2020

Guam Marine Conservation Plan

Prepared By
Guam Department of Agriculture
Division of Aquatic and Wildlife Services

Photo Courtesy by DAWR

UFISINAN I MAGA'HÅGA
OFFICE OF THE GOVERNOR

LOURDES A. LEON GUERRERO
MAGA'HÅGA • GOVERNOR

JOSHUA F. TENORIO
SIGUNDO MAGA'LÅHI • LIEUTENANT GOVERNOR

July 24, 2020

Mr. Michael D. Tosatto
Regional Administrator
Pacific Islands Regional Office
NATIONAL MARINE FISHERIES SERVICE
NOAA Inouye Regional Center
1845 Wasp Blvd., Building 176
Honolulu, HI 96818

Re: Guam's 2020 Marine Conservation Plan (MCP)

Hafa Adai! Mr. Tosatto,

I am sharing with you Guam's 2020 Marine Conservation Plan (MCP), to be reviewed and approved by the National Marine Fisheries Service, acting on behalf of the Secretary of Commerce.

The Western Pacific Regional Fishery Management Council reviewed and approved the plan at its 182nd meeting held via WebEx on June 22-25, 2020.

The MCP was vetted by Government of Guam agencies, local stakeholders and the community at large through public meetings held in the southern, central and northern villages. All comments and concerns are reflected in the MCP and is now ready for approval.

The MCP is an opportunity for the government and my administration to show tangible support of our fishing community with projects that will have lasting and positive results for all, especially the fishing community on Guam. It identifies plans that will not only benefit the whole island of Guam, but also develop and expand our local capacity to effectively manage fragile marine ecosystems and infrastructure. I look forward to a successful review and subsequent approval of the Plan.

Si Yu'us Ma'ase for your continued support.

Senseremente (Sincerely),

LOURDES A. LEON GUERRERO
Maga'hågan Guåhan (Governor of Guam)

cc via email: ***HONORABLE Joshua F. Tenorio,*** *Lt. Governor of Guam*
Kitty Simonds, Executive Director, Western Pacific Regional Fishery Management Council
Chelsa Muña-Brecht, Director, Guam Department of Agriculture

RICARDO J. BORDALLO GOVERNOR'S COMPLEX • HAGÅTÑA, GUAM 96910
P.O. BOX 2950 • HAGÅTÑA, GUAM 96932
671.472.8931 • 671.472.8932/6

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Guam Marine Conservation Plan

1. INTRODUCTION

The U.S. Public Law 94-265 established the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to serve as the primary law governing marine fisheries management in United States federal waters. Section 204(e) of the MSA authorizes the Secretary of State, with the concurrence of the Secretary of Commerce (Secretary) and in consultation with the Western Pacific Regional Fishery Management Council (Council), to negotiate and enter into a Pacific Insular Area Fishery Agreement (PIAFA). A PIAFA would allow foreign fishing within the 200-mile U.S. Exclusive Economic Zone (EEZ) adjacent to Guam with the concurrence of, and in consultation with, the Governor of Guam. Before entering into a PIAFA, the Governor of Guam, with the concurrence of the Council, must develop a 3-year Marine Conservation Plan (MCP) providing details on uses for any funds collected by the Secretary under the PIAFA.

In addition to PIAFA funds, the MSA provides that fines and penalties of violations by foreign vessels occurring within the EEZ around Guam, including sums collected from forfeiture and disposition or sale of property seized by the federal government, are to be deposited into the Government of Guam's Treasury and to be used to implement the Guam MCP. Also authorized by the MSA is the Western Pacific Sustainable Fisheries Fund, which allows the Council to use funds to implement projects contained in this MCP.

The MSA requires that the MCP shall be consistent with the Council's Fishery Ecosystem Plan (FEP) for the Mariana Archipelago and the Fishery Ecosystem Plan for Pacific Pelagic Fisheries. The MSA also requires that the MCP include, but not limited to, the following conservation and management objectives:

(i) Pacific Insular Area observer programs, or other monitoring programs, that the Secretary determines are adequate to monitor the harvest, bycatch, and compliance with the laws of the United States by foreign fishing vessels that fish under Pacific Insular Area fishing agreements;

(ii) Conduct of marine and fisheries research, including development of systems for information collection, analysis, evaluation, and reporting;

(iii) Conservation, education, and enforcement activities related to marine and coastal management, such as living marine resource assessments, habitat monitoring and coastal studies;

(iv) Education and training in the development and implementation of sustainable marine resources development projects, scientific research, and conservation strategies; and

(v) Western Pacific community-based demonstration projects under section 112(b) of the Sustainable Fisheries Act and other coastal improvement projects to foster and promote the management, conservation, and economic enhancement of the Pacific Insular Areas.

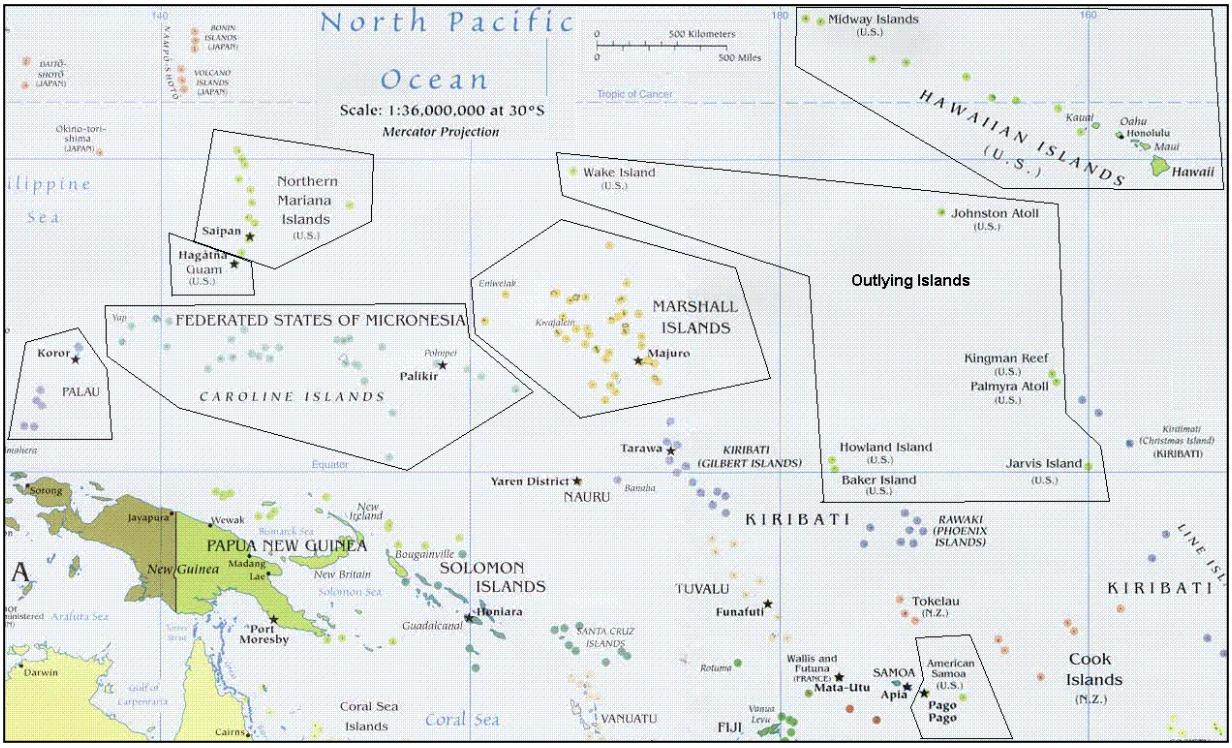

Figure 1

The Pacific Insular Areas include American Samoa, Guam, the Northern Mariana Islands (NMI), Baker Island, Howland Island, Jarvis Island, Johnson Atoll, Kingman Reef, Midway Island, Wake Island, and all islands and reefs adjacent to any of the above (Figure 1).

The U.S. Exclusive Economic Zone (EEZ) around Guam is 84,170 square miles, while Guam has a land area of around 212 square miles. The US EEZ around Guam borders the Federated States of Micronesia (FSM), 100 miles to the south, and the Commonwealth of the Northern Mariana Islands, 20 miles to the north, with around 25 percent of the EEZ bordering international waters.

The dynamic nature of the tuna fishing industry in the central and western Pacific and complexity of regional and subregional fisheries management and development issues present challenges for the development of a long-term plan. The three-year time frame of the MCP provides an opportunity for periodic evaluation and adjustment of programs and projects as new issues and prospects develop. This plan demonstrates that there are extensive opportunities to pursue marine conservation and development activities in the EEZ around Guam. However, the quantity and timing of the funds available for implementation of the MCP is uncertain, and, as such, the ability to capitalize on these opportunities should be cast with reasonable expectations.

<u>Objectives of the Mariana Archipelago FEP and Pelagic FEP</u>

The following lists the objectives of the Mariana Archipelago and Pelagic Fishery Ecosystem Plans (FEP), which were approved by NMFS in 2009.

Objective 1: To maintain biologically diverse and productive marine ecosystems and foster the long-term sustainable use of marine resources in an ecologically and culturally sensitive manner through the use of a science-based ecosystem approach to resource management.

Objective 2: To provide flexible and adaptive management systems that can rapidly address new scientific information and changes in environmental conditions or human use patterns.

Objective 3: To improve public and government awareness and understanding of the marine environment in order to reduce unsustainable human impacts and foster support for responsible stewardship.

Objective 4: To encourage and provide for the sustained and substantive participation of local communities in the exploration, development, conservation, and management of marine resources.

Objective 5: To minimize fishery bycatch and waste to the extent practicable.

Objective 6: To manage and co-manage protected species, protected habitats, and protected areas.

Objective 7: To promote the safety of human life at sea.

Objective 8: To encourage and support appropriate compliance and enforcement with all applicable local and federal fishery regulations.

Objective 9: To increase collaboration with domestic and foreign regional fishery management and other governmental and nongovernmental organizations, communities, and the public at large to successfully manage marine ecosystems.

Objective 10: To improve the quantity and quality of available information to support marine ecosystem management.

2. MARINE CONSERVATION PLAN

2.1 Overview of the MCP

This document is Guam's Marine Conservation Plan (MCP) and describes how the Governor of Guam proposes to allocate funds obtained under a PIAFA or collected from fisheries violations within the Guam EEZ for the period 2017-2020. The document provides information on the process by which the MCP was developed and reviewed, the programmatic objectives that were determined to be funding priorities and the project activities to be undertaken. Given the uncertainty of the quantity and timing of the funds available for implementation of the MCP, this plan should be viewed as a working document subject to periodic review and revision, subject to the MSA and associated procedures.

To avoid duplicating existing marine conservation programs and projects in Guam, activities being pursued under the Guam Fisheries Development and Management Plan, Guam's Coral Reef Initiative, Guam's Coral Reef Conservation Program, Guam's Comprehensive Economic Development Plan and the Port Authority of Guam Master Plan were considered.

The MCP, in certain instances, calls for the initiation or continuation of activities complementary to existing programs/projects. These complementary programs may be conducted in conjunction with the Council, National Marine Fisheries Service (NMFS), local or Micronesian-based entities or with regional marine resource conservation, development or management organizations.

The MCP is consistent with the Council's fishery ecosystem plans. The plan contains conservation and management objectives including criteria for determining when such objectives have been met as well as prioritize planned projects.

2.2 MCP Objectives

The Guam MCP contains six conservation and management objectives under which planned projects and activities designed to meet the objective are identified and described, as follows:

Objective 1. Fisheries Resource Assessment, Research and Monitoring

1. Continue long-term assessment and monitoring of Guam coral reef flat communities, monitoring of coral health; and coral community ecology monitoring.
2. Sequencing plankton to improve rabbitfish migration into Guam's waters.
3. Collection and tagging of near-shore reef fish to provide quantitative assessment of the impact of fishing in Guam's coastal zone.
4. Develop and print voluntary catch logs and data collection to assess impacts on current and proposed regulations upon fisheries, fishermen and fishing communities.

Objective 2. Effective Surveillance and Enforcement Mechanisms

1. Increase enforcement and surveillance of the U.S. EEZ around Guam.
2. Increase enforcement and surveillance of the marine preserves around Guam.

Objective 3. Promote Ecosystems Approach to Fisheries Management, Climate Change Adaptation and Mitigation, and Regional Cooperation

1. Develop a permit, reporting and/or quota transferability program to utilize Guam's quota allocations established under the WCPFC.
2. Support coral protection, conservation, and restoration efforts while also improving herbivore reef fish biomass, as identified in the 2019 Guam Reef Resiliency Strategy, through the establishment of herbivore hatchery.

Objective 4. Public Participation, Research, Education and Outreach, and Local Capacity Building

1. Development and distribution of public information materials promoting sustainable use of ocean resources.
2. Provide education and training to community members, building capacity for community managed herbivore reef fish hatchery.
3. Conducting meaningful fisheries research on telemetry and tracking of reef fish for biological study, data compilation, and fish health assessment.

Objective 5. Domestic Fisheries Development

1. Purchase of a Fish Aggregate Device (FAD) deployment vessel to reduce the high costs of FAD deployments.
2. Completion of ADA compliant fishing/viewing platform at the Paseo de Susana Park along the Hagatna Marina Channel.
3. Restocking herbivore fisheries with focus on rabbitfish.

Objective 6. Recognizing the importance of island cultures and traditional fishing practices and community based management

1. Develop and promote education workshops and awareness campaign on Traditional Fishing techniques; Provide fishing education and training to youth in villages using seized fishing gear.
2. Develop a closer relationship between migrant fishers, local fishers, and resource managers through outreach, education, and activities.
3. Statistical analysis of traditional fishing practices and implementation of Master of Traditional Fishermen Program.

2.3 Project Selection and Evaluation

Guam's initial MCP objectives were prepared by the Council's PIAFA Working Group and were reviewed during three meetings held in Guam and Hawaii between 1996 and 1999. These meetings were attended by interested parties from various Guam public sector agencies, the U.S. government (Council, NOAA, NMFS, USCG) and the private sector. Following these meetings, an array of programmatic activities and projects were developed. Every three years since the development of Guam's initial MCP, Guam's MCP objectives, projects and programs have been assessed and updated to reflect changes. The objectives and specific strategies identified in the MCP are consistent with the MSA National Standards, Operational Guidelines and applicable FEPs, as well as Government of Guam marine resource regulations.

2.4 Plan Review Process

Responsible entities are provisionally identified as being accountable for implementation of projects and for providing assistance where necessary to ensure that project aims are met.

Guam's MCP is not subject to Guam's Comprehensive Development Plan review process relative to Guam Code Annotated (GCA) (5 GCA, Chapter 1, Article 2, §1205). The inclusion of the MCP as an element in the island's Comprehensive Development Plan would commit the Government of Guam to actions beyond a three-year time frame with secure funding to carryout out the strategies identified in the MCP. The past two decades have proven that PIAFA funds and fishing violation fees placed in the Western Pacific Sustainable Fisheries Fund are not a viable funding source since the quantity and timing of funds available for implementation of the MCP is uncertain. Those strategies that were identified in Guam's previous Marine Conservation Plans that have been carried out through other federal funding sources would be removed from this updated MCP once fully completed.

As a three-year plan that is subject to change, Guam's 2020 MCP was made available for public review and comment through the Division of Aquatic and Wildlife office,
DAWR social media and to public sector marine related entities from April 20, 2020 to May 04, 2020.

2.5 Prioritization of Objectives and Projects

The various projects described in the MCP are ranked high, medium or low priority. Activities designated as "high" are those deemed in need of immediate attention or resources. These rankings are subject to re-examination as conditions change. Ranked from highest to lowest priority, these projects are identified in the following table:

Table 1: 2020 MARINE CONSERVATION PLAN PROJECT LISTING

No.	Project Description	Project Strategy No.	Amount	Priority
1	Herbivore Reef Fish Hatchery	3.2	$80,000	High
2	Teaching Traditional Fishing in the Villages	6.1	$70,000	High
3	Plankton-Seq: Deep Sequencing in Search of Mañahak Candy	1.2	$143,835	High
4	Improving Relationships between Resource Members, Local, and Migrant Fishermen	6.2	$24,000	High
5	Creating Cross Sectoral Capacity for Tracking Contaminated Reef Fish	4.2	$310,503	High
6	EEZ Enforcement	2.1	$100,000	High
7	Law Enforcement Drone Surveillance of Marine Preserves	2.2	$34,761	High
8	Developing a Mañahak Hatchery for Restocking Purposes	5.4	$148,000	High
9	The Americans With Disabilities Act (ADA) Accessible Fishing Platform	5.3	$320,000	High

Table 1: 2020 MARINE CONSERVATION PLAN PROJECT LISTING				
No.	**Project Description**	**Project Strategy No.**	**Amount**	**Priority**
	Phase IV: Expansion of Fishing Platform by 45 ft.			
10	Fish Aggregating Device Deployment Vessel	5.2	$250,000	High
11	Rehabilitations and Improvements to Agat Small Boat Marina Dock B	5.1	$4,694,718 2,700,000	High
12	Shallow Bottom Fishing along the Outer Reef Flat: The Effects of Long Term Unsustainable Fishing Effort, Marine Preserve Designation, and Effort Limited by Rout Sea Conditions	1.4	$29,255	High
13	Abandoned Gill Net Removal from Reefs	1.1	$19,000	Medium
14	Guam Volunteer Fishery Data Collection Project	1.3	$50,000	Medium
15	Longline Permit, Reporting, and Quota Utilization Program to Facilitate Responsible Fisheries Development	3.1	$100,000	Medium
16	Education Component in the School for a Marine Fisheries Program	4.1	$45,000	Low
17	Preservation of Traditional In-shore Fishing Practices	6.3	$60,000	Low
		TOTAL PROJECT COSTS:	**$9,179,072**	

3. PROGRAM OBJECTIVES AND PROJECTS

The plan lists six objectives covering a diverse range of fishery conservation and management issues and initiatives. For each objective, strategies that are designed to specifically meet the objective are identified. The strategies' outline describes their purpose and scope, provide time frames and estimated funding required for their implementation and the evaluation criteria.

OBJECTIVE 1: Fisheries Resource Assessment, Research and Monitoring

General Strategy: To help meet this objective, cooperative research projects and joint project agreements with institutions, agencies, researchers and the fishing community to collect scientific fishery information, monitor fishery resources, assess research and monitoring programs, and support fisheries research will be conducted.

Project Strategy 1.1 Abandoned Gill Net Removal from Reefs

Need: Abandoned gill nets are a hazard to both marine life and humans on the reef flats around Guam. Fish, crustaceans, and other fish gill animals can

get entangled and die, and endangered species such as sea turtles can drown if unable to reach the water surface due to entanglement in a gill net. Abandoned gill nets can also entangle and break corals. With the recent listing of several coral species found on reef flats around Guam as endangered, there is a risk of impacting other species covered under the Endangered Species Act (ESA) with abandoned nets. Abandoned nets are also a risk to recreational users and fishers. Gill nets can entangle arms and legs of unaware people in the water. They can snag hook and line fishing gear, causing loss of tackle, and increasing the hazards in the water. Twice abandoned gill nets have been found with highly venomous stonefish tangled in them. Stonefish can easily be overlooked when handling a gill net, and inflict an extremely painful sting.

Status Update: Although numerous statutes are in place pertaining to gill net use, such as the size of net, size of mesh, and the amount of time a net can be deployed before being removed, abandoned gill nets continue to be a problem on the reef flats around Guam. Further, enforcement of gill net removal remains a challenge due to the lack of conservation enforcement officers.

Description: Abandoned gill nets will be recovered wherever they are found on the reef flats around Guam. The location will be documented, Characteristics of the net will be logged, such as length, mesh size, estimated duration of abandonment, etc. Organisms entangled in the net will also be noted, with identification to lowest possible taxa, size, state (live, injured, or dead) and disposition. As fishermen are frequently the source of information for location of abandoned gill nets, an incentive program would be initiated to reward fishers or other users for reporting gill nets. These incentives might include things such as fishing gear, hats, clothing, or gas cards. Abandoned gill nets will be retrieved and brought to the DAWR offices for cataloging and disposal.

Priority Sequence:

- Small hand tools, e.g. knives, gloves and shears to be purchased to assist with removal of entangled gill nets
- Standardized data sheets will be created to document each gill net incident
- Purchase of incentive items for reporting public
- Establish an account to allow DAWR staff to bill work hours to gill net retrieval.

Priority Level: Medium

Time Table: 24 months

Cost Estimate: $2000.00 for small tools and safety gear
$2000.00 for incentives for the public who report abandoned gill nets.
$15,000.00 for salaries of DAWR staff to recover and document abandoned gill nets

Accountability: Guam Department of Agriculture

Evaluation Criteria: An annual report will be generated, to include number of nets retrieved, number of incentives presented, length, size mesh of recovered nets, and status and disposition of all organisms entangled in abandoned gill nets

Project Strategy 1.2 Plankton-Seq: Deep Sequencing in Search of Mañahak Candy

Description: Two species of (juvenile rabbitfish), *Siganus argenteus* and *S. spinus*, are arguably the most aquaculturally promising food fishes within the Mariana Archipelago. As their common name implies, rabbitfish spawn year-round, grow and mature rapidly, and play a major ecological role as generalist herbivores on tropical coral reefs. Although some facilities have established protocols to close the loop on several rabbitfish species, few have established robust methods for their mass production. Like many other marine species with pelagic larvae, high mortality rates during this critical stage of life hinders economic growth of the industry, which currently relies upon juvenile and adult rabbitfish captured from the wild as starting points. By combining state-of-the-art genetics with classical taxonomy, this study will unlock the ecological mysteries underpinning our cultural reliance upon annual *mañåhak* runs. Although these rabbitfish species spawn according to monthly lunar cycles, juveniles only recruit *en masse* once or twice a year. We hypothesize that larval mortality rates are high throughout most of the year, except during the annual events when specific prey become abundant. Monitoring the seasonal variation of plankton populations should therefore lead to the discovery and characterization of zooplankton more suitable for these and many other coral reef species that recruit to our reefs during these specific times of year and unleash the full potential of aquaculture to enhance and restore culturally important reef fish stocks.

The overarching goal of this project is to reduce the mortality rate of rabbitfish larvae through the systematic isolation, identification and culture of their natural zooplankton prey (e.g., an uncharacterized copepod species). **Sampling plankton communities before, during and after the seasonal *mañåhak* runs will: i) enable temporal characterization of plankton communities using next-generation sequencing, while simultaneously ii) providing zooplankton to 'seed'**

the production of aquaculture feed.

NMC-CREES and the UOGML have both spent a great deal of effort developing an economically viable industry (i.e., full-cycle aquaculture) based on the two most preferred rabbitfish species in the Mariana Islands; i.e., *S. argenteus* and *S. spinus*. Yet one major hurdle remains to be overcome before the full potential of this, as well as many other promising aquaculture opportunities can be realized: **the industry is plagued by an extremely low survival rate during the pelagic larval stage (i.e., from hatching to metamorphosis) in artificial settings**. NMC-CREES has found promising, yet limited success in offering alternative types of commercially available zooplankton (e.g., artemia, rotifers and copepods) as live feed during this delicate time.
Recent discoveries using DNA metabarcoding techniques (targeted DNA seq, 18S-metaseq) have transformed our ability to characterize biodiversity (Drummond et al., 2015), as well as the temporal and spatial dynamics of plankton ecology (Blanco-Bercial et al., 1992; Carol et al., 2019). We seek to capitalize on these breakthroughs via the *mélange* of three STEM disciplines: aquaculture, genetics, and taxonomy with indigenous knowledge. **By documenting the plankton populations that support a massive seasonal recruitment of on Guam but not in the CNMI, we will characterize plankton which only become abundant on Guam when rabbitfish larvae appear and thus, prey that most greatly contribute to survival of pelagic rabbitfish larvae/*mañåhak* runs will be isolated and cultured as live feed.**

Priority Level: High

Time Table: October 1, 2020 to September 30, 2021

Cost Estimate: $143,835

Accountability: The University of Guam Marine Laboratory

Evaluation Criteria: A final report detailing Guam's increasing our understanding of reef fish ecology, **capacity building (**by training Guamanians to capture and rear zooplankton critical to sustainable reef fish aquaculture**),** and **stock enhancement** (by increasing production and release of ecologically and culturally important herbivorous fish).

Project Strategy 1.3 Guam Volunteer Fishery Data Collection Project

Background:	Good fishery data by Guam's local fishing community, which includes its commercial, recreational and subsistence fishers, is needed to provide a history of catch, to help identify why changes are occurring in marine resources and to assess the status of the stocks. The data also will enable Guam to assess how its fisheries are changing over time and their dynamics. To help improve Guam's fish stock, seashore preserves have been established and other regulations are under consideration to promote the development and sustain ability of Guam's fishery. Through the use of fishery data, the impacts of current and proposed regulations upon the fisheries, fishermen and the fishing communities can be determined. Guam's fishermen and fishing industry will be able to work more effectively with government fishery managers to develop regulations and laws that address their needs and while protecting the fishery resource.
Description:	Data from the Creel Survey conducted by DAWR will support the Guam Volunteer Fishery Data Collection project. Through Guam Volunteer Fishery Data Collection project, the Guam Fisherman's Cooperative Association will recruit fishermen to participate voluntarily in collecting data. At a minimum, the local fishing community will annually fill out the survey forms. They will also be actively encouraged to fill out and return a Fishing Trip Survey form to document all fishing trips using any fishing method. Funding is required to develop and print voluntary catch logs that will be given to fishermen, to provide additional secure drop boxes in which fishermen can submit their catch logs, and to contract the services of an individual to enter the data from the catch logs into the data system.
Priority:	Medium
Time Table:	On-going
Cost Estimate:	$50,000 for the Fishery Data Collection activities by GFCA.
Accountability:	Guam Fishermen's Cooperative Association.
Evaluation Criteria:	Annual report on the amount of fish harvested by Guam's subsistence and commercial fishermen and the economic impact the fish harvest has upon Guam's economy.

Project Strategy 1.4 Shallow Bottom Fishing along the Outer Reef Flat: The Effects of Long Term Unsustainable Fishing Effort, Stocked from Marine Preservation Designations and Protected by Rough Sea Conditions

Background:

Rod and reel fishing and bottom fishing can be considered the most popular recreational fishing methods on the island. Rod and reel fishers make up 70% of shoreline fishing activity, making it the most popular shoreline fishing method. For boat-based fishers, bottom fishing is second only to trolling. This method generally captures shallow water species of snappers *(Lujanidae*), groupers (*Serranidae*), emperors (*Lethrinidae*), and trevally (*Carangidae*). However, important economic deep water snapper species, from the genera *Etelis* and *Pristipomoides*, are also caught. For trevally, hook-and-line fishing targets all life cycles stages beginning with juvenile, an important fishery when seasonal schools enter bays and feed along the shoreline, to mature adults of the giant trevally *(Caranx ignobilis*). This fishing method is done by recreational, subsistence, and commercial fishers.

Rod and reel or bottom fishing is the most common fishing method for several reasons. First, this fishing method does not require expensive gear, such as nets, and proficiency can be taught to young children. Second, this method is relatively safe since the fisher does not need to enter the marine environment and increase their risk of drowning, as observed with spear fishing. Lastly, this method can be done as a solitary activity or with groups of friends or family. Rod and reel fishing can be done in fresh water. Marine environments such as Masso Reservoir have been constructed to increase access to fishing areas and to make this type of fishery safer. The Department of Agriculture also constructed the Merizo Pier and the platforms at Ylig Bay, Jeff's Pirate's Cove, and at Paseo. Rod and Reef fishing is the only method that can be done year round at two of the five marine preserves, the Tumon Bay Marine Preserve and the Pati Point Marine Preserve.

A significant factor that impacts bottom fishing and rod and reel fishing is that other fishing methods also harvest snappers, emperors, groupers, and jacks. Gill nets and drag nets can easily deplete the same species when done unsustainably. Spear fishers impact bottom fish species in areas that are frequently fished by commercial SCUBA divers and commercial free divers. Lastly, harvest for recreational fishers can be impacted from commercial fishing activity, especially commercial boats that take numerous daily trips of large groups of fishers to the same stretch of shallow reef.

Fishing activity is concentrated on the west side of the island. Access to the east side is limited due to challenges with makeshift boat ramps and rough sea conditions during most of the year. Fishing on the east side, therefore, is limited to the calm summer months or short periods when sea conditions allow boaters to either launch off makeshift ramps or travel from public boat ramp at Hagatna or Merizo. During these calm periods, however, fishing effort can be high, especially if there are commercial fishers. Stretches of reefs on the east coast, too, are relatively small, making it easy to impact them in a short period. While rough sea conditions limit fishing effort, fishing activity during periods of calm seas may impact fish stocks if fishing activity is high. Historically, the east side has been fished extensively by commercial SCUBA fishers and gillnets, two methods which are capable of impacting fish stocks.

The Department of Agriculture's Fisheries section has been collecting data from shore-based rod and reel fishers and boat-based bottom fishers since the 1970s. This allows various fishing sectors to be analyzed for trends in catch, participation, and effort. At the Agat marina, commercial bottom fishers have been surveyed since the opening of the marina in the 1990s. During the early 1990's, as many as four (4) commercial operators began operating out of the Agat marina with as many as 30 guest bottom fishing along the same two mile stretch of reef at Agat. This provides a unique opportunity to analyze the effect of high fishing effort over a relatively long period on a small reef areas. Initial analysis showed rapid depletion of important fish species, followed with a decrease in the size of fish harvested, and finally catches which comprised of juveniles and non-desired smaller fish species.

Public Law 24-21 was passed in 1997 that established five (5) permanent marine preserves. Two of the preserves, the Tumon Bay and Pati Point Marine Preserves, allow limited rod an reef fishing year round. The Pati Point Marine Preserve allows shoreline rod and reel fishing for all species, while the Tumon Bay Marine Preserve allows shoreline rod and reel fishing for only rabbitfish, convict tang, and juvenile jacks. Boat-based bottom fishing is allowed to begin at the 100 foot contour at the Tumon Bay marine preserve. Boat-based bottom fishing is allowed only beyond the 600 foot contour at the Pati Point Marine Preserve, the Achang Bay Marine Preserve, and the Piti Bomb Holes Marine Preserve. The Tumon bay 100-foot contour, however, is regularly fished by commercial bottom fishing charter boats from the Agana boat basin, proving an opportunity to observe simultaneously the effect of having high fishing effort and spillover effect.

Description: The objective of this project is to analyze the effect that high fishing effort has had on shallow reef fish stocks. This includes areas that limit fishing effort by legislation, marine preserve, and from rougher sea conditions, reef areas on the east side.

Data on bottom fishing activity from commercial boats from the Agat marina provide a unique opportunity to observe the effect of high fishing effort over a long period on small reef areas. This impact on the fish populations of the outer reefs at Agat from these boats can then be compared with reef fish stocks along the Tumon Bay marine preserve, from which some data is available, and reefs on the east side of the island. The Catch Per Unit Effort (CPUE), the predominant species caught before and after fishing effort increased, and general fish size can then be compared and discussed. The resultant data can answer questions relating to the effect of high fishing effort over time, marine preserve designation, and the effect of natural closure due to seasonal rough sea conditions. Management options currently in practice can then be discussed and analyzed for their effectiveness, and compared with areas having minimal regulations.

Agriculture's boat-based creel program has been collecting catch and effort data from commercial bottom fishers from the Agana boat basin and the Agat marina. This source of data will first be separated out and analyzed. Commercial bottom fishing operators from the Agat marina were surveyed since the marina first opened in the 1990s when their activity first began. Commercial bottom fishing boaters from the Agana boat basin were less common but also collected, usually the commercial trolling boats also engaging in bottom fishing. Bottom fishing activity limited to the Agat reef flat and Tumon Bay can be separated out from the boat based creel system.

Second, the commercial fishing boats from the two public marinas will be approached for their assistance in allowing staff to observe their guests fishing. This will provide current data on effort, participation, and catch data from bottom fishing occurring along Agat and Tumon Bay. Although fisheries staff have developed a good relationship with commercial boat operators, incentives may be required for their continued cooperation and participation. This part of the project will be limited to staff observing and collecting catch data without interfering with the operation of the fishing charter.

Lastly, Fisheries staff will conduct limited fishing trips to Agat Bay, Tumon Bay, and weather permitting, the east side of the island to conduct

shallow bottom fishing. These trips will provide catch and effort data to compare with the catch observed on the commercial fishing boats. Currently, the number of trips required to make the study valid has not been determined.

The resultant data will be analyzed in several ways. First, historical data from the Agat marina commercial bottom fishing boats that fished along the outer reef flat at Agat will be analyzed, to observe if any trends occurred over time, especially with catch composition and fish size. The dataset should provide a picture of the effect of constant fishing effort on a relatively small section of the reef. Second, commercial bottom fishing activity that occurred at Tumon bay will be analyzed to determine if there has been any effect on catch composition due to the bay's designation as a marine preserve. Lastly, catch composition and fish size from fish caught on the east side of the island will be analyzed to observe any trends that result from the natural closure of the area from rough sea conditions.

Local fish resources are important, both economically and culturally. However, impacts to local fish stocks are numerous and complex. Analyzing and collecting data on bottom fishing activity, focusing on the effect of long term constant fishing effort, the effect of being designated a marine preserve, and the effect of rough seas naturally limiting fishing activity can be useful to determine the effectiveness of local regulations and local fishing practices. The results of this project may clarify whether additional management options or different approaches should be considered to help increase fish stocks.

Management of the marine environment to ensure that fish stocks are healthy is complex. On the plus side, laws such as the marine preserve regulations limit fishing effort and provide "no-fishing" zones to allow individual fish to increase in size and fish numbers to increase. The increase in fish size allows fish to reach larger sizes, with these larger fish producing more eggs and healthier eggs. The increase in the number of fish in the preserves would allow fish to "spill over" to adjacent fishing areas. Educational outreach activities are an important part of fishery management. Fishers are encouraged to practice ethical and sustainable fishing practices and non-fishers are encouraged to practice good stewardship of the environment. Both are necessary to keep fish stocks healthy. On the other hand, it is important to note that over fishing and degrading of the marine environment contribute to the decrease in fish stocks. Environmental impacts that negatively impact fish stocks include marine activities such as dredging and damaging coral. Additionally, land based activities such as soil contaminants and trash adversely impact the

health of fish stocks. The extent and level of impacts on Guam's fisheries resources have also caused major division among commercial fishers, recreational fishers and subsistence fishers. Cultural fishing practices have also caused division with migrant and local fishers.

Priority Ranking: High

Time Table: The project is expected to take one fiscal year.

Cost Estimate: This project is estimated to cost $29,255. Most of the cost would be for staff time, engaged in either the collection of fishing data or data analysis. A maximum of five (5) staff is recommended, and equipment for each would include fishing gear and protective gear. Other equipment and supplies needed for the project would include two coolers, three measuring boards, bait, fuel for the agency boat, and miscellaneous office supplies.

Accountability: The Department of Agriculture's Division of Aquatic and Wildlife Resources. The coordinator for this project, however, would be Fisheries Biologist Thomas Flores, Jr., responsible for the project tasks and progress reports.

Evaluation Criteria: Annual report describing the effect of long term fishing effort on a specific outer reef flat that has historically been utilized by commercial bottom fishers and where fishing data has been collected. This will be compared with two other outer reef flats having different management strategies: an outer reef flat that has a marine preserve designation and where data has been collected, and outer reef flats on the east side of the island that experiences natural rough seas. The effect on bottom fish species, fish size, and fish diversity will be analyzed and discussed.

OBJECTIVE 2: Effective Surveillance and Enforcement Mechanisms

General Strategy: Support activities designed to provide effective compliance with fisheries management measures, including the implementation of observer programs, inspection schemes, enforcement training, vessel monitoring systems and other technologies to monitor fisheries.

Project Strategy 2.1 EEZ Enforcement

Background: Enforcement capabilities at the federal level for the insular areas of American Samoa, Guam and the Northern Mariana Islands consist of NMFS enforcement agents and limited U.S. Coast Guard support. A

federal-local cooperative agreement has been completed that permits Guam law enforcement and conservation officers to assist in the enforcement of the MSA, the Endangered Species Act and the Marine Mammal Protection Act.

Description: Additional enforcement services are required to enforce the MSA, the Endangered Species Act and the Marine Mammal Protection Act. In particular there exists a critical need for increased surveillance of Guam's EEZ. In order to effectively increase enforcement, Guam requires capacity building, training and monitoring vessels.

Priority Level: High

Time Table: 18 months

Cost Estimate: $100,000 for Purchase of Enforcement Vessel

Accountability: Division of Aquatic and Wildlife Resources, Guam Department of Agriculture

Project Strategy 2.2 Law Enforcement drone Surveillance of Marine Preserves

Background: Funding from this grant will be used to improve surveillance capabilities of the Guam Department of Agriculture Conservation Officers (GCO) to more effectively and efficiently enforce Guam's natural resource rules and regulations. Many of the areas GCO are tasked to monitor are rugged and remote, and access is challenging.

The GCO is the unit of the Guam Department of Agriculture tasked with enforcement of Guam's natural resources rules and regulations. The section has existed since 1964. Currently, there are 6 officers in the GCO. Staffing is at the lowest level it has been in the more than 50 years the GCO have existed. Work is progressing on other grants to hire ten recruits, but supplies and funding to equip these officers is lacking. This grant will be used to purchase a drone and associated equipment to facilitate the ability of officers to survey conservation areas for security, monitor remote or inaccessible areas for potential violators to prevent destruction of natural resources and to assist in the restoration of these resources when destroyed by human or natural incidents.

This proposal is for the purchase a drone for existing and incoming conservation officers. Monitoring is a critical component of conservation, enforcement and restoration. The ability to monitor large and/or remote

areas greatly enhances the likelihood of successful management of natural resources.

The purchase of this drone will push the GCO efforts into the 21st century and increase the chances of successful conservation efforts. Using this technology will put them on par with other conservation, law enforcement and restoration agencies and provide empirical evidence of these efforts. The images obtained utilizing this technology will document conservation efforts, enhance apprehension and conviction of violators as well as improve restoration efforts of destroyed natural resources. As the saying goes, a picture is worth a thousand words!

This proposal also requests travel funds for 2 conservation officers to attend training related to the operation and maintenance of the drone.

Priority Level: High

Time Table: 18 months

Cost Estimate: $34,761

Accountability: Guam Department of Agriculture Conservation Officers

Evaluation Criteria: Number of successful enforcement issues detected and mitigated.

OBJECTIVE 3: Promote an Ecosystem Approach in Fisheries Management, Climate Change Adaptation and Mitigation, and Regional Cooperation

General Strategy: Support efforts to help coordinate fisheries conservation and management and address impacts from climate change within an ecosystem, including active participation in the Western Pacific Regional Fisheries Management Council, the Western and Central Pacific Fisheries Commission, the Secretariat of the Pacific Community, Forum Fisheries Agency, and other international and regional organizations.

Project Strategy 3.1 Longline Permit, Reporting, and Quota Utilization Program to Facilitate Responsible Fisheries Development

Background: Guam is a participating territory in the Western and Central Pacific Fisheries Commission (WCPFC), which recently established longline quotas for bigeye tuna in the western and central Pacific Ocean (WCPO) region (WCPO). As a participating territory, Guam afforded the right as a Small Pacific Island Developing State to utilize its quotas to responsibly develop its own domestic fisheries.

Description:	Funds will be used to develop a permit, reporting, and/or quota transferability program that will utilize Guam's quota allocations established under the WCPFC. Funds may also be used in the development of the program to identify, develop, and establish partnerships or arrangements for Guam's quotas to be utilized by U.S. fishing or foreign vessels in exchange for funds or training assistance to responsibly develop Guam's fisheries.
Priority:	Medium
Time table:	36 months
Cost Estimate:	$100,000
Accountability:	Government of Guam, Western Pacific Regional Fishery Management Council, National Marine Fisheries Service
Evaluation Criteria:	Development of permit, reporting, and/or quota transferability program to facilitate funding and training for fisheries development in Guam as well other projects listed in this MCP.

Project Strategy 3.2 Herbivore Reef Fish Hatchery

Project Description

This project's main purpose is to adapt and transfer knowledge of siganid aquaculture to close the loop on other native species within Micronesia; e.g., *S. spinus*. Harvesting rabbitfish using specialized throw-nets is an ancient *CHamoru* fishing tradition that has been continually practiced for thousands of years. This tradition continues today, and will serve as our primary source of *mañåhak* from the wild. By including local cultural practitioners as meaningful contributors to this work, our findings and conservational efforts become more visible.

Objective 1: Establish Hatcheries

To initiate our efforts towards developing a fully-functional aquaculture facility within the Guam Department of Agriculture (DOAG), we must construct a marine hatchery to maintain a broodstock of our target species. The establishment of this facility is essential to explore the feasibility of *S. spinus* as an aquaculture product for subsistence fishing and restocking purposes. If we are successful with closing the loop on the reproductive cycle and grow-out of *S. spinus* in captivity, these

techniques could be adapted to other local reef fish species of interest and facilitate future aquaculture projects.

Objective 2: Obtain juvenile (*mañåhak*) and adult (*Sesyun*) *Siganus spinus* and rear them in the newly established DOAG Hatchery. The harvest of post-larval siganids as they recruit to the reef flats during the moon's last quarter in April/May or October/November has been a long-standing cultural tradition on Guam. Therefore, during *mañåhak* "runs", juveniles will be collected from the wild using throw-net (*Talåya*). During off-season captured at night an hour or two after sunset, a few days before/after a new moon, equipment will include gloves, scoop nets, buckets with mesh openings, and mesh dive nets. Once the desired amount is reached for either capture method, the fish will be immediately transferred to the DOAG Hatchery into a holding tank where they will be acclimated for one week. If a site requires vehicle transport to the DOAG Hatchery, portable aeration systems will be applied to the buckets to maintain the fish during transport. The fish will be acclimated in 100-350 gallon rectangular tanks, 0.5-1.0 m in depth, refreshed at a rate of 10 times per day. Although the adults will be used as a brood stock, juveniles will be released back into their collection site after each feeding trial. In terms of restocking, there is no intended fish size for the target species to reach before being released back into the ocean. Rather, we are observing variations of feeds that will optimize their growth and survivability in the hatchery. Considering their high mortality as new recruits, the hatchery will act as a nursery during the feeding trials by which at the end of each trial the samples will have developed enough to fend for themselves out in the wild.

Objective 3: Amass a broodstock, spawn, and rear *S. spinus* larvae *in situ*.
Although the University of Guam Marine Laboratory (UOGML) has already been successful in growing out juvenile *S. spinus* and *S. argenteus* and maintaining adults in captivity for long periods, spawning of brood stock was out of the scope of these previous funded projects. Thus, requested funds include culture tanks suggested by our colleagues to maximize spawning induction, egg-collection (siganid eggs are adherent), larval rearing, and metamorphosis (Miguel, person. comun.). As was just mentioned, feeding protocols optimized for naturally inducing *S. lineatus* will be attempted first. These include the use of feeds created for other aquaculture species, but have been found to support the reproductive capabilities of rabbitfish in captivity.

According to a study at the University of the Ryukus, *S. spinus* has been observed to spawn around the time of the new moon (Harahap et al., 2001). This is no different for *S. lineatus* reared at Palau Community College and thus, we also expect this to be the case for *S. spinus*. If natural spawning continues to be an obstacle, Human Chorionic Gonadotropin (HCG) will be used to induce spawning.

Planktonic Stage. S-type rotifers, etc., will be purchased and kept dormant until needed. Upon spawning, these cultures will be prepared and added to 500 gallon larval-rearing tanks using the densities and succession pattern developed for *S. lineatus*. Eggs will be collected prior to adhering to tank walls and transferred to these pre-conditioned larval-rearing tank(s). Larvae will therefore have an immediate source of sustinence upon emergence. Two days later, S-type rotifers and/or *T. holothuriae* will be introduced within this ecosystem, which will be maintained until metamorphosis, when an optimized commercial feed can be added to the tanks.

Objective 4: Optimizing Grow Out. During the moon's last quarter in April or May *mañåhak* recruit to Guam, and *peskadot* begin fishing. Three days after their arrival, the digestive tracts of these fish become fully developed, their characteristic color pattern appears, and they begin to feed on macro-algae. Sustainability is built into this *Chamorro* cultural tradition. In fact, we have a name for rabbitfish once they have developed their digestive tract: *dågge*, which is not targeted as a food fish due to its undesirable taste, but rather a sign that the *mañåhak* season has ended. Incidentally, by recruiting *peskadot* to aid us in capturing *dågge* for our research, we essentially extend their season by a day, contribute to their economic wellbeing, and do so in ways that meaningfully include them in our research. If the production of F_1-progeny from Objective 2 becomes rate limiting, wild-caught *dågge* will be used instead. If the timing of a recruitment event corresponds with a successful hatch in captivity, we will include wild *dågge* in our experimental design, and compare these data to those observed for the F_1-progeny from Objective 2.

Priority: High

Time table: 24 months

Cost Estimate: $80,000

Accountability: Department of Agriculture, Division of Aquatic and Wildlife Resources

Evaluation Criteria: Establish hatchery and successfully grow out mañahak for release into the marine preserves.

OBJECTIVE 4: Public Participation, Education and Outreach, and Local Capacity Building

General Strategy: Support activities to produce videos and audio programs on the importance of fisheries, public involvement, and community-based management; print ads and articles to inform the public on upcoming meetings or issues; create lunar calendars, brochures, flyers, displays, and exhibits to inform the public; develop school curricula and educational resources of for student courses on issues related to marine resource management.

Project Strategy 4.1 & 6.1 Education Component in the School for Marine Fisheries Program

Description: The 2020 Guam Marine Conservation Plan contains six conservation and management objectives, of which objective 4 involves "Public participation, education and outreach, and local capacity building" and objective 6 places attention on "Recognizing the importance of island cultures and traditional fishing practices and community based management." Micronesian Archaeological Research Services, Inc. (MARS) is in a good position to conduct a project that will meet these objectives.

MARS is a scientific and educational non-profit corporation, incorporated on Guam in January 1992. Education is part of the mission of MARS, and the MARS archaeologists frequently give presentations at the University of Guam, Guam Community College, public and private schools, and for other organizations and events as well.

Marine Resource Use is the specialty of Judith R. Amesbury, who is one of the founders and directors of MARS. In 2005, MARS obtained a grant from the Pelagic Fisheries Research Program (PFRP) at the University of Hawaii to research pelagic fishing in the Mariana Archipelago. Amesbury and Hunter-Anderson produced a lengthy report, which is available on the PFRP website http://www.soest.hawaii.edu/PFRP/pdf/MARSreport.pdf, and Amesbury published an academic paper in Australia, available at http://www.soest.hawaii.edu/PFRP/reprints/AmesburyTerra_Australis392013.pdf.

In 2010, MARS obtained grant funds from four federal and local sources in order to study "Traditional Fishing on Guam." Amesbury produced a

booklet with that title, and ten thousand copies were printed. Half of the booklets went to Guam Preservation Trust to donate to the Guam public schools and half were distributed at public events on behalf of the Western Pacific Regional Fishery Management Council. As part of the same project, a 30-minute film was also produced. The film has been shown many times in classrooms, conferences and on television.

Other Marine Resource Use projects by Amesbury have resulted in another booklet, "Who Wears the Beads?", a 28-page booklet about the shell and shark teeth ornaments from the Naton Beach Site on Tumon Bay was produced and a website, www.natonbeachguam.com, as well as two displays. (See MARS Previous Educational and Public Outreach Projects below).

Priority: Low

Time Table: 24 months

Cost Estimate: MARS is proposing to produce two new booklets and to reprint the "Traditional Fishing on Guam" booklet. These products meet both Objectives 4 and 6 in the in the MCP.

1) Over the years, Amesbury has conducted interviews with numerous fishermen in Guam, Rota, Tinian and Saipan. These interviews could be prepared for publication and turned into an informative booklet entitled "*Peskadot Marianas*: Fishermen of the Mariana Islands". Estimated cost of creating the booklet and printing 10,000 copies is $45,000.

2) Although the lengthy report and academic paper about Pelagic Fishing are available on the PFRP website, there is no booklet similar to the Traditional Fishing booklet available to the public. Estimated cost of creating the booklet "Pelagic Fishing in the Mariana Archipelago" and printing 10,000 copies is $45,000.

3) There is a need for more copies of the "Traditional Fishing on Guam" booklet and film. Those products could be reproduced relatively inexpensively. Another 10,000 copies of the booklet, plus additional copies of the film, would cost an estimated $10,000.

All of these products would be made available to the public for free. The products would be distributed to the schools, and they would be made available to the general public at presentations and public events that celebrate the history and culture of the Mariana Islands, such as *Gupot Fanha'aniyan Pulan CHamoru* (Chamorro Lunar Calendar Festival).

This project could be broken into two years with Product 1 produced in the first year and Product 2 produced in the second year. Amesbury will continue to seek other funding for Product 3.

Accountability: Micronesian Archaeological Research Services, Inc. (MARS)

Evaluation Criteria: Publication of the following booklets: "*Peskadot Marianas*: Fishermen of the Mariana Islands"; the "Pelagic Fishing in the Mariana Archipelago" and the "Traditional Fishing on Guam" booklet and film. Development and distribution of public information materials promoting sustainable use of ocean resources.

Project Strategy 4.2 Creating Cross Sectoral Capacity for Tracking Contaminated Reef Fishes

Prior to European contact and conquest, the *Chamorro* people were renowned throughout the Western Pacific for their ability to fish the open ocean in addition to their inshore waters. Yet, since then, native *Chamorro* fishing practices, including much of their original maritime skills, knowledge and gear, have been replaced (both forcibly and opportunistically) with western technology. Consequently, local reliance on the indigenous knowledge and traditions which had sustained the *Chamorro* for centuries, along with our spiritual connection to the bounty our oceans, has waned. Like many other cultures throughout the Pacific, the people of Guam now face the danger of losing their cultural connection to the safe, sustainable seafood supply that has defined them as a people for centuries.

Description: The overarching goal of this proposed project is to **create local capacity** that will empower the US Territory of Guam to conduct animal telemetry studies and increase understanding regarding migratory patterns of fish species important to local fisheries (e.g., targeted fish species and predatory sharks). To achieve our goal, **training will be an integral component of all stages of the project** and will consist of both formal classroom instruction and practical fieldwork activities. To sustain this newly-acquired jurisdiction capacity well into the future, the range of backgrounds among trainees will reflect the diversity of stakeholders whose quality of lives depend on the stability of local fisheries, including local fisher-folk, government and private agencies, persons from academic institutions, and cultural practitioners. Together, we will establish the Guam Telemetry Network (GT^N), a cross-sector collaboration operating as an equal partnership between those who manage the

jurisdiction's fisheries and those whose lives depend upon their accessibility.

At the conclusion of this project, Guam will: i) have an established fish tracking array and a collaborative network capable of maintaining and operating the system; ii) exponentially increase the number of personnel collaboratively working on marine species of local importance; and iii) empower its citizens with knowledge regarding if, how, and/or when, some species they catch may migrate in and out of artisanal fishing grounds. Creating a collaborative animal telemetry network on Guam, whose primary mission is to fill data-gaps regarding fish species chosen solely for the benefit this jurisdiction represents a unique opportunity for the US Fish & Wildlife Service to advance their mission goal to restore and better manage the US Territory of Guam's declining fishery resources, while simultaneously promoting efficient and effective governance.

Priority: High

Time Table: 16 months

Cost: $310, 503

Accountability UOG ML and Guam Department of Agriculture DAWR

Evaluation Criteria: Established fish tracking array and network capable of maintaining and operating the system.

OBJECTIVE 5: Domestic Fisheries Development

General Strategy: Conduct activities that assist communities in developing their fisheries, including training, supporting new or improvements to boat harbors, piers, boat ramps, and construction of cold storage and fish processing facilities, fish markets, the procurement of ice making machines, product transportation, vessel designs, training vessels, and fishing gear.

Project Strategy 5.1 Rehabilitation and Improvements Agat Small Boat Marina Dock B

Description The U.S. Territory of Guam is located in the Western Pacific, approximately 7.5 hours' flight west of Honolulu. Under Government of Guam ownership, the Port Authority of Guam ("PAG") controls the Gregorio D. Perez Marina ("GDP Marina") and Agat Marina. The PAG's core business is to oversee the Guam

Commercial Port, which provides the people of Guam with ocean commerce, shipping, recreational and commercial boating as well as sea vessel navigation. The PAG provides a critical role with a reported 90 percent of the day-to-day goods and supplies consumed by Guam residents passing through the Port. Management of Guam's marinas was transferred to the PAG in 1984, Public Law 17-71, authorizing transfer authority for Guam's Public Harbors, Small Boat Marinas, and Facilities from the Department of Parks and Recreation to the PAG.

Guam's marinas provide a gateway to the island's vast oceanic resources. The marinas are also critical to Guam's visitor industry, which estimates of more than 250,000 visitors annually using the marinas. For many years, Guam's marinas have suffered from neglect and both marinas are in overall poor condition. However, most recently, marina-related concerns are being addressed and major repair work has recently commenced and/or completed.

Project Title: Renovation and Site Improvements to the Gregorio D. Perez Marina and Agat Marina

Status Update:

1. GDP Marina Dock "A" Repairs – Completed in September 2011 (***DOCKING SYSTEM NEEDS REPLACEMENT, CONDITION DETERIORING)***
2. GDP Marina Renovation & Site Improvements (406 LF Concrete Sheet Metal Pilings) Phase 1 – Completed on March 2012
3. GDP Marina Dock "B" Repairs – Completed in August 2012
4. GDP Marina Dock "C" Repairs – Completed in January 2013
5. GDP Marina Dock A & B Pile Extension – Completed January 2013
6. GDP Marina New Water Line – Completed in May 2013
7. GDP Marina Renovation & Site Improvements (506 LF Concrete Sheet Metal Pilings) Phase 2 – Completed on October 2013
8. GDP Marina Renovation and Installation of Ejector Pump – Completed in January 2016
9. GDP Marina Installation of Coin Operated Pressure Washer – Completed in October 2018
10. Agat Marina Dock "A" Replacement/Repair – Completed in June 2014
11. Agat Marina Docks "C" & "D" Replacement/Repairs – Completed May 2015
12. Agat Marina Concrete Catwalk Repair – Completed in February 2016

13. Agat Marina Demolition of Damaged Dock "B" – Completed January 2019

Description: The GDP marina, also commonly known as Agana Boat Basin or Hagåtña Marina, benefits from a prime location on the waterfront of Guam's capital city, Hagåtña. The GDP Marina improvements were originally built in the pre-World War Two era. The existing improvements were mostly constructed by the US Army Corps of Engineers in 1977 at a cost of $1.2 Million. The marina consists of two small lagoons formed by a series of breakwaters consisting of earth fill retained by steel sheet piles. The marina
contains 8.23 acres of fast and submerged land and includes 61 slips, 45 at the inner basin and 16 at the outer basin.

The Agat Marina is located along Route 2 and the oceanfront in Agat. The Agat Marina was built by the U.S. Army Corps of Engineers under the authority of Section 107 of the Rivers and Harbors Act of 1960. The project was completed and dedicated in March 1989, and construction of shore-side facilities by the Government of Guam was completed in September 1990. This marina is comprised of over two acres of shore side facilities and approximately nine acres in the basin. The original design included a total of 154 slips including accommodations for 9 sixty foot vessels, 30 forty-five foot vessels, and 115 twenty-five foot vessels or less.

Need: Marina repair costs can be substantial. The budgeted capital expenditure for marinas nationwide reflects an average of approximately $1,500 per slip per year. Considering the higher costs of construction on Guam, it would not be unreasonable to budget up to $2,000 per slip per year, or approximately $250,000 to $300,000 per year. This figure assumes that all required upgrades have already been completed.

Due to the significant costs associated with marina repairs, it is critical that an experienced, transparent and efficient management structure be implemented for Guam marinas, inclusive of a financial reporting and accountability framework. Quality

management will likely result in additional federal grants to improve Guam's marinas.

Fortunately, management has pushed forward with badly needed repair work in Agana. Phase I repairs commenced in May 2011 and include 461 linear feet of removal and installation of new bollards, new sheet piles, walkway, railings and other work. Funding for the renovations is from two grant awards from the US Department of Interior under the Capital Improvement Program. Phase II repairs commenced in March 2013 and included a 561 linear feet of removal and installation of new bollards, new sheet piles, walkway, railings and other work. A third application has been submitted for Phase III, however, unfunded to date. Also funded was $640,000 to repair the docks.

The Guam Fisherman's Cooperative Association ("GFCA"), along with other private sector commercial operators, provided PAG with a list of priority projects and estimated costs for the GDP and Agat marinas. A summary of these GFCA figures is shown as follows.

GDP Marina Items	Estimated Cost
Immediate Needs	
• Extend Dock Pilings 5 feet	$ 150,000
• Fire Suppression	$ 100,000
• Limited Dredging	$ 400,000
a) Access Channel	
b) Entrance to Outer Marina	
c) Obstacles removal	
Long Term Needs	
• Dry dock improvements	$1,000,000
• Boat ramp and parking	$1,500,000
• Fuel dock replacement	$ 40,000
• Multi-purpose building	$ 500,000
• Docks in Outer Marina (75)	$3,000,000
• Sheet Piling	$1,500,000
Total	**$8,190,000**

Agat Marina Items	Estimated Cost
Immediate Needs	
• Replace docks	$1,300,000
• Security Cameras	$ 100,000
• Fishing Platform	$ 300,000
• Channel Markers	$ 100,000
• Dock "D" sediment mitigation	$ 350,000
Long Term Needs	
• A/E Design and Structural Assessment for the Repair Concrete Fuel Pier Area	$ 500,000
• Dredging	$1,200,000
• Construction of the Concrete Fuel Pier Area	$3,800,000
Total	**$7,650,000**

The total estimated GDP Marina and Agat marina repair cost reflects over $15.8 million.

Federal grants are critical considering the high costs of these projects. Once quality management is in place, and major marina repairs are completed, it is unlikely that Guam's marinas will again deteriorate to the current levels.

Priority – Sequence - Immediate

- Plan to complete Phase III at GDP Marina within 24 months
- Plan to repair & repair worn docks in GDP Marina within 24 months
- Conduct A/E Design and Structural Assessment for the Repair Concrete Fuel Pier Area at Agat Marina
- Construction of concrete fuel pier area at Agat Marina

Priority – Sequence – Near Term Recommendations (24 months to 36 months)

- Commitment to maintain & improve marinas

- Fund health and safety required repairs (docks, bathrooms, pump, fueling, siltation issues, navigation, fire suppression and security)
- Expand Grant writing programs for Guam Marinas

Priority Level: High

Time Table: 12 months to 24 months

Cost Estimate: **$3,294,718** for Phase III of GDP Marina Renovation and Site Improvements 508 Liner Foot of Concrete and Sheet Metal Pilings, Installation of an Oil Water Separator, and Construction Management Services

$900,000.00 for Repair & Replacement of worn docks in GDP Marina

$500,000 for the A/E Design and structural assessment for the repair of the refueling pier and boat ramp loading pier in Agat Marina

Accountability: Port Authority of Guam

Evaluation Criteria: When repairs and structural assessment are complete to the GDP Marina and Agat Marina, it permits safe access to the docks and loading pier, thereby encouraging local people to develop fishing resources, charter boat activities for tourists and to enhance recreational activities for residents of Guam.

Status Update: While Agat Marina Docks A, C, and D, were completed, Dock B is in need of rehabilitation. In addition, the fuel pier servicing the marina's boats and well as the marina's boat ramp loading pier is in need of repairs and replacements.

Description: Agat Marina is located in the village of Agat on the west coast of Guam near Gaan Point. It is a small boat harbor (often called Agat Small Boat Harbor) that was excavated from a coral reef flat and is protected by a detached breakwater. The boat harbor basin construction was completed in 1989 with contributions from the U.S. Army Corps of Engineers and the Port Authority of Guam. Shore side facilities were completed in 1990. The USACE describes the site as, "The project consists of an entrance

channel 930 feet long, 120 feet wide, 14 feet deep; a turning basin 120 feet long, 150 feet wide, 7 to 11 feet deep, a main access channel 500 feet long, 75 feet wide, 9 feet deep; two breakwaters 985 feet long and 50 feet long, respectively; and two revetted moles 180 feet long. The protected basin provides berthing areas for up to 150 boats."

The floats are manufactured by Meeco and are constructed of timber decking and whalers, polyethylene flotation tubs, and vinyl fenders. Steel pipe guide piles are used to secure the floats in position. The marina consists of four docks, numbered A, B, C, and D. The main walks are 7-feet-wide and the finger floats are 3-feet-wide. Utility services include potable water (double hose bibs at slips) and electrical power (Midwest receptacles). Guide piling consist of 9-inch diameter painted and concrete-filled steel pipe piles. The fixed guide piles are not tall enough to prevent the docks and guides from floating above them and breaking fee during a typhoon event.

The boat basin also includes a wide concrete boat ramp, a concrete fuel and loading dock. Upland facilities include a parking area for vehicles and vehicle/boat trailer combinations, and administration office, and a restaurant.

Need:

The Agat Marina is one of only two public small-boat marinas, which support the island's estimated 817[a] boaters. In addition, the marina was seen as a means of stimulating growth in boating activities with emphasis in fisheries, allowing improved access to fishing grounds in the south, addressing the demand for permanent dockage space, providing additional safe harbor in bad weather, and facilitating search and rescue activities for the area.

The conditions of Dock B have deteriorated through the years and have become structurally. In addition, the concrete fuel pier and loading dock is damaged and unsafe for vehicular traffic. Access is gated and signed as unsafe. Thus, the demolition and removal of Dock B is necessary to ensure the welfare and safety of the community

Priority Sequence:

- Renovation of Dock B
- Conduct A/E Design and Structural Assessment for the repair of the refueling pier and boat ramp loading pier
- Replacement and repair refueling pier and boat ramp loading pier

[a] Guam Police Department, Boat Registration Statistics, December 20, 2016

Priority Level: High

Time Table: 24 months

Cost Estimate: $1,000,000 for Repairs to Dock B
$200,000 for A/E Design and structural assessment for the repair of the refueling pier and boat ramp-loading pier
$1,500,000 for Repair and Construction of Refueling Pier Repair and Boat Ramp Loading Pier

Accountability: Port Authority of Guam

Evaluation Criteria: When repairs and structural assessment are complete to the Agat Marina, it permits safe access for anglers to access the loading pier, access their boats, and allow access to fishing grounds in the south.

Project Strategy 5.2 Fish Aggregating Device Deployment Vessel

Background: The Department of Agriculture currently obtains a purchase order to deploy fish aggregating devices (FADs), which are floating objects that attract, aggregate and hold pelagic fish in the area, ultimately increasing the catch of fishermen. FADs are a popular device for fishers in the Marianas. When FADs go offline, fishermen expect that the FADs will be replaced in a reasonable amount of time. The cost to deploy a FAD is high at approximately $20,000 per deployment with only one company currently able to deploy FADs. This high cost limits the amount of FAD deployments due to funding availability. Deployment costs have increased each year resulting in DAWR reducing the number of FAD deployments per year. Alternatives are needed to reduce the cost of deployments.

Description: With the purchase of a FAD deployment vessel, FAD deployments can be conducted more frequently allowing fishermen the opportunity to increase their catch. FAD anchors alone weigh about 1-2 tons and require boats that can handle such weight to include the ability to deploy the anchor/buoy. With an average cost of $20,000 for deployments, DAWR can expect a return on the FAD deployment vessel in a little over 2 1/2 years assuming a cost of $250,000 for the vessel.

Priority Level: High
Time Table: 18 months

Cost Estimate: $250,000 for Purchase of Deployment Vessel

Accountability: Division of Aquatic and Wildlife Resources, Guam Department of Agriculture

Evaluation Criteria: The FAD deployment vessel is purchased. FAD deployments will be conducted frequently allowing fishermen the opportunity to increase their catch and reduce the high cost of FAD deployments.

Program Strategy 5.3 The Americans with Disabilities Act (ADA) Accessible Fishing Platform

Status Update: Phase I, Phase II and Phase III of the Americans with Disabilities Act (ADA) Accessible Fishing Platform Project have been completed.

Need: The Americans with Disabilities Act (ADA) is a comprehensive civil rights law that prohibits discrimination on the basis of disability. The ADA requires that newly constructed and altered state and local government facilities, places of public accommodation, and commercial facilities are readily accessible to, and usable by, individuals with disabilities. Recreational facilities, including fishing piers and platforms, are among the facilities required to comply with the ADA access requirements.

Paseo de Susana Park is an established popular recreational area owned and operated by the Government of Guam. There is no ADA access to the water resources at this location along the Hagatna Marina Channel. Moreover, the lack of access to water resources is not limited to this recreational area.

Many of Guam's anglers brave the Hagatna Marina Channel's terrain to fish. The anglers most especially fish at the Hagatna Marina Channel during the seasonal run of the Atulai (Mackerel – Big Eye Scad). Too often anglers will slip or lose their balance while trying to navigate the large boulders that block their way down to the water level in order to cast their lines. Accessing the channel by Guam's physically challenged citizens and its manåmko (senior citizens) is nearly impossible. The construction of a fishing platform will provide a safe location for all of Guam's anglers, including its senior citizens and disabled citizens, to fish and it will ensure individuals with disabilities have access to the fishing area.

Project Description: This project constructed an access ramp and fishing platform that fully complies with ADA standards in order to provide recreational and subsistence fishing access to the Hagatna Marina Channel to Guam's disabled citizens. The facility consists of concrete surfaced ramps and

platforms with steel guardrails and wheel stops approximately 15 feet wide and 227 feet from the first three Phases of the project. The total length of the platform will be 272 feet. In addition to providing access, Department of Agriculture will provide training, guidance, and mentoring for those with ADA needs to fully utilize the platform.

The project's A&E phase, which is the preparation of the design and construction plans for an ADA compliant fishing/viewing platform at Paseo de Susana Park along the Hagatna Marina Channel were done by Duenas, Camacho & Associates, Inc. with input from the Department of Agriculture, Department of Parks and Recreation, the Guam Fisherman's Cooperative Association, and the Guam Organization of Saltwater Anglers. The first construction phase was the establishment of an ADA access platform on the rock wall along the Hagatna Marina Channel at Paseo de Susana Park. The park is centrally located between the Hagatna Marina and East Hagatna Bay and has established pavilions, day use facilities, baseball stadium, and a softball park to include ADA compliant restrooms. The platform is located in close proximity and is a popular area for angling and wildlife viewing.

- Phase 4: Expansion of Fishing Platform by 45 feet to maximize the use of the accessible area and bring the platform to completion at 272 feet in length.

Objectives:

(1) Develop and enhance Western Pacific community-based fishing opportunities benefiting Guam residents.
(2) Promote and foster cultural fishing practices and conservation enhancement through public awareness to improve decision making on coastal issues.
(3) Foster capacity building in coastal science and education through observation.
(4) Perpetuation of Chamorro fishing traditions and values.
(5) Bridge barriers that prevent full participation in fisheries by Guam residents.

Priority Level: High

Time Table: 12-24 Months

Cost: $320,000

Accountability: Guam Department of Agriculture

Evaluation Criteria: Completion of an ADA compliant fishing platform and its use by persons with disabilities.

Project Strategy 5.4 Developing a Manahak (Rabbitfish) Hatchery for Restocking Purposes

Background: Rabbitfish (*Siganidae*) is a traditional and highly valued food fish in the Micronesia and Indo-western Pacific region. Approximately 16 species belonging to the genus *Siganus* are found in the waters of Micronesia (Woodland and Allen, 1977; Woodland and Randall, 1979; Woodland, 1983; 1990; Park et al., 2006). Among them, three species of rabbitfish, *Siganus argenteus, S. randalli* and *S. spinus*, are culturally important food fishes and have great potential for aquaculture. Although rabbitfish juveniles and adults are currently harvested from the ocean as food resources, the annual catches on Guam are declining rather than growing. Because rabbitfish serves as primary consumer in the coral reef ecosystem, restocking the improved high health stock rabbitfish to the Guam ocean and providing such stocks as the food resource for human consumption via aquaculture means would benefit the buildup of healthy marine resource habitats and protection of human health by minimizing the ciguatera toxicity and other possible health risk in the reef fish food chain.

Siganus argenteus demonstrated a reasonably fast growth rate and relatively high density tolerance from a small scale experiment conducted and by the Secretariat of the Pacific Community at New Caledonia (SPC Fisheries Newletter, 2008). *S. randalli and S. spinus*, two closely related rabbitfish species, but smaller in maximal size than *S. argenteus*. *S. randalli* were cultured in cages with rearing information collected during a previous study conducted in 1994 at the UOG hatchery. Results indicated that *S. randalli* could grow from 9.5g to 100.2g in 85 days and with a stocking density of 44 fish/m^3 in marine cages (Brown et al., 1994). In that study, a commercial catfish feed with 36% crude protein content was used. However, fish also exhibited lateral line erosion shortly after the second month, and this condition appeared to be closely associated with nutritional deficiencies. The specific nutrient deficiencies remain unknown and if such deficiencies would also affect growth and survival of *S. randalli*. In addition, a variety of infectious agents can cause health problems in rabbitfish. To prevent disease outbreaks caused by various parasites and bacterial pathogens, nutritional modulation to enhance the immune response may be a better alternative than applying antibacterial

drugs and chemotherapeutic treatments. The significance of a proper diet in preserving the health of fish and other living organisms is widely recognized. Specific immuno-nutrients such as vitamin E and prebiotics have resulted not only in enhanced growth performance but also in an improved innate and acquired immune function in marine fish such as red drum and hybrid striped bass (Li and Gatlin, 2004; 2005; Burr et al., 2005, Buentello et al, 2009).

Siganidae species are usually considered to be herbivorous, and can be potentially reared using diets without fishmeal (El-Dakar et al., 2007), which would be desirable as plant protein diet could be formulated and the nutritionally complete diet to be determined for improving the rabbitfish stock health, promoting growth, maturation and larval rearing. In the meantime, the exploration of the best practices of culture system under domestication was undertaken, namely, polyculture with other marine species in the ponds and cages at the hatchery. Our preliminary trial showed that the rabbitfish *S. spinus* grew much faster while being stocked in the specific pathogen free shrimp ponds than in the pond by themselves, and they were able to reach to more than ½ pound from fingerling in 2-3 months without any other special treatments. However, the nutritional requirements and culture system and techniques of rabbitfish have rarely been studied under domesticated conditions. The outcomes of proposed project could help fill in the knowledge gaps and address the key nutritional requirements for the performance and health of *S. argenteus, S. randalli or S. spinus*, and consequently contribute to a healthier marine ecosystem by restocking the hatchery reared rabbitfish in Guam waters and protect human health.

Description:

The specific objectives of the proposed project are: 1) to evaluate and optimize the culture systems for the three rabbitfish species in terms of grow out performance, and maturation, etc.; 2) to systematically characterize key nutritional requirements of rabbitfish by choosing one experimental model among the three rabbitfish species; 3) to determine the effect of selected nutrients on specific and non-specific immune response of rabbitfish; 4) to determine the effects of several prebiotic compounds on growth performance, immune responses and disease resistance of juvenile rabbitfish; and 5) to identify the overall health status of the hatchery reared stock in comparison with the wild rabbitfish stock and conduct restocking.

Frank Roberto will oversee the project. He will be responsible for obtaining, maintaining the stock in the hatchery for various trials and performing restocking with the assistance of hatchery staff, and UOG

students. Dr. Sealy will assist in the diet formulation, diet preparation and experimental design and sample analyses.

The first year the project will be focused on the collection of the three dominant indigenous rabbitfish species from the wild, domestication, and then evaluation and optimization of the culture systems of raising the rabbitfish in the UOG hatchery, followed by a series of experiments in developing the nutritionally complete diets for the rabbitfish.

Culture systems and techniques will be explored and developed for rabbitfish aquaculture. Outdoor tank, pond, cage and polyculture options will be included for the most suitable culture systems under domestication. Water quality will be monitored and multiple water parameters will be kept within the desirable ranges for rabbitfish culture. Depending on the availability of the rabbitfish sources, single or combined species will be grouped either in the tanks or in the cages for studying the density effect and polyculture effects. Specific pathogen free *Penaeus vannamei* will be chosen as the marine species along with the rabbitfish in the same outdoor system because the preliminary study showed that no adverse effects for either shrimp or fish occurred for such polyculture. Instead, rabbitfish grew 5 times faster in polyculture those in monoculture. Performance data of the experimental marine organisms will be collected and analyzed to determine the most practical culture regimes that would be in the hatchery for rearing the rabbitfish.

Multiple feeding trials will be conducted and evaluated to determine the energy and protein requirements, vitamin E requirement, etc. Each feeding trial will last up to 12 weeks and will be conducted in the cages in the outdoor concrete tanks in the hatchery. The 3 x 2 factorial design will be employed in which diets will be formulated to contain 25, 35 or 45% protein to provide a range that typically encompasses most marine species studied thus far and 10 or 20% lipid for the energy and protein requirements. Vitamin E deficiencies in various fish species result in muscular dystrophy, edema of heart, muscle and other tissues, anemia, depigmentation, and ceroid pigmentation of the liver. In addition, supplemental dietary vitamin E added above the requirement level has been used to improve the immune function, and to increase oxidative stability of fillets. Vitamin E supplementation will be at 0, 15, 30, 60 and 120 mg/kg diet. Grow out performance and tissue samples of rabbitfish from each dietary treatment will be collected and analyzed for determination of the key nutritional requirements.

The second year of the project will assess immune responses and overall health status of the stocks and by the end the project, conduct the

restocking them in the ocean after the healthy stocks are obtained. A few types of commercially available prebiotics will be used for the feeding trial conducted at the UOG hatchery in the cages maintained outdoors. Immediately following the feeding trial, gastrointestinal tract (GIT) contents from representative fish in each cage fed the various dietary treatments will be sampled to characterize potential changes in microbiota using denaturing gradient gel electrophoresis (DGGE) analysis (Li et al., 2007) and GIT morphology. Immunity indexes, such as whole blood neutrophil oxidative radical, plasma lysozyme activity, superoxide anion, will be evaluated for the health status of the rabbitfish and profiles of the wild rabbitfish stock will be compared.

Prior to restocking to the ocean, ciguatera test will be applied and DNA will be sampled in order to establish the genetic database for reliable and consistent monitoring of rabbitfish diversity on a continuous basis. The genetic analysis of these samples will help us to gain more insight on the marine ecosystem conservation and fishery management.

This project is a very exciting blend of basic research on fish nutrition and immunology with the practical goal of improving the health status of rabbitfish in general. Findings in basic science have been paralleled by encouraging results in aquaculture settings, where modulation of the levels of specific nutrients in the diet has resulted in significant improvements in disease resistance of fish. From an applied science standpoint, the proposed research may prove fundamental to developing biotechnological strategies whereby variations in diet formulation may allow better growth and survival of cultured rabbitfish. For the fisheries and aquaculture (the stakeholder), this knowledge also may result in reduced grow-out periods and improved immune responses and health status.

Priority Ranking:	High
Time Table:	24 months
Cost Estimate:	$148,000: $80,000 in Year 1 $68,000 in Year 2
Accountability:	University of Guam Hatchery
Evaluation Criteria:	Progress reports will be prepared and submitted to the Department of Agriculture and the funding agencies. At the end of the two-year study, one or two manuscripts will be prepared and submitted to respected scientific journals in the fields of marine aquaculture, conservation or fisheries research. All data will be accessible to the public, government agencies and scientific community.

OBJECTIVE 6: Recognizing the importance of island cultures and traditional fishing practices and community based management

General strategy: Support projects identified and consistent with the Western Pacific Community Development Program, Western Pacific Community Demonstration Program, Western Pacific Marine Education and Training Program or other community programs that promote the management, conservation, and economic enhancement of communities in Guam as well as to promote traditional and indigenous fishing rights, practices, and management approaches.

Project Strategy 6.1 Teaching Traditional Fishing in the Villages

Description: For centuries the people of Guam and Northern Marianas have relied on the ocean and water system as a life sustaining force. The ocean has shaped our Pacific Island Identity. We have a rich history of traditional fishing knowledge and other cultural skills that persist among small circles, but the changing tide and life style associated with westernization and modernization have noticeable consequences. Guam is a small island covering an area of 212 square miles. Guam is about thirty-two miles in length, with a width of 4 to 8 miles. To the east lies the Marianas Trench and Challenger Deep, the deepest spot on earth. To the western trough lies an active spreading center with hydrothermal vents and fascinating chemosynthetic communities. The beaches and water systems are important natural resources that contribute greatly to the community, both economically and culturally. Fishing skills play an important role in many of our Pacific Islanders cultures and are central to our indigenous way of life. As our community continues to evolve and adopt western practices, many of our youth are unable to demonstrate both traditional skills in fishing and other basic cultural activities. Traditional fishing methods and basic cultural skills are being lost to our youth and too few educational outlets exist to promote and pass down traditional knowledge to them.

The objectives of this project strategy are:

1. To provide non-formal education workshops, awareness, and demonstration sites to promote Guam traditional fishing methods;
2. To provide an educational enrichment program in traditional fishing methods to middle and high school students;
3. To provide a series of demonstrations and public awareness at selected sites on Guam to promote hands-on learning activities for the teaching of traditional fishing techniques;
4. To provide the local youth with the opportunity and skills to be more effective in traditional fishing methods and traditional conservation;

and

5. To create collaborative partnerships with local agencies and Master traditional fishermen for the promotion and sustainability of traditional fishing methods.

Priority: High

Time Table: 24 Months

Cost Estimation: $70,000

Accountability: University of Guam Youth Development 4H Program and Guam Department of Agriculture

Evaluation Criteria: Pre and Post evaluation will be an instrument to measure knowledge. Data sheet for number of participants, fishing skills acquired by participants.

Project Strategy 6.2 Improving Relationships between Resource Managers, Local and Migrant Fishermen

Background: Beginning in 2007, Guam has seen an increase in the amount of fishing activity by regional migrant citizens, primarily from the Federated States of Micronesian (FSM). One of the effects of this fishing activity has been an increase in conflicts with local fisherman, as well as local resource managers. These conflicts include perceived trespassing; novel fishing methods that are illegal; violations of the MPAs and other laws regarding marine organism take, both out of ignorance of the laws, as well as willful violations; a lack of safety while at sea; and the rise of commercial fishery consisting of these fishers and stores that purchase fish from them.

Over the last decade there has been a deterioration of the relationship between local fishermen, migrant fishermen, the indigenous advocates, local and federal government professions, local policy makers and critical stakeholders. Before we can address building the relationship between these various stakeholders, the Department of Agriculture, Division of Aquatics and Wildlife Resources would like to address the concerns from the local community related to fishing practices among our FSM fishing community, especially the Chuukese community.

Description: The project will aim to develop a closer relationship with the Chuukese community, the largest migrant population from the Freely Associated States of Micronesia, through an effective targeted public outreach and education campaign. The issues to be address through this project will include, Guam fishing and MPA laws and regulations, rules and

regulations of the different MPAs, size and catch restrictions, cultural differences between Chamorro and Chuukese fisherman regarding fishing boundaries, safety concerns, spearfishing practices, commercial verse noncommercial sales, and other critical issues that have cause conflict among local and Chuukese fishermen.

The targeted educational campaign will include developing printed material in both English and Chuukese with messages that are culturally appropriate, producing video and radio public service announcements as well as using other traditional and social media platforms that can get the messages out to the targeted community.

In addition to the materials being produced for this campaign, at least two workshops lead by local Chuukese government, traditional and religious leaders will be conducted. These workshops foster opportunities for sharing of information in fellowship. These workshops will be held in areas where communities gather including religious events. In the Chuukese culture, church functions are the most appropriate venue to obtain information and receive material. DAWR will also partner with the Governor's Community Outreach Program, Micronesian Resource Center One Stop Center to distribute material to the Chuukese communities around the island. The Micronesian Resource Center One Stop Center can provide transportation to assist Micronesian migrant communities with public services that are available. DAWR will provide all the material from the project for distribution. DAWR will also partner with local fish shops to distribute materials produced by this project.

During year two, a workshop is planned within various partners to discuss the effectiveness of this effort and lessons learned. These lessons will be shared with other Micronesia migrant communities. The goal of the workshop is to learn what works and what doesn't when communicating with the various migrant populations on the island. It will also provide opportunities for fisheries personnel to more effectively combine local customs, traditional knowledge and scientific knowledge to effectively manage Guam's limited resources.

During year two, the PI will work with the various high school students interested in working with Micronesian communities in educating them on appropriate practices for fishing on Guam. As part of a service-learning project, students will participate in community outreach activities and distribute material, share information with families and engage with sectors of the population that DAWR traditionally has limited interaction.

The overall outcome of this project is to improve relationships between resource managers, local fisherman and recent migrant fisherman on Guam. In addition, the outcome of this project is to increase the educational awareness level of Chuukese residents on Guam to enact positive behavioral changes for those affecting the reef through appropriate fishing practices. Through this effort, it is expected that a better relationship will be developed between the Chuukese fishing community and the local fishing community.

It is expected that this targeted campaign will serve as a pilot project for all other migrant communities on Guam. If successful it is expected that the project will be expanded to other communities such as the Filipinos, the Palauan, the Yapese, Pohnpeians, Chinese, Korean, etc.

Priority Ranking: High

Time Table: 24 months

Cost Estimate: $24,000. Products produced by this project will include multiple items including printed pamphlets, posters, online media, magnetics, pens, tee shirts, workshop materials, and radio and newspaper advertisements to support the targeted messaging campaigns.

Budget Justification: Contract cost include printing for materials for public outreach events, cost for logistics and facilitation for an outreach workshop, media cost including advertisement and airing of PSAs.

<u>Supplies</u>
Workshop materials – pens, notepads, markers, etc. - $2,000.

<u>Contractual</u>
Media: Production and airing of PSAs, print ads, radio and television time to advertise workshops, etc. Budgeted amount is based on similar needs for other projects - $10,000.

Printed materials: Printed materials including translation for pamphlets, posters, flies stickers, etc. for distribution to the local Chuukese fish shops, Chuukese fisherman, and for use at the workshops, and for distribution to Governor's Outreach Program for Micronesian communities. Some promotional items will be produced in conjunction with this effort - $10,000.

Workshop support: Room rental and other costs to provide a venue for the workshop - $2,000.

Accountability: Department of Agriculture

Evaluation Criteria This project is focused on developing effective messages and material for education and outreach targeted at the Chuukese community about appropriate fishing practices and the threats to coral reefs. The activities to achieve this goal include the following:

1. Developing appropriate printed material in both English and Chuukese. The PI will work with local Chuukese fishermen on in developing appropriate messages regarding perceived trespassing, Guam fishing laws, catch limits, violations of MPA and other laws regarding marine organism take, and safety at sea. Most of the background information is readily available; however, the material will need to be updated in a way that will be understood by local Chuukese fisherman. The material will also be translated into the Chuukese language.
2. Develop appropriate social media, video and radio Public Service Announcements to accompany the printed material. In addition, collateral material such as magnetics, tee shirts, pens, etc. will be developed for this project and for future use. This will be available for community groups to use for various events as well as to be posted on social media platforms.
3. Provide a minimum of two workshops at the appropriate Chuukese community functions. These workshops will be led by local Chuukese leaders and staff from the DAWR. This will be an informal format to start the discussion and to build a relationship between the Chuukese fishermen and the DAWR. After the workshops, follow up discussions will be conducted to respond to the Chuukese fishermen's concerns, to provide additional materials and provide assistance as needed.
4. The PI will also coordinate with the Micronesian Resource Center One Stop Shop to provide appropriate materials for distribution.
5. During year two, a general workshop with all stakeholders will be conducted to discuss the impact from the project and the effectiveness of the material that were produced.
6. During year two, the PI will work with the various local high schools in getting students involved in educating their community on appropriate fishing practices. It is hoped that the service-learning project can be developed with all the other Micronesia residents. Along with the DAWR staff, students will participate in at least two community events to distribute material and engage with local Micronesian communities and obtain feedback that can strengthen and

improve the relationship between Micronesian fishermen and Chamorro fishermen.

Project Strategy 6.3 Preservation of Traditional In-shore Fishing Practices

Background: Traditional in-shore fisheries practices are being displaced by the utilization of modern gear and methods, and there are indications that traditional fishing knowledge is already becoming scarce. While there are several programs designed to provide practical training and create an appreciation for fishing among Guam's youth and the community in general, there are no specific programs which are geared toward the preservation of traditional fishing methods. This program strategy is proposed in two phases. The first phase is to identify the types of traditional fishing methods that continue to be employed for inshore harvesting, and the level of decline in the application of the methods. The second phase would apply these findings in the development of preservation programs.

Description: Phase I: Statistical Profile of Existing In-shore Traditional Fishing Practices. The DAWR conducts in-shore creel surveys which provide data to include fishing location, species caught, and gear used. The data sets reflect consistent surveys from 1985 to present. In addition, the GFCA conducts in-shore volunteer data surveys. In-shore data can be extracted from these two sources and be analyzed to provide a comparison on the level of gear utilization for activities classified as traditional fisheries, and provide a comparison on the level of application of traditional fishing practices in comparison to other fisheries activities, covering the time period of the data base.

Phase II: Development of Community Oriented Apprenticeship Programs for Traditional In-shore Fishing Practices. Create a Master Traditional Fisherman program within the Guam Council on the Arts and Humanities. Develop criteria for qualifying masters. Conduct community outreach to identify and archive Guam residents who possess traditional fishing knowledge, to include gear used, gear manufacturing and repair techniques, and other information necessary to preserve and convey the practices. The master program would also establish an apprenticeship curriculum that would include the identification of individuals to do teaching, length of apprenticeship, technique(s) to be applied, and number of apprentices. Stipends would be made available to both teachers and students based on length of time required to accomplish program and materials required.

Priority Level:	Low
Time Table:	Phase I - 3 months Phase II - Continuous
Cost Estimate:	Phase I - $10,000 Phase II - $50,000 annually
Accountability:	Phase I: Guam Fishermen's Cooperative Association (should the proposed marine biologist under the Guam Volunteer Fishery Data Collection Project be funded, the biologist will assist the GFCA with the implementation of this Phase) Phase II: Guam Council on the Arts and Humanities
Evaluation Criteria:	Phase I - Completion of statistical analysis of traditional fishing practices and identification of existing activities Phase II - Implementation of Master of Traditional Fisherman Program.

4. OTHER MARINE CONSERVATION SUGGESTED OBJECTIVES

This section reviews those objectives suggested by the Council's PIAFA Working Group that were de-emphasized in the development of Guam's first 1999 MCP. They continued to be recognized in Guam's 2005 and remain recognized in this plan too. If conditions change, they may be reconsidered for inclusion in future plans.

4.1 Data Collection and Reporting

Fresh fish enter the commercial market in Guam from three sources: full-time commercial fishermen, part-time commercial fishermen and subsistence or recreational fishermen who sell portions of their catch. Before the Guam Fishermen's Cooperative Association (GFCA) was established in July 1979 there was no central place to sell fish. The Coop subsequently became the primary distribution center for fresh local fish. In 1982, WPacFIN began working with the Coop to improve their invoicing system and to obtain data on all fish purchases on a voluntary basis. A cooperative fishery data collection system was established. Data from two other fish wholesalers were collected beginning in 1983 and continued until their closing in 1987. Presently, the Guam Fishermen's Cooperative Association is the primary source for data collection efforts for Guam based commercial, recreational and subsistence fishery activity.

Monthly and annual summary reports of commercial landings data are generated by GFCA. Data are summarized in tables containing information on the pounds landed, value and the average price per pound for each species or species group.

The Bureau of Statistics and Plans collects landing information from vessels which transship fish through the Commercial Port of Guam. In general, foreign long line vessels offloading in Guam have maintained good landings records. Data collected by the Bureau of Statistics and Plans include vessel length and capacity; vessel name, flag and type; offloaded tuna and billfish by species weight, value and destination of catch; fish transshipment by species; exporting agent; mode of transportation and destination; and vessel agent listing. In 2019, a total of 9 vessels made 75 Port-of-Calls, offloading 868.3 metric gross tonnage of fishes. Marine fisheries big eye and yellow fin tuna continue to make up the largest catch followed by blue marlin, swordfish and black marlin. Table 3 provides a ten-year breakdown of tuna offloaded in Guam by species from the Transshipment Summary Data (in metric tons) from CY 2009 - 2019.

ANNUAL REPORT ON TUNA OFFLOADED IN GUAM BY SPECIES
SOURCE: TRANSSHIPMENT SUMMARY (IN METRIC TON). DATA FROM: 2009 – 2019

CY	POC * VES	BET	YFT	ALB	BEM	BKM	SWO	OTH	OTN	OTC	TOT
2009	268 * 67	1826.6	949.9	5.2	59.6	31.0	25.6	0.0	4.5	1.6	2904.2
2010	186 * 32	987.6	715.2	23.2	98.2	36.6	34.9	0.0	0.1	1.8	1897.8
2011	168 * 23	1343.4	532.0	22.0	53.5	36.3	19.2	0.8	0.0	9.4	2016.6
2012	214 * 28	1690.3	501.0	29.0	78.3	3.0	45.8	0.0	3.6	58.0	2408.9
2013	202 * 24	1379.5	435.8	47.7	103.1	0.0	49.7	0.0	0.6	30.5	2047.0
2014	189 * 26	1854.5	291.6	19.9	58.9	0.1	48.1	0.0	0.7	15.7	2289.5
2015	174 * 23	1358.3	597.8	46.2	44.5	0.0	24.2	0.0	0.7	21.2	2092.9
2016	106 * 16	685.0	566.5	2.8	26.9	8.5	19.6	0.0	1.1	3.1	1313.5
2017	81* 9	910.2	306.6	3.9	0.072	8.7	15.4	0.0	0.2	0.2	1245.3
2018	94* 8	917.6	205.2	4.6	0.0	11.8	24.8	0.0	0.0	0.9	1165.0
2019	75* 9	559.7	285.6	3.9	0.0	6.6	11.9	0.2	0.0	0.3	868.3
Total	3,235* 163	23,665.1	11,094.3	353.3	1,028.4	500.3	450.2	12.7	44.1	172.6	37,320.9

Note:POC: Port-of-Calls; VES: Vessels; BET: Bigeye; YFT: Yellow Fin; ALB: Albacore; BEM: Blue Marlin; BKM: Black Marlin; SWO: Swordfish; OTH: Other; OTN: Other Non Tuna; OTC: Other Species Combined; and TOT: Total.

Source: Bureau of Statistics and Plans, Planning Information Program

5. Acronyms

BSP	=	Bureau of Statistics and Plans
CESU	=	Cooperative Ecosystem Studies Units
Council	=	Western Pacific Regional Fishery Management Council
CPUE	=	Catch Per Unit Effort
DAWR	=	Division of Aquatic and Wildlife Resources, Department of Agriculture
ESA	=	Endangered Species Act
EEZ	=	Exclusive Economic Zone
FAD	=	Fishing Aggregating Device
FEP	=	Fishery Ecosystem Plan
FSM	=	Federated States of Micronesia
GEDA	=	Guam Economic Development Authority
GFCA	=	Guam Fisherman Cooperative Association
GPS	=	Global Positioning System
MCP	=	Marine Conservation Plan
MSA	=	Magnuson-Stevens Fisheries Management and Conservation Act
NMI	=	Northern Mariana Islands
NMFS	=	National Marine Fisheries Service, US
NOAA	=	National Oceanic and Atmospheric Administration, US
NOS	=	National Ocean Survey (NOAA), US
PI	=	Principal Investigator
PIA	=	Pacific Insular Area
PIAFA	=	Pacific Insular Area Fishing Agreement
Secretary	=	U.S. Secretary of Commerce
SPC	=	Secretariat of the Pacific Community
SWM	=	Shallow Water Mooring Buoys
UOG	=	University of Guam
UOGML	=	University of Guam Marine Laboratory
USCG	=	United States Coast Guard
VMS	=	Vessel Monitoring System
WCPFC	=	Western and Central Pacific Fisheries Commission
WCPO	=	western and central Pacific Ocean (WCPO) region
WPacFIN	=	Western Pacific Fishery Information Network