fisheries-independent data sources  
 biomass ----- size ----- binomial



**Figures 9a-b.** Heatmaps visualizing the effect sizes of statistical tests for each species-dataset derived from fisheries-independent data sources (a) and fisheries-dependent sources (b). Target species were clustered into groups based upon the effect sizes describing the strength of their responses to fishing pressure. Data sources on the x-axis were organized from left to right based upon biomass or size examinations within each. Grey colors indicate that insufficient data were available to perform tests. The gradient of white to dark red colors scales with the magnitude of standardized effect sizes. Numbers after species indicate their respective families: <sup>1</sup>snappers (Lutjanidae), <sup>2</sup>parrotfishes (Labridae: Scarinae), <sup>3</sup>emperorfishes (Lethrinidae), <sup>4</sup>goatfish (Mullidae), <sup>5</sup>trevally (Carangidae), <sup>6</sup>rabbitfishes (Siganidae), <sup>7</sup>groupers (Epinephelidae), <sup>8</sup>surgeonfishes (Acanthuridae), and <sup>9</sup>rudderfish (Kyphosidae). Graph taken from Houk and Taylor, 2025.

As fishing pressure increases, the target species that dominate landings can shift, and some species can become “winners” or “losers” based upon their biological capacity to cope with and recover from exploitation (Houk et al. 2021). For example, the results suggested that three of the selected target species have experienced highly significant declines in proportional biomass through time and across spatial fishing gradients: the large-bodied parrotfish *Chlorurus microrhinos*, the large-bodied grouper *Variola louti*, and the large-bodied emperor *Lethrinus rubrioperculatus*. Identifying these sensitive species among multi-species fisheries can be difficult because sensitive populations may be compromised by the time regular monitoring or data collection events begin. This has been previously hypothesized for the largest target species that were selected for assessments but did not

have sufficient data: the bumphead parrotfish (*Bolbometopon muricatum*) and the Napoleon wrasse (*Cheilinus undulatus*). Meanwhile, other desirable species have shown non-significant trends, size-based responses, or both size-and-biomass trends equally. These contracting responses helped to identify management interventions that may be best suited for each target species.

In conclusion, the current understanding of Guam’s fish stock status is one of concern but also cautious optimism. Decades of overexploitation have led to shifts in species composition and ecosystem structure, but with the right management measures, there is potential for recovery. Adaptive, data-driven strategies will be essential.



## C. FISHERIES MANAGEMENT MEASURES

The measures were created through group settings that brought together diverse community voices and expertise, and were designed to be realistic, enforceable, and easy to assess through ongoing data collection and evaluation. Two main types of fishery management measures are being implemented as part of the Guam Fisheries Management Plan:

1. *Licensing and permitting measures*: to provide accurate data on the number of active fishers, encourage compliance with regulations by linking licenses to enforcement, generate small-scale revenue, and foster communication and collaboration between managers and fishers;
2. *Non-spatial management measures*: to include a ban on harvesting certain species, prohibition of certain gear types, a ban on commercial sales for six species, and minimum catch size limits.

### 1. Permitting & Licensing Measures

Effective permitting and licensing measures are crucial tools in fisheries management, allowing for better monitoring, regulation, and sustainable use of marine resources. For Guam’s fisheries, the implementation of a well-structured permitting and licensing system will help address challenges such as resource allocation, overfishing, and equitable access while promoting responsible fishing practices. A permitting scheme, whereby all resource users are required to have the appropriate license for the activities they are undertaking is a proven method of tracking resource use. Limiting the number of approved for some activities, such as commercial fishing, can also be an effective measure to ensure sustainable harvesting levels, if adequately enforced or compliance

ensured through heavy penalties. Permit fees can also be used to generate revenue to cover administrative and enforcement costs.

Fishers may only hold *one* type of fishing license in a given calendar year. Limiting fishers to one type of fishing license per calendar year strengthens enforcement and prevents regulatory loopholes. Without this restriction, individuals could circumvent catch limits, gear restrictions, or reporting requirements by claiming multiple license types (e.g., switching between subsistence, recreational, or commercial activities to avoid compliance obligations). By ensuring that each fisher operates under a single, clearly defined license category, enforcement officers can more effectively monitor fishing activity, verify compliance, and maintain accurate catch and effort data for management purposes. Below, we outline the types of permits and licenses under consideration, their purpose, and how they will contribute to the objectives of the Guam Fisheries Management Plan.

### *Recreational/Subsistence Fishing License*

A person would need to have a recreational/subsistence fishing license in order to fish within Guam's waters for sustenance and artisanal purposes. Subsistence fishing is to provide fish for personal consumption, giving it away to friends and relatives, and meeting cultural obligations. The subsistence license also covers artisanal fishing – the occasional, small-scale sale of fish to family or friends to offset fishing costs. This license would only be available to Guam citizens.

- **Purpose:** To monitor fishing activities conducted for non-commercial purposes, ensuring that subsistence and recreational fishing remain sustainable and do not undermine stock health.
- **Key Features:**
  - Available to Guam residents engaging in non-commercial fishing activities.
  - Individuals holding this license may apply for a permit to engage in nighttime spearfishing for recreational or subsistence purposes.
  - Includes mandatory reporting to DAWR creel surveyors for catches, locations, and fishing effort when intercepted during a scheduled survey.
- **Benefits:**
  - Provides data on subsistence and recreational catch to enhance stock assessments.
  - Provides data on the number of individuals partaking in non-commercial fishing activities.
  - Helps identify fishing hotspots and potential areas of concern for overexploitation
  - Fosters community engagement in sustainable practices
- **Monitoring:**
  - Track the number of licenses issued annually and analyze trends over time.
  - Require basic catch reporting as a license condition (e.g., participation in creel/interview surveys and/or catch-mat data submission online).
  - Conduct periodic field checks to verify license possession and collect compliance data.
- **Enforcement:**
  - Conservation officers and enforcement partners will conduct spot checks at common fishing access points and during patrols.
  - Violations (e.g., fishing without a valid license, falsifying information) will result in citations, fines, or license suspension in accordance with regulations.

- Outreach and education will be prioritized during the initial implementation period to promote compliance and understanding of the new licensing system.

### *Commercial Fishing License*

A person would need to have a commercial fishing license in order to fish within Guam's waters for commercial fishing purposes. Commercial fishing is fishing with the primary purpose of selling the catch. In order to apply for this license, fishers would need to be registered with a business license from the Guam DMV.

- **Purpose:** To manage fishing activities conducted for profit and to ensure compliance with sustainable harvest limits.
- **Key Features:**
  - Required for individuals harvesting fish for sale, whether to markets, restaurants, or other buyers.
  - Includes reporting requirements for species, sizes, and effort per trip.
- **Benefits:**
  - Provides essential data to evaluate the impact of commercial fishing on stocks.
  - Ensures accountability and adherence to management measures.
  - Enables targeted interventions in cases of overharvesting.
- **Monitoring:**
  - Maintain a registry of all licensed commercial fishers and vessels, including license numbers and gear types.
  - Require basic catch reporting as a license condition (e.g., participation in creel/interview surveys and/or catch-mat data submission online).
  - Verify landings and sales through fish market monitoring, dockside sampling, and coordination with buyers and processors.
- **Enforcement:**
  - Conservation officers and authorized agents will conduct port and market inspections, vessel checks, and at-sea patrols to confirm licensing and reporting compliance.
  - Unlicensed commercial activity (e.g., selling fish without a valid commercial license) will result in penalties, fines, or license suspension/revocation.
  - Implement progressive enforcement: initial focus on outreach and education, followed by consistent enforcement once awareness has been established.
  - Partner with markets and cooperatives to ensure that all commercial sellers display proof of a valid license when selling catch.

### *Non-resident/Guest Fishing Permit*

A person would need to have this permit in order to fish within Guam's waters as a guest or non-resident, including guests on fishing charters.

- **Purpose:** To regulate fishing activities conducted by visitors and non-residents, ensuring that these activities align with Guam's sustainable fisheries management goals.
- **Key Features:**
  - Short-term permits designed for tourists or visiting fishers.
  - Permits could specify allowable areas, gear types, and species.
  - Clear instructions on reporting requirements for catches, if applicable.

- **Benefits:**
  - Prevents overharvesting by unregulated visitors.
  - Generates revenue to support management and monitoring efforts.
  - Promotes awareness of Guam’s fisheries regulations among tourists.
- **Monitoring:**
  - Maintain a record of all issued Non-Resident/Guest Fishing Permits, including duration, issuing entity (e.g., charter operator or agency), and associated vessels or fishing gear type.
  - Conduct random dockside, shoreline, and charter inspections to verify that all guests possess valid permits and are aware of Guam’s fishing regulations.
  - Coordinate with tourism and charter companies to ensure that permit information and fishing rules are clearly communicated before trips.
- **Enforcement:**
  - Conservation officers will conduct spot checks at marinas, charter docks, and shoreline access points to ensure guests are properly permitted.
  - Outreach materials (e.g., signage at marinas, online booking platforms, and tourism websites) will be used to increase awareness and voluntary compliance.

### *Commercial Vendor License*

Businesses and individuals would need to have this license in order to sell fish.

- **Purpose:** To provide legal authorization for entities, markets, or businesses engaged in commercial fishing operations.
- **Key Features:**
  - Required for any business operating in the commercial fishing sector.
  - All fishers employed under the Commercial Vendor License must hold a Commercial Fishing License and must be registered at the Guam DMV with a Guam Business License.
  - Tied to compliance with size limits and reporting requirements.
- **Benefits:**
  - Encourages professionalism and accountability in the commercial sector.
  - Facilitates and provides access to data collection.
  - Supports enforcement by distinguishing licensed operators from illegal fishing activities.
- **Monitoring:**
  - Maintain a registry of all licensed commercial vendors, including markets, restaurants, roadside sellers, and individual vendors authorized to sell fish.
  - Require vendors to display their license prominently at their place of business or sales location.
  - Conduct routine market inspections to verify vendor licensing, product source documentation, and adherence to species and size restrictions.
  - Cross-check vendor purchase records against commercial fisher catch reports and import data to improve traceability of seafood products sold within Guam.
- **Enforcement:**
  - Conservation officers and authorized inspectors will perform spot checks at fish markets, roadside stands, and restaurants to confirm valid licenses and lawful species sales.
  - Unlicensed sales of fish or failure to maintain proper documentation will result in penalties, fines, or license suspension/revocation.

**Table 3: Proposed Guam Reef Fisheries Licensing & Fee Schedule**

<b>PERMITTING MANAGEMENT MEASURES</b>					
<b>Proposed Licenses/ Permits</b>	<b>Description</b>	<b>Projected Benefits</b>	<b>Proposed Fee</b>	<b>Measurable Indicators</b>	<b>Review/ Adjustment Process</b>
Recreational/ Subsistence Fishing License	A person must have a Recreational/Subsistence Fishing Permit in order to fish within the waters of Guam for sustenance and recreational purposes.	Enhanced data collection, improved management, fosters stewardship	Free/one-year	Harvest metrics, fishing effort data, compliance rates, revenue generated, stakeholder engagement, permit issuance metrics	Phase in with 6-month grace period; review and adjust in three years
Nighttime Spearfishing Permit	Individuals holding a Recreational/Subsistence Fishing License may apply for this permit.	Preservation of cultural practices, food security support, data collection & management	Free/one-year	Number of permits issued, reported catch data, compliance rate, population trends of target species	Phase in with 6-month grace period; review and adjust in three years
Guest Fishing Permit	Non-residents, visitors, and tourists fishing for food with limit of up to 25 lbs/day/person	Control access, retain local benefits, education and awareness	\$5/day/person	Compliance and enforcement, revenue metrics, permit issuance metrics, educational engagement	Phase in with 6-month grace period; review and adjust in three years
Commercial Fishing Permit	A person must have a CFP in order to fish for commercial fishing, with the primary purpose of selling.	Retain local benefits, ensure equitable allocation of resources, avoid overfishing, increase commercial fishing data	\$100/year/person	Compliance rates, revenue metrics, fishing effort, catch data, stakeholder satisfaction	Phase in with 6-month grace period; review and adjust in three years
Commercial Vendor License	Every business that sells fish – such as commercial fish markets – must have a commercial vendor license.	Equitable allocation of resources, accountability of commercial markets, improved enforcement	Annual fee of \$500	Quantity (weight and species composition) of fish reported through licensed vendors; economic value of seafood sold through licensed vendors (total revenue tracked).	Phase in with 6-month grace period; review and adjust in three years

## 2. Table Summary of Proposed Non-spatial Management Measures

A set of newly proposed non-spatial management measures to regulate harvest is proposed. The summary table is below (Table 4), with species and management measures detailed in the following pages.

Management Measure	Projected Benefits	Measurable Indicators	Review/ Adjustment Process
Ban on all harvesting for <i>Bolbometopon muricatum</i>	<ul style="list-style-type: none"> <li>• Rebuild stocks</li> <li>• Restore ecosystem and fishery benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries-independent surveys measuring density and abundance</li> </ul>	Reevaluation of ban after 10 years
Minimum catch size limit of 12 inches for 8 species	<ul style="list-style-type: none"> <li>• Allow fish to reproduce before harvest</li> <li>• Protect juvenile fish</li> <li>• Increase population resilience</li> <li>• Reduces risk of stock collapse</li> </ul>	<ul style="list-style-type: none"> <li>• Proportion of mature fish in the catch</li> <li>• Spawning potential ratio (SPR)</li> <li>• Catch-per-unit effort</li> <li>• Fisheries-independent surveys measuring size structure of the population</li> </ul>	Reevaluation after 3 years
Minimum catch size limit of 24 inches for <i>Cheilinus undulatus</i>	<ul style="list-style-type: none"> <li>• Allow fish to reproduce before harvest</li> <li>• Protect juvenile fish</li> <li>• Increase population resilience</li> <li>• Reduces risk of stock collapse</li> </ul>	<ul style="list-style-type: none"> <li>• Proportion of mature fish in the catch</li> <li>• Spawning potential ratio (SPR)</li> <li>• Catch-per-unit effort</li> <li>• Fisheries-independent surveys measuring size structure of the population</li> </ul>	Reevaluation after 3 years
Ban on commercial sales for 6 species	<ul style="list-style-type: none"> <li>• Reduces harvest pressure on vulnerable, heavily targeted species</li> <li>• Encourages targeting alternative species that are more resilient or better managed</li> <li>• Prevents dominance of smaller, faster-growing species</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries-independent surveys measuring density, size structure, and abundance</li> <li>• Commercial landings data</li> <li>• Subsistence/recreational catch monitoring</li> </ul>	Reevaluation after 3 years
Commercial ban on nighttime spearfishing activities	<ul style="list-style-type: none"> <li>• Fish populations can rebound</li> <li>• Relief for vulnerable species</li> <li>• More abundant catches for recreational/subsistence fishers</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries-independent surveys measuring abundance and biomass of key target species</li> <li>• Size structure: proportion of larger/older individuals in populations</li> <li>• Species composition: recovery of vulnerable nocturnal/resting species that are heavily targeted at night</li> </ul>	Reevaluation after 3 years

### 3. Details on Proposed Non-spatial Management Measures

The following pages provide details on the proposed non-spatial management measures for critical species, with justification drawn from current stock assessments, local ecological knowledge, and the urgent need to rebuild vulnerable fish populations. These measures focus on regulating harvest through size restrictions, species-specific protections, and limitations on sales and gear use, rather than relying solely on spatial closures. This approach balances the need for conservation with the continuation of cultural practices and community access to marine resources.

Minimum size limits are proposed for nine species, based on size-at-maturity information from Guam-specific life history studies where available, or from regional sources when local data are limited. Establishing these limits ensures that individuals are able to spawn at least once before being harvested, thereby supporting recruitment and long-term population stability.

For one highly vulnerable species, a full ban on harvest is recommended to provide maximum protection and prevent further decline. This prohibition reflects both the ecological significance of the species and the observed depletion in local waters.

In addition, a ban on the commercial sale and import of six culturally and ecologically important species is included to reduce market-driven pressure on local populations. By removing the financial incentive for harvesting and preventing the entry of imported individuals that can mask local declines, these measures support both conservation goals and food security.

Finally, a ban on commercial nighttime spearfishing is proposed, recognizing that this method disproportionately targets large, reproductively important individuals and can quickly deplete populations. Subsistence fishers will still be permitted to practice nighttime spearfishing under a permit system, maintaining traditional practices while limiting the scale and intensity of harvest.

Together, these non-spatial management measures represent a targeted and adaptive framework to safeguard Guam's fisheries. By focusing on species-specific protections grounded in both science and cultural knowledge, the plan seeks to ensure that critical stocks can recover and remain available for future generations.

## BAN ON HARVESTING of *Bolbometopon muricatum*

This measure would prohibit the harvest or possession of *atuhong* (bumphead parrotfish).

- **Population assessment:** The bumphead parrotfish (*atuhong*) is considered endangered. Stock assessments were unable to be conducted for this species due to the lack in data, hinting at the scarcity of *atuhong* in Guam's reefs. The most effective measure would be a ban on the harvesting for this species to avoid population collapse.
- **Long-term goals:** Rebuild its population to levels that support ecological functionality and allow for potential cultural and subsistence uses in the future, while ensuring its long-term sustainability through protective measures and adaptive management.
- **Measurable objectives:**
  - Restore adult *Bolbometopon muricatum* populations in Guam waters by achieving detectable and increasing densities beyond the current baseline of zero adults.
- **Appropriate management measure:** total ban on harvesting and possessing
  - Targets:
    - Detect  $\geq 1$  adult at  $\geq 5\%$  of standardized transect sites within 10 years.
    - Increase juvenile densities relative to current baseline, demonstrating consistent recruitment over rolling 5-year periods.
  - Limits:
    - Failure to detect adults at  $\geq 5\%$  of sites after 10 years.
    - Juvenile density declines  $>20\%$  from current baseline.
    - No measurable improvement in size-class distribution after 15 years.
- **Harvest control rules (HCR):**
  - HCR 1: If monitoring shows that population indicators remain below the limit reference point, the full harvest ban will remain in place to prevent further declines.
  - HCR 2: If monitoring shows that population indicators are approaching the target reference point, the harvest ban will be maintained to support ongoing recovery.
  - HCR 3: If monitoring shows that population indicators have exceeded the target reference point and demonstrate sustained recovery, management options may be re-evaluated to ensure long-term population stability, such as the reopening of limited harvesting.



**MINIMUM CATCH SIZE LIMIT OF 12 INCHES FOR 8 SPECIES**

*Caranx melampygus, Chlorurus frontalis, Chlorurus microrhinos, Hipposcarus longiceps, Monotaxis grandoculis, Naso unicornis, Scarus altipinnis, Scarus rubroviolaceus*

If adopted, this measure would prohibit the harvest or possession of any of the listed species smaller than 12 inches fork length. The only exception would apply to newly recruited bluefin trevally (i'e'), which may be harvested at sizes up to 3 inches fork length.

• **Stock assessments:**

Target species	FD consensus	FI consensus
<i>Caranx melampygus</i>	4	1
<i>Chlorurus frontalis</i>	5	2
<i>Chlorurus microrhinos</i>	1	1
<i>Hipposcarus longiceps</i>	5	3
<i>Monotaxis grandoculis</i>	5	3
<i>Naso unicornis</i>	3	3
<i>Scarus altipinnis</i>	5	1
<i>Scarus rubroviolaceus</i>	5	1

Response	
1	decline in % biomass strongest response
2	decline in size strongest response
3	decline equal in size and % biomass
4	increase in % biomass with mixed size response
5	mainly non-significant trends
6	Insufficient data



- **Long-term goals:** Maintain a healthy age and size structure, protect reproductive capacity, and support ecological balance and subsistence needs.
- **Appropriate management measure:** Minimum size limit
- **Measurable objectives:**
  - Increase the percentage of catch that is greater than its L50 (12 inches).
    - Target: 100% of catch  $\geq$  12 inches
    - Limit: 60% of catch  $\geq$  12 inches
  - Increase the selectivity of this species to be greater than or equal to its L50 (12 inches).
    - Target: SL50  $\geq$  12 inches
    - Limit: SL50  $\leq$  10 inches
- **Harvest control rules (HCRs):**
  - HCR 1: If SL50 falls below the limit reference point, fishing pressure on smaller size classes will be reduced to prevent stock collapse.
  - HCR 2: If, after monitoring, SL50 is at the target reference point, fishing may continue under current regulations, ensuring the stock remains sustainable.
  - HCR 3: If, after monitoring, SL50 is above the target reference point, fishing opportunities may be adjusted to optimize sustainable harvest.

*MINIMUM CATCH SIZE LIMIT OF 24 INCHES FOR Cheilinus undulatus*

If adopted, this measure would prohibit the harvest or possession of *tanguison* (napoleon wrasse) smaller than 24 inches fork length.

- **Stock assessment:** The napoleon wrasse (*tanguison*) is considered endangered by the IUCN. Stock assessments were unable to be conducted for this species due to the lack in data, hinting at the scarcity of *tanguison* in Guam's reefs.
- **Long-term goals:** Maintain a healthy age and size structure, protect reproductive capacity, and support ecological balance and subsistence needs.
- **Appropriate management measure:** Minimum size limit
- **Measurable objectives:**
  - Increase the percentage of catch that is greater than its L50 (22 inches).
    - Target: 100% of catch  $\geq$  24 inches
    - Limit: 60% of catch  $\geq$  24 inches
  - Increase the selectivity of this species to be greater than or equal to its L50 (22 inches).
    - $SL_{50} \geq 24$  inches
    - $SL_{50} \leq 20$  inches
- **Harvest control rules (HCRs):**
  - HCR 1: If  $SL_{50}$  falls below the limit reference point, fishing pressure on smaller size classes will be reduced to prevent stock collapse.
  - HCR 2: If, after monitoring,  $SL_{50}$  is at the target reference point, fishing may continue under current regulations, ensuring the stock remains sustainable.
  - HCR 3: If, after monitoring,  $SL_{50}$  is above the target reference point, fishing opportunities may be adjusted to optimize sustainable harvest.



**Adult**



**Juvenile**

### BAN ON COMMERCIAL SALES FOR 6 SPECIES

*Cheilinus undulatus*, *Chlorurus frontalis*, *Chlorurus microrhinos*, *Hipposcarus longiceps*, *Scarus altipinnis*,  
*Scarus rubroviolaceus*

This measure would prohibit the sale or import of the listed species.

- **Long-term goals:** Rebuild populations to levels that support ecological functionality.
- **Appropriate management measures:** Temporary ban on commercial harvests
- **Measurable objectives:**
  - Increase the transect density/abundance estimates in fisheries-independent datasets.
    - Target: 20% increase in mean transect density within 5 years (i.e.,  $\geq 120\%$  of baseline)
    - Limit: No net decline from baseline ( $\geq 100\%$  of baseline)
  - Decrease fishing mortality (F) to be less than its natural mortality (M).
    - Target:  $F \leq 0.3M$
    - Limit:  $F \leq 0.8M$
- **Harvest control rules (HCRs):**
  - HCR 1: If fishing mortality (F) falls below the limit reference point, fishing effort will be reduced to prevent overexploitation.
  - HCR 2: If, after monitoring, the data show F is at the target reference point, fishing may continue under current regulations, ensuring that the stock remains sustainable.
  - HCR 3: If, after monitoring, the data show F is above the target reference point, fishing opportunities may be increased to optimize sustainable harvest.



Nighttime spearfishing allows fishers to target sleeping reef fish, making them especially vulnerable to capture. Both fishers and scientists have identified this method as highly efficient and potentially unsustainable when conducted at commercial scales. Over the past decade, community members have consistently raised concerns that nighttime spearfishing has contributed to declines in key reef fish species, many of which are central to food security and cultural practices.

In response, this measure would prohibit commercial nighttime spearfishing. Licensed commercial fishers may not engage in nighttime spearfishing between 7:00 PM and 6:00 AM using spears, three-prongs, pole spears, spearguns, or makeshift spears for the purpose of capturing reef fish for sale. Subsistence and recreational nighttime spearfishing remain permitted under this framework, ensuring that cultural practices continue while limiting commercial-scale harvest.

To prevent circumvention of the rule, licensed commercial fishers would also be prohibited from being in possession of speared fish or spearfishing gear during nighttime hours. This safeguard is intended to close enforcement loopholes, making it clear when violations occur and reducing the burden on conservation officers to prove intent. By removing opportunities for commercial fishers to claim subsistence activity or disguise catch as daytime catch, the regulation supports fair and consistent application of the law, reinforces community trust in management, and strengthens overall compliance.

#### *Expected Outcomes*

- Reduced commercial exploitation of vulnerable reef fish populations during nighttime hours.
- Opportunity for recovery of important reef species and improved stock sustainability.
- Stronger alignment between scientific recommendations and community priorities.

#### *Indicators of Effectiveness*

- Commercial catch reports via DAWR creel surveys documenting reduced nighttime harvest.
- Monitoring of reef fish populations (abundance, density per transect, size structure, species composition).
- Community surveys assessing fisher perceptions of reef health and fairness of management measures.
- Compliance and enforcement reports related to nighttime spearfishing.

## 4. Updates to Current Fisheries Regulations

Guam's existing fisheries regulations focus primarily on marine protected areas, certain gear restrictions, and catch and size limits for a limited set of invertebrates, such as sea cucumbers. While these measures were important steps when first established decades ago, they no longer reflect current scientific understanding, ecosystem conditions, or community needs. This management plan recognizes the need to update and expand Guam's regulatory framework to better address finfish stocks, modern fishing practices, and long-term sustainability, while maintaining cultural traditions and food security.

TABLE 5: Summary of Existing Gear Regulations & Proposed Revisions		
Gear Type	Current Regulation	Proposed Revised Regulation
Surround nets	Must be removed within 6 hours of setting.	Must be removed within 6 hours of setting; net must be registered and tagged by the DoAg DAWR.
Gill net	The use of a gill net for the commercial harvest of aquatic animals is prohibited. Net length is limited to 1,000 feet and must be removed within 6 hours.	The use of a gill net for the commercial harvest of aquatic animals is prohibited; net length is limited to 100 feet and must be removed within 6 hours; net must be registered and tagged by the DoAg DAWR.

TABLE 6: Summary of Existing Species Regulations & Proposed Revisions		
Species	Current Regulation	Proposed Revised Regulation
<i>Trochus niloticus</i> (aliling)	<ul style="list-style-type: none"> <li>• 4-inch size limit for commercial harvest, local sales only</li> <li>• No commercial export</li> <li>• No more than 1,000 pieces of <i>Trochus</i> can be taken per person per year for local commercial sale.</li> <li>• The island-wide total commercial harvest shall be set at 10,000 pieces annually. Once this total is obtained, the season shall be closed.</li> <li>• 50 per day, including shells, for personal use</li> </ul>	<ul style="list-style-type: none"> <li>• (All commercial verbiage will be removed.)</li> <li>• No commercial harvesting of <i>Trochus</i> shall be allowed. This does not include cultured <i>Trochus</i> in a Department of Agriculture approved facility.</li> <li>• 25 per day, including shells, for personal use</li> </ul>
Harvest of Marine Gastropods Other Than <i>Trochus</i> for Personal Use	<ul style="list-style-type: none"> <li>• Harvest shall be limited to 30 pieces, shells included of mixed gastropods per person per day. <ul style="list-style-type: none"> <li>○ Exception: The personal harvest of selected conchs is permitted. No more than 1,000 per day per person combined of the species <i>Strombus fragilis</i>, <i>Strombus gibberelus</i>, <i>Strombus luhuanes</i>, locally referred to dogas, may be taken.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Harvest shall be limited to 25 pieces, shells included, of mixed gastropods per person per day. This bag limit includes the personal harvest of selected conchs of the species <i>Strombus fragilis</i>, <i>Strombus gibberelus</i>, and <i>Strombus luhuanes</i>.</li> </ul>
Harvest of Marine Bivalves (clams, oysters, and mussels) other than <i>Tridacna</i> for Personal Use	<ul style="list-style-type: none"> <li>• Harvest shall be limited to 200 pieces, shells included of bivalves combined per person per day.</li> </ul>	<ul style="list-style-type: none"> <li>• Harvest shall be limited to 25 pieces, shells included of bivalves combined per person per day.</li> </ul>
Harvest of Echinoderms	<ul style="list-style-type: none"> <li>• Harvest shall be limited to 100 pieces combined per person per day.</li> </ul>	<ul style="list-style-type: none"> <li>• Harvest shall be limited to 10 pieces combined per person per day.</li> </ul>



## D. COMPLIANCE AND ENFORCEMENT

### 1. Importance of Compliance and Enforcement

Effective compliance and enforcement are critical to the success of any fisheries management plan. Even the most well-designed measures will not achieve their objectives if they are not followed or cannot be enforced. In Guam, where many species are both ecologically important and culturally significant, ensuring compliance is essential to rebuilding depleted stocks, maintaining food security, and preserving traditional fishing practices for future generations.

Compliance relies on a combination of clear regulations, effective monitoring, and strong community engagement. Fishers need to understand the purpose and benefits of each measure, such as size limits or species protections, in order to foster stewardship and voluntary adherence. Outreach, education, and collaboration with fishing communities are therefore as important as the rules themselves.

Enforcement provides the necessary accountability to ensure that non-compliance does not undermine the efforts of law-abiding fishers. This requires coordination between enforcement officers, resource managers, and local communities, as well as practical tools such as permits, reporting requirements, and market inspections to prevent illegal sales. Recognizing the limitations of enforcement capacity on Guam, this plan emphasizes community partnerships and co-management approaches to strengthen monitoring and compliance.

By combining community-driven stewardship with consistent enforcement, the measures outlined in this plan can be implemented effectively and fairly. Ensuring compliance is not simply about rule enforcement, but about building trust and shared responsibility for the sustainable future of Guam's fisheries.

### 2. Outreach & Enforcement Approaches to Increase Compliance & Awareness

Successful implementation of the proposed measures requires both effective outreach and practical enforcement. Outreach efforts ensure that fishers understand the rationale and details of each measure, while enforcement provides accountability and fairness. Together, these approaches build community trust, support voluntary compliance, and reduce the burden on enforcement officers.

- Size Limits (9 species)

- *Outreach*: Develop clear, easy-to-read guides with illustrations of species and their minimum sizes; distribute materials through fishing stores, community centers, and social media. Conduct in-person workshops with fishing groups to explain how size-at-maturity protects future harvests.
- *Enforcement*: Conduct dockside and market inspections to verify sizes; incorporate size checks into routine patrols. Encourage community reporting of undersized sales.
- Full Ban on Atuhong
  - *Outreach*: Publicize the ban broadly through radio, print, and digital platforms; highlight the ecological and cultural importance of protecting the species. Provide fishers with identification cards to avoid accidental harvest of juvenile and adult individuals.
  - *Enforcement*: Zero-tolerance inspections at markets and landing sites; confiscation of banned catch; targeted patrols in areas where the species is known to occur.
- Ban on Commercial Sales for the “Big Six”
  - *Outreach*: Inform both vendors and consumers about the sales and import ban. Work with wholesalers, markets, and restaurants to ensure awareness. Promote local substitutes and highlight the conservation benefits.
  - *Enforcement*: Regular inspections of retail and wholesale markets; coordination with customs agencies to prevent illegal imports; penalties for non-compliance to remove financial incentive.
- Ban on Commercial Nighttime Spearfishing
  - *Outreach*: Social media posts, radio shows, and posters to explain the reasoning behind the ban, emphasizing community concerns about declines. Provide clear information on the permit process for subsistence fishers.
  - *Enforcement*: Conduct nighttime patrols targeting known spearfishing grounds. Require permits to be carried during subsistence night fishing. Impose penalties for licensed commercial fishers found in violation.

Signage at marinas and popular fishing spots summarizing all measures will also be developed and installed. Through these combined outreach and enforcement strategies, the management measures will be more widely understood, more fairly applied, and more likely to succeed in sustaining Guam’s fisheries.

### 3. Guam Conservation Officer Law Enforcement Program

#### *Authority & Staffing*

The Director of Agriculture serves *ex officio* as the Chief Conservation Officer and appoints Deputy Conservation Officers, all of whom have full peace-officer authority—enabling them to carry firearms, make arrests, and issue citations under Guam law. The program is supported by the Civilian Volunteer Conservation Officer Reserve, a volunteer force created to provide supplemental enforcement capacity. Volunteer officers receive training, equipment, and a modest allowance if they volunteer at least 42 hours per month, and they carry the same powers and rights as full-time officers during their service.

#### *Roles & Activities*

Conservation officers enforce local and federal natural-resource laws related to fisheries, wildlife, forestry, and conservation. Their duties include investigating violations, apprehending offenders, and ensuring the protection of endangered species, marine preserves, and conservation lands. Their core mission emphasizes a science-based, community-oriented approach—coupling law enforcement with education and outreach.

### *Enforcement Improvements & Capacity Building*

Guam has strengthened enforcement through key capacity enhancements:

- **Apprenticeship Program:** In 2025, Guam launched its first Conservation Officer Apprenticeship program, inducting 11 new recruits who are undergoing intensive training.
- **Training Academy:** The Guam Community College’s Criminal Justice Division established a Regional Conservation Terrestrial and Marine Enforcement Academy, setting the standard for local and regional enforcement training.

### *Collaboration & Resource Support*

To enhance enforcement effectiveness, the program has forged agreements and partnerships:

- The program works collaboratively with federal and armed forces agencies—particularly through increased surveillance and shared resources—to monitor both terrestrial and marine environments more effectively. Partners include the United States Coast Guard and the Guam Army National Guard.

### *TOKA Hotline and Mobile App*

- With support from the University of Guam Center for Island Sustainability and Sea Grant, the TOKA Hotline was launched to provide the public with a direct line to conservation officers. Community members can call or text 671-864-TOKA to report illegal fishing or related activities. In addition, the TOKA mobile application, available on both Android and iPhone, offers another convenient platform for reporting violations and strengthening community involvement in conservation.

## 4. Fines and Penalties

The effectiveness of fisheries management depends not only on well-designed regulations but also on meaningful consequences for violations. Fines and penalties serve as essential tools to deter illegal activity, ensure fairness for law-abiding fishers, and uphold the integrity of management measures. These measures are intended not simply as punitive, but as a safeguard to protect marine resources, cultural practices, and community food security for future generations. A person committing a violation would be subject to pay the fine as indicated in the above table. Each violation will be counted as a separate violation and punished separately.

Table 7. Prohibited Activities and their Proposed Respective Fine

Prohibited Activity	Fine
Fishing without a permit – recreational/subsistence fishing	\$50
Fishing without a permit – commercial fishing	\$200
Harvesting, taking, or possessing <i>atuhong</i>	\$500
Harvesting, taking, or possessing undersized fish with size limits	\$500
Spearfishing at night while in possession of a commercial fishing license	Confiscation of assets
Spearfishing at night without a permit – recreational/subsistence fishing	\$1,000



## E. ADAPTIVE MANAGEMENT

Fisheries in Guam are complex social-ecological systems, where biological, ecological, and human dimensions interact in ways that are not fully predictable. While scientific studies and traditional ecological knowledge provide essential insight into the status of stocks and ecosystems, data gaps and natural variability introduce a level of uncertainty into management decisions. Adaptive management is a structured approach that treats management actions as experiments, allowing measures to be refined over time as new information becomes available and as the effects of interventions are better understood.

Adaptive management in Guam follows a structured sequence:

1. *Information Gathering* – Collect baseline data on fish populations, harvest patterns, and ecosystem health, integrating both fisheries-dependent and fisheries-independent sources, as well as local fisher knowledge.
2. *Planning and Objective Setting* – Clearly define management objectives and specify alternative scenarios or hypotheses regarding stock response to management measures.
3. *Implementation of Management Measures* – Apply the selected measures, including size limits, species bans, sales restrictions, and nighttime spearfishing regulations, while continuing monitoring.
4. *Monitoring and Data Collection* – Track measurable indicators such as catch composition, size distribution, density per transect, population trends of key species, compliance rates, and community engagement metrics.
5. *Review and Adjustment* – At predetermined intervals, evaluate monitoring results using harvest control rules to determine whether management measures are meeting objectives. Adjust regulations as needed, considering both scientific data and community input.

In the context of this management plan, all proposed measures are considered provisional until reviewed through this adaptive process. Each action will be evaluated at specific time periods to determine effectiveness, identify unintended consequences, and explore alternative strategies where necessary. The harvest control rule framework described in Section 4 of *Guam Reef Fisheries Profile* provides an objective mechanism for decision-making, linking measurable indicators to management adjustments. By applying this framework, Guam's fisheries management can remain flexible, evidence-based, and responsive to

chances in stock status, ecosystem conditions, and community needs, ensuring the long-term sustainability of critical marine resources.

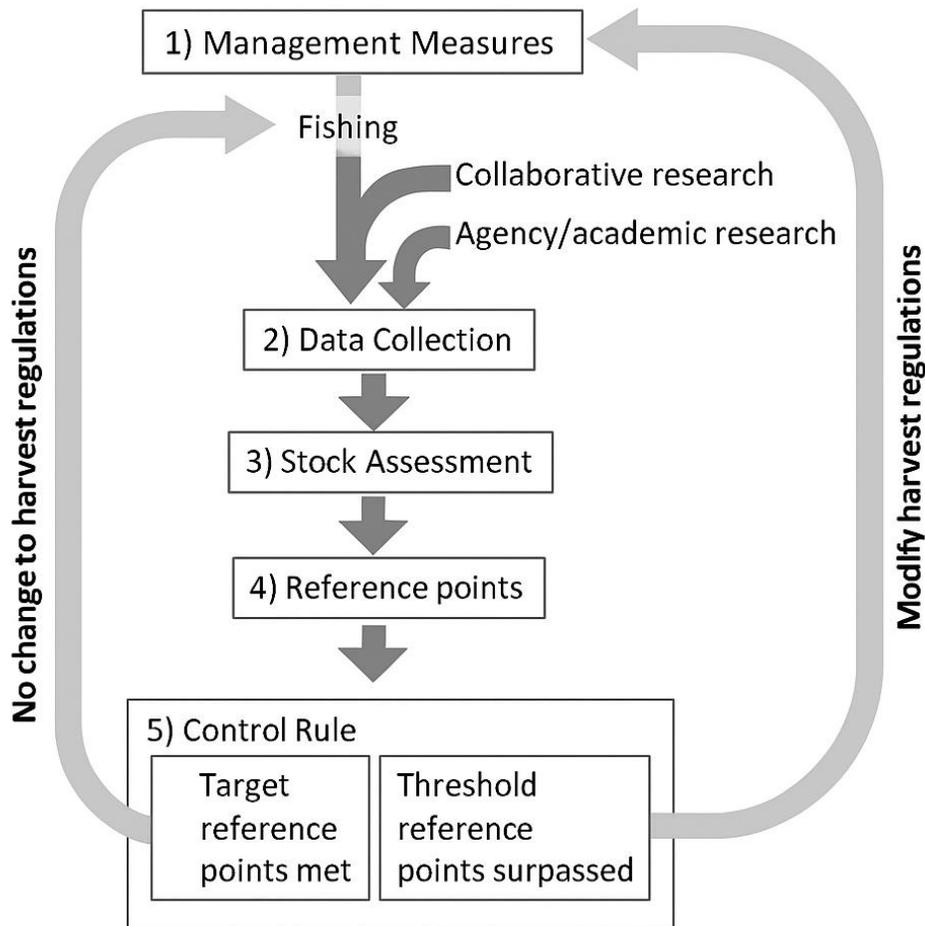


Figure 10. Adaptive management uses monitoring data and assessments to guide decisions, applying a control-rule approach to adjust management measures as needed.

## 1. Data & Monitoring

Effective fisheries management relies on timely, accurate, and comprehensive data to guide decisions and ensure the sustainability of fish populations and their habitats. The following monitoring programs will be prioritized to track the status of fish stocks and evaluate the effectiveness of management measures, providing the information needed to support adaptive management and informed decision-making. Many of these programs contributed data to the initial population assessments described in Section B6 (Current Understanding of Guam’s Fish Stocks) and will continue to collect data to inform future assessments.

### *Fisheries-dependent monitoring*

- DAWR monthly creel surveys – described in Section B5.
- UOG Center for Island Sustainability & Sea Grant catch data – Fishers submit catch data using a catch-mat approach to extract precise fork-lengths and species IDs, along with associated fishing information.

### *Fisheries-independent monitoring*

- Guam Long-term Coral Reef Monitoring Program – described in Section B5
- Stereo-video long-term monitoring program (Taylor Lab) – described in Section B5
- Micronesia Coral Reef Monitoring Program – described in Section B5

## 2. Review and Decision-Making Process

The review and decision-making process ensures that fisheries management is responsive, evidence-based, and adaptive. By systematically evaluating monitoring data, stock assessments, and stakeholder input, managers can adjust management measures to maintain sustainable fish populations and support resilient fishing communities. This process integrates scientific information, traditional ecological knowledge, and socio-economic considerations to guide transparent and accountable decisions.

### *Regular Review Cycles*

Management measures and monitoring results are reviewed on a regular, predefined schedule:

- **Annual Reviews:** Focus on operational and compliance data, fishing effort, and preliminary stock indicators to identify emerging trends or issues.
- **Period Assessments:** Comprehensive population assessments for target species are conducted every 3-5 years, or more frequently if significant ecological or socio-economic changes occur.
- **Ad Hoc Reviews:** Additional reviews may be triggered by unexpected changes in stock status, environmental disturbances, or new scientific findings.

### *Stakeholder Engagement*

Incorporating stakeholder input is central to transparent and effective decision-making:

- **Consultation:** Fishers, community members, and relevant organizations provide observations, traditional knowledge, and feedback on management measures.
- **Workshops & Meetings:** Periodic engagement sessions allow stakeholders to review findings, discuss concerns, and contribute to decision-making.
- **Feedback Integration:** Stakeholder insights are documented and considered alongside scientific data when evaluating management options.

### *Decision-Making Framework*

Decisions regarding management measures follow a structured, adaptive framework:

- **Evidence-based Adjustments:** Management measures are modified based on monitoring results, assessment findings, and stakeholder input.
- **Control Rules:** Predefined harvest control rules guide responses to changes in stock status (e.g., adjust size limits, implement seasonal closures, etc.)
- **Documentation:** All decisions and the rationale behind them are recorded and communicated to stakeholders to ensure transparency.

This process ensures that fisheries management remains dynamic, evidence-driven, and responsive to both ecological and social factors, supporting the long-term sustainability of Guam's fisheries.



## F. CONCLUSION

The Guam Coastal Fisheries Management Plan represents a significant step toward building a coordinated and adaptive approach to managing our island’s marine resources. It reflects the collective commitment to sustaining fish populations, protecting habitats, and supporting the cultural and economic well-being of our fishing communities. This plan is informed by the best available science, local and traditional knowledge, and the expressed priorities of the people of Guam.

The management measures outlined here are designed to complement one another and must be implemented together to be effective. Continued outreach and education will be essential to strengthen community understanding and support, while compliance and enforcement efforts will help ensure the integrity of the measures.

It is important to recognize that rebuilding fish populations is a long-term process. Some species will respond more quickly to management actions, while others—particularly those that are slow-growing or highly mobile—may take years before clear signs of recovery are evident. By maintaining an adaptive management framework and integrating new monitoring data, Guam can evaluate progress, make necessary adjustments, and improve outcomes over time.

In closing, this plan represents a foundation for collaborative and adaptive fisheries management in Guam. Recognizing that fisheries and community needs will continue to evolve, the plan is intended to grow and adapt alongside them. Ongoing input from both scientific and fishing communities will remain essential to refining these strategies and ensuring that management actions continue to reflect current knowledge, conditions, and priorities. Through this living approach, the plan aims to sustain healthy fisheries and resilient coastal communities for generations to come.

With this Fisheries Management Plan, the people of Guam are investing in the future of their fisheries and ecosystems, taking action to safeguard marine resources for generations to come.

## G. REFERENCES

- Burdick, D. 2023. "A Report of Guam Long-Term Coral Reef Monitoring Program Activities Between 2010 and 2021." University of Guam Marine Laboratory Technical Report Mangilao. Guam. 120.
- Houk, P. and van Woesik, R. 2013. "Progress and Perspectives on Question-Driven Coral-Reef Monitoring." *Bioscience*, Volume 63, Issue 4. <https://doi.org/10.1525/bio.2013.63.4.10>
- Houk, P., R. Camacho, S. Johnson, et al. 2015. "The Micronesia Challenge: Assessing the Relative Contribution of Stressors on Coral Reefs to Facilitate Science-To-Management Feedback." *PLoS One* 10: e0130823.
- Houk, P., J. Cuetos-Bueno, B. Tibbatts, and J. Gutierrez. 2018. "Variable Density Dependence and the Restructuring of Coral-Reef Fisheries Across 25 Years of Exploitation." *Scientific Reports* 8: 5725.
- Houk, P., S. Lemer, D. Hernandez-Ortiz, and J. Cuetos-Bueno. 2021. "Evolutionary Management of Coral-Reef Fisheries Using Phylogenies to Predict Density Dependence." *Ecological Applications* 31: e02409.
- Houk, P., F. Castro, A. McInnis, et al. 2022. "Nutrient Thresholds to Protect Water Quality, Coral Reefs, and Nearshore Fisheries." *Marine Pollution Bulletin* 184: 114144.
- Houk, Peter & Taylor, Brett. 2025. Comparing Data-Poor and Data-Rich Stock Assessments to Generalise Guidance for Pacific Coral-Reef Fisheries. *Fish and Fisheries*. 1-15. 10.1111/faf.12903.
- MacNeil, M. A., N. A. Graham, J. E. Cinner, et al. 2015. "Recovery Potential of the World's Coral Reef Fishes." *Nature* 520: 341–344.
- Sablan, L., B. Taylor, and P. Houk. 2025. "Environmental Drivers of Non-Commercial Reef Fisheries in Guam." *Fisheries Research* 281: 107180.
- Taylor, B. M., P. Houk, G. R. Russ, and J. H. Choat. 2014. "Life Histories Predict Vulnerability to Overexploitation in Parrotfishes." *Coral Reefs* 33: 869–878.
- Taylor, B. M., A. E. K. Duenas, and I. D. Lange. 2022. "Decadal Changes in Parrotfish Assemblages Around Reefs of Guam, Micronesia." *Coral Reefs* 41: 1693–1703.
- Weijerman, M., I. Williams, J. Gutierrez, S. Grafeld, B. Tibbatts, and G. Davis. 2016. "Trends in Biomass of Coral Reef Fishes, Derived From Shore-Based Creel Surveys in Guam." *Fishery Bulletin* 114: 237–256.
- Williams, I., J. Zamzow, K. Lino, M. Ferguson, and E. Donham. 2012. "Status of Coral Reef Fish Assemblages and Benthic Condition Around Guam: A Report Based on Underwater Visual Surveys in Guam and the Mariana Archipelago." April–June 2011. US Department of Commerce NOAA Tech. Memo. NOAA-TM-NMFS-PIFSC-33:1-22.