

# PACIFIC ISLANDS FISHERIES SCIENCE CENTER



## Guam as a Fishing Community

By

Stewart Allen  
Paul Bartram

February 2008



Administrative Report H-08-01

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Administrative Reports may be cited as follows:

*Author. Date. Title.* Pacific Islands Fish. Sci. Cent., Natl. Mar. Fish. Serv.,  
NOAA, Honolulu, HI 96822-2396. Pacific Islands Fish. Sci. Cent.  
Admin. Rep. H-XX-YY, xx p.

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February 2008



## EXECUTIVE SUMMARY

The first people to arrive in Guam, at least 3500 years ago, were experienced fishermen (Amesbury and Hunter-Anderson, 2003; Amesbury, 2006). Archaeological excavations in Guam yield fish bones of both inshore species and the offshore pelagics which the indigenous Chamorros caught using sailing canoes. Today, fishing in Guam continues to be important not only by contributing to the subsistence needs of Chamorro and immigrant populations, but by perpetuating their maritime history and cultural identity.

Occupation of Guam by foreign nations has dramatically changed the island's ecosystems, reshaped communities, and disrupted fishing traditions. Spanish colonizers destroyed the indigenous Chamorros' seagoing canoes, suppressed offshore fishing practices and relocated populations from their traditional homes adjacent to inshore fishing grounds in the 17<sup>th</sup> and 18<sup>th</sup> centuries. During World War II, Guam was occupied by the Japanese military and then recaptured by the United States, continuing the introduction of alien plants and animals, imported foods, and unfamiliar methods of resource management which further disconnected the indigenous population from their resource base.

In addition, the typhoons and super typhoons that have always swept over Guam continue to profoundly affect fish habitat as well as human inhabitants and their ability to fish. As a physically isolated island community, Guam is vulnerable to these and other social, economic, and environmental forces (Allen and Glazier, 2005). A new "ecosystem disturbance" facing Guam is the imminent buildup of U.S. military population on Guam planned to occur from 2008 to 2012. The influx of construction workers and infrastructure will provide benefits to some sectors of Guam's economy, but could adversely impact marine ecosystems and fisheries substantially more than any perturbations since World War II.

The present report traces the history of Guam fisheries and fishing communities from the earliest evidence to the present. Despite dramatic changes in marine resources and ecosystems, human populations and food sources, many of the indigenous people of Guam and its immigrant communities continue to depend on fishing and locally caught seafood to reinforce and perpetuate cultural traditions such as community sharing of food. Although fishing has made and continues to make contributions to Guam's economy, its sociocultural influences are far deeper.

These traditions are embodied in a 30-year old community-owned organization, the Guam Fishermen's Cooperative Association (GFCA), which provides a variety of benefits not just to its members, but to fisheries and the greater Guam community as a whole. GFCA now plays a role in fisheries data collection, fisheries training and demonstration, and fisheries management. GFCA's interest in playing a larger role in fisheries management is reflected in its 2006 proposal to adopt bottomfish management responsibilities for Guam's offshore banks.

Guam's indigenous fishing community has demonstrated resiliency in the face of natural perturbations (e.g., typhoons, droughts), as well as past human perturbations

(including access restrictions, military occupation, tourist ocean activities, and pollution and runoff from coastal and upland development). GFCA, as the most central and strongest group representing fishermen from the entire island, may play a pivotal role in addressing future challenges such as the significant population influx associated with the new U.S. military buildup.

We hope that this report will provide a sociocultural context for fishing that will assist the community of Guam as it adjusts to the coming military buildup and future challenges. Monitoring the institutional, socioeconomic, and cultural aspects of fishing will continue to be just as important as monitoring fish populations and habitat in Guam's ability to sustain itself as a fishing community.



Welcome sign at Guam International Airport (one indicator that you're entering a fishing community).

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## INTRODUCTION AND PURPOSE

In 1996, the Magnuson Fishery Conservation and Management Act was reauthorized and amended by enactment of the Sustainable Fisheries Act (SFA), which also renamed it the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA required Fishery Management Councils to amend existing fishery management plans and, among other things, to pay more attention to human fishing communities. National Standard 8 of the MSA (NS8) specified that:

Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and the rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities (MSA Section 301(a)(8)).

The amendments also defined fishing community:

The term “fishing community” means a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community. (MSA Section 3(16))

The National Standard Guidelines (50 CFR 600.345(b)(3)) provided additional definition of fishing communities:

A fishing community is a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent services and industries (for example, boatyards, ice suppliers, tackle shops).

Social scientists in each National Oceanic and Atmospheric Administration (NOAA) Fisheries Service region have been assessing communities' dependence on and engagement in fishing activities to identify fishing communities for the purpose of MSA. They are then developing profiles of those communities to enable consideration of how they would be affected by proposed regulations as required by NS8.

The Western Pacific Regional Fishery Management Council (Council) proposed that each of the major island areas under its jurisdiction (Hawaii, Guam, American

Samoa, and the Commonwealth of the Northern Mariana Islands (CNMI) (see Fig. 1) be identified as a fishing community:

In contrast to most U.S. mainland residents, who have little contact with the marine environment, a large proportion of the people living in the Western Pacific region observe and interact daily with the ocean for food, income and recreation...fishing also continues to contribute to the cultural integrity and social cohesion of island communities...In each island area within the region the residential distribution of individuals who are substantially dependent on or substantially engaged in the harvest or processing of fishery resources approximates the total population distribution. These individuals are not set apart...from island populations as a whole (WPRFMC 1998, p. 52-53).

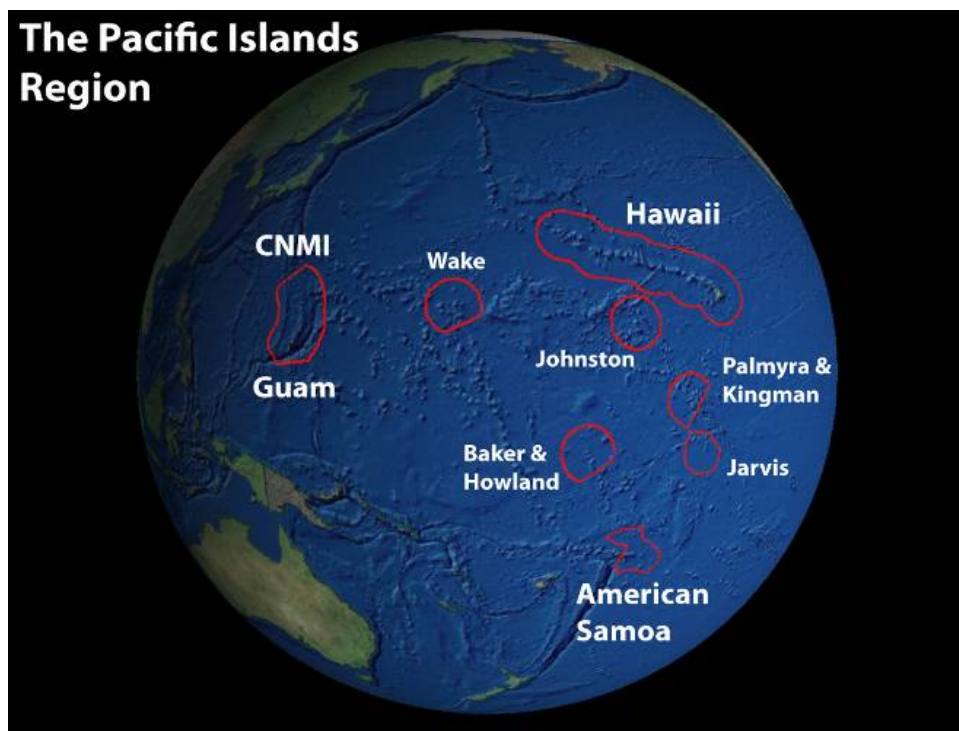


Figure 1.--Guam's location relative to other areas under the jurisdiction of the Western Pacific Regional Fishery Management Council.

On April 19, 1999, the National Marine Fisheries Service (NMFS) approved identification of American Samoa, the Northern Mariana Islands, and Guam as fishing communities (64 FR 19067). NMFS rejected the characterization of the State of Hawaii as a fishing community because it was overly broad and encouraged the Council to identify fishing communities in Hawaii at smaller scales.<sup>1</sup>

<sup>1</sup> In 2004, NMFS approved a Council recommendation, supported by the Pacific Islands Regional Office (PIRO) and the Pacific Islands Fisheries Science Center (PIFSC) to identify each of the inhabited, main islands of the State of Hawaii as fishing communities (Kauai, Niihau, Oahu, Maui, Molokai, Lanai, and the island of Hawaii).

This report describes Guam as a fishing community. It will be updated regularly as social, economic, and environmental conditions change and fisheries management adapts to those changes. We have tried to strike a balance between the report being short enough to be useful and long enough to cover the full range of topics and issues necessary to understand Guam as a fishing community. Readers are encouraged to let us know if we have missed an event, activity, or research report that is part of the story of the social, cultural, and economic importance of fishing on Guam.

Describing the characteristics of Guam as a fishing community is especially relevant because NMFS and the Council are shifting to an ecosystem-based approach to fisheries management. The NOAA Fisheries Service's definition of an ecosystem approach to fisheries (EAF) makes it clear that humans are components of ecosystems and that understanding and meeting current and future societal needs is a critical aspect of management:

An approach to fisheries management that strives to balance diverse societal objectives by taking into account the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries. The purpose of EAF is to plan, develop, and manage fisheries in a manner that addresses the multiple needs and desires of society, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems (NOAA Fisheries Service, 2006).

Ecosystem-based management is the sum of many interrelated and integrated activities. Just as biodiversity can strengthen the resilience of natural systems, diversity in management approaches such as community-based initiatives provides a valuable contribution, allowing for locally relevant management strategies. This has already been demonstrated in U.S. land-management policies; the lack of ecosystem-based land management policy at the national level has empowered people and communities to attempt *ad hoc* experiments on the ground. Early evidence has indicated that such approaches are achieving success (Yaffee, 1999).

One Council goal of this shift is to facilitate adoption of community-based management approaches to fisheries management (Western Pacific Regional Fishery Management Council, 2006). Management of natural resources is usually discussed in terms of scientific research and government regulation without regard to the level of public confidence and cooperation in the process. However, an ecosystem-based approach recognizes that responsible actions by citizens and communities are necessary for long-term wise use of marine resources. In some cases, localization can rebuild the connections to the natural world lost in today's society.

This report begins with an overview of Guam's population, economy, and the economic role of commercial fishing. This is followed by a short history of fishing on Guam and the nature and level of the community's dependence on fishing and seafood. Trends in reef and inshore fishing are explored in greater detail, along with some of the

key issues facing the sustainability of shoreline fishing on Guam. Following that is an overview of offshore fishing on Guam, with a focus on the Guam Fishermen's Cooperative Association (GFCA) and its developing role as a fishery and community institution, and the current issues associated with offshore fishing. The Conclusions section discusses the resiliency of Guam as a fishing community and identifies a key set of indicators recommended to be tracked over time to monitor trends.

## DESCRIPTION OF GUAM AND ITS POPULATION

Guam is the southernmost island of the Mariana Archipelago, located at 13 deg N latitude, 144 deg E longitude (Bureau of Statistics and Plans, 2006). It has been an unincorporated U.S. territory since 1898. Although it is the largest island in Micronesia<sup>2</sup>, Guam is relatively small in both land area (209 miles<sup>2</sup>) and surrounding Exclusive Economic Zone (EEZ). The EEZ is approximately 82,400 square miles, truncated where there are common borders with the CNMI and Federated States of Micronesia EEZs. About 20 percent of the perimeter of Guam's EEZ borders international waters. It is 28<sup>th</sup> in size of 30 EEZs in the Secretariat of the Pacific Community (SPC)'s statistical area (Anon., 1999). Figure 2 shows the location of Guam relative to the rest of Oceania.



Figure 2.--Guam's location within Oceania.  
[www.topsecret.net/intelink/werzit/maps/oceania.html](http://www.topsecret.net/intelink/werzit/maps/oceania.html)

<sup>2</sup> Micronesia consists of hundreds of small islands spread over a large region of the western Pacific. Politically, Micronesia consists of eight nation-states and territories: the Federated States of Micronesia (Kosrae, Yap, Pohnpei and Chuuk); the Republic of the Marshall Islands; the Republic of Palau; The Commonwealth of the Northern Marianas (CNMI); The Republic of Nauru; The Republic of Kiribati; the Territory of Wake island; and the Territory of Guam.

Approximately 30 miles long and 4–12 miles wide, Guam is a volcanic island over which limestone deposits formed during geologic epochs when sea level was higher. The relatively flat northern portion of Guam is a limestone plateau rising sharply from the shoreline. The southern half of the island is mountainous with river valleys, wider beaches, and some of the most protected bays on the island. The steep topography creates numerous watersheds drained by small rivers (Porter et al., 2005). Guam’s shoreline of about 116 miles is bordered by about 80 miles of coral reefs (Bureau of Statistics and Plans, 2006).

The original inhabitants of Guam, Chamorros, are believed to have come from Southeast Asia as early as 2,000 B.C. and to have possessed linguistic and cultural characteristics similar to those of Malaysia, Indonesia and the Philippines.

Guam is an unincorporated, organized territory of the United States. With passage of the Guam Organic Act in 1950, the Secretary of the Interior gained administrative responsibility for the island. The Act conferred U.S. citizenship to the people of Guam and established local self-government. It provided for locally elected executive and legislative branches, an appointed judicial branch, and one elected, nonvoting delegate to the U.S. House of Representatives.

The most relevant aspect of Guam’s climate and environment is perhaps the regular occurrence of natural disturbances, most notably typhoons and super typhoons. These not only affect the island’s population and economy, but impact fishing infrastructure and boats, fish habitat, and fishermen’s ability to fish. Amesbury (2005-2006) provides a timeline showing environmental events affecting Guam (Fig. 3).

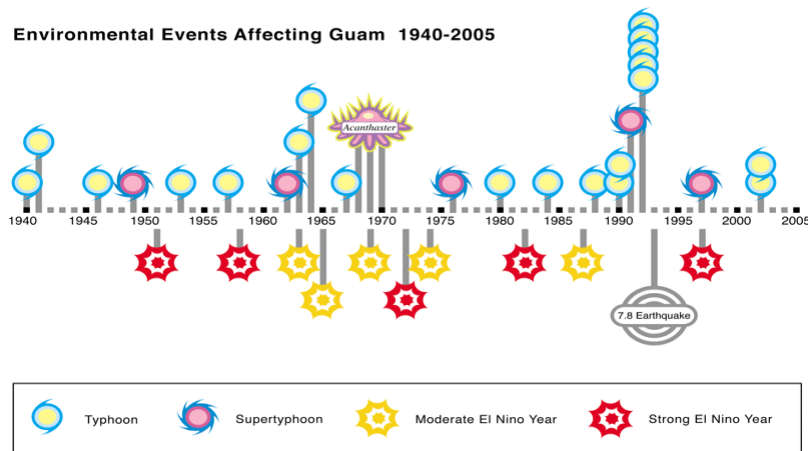


Figure 3.--Environmental events affecting Guam. Acanthaster refers to a crown-of-thorns seastar (*Acanthaster planci*) outbreak which occurred throughout Micronesia.<sup>3</sup>

<sup>3</sup> Technically, the Acanthaster outbreaks are not environmental events but are considered to be normal biological processes. It is included because of the implications for Guam and significant effects.

## Population

According to the 2000 U.S. Census, Guam had a total population of 154,805 (including military) in 2000, compared to 133,152 residents in 1990 (U.S. Department of Commerce, 2003). The average annual population growth rate between 1990 and 1999 was 2.3 percent, low for developing economies in the Pacific Islands where a growth rate between 2.5 and 4.0 percent is typical (Gov. of Guam, 2003). Just over half (51 percent) of the population was male and just under half (49 percent) female. The median age was just over 27. Just over half (52 percent) of the population were born in Guam, 27 percent were born in Asia, and another 12 percent born in the United States. Of the 32 percent who were foreign born, 43 percent were naturalized citizens and 56 percent were not citizens.

In 2000, 37 percent of Guam's population identified themselves as Chamorro, Guam's indigenous population, followed by 32 percent who identified themselves as Asian (about 80 percent of whom were Filipino), 17 percent as other Pacific Islander, 7 percent as white, and 1 percent as black. These were the proportions for the 86 percent of the population who identified themselves as having just one ethnicity or race. In the 2000 Census, people could also identify themselves as belonging to two or more races or ethnic groups. Nearly 14 percent identified themselves as belonging to two or more races or ethnic groups; of these, 50 percent said they were Asian and other and 37 percent said they were Chamorro and other. Considering these two measures of race/ethnicity together, about 42 percent of Guam's population is all or part Chamorro.

The official languages of Guam are English and Chamorro, and given the multicultural population, it is not surprising that of the population 5 years and older, just 38 percent said they speak only English. Of the nearly 62 percent who said they speak a language other than English, 15 percent said they speak the other language less frequently than English, 23 percent said they speak the other language as often as English, and 23 percent said they speak the other language more frequently than English. However, less than one percent said they do not speak English.

Of the population age 25 or older, 76 percent have a high school diploma or higher, and 20 percent have a bachelor's degree or higher.

The average household size was (3.9), slightly smaller than the average family size of (4.3). The traditional pattern of extended family households with multigenerational clustering of relatives persists especially in Guam's southern villages despite rapid socioeconomic change. In households of grandparents living with their grandchildren, 41 percent of the grandparents are responsible for meeting the basic needs of the grandchildren (U.S. Department of Commerce, 2003). However, the percentages are higher in the southern districts (52 percent in Umatac, 57 percent in Merizo, 57 percent in Inarajan, and 53 percent in Talafofo).

The mean annual household income on Guam in 1999 was \$49,617; the median income was \$39,317. Eight percent of households had incomes less than \$2,500 while 10 percent had incomes of \$100,000 or more. The mean and median family incomes were slightly greater than the household values, at \$51,674 and \$41,229, respectively. Guam's per capita income in 1999 was \$12,722. In 1999, 20 percent of families were defined as in poverty status (having a family income below poverty level). Of the 2,434 families with female head of household and no husband present, 39% were living in poverty (the poverty threshold for a four-person family was \$17,029).

Although in some cases commercial fishing contributes substantially to household income, nearly all Guam domestic fishermen hold jobs outside the fishery (Myers, 1993). Domestic fishing on Guam supplements family subsistence, which is gained by a combination of small-scale gardening, ranching and wage work (Amesbury and Hunter-Anderson, 1989).

Of the 47,677 housing units in Guam in 2000, 81 percent were occupied and 19 percent vacant; just a tiny proportion of the vacant units were for seasonal, recreational or occasional use. Of the occupied housing units, 48 percent were owner-occupied and 52 percent renter-occupied. Nearly all households (98 percent) had access to public water supplies, and 71 percent had access to public sewage disposal (with 26 percent using septic tank or cesspool).

Guam is organized into 19 election districts, often referred to as villages, each having a mayor; the districts vary in population size, per capita income, household size, median age and other demographic characteristics.

## **Economy**

Guam's economy has been dominated by tourism and the U.S. military. The most recent aggregate estimate of Guam economic activity was locally calculated at \$3.4 billion in 2002 in current — not inflation adjusted — dollar terms (First Hawaiian Bank 2006). This compares to Hawaii's Gross State Product of about \$43.4 billion in current dollar terms that same year. Guam's economy is smaller than the economies of Maui or the Big Island but slightly larger than that of Kauai. The CNMI economy was estimated to be \$949 million in 2002.

In 2000, Guam's potential labor force (the population of individuals 16 years and older) was 105,014. Sixty-six percent were employed in the labor force; 94 percent (64,452) of those were civilian and 4 percent (4,442) were with the armed forces. The unemployment rate among civilians in the labor force was a historical high of 15.3 percent in 2000, reflecting the recession that took place as a result of military downsizing and a downturn in the Asian economy. However, that rate had dropped to 6.9 percent by March 2006 (Guam Department of Labor, 2007) as job growth was positive after being in negative territory since 2000 (First Hawaiian Bank, 2006). Among those in the labor

force, 4 percent also reported engaging in subsistence activity, compared to 2 percent of those not in the labor force.

In 2000, employment was divided among a number of sectors: 18 percent of workers were in tourism-related services; 15 percent in education, health and social services; 13 percent in retail trade; 11 percent in public administration; and 10 percent in construction. One-half of 1 percent (296 individuals) were in agriculture, forestry, fishing and hunting, and mining. Private wage and salary workers accounted for 69 percent of employment, and government workers 26%. Remaining workers were mostly self-employed.

## **Military**

The U.S. military has had a presence on Guam since 1898. By the time World War II began, an estimated 90 percent of the living standard for Guam was derived from U.S. Navy expenditures (Office of the Chief of Naval Operations, 1951). Total federal spending on Guam ranged from approximately \$1.1 billion in 1993, 1994, and 1998, to a current level of approximately \$888.3 million. Of this, defense-related spending represented about two-thirds in 1994, which was down to one-half in 2000. Although the influx of new military personnel and dependents is expected to boost that sector of the economy, the recent history is mixed. In the mid-1990s Guam lost 4800 direct jobs as a result of base closures, unit transfers, and scaled back levels of military activity on Guam (government of Guam, 2001). The total job loss was estimated as 6800—significant also because many of these were high-paying, skilled, professional, and managerial positions.

An imminent military buildup will lead to unprecedented levels of military spending on Guam:

A total of perhaps \$15 billion in military spending has been announced for Guam, to be spread over a 10-year period. About \$10+ billion of this has been identified to fund the transfer of the III Marine Expeditionary Force, more than 8000 active duty personnel plus 9000 support personnel and dependents, from Okinawa to Guam by 2013 (First Hawaiian Bank, 2006).

In addition, the Air Force is expected to add 4000 personnel (and an unknown number of dependents) in roughly the same time frame. As will be discussed, the effects of this influx are expected to be not just economic, but social and environmental.

## **Tourism**

The island has been a popular vacation destination for Asian tourists due to its tropical climate and close proximity (3 to 4 hours flying time from Japan). The peak tourist years were between 1995 and 1997, when approximately 1.4 million tourists arrived annually.



The ups and downs of the industry, however, were demonstrated by the precipitous decline in tourism resulting from the events of 9/11, resulting in a drop in monthly visitor counts from 132,249 in August of 2001 to 71,280 in September. A corresponding drop in average room rates also was evident. Super typhoon Pongsona in December 2002 also disrupted the tourism industry. A decrease in tourism after 1997 was a result of the Asian financial crisis and the crash of a Korean Air Lines (KAL) jet in 1997, which prompted KAL to discontinue flights to Guam.

Tourism levels are approaching past peaks. In 2005, 1,227,587 visitors came to Guam, nearly all civilians and of whom 80 percent came from Japan. There are at least 20,000 tourism related jobs on Guam, about 35% of total island jobs in 2006 (First Hawaiian Bank, 2006).

### Fisheries

Commercial fisheries have made a relatively minor contribution to Guam's economy. Between 1980 and 2006, the ex-vessel value of domestic commercial landings ranged from about \$179,000 in 1980 to \$1.33 million in the year 2000 (Fig. 4); in 2006, the 328,770 lbs landed commercially were worth about \$710,720 (WPacFIN, 2007). Pelagic species dominate the commercial landings throughout the time series, although reef fish are an increasing proportion beginning in 1998 (Fig. 5).<sup>4</sup>

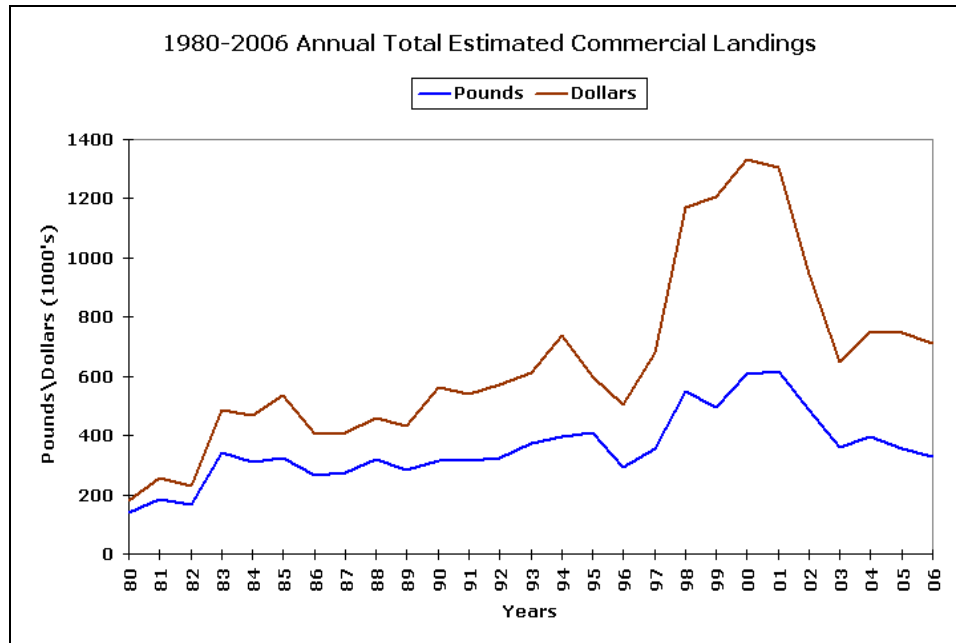


Figure 4.--Trends in value of commercial landings.

<sup>4</sup> Changes in data collection coverage could account for this increase.

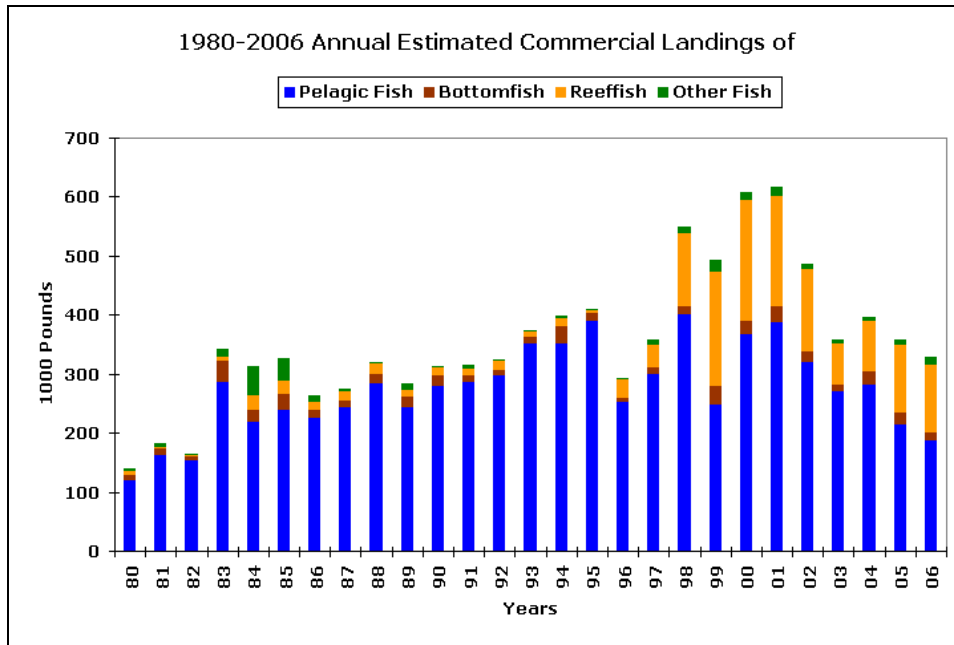


Figure 5.--Trends in commercial landings, by fish type.

Since the late 1970s, the most important commercial fisheries activity in Guam has been the territory's role as a major regional fish transshipment center and resupply base for domestic and foreign tuna fishing fleets. Services provided on Guam include fueling, provisioning, unloading, air and sea transshipment, net and vessel repairs, crew repatriation, medical care, and warehousing.

Among Guam's advantages as a home port are well-developed port facilities in Apra Harbor, an availability of relatively low-cost vessel fuel, a well-established marine supply/repair industry, and recreational amenities for crew shore leave (Hamnett and Pintz, 1996). In addition, the territory is exempt from the Nicholson Act, which otherwise prohibits foreign ships from landing their catches in U.S. ports. In the late 1970s, the majority of vessels calling in Apra Harbor to discharge frozen tuna for transshipment were Japanese purse seine boats and carrier vessels. Later, a fleet of U.S. purse seine vessels relocated to Guam, and in the late 1980s, Guam became an important port for fresh tuna transshipment by foreign vessels, primarily from the Japanese and Taiwanese longline fleets. The presence of the longline and purse seine vessels created a demand for a range of provisioning, vessel maintenance, and gear repair services.

By the early 1990s, fresh tuna that was landed on Guam by foreign longliners or flown into Guam from the Federated States of Micronesia and elsewhere on air cargo planes was being transshipped out of Guam to the Japanese market on wide-body passenger planes (Hamnett and Pintz, 1996). A second air transshipment operation that began in the mid-1990s air freighted fresh tuna to Europe that did not meet Japanese *sashimi* market standards.

Trends in the number of port calls made in Guam by various fishing fleets reflect the volatility of the industry. The number of vessels operating out of Guam decreased by almost half from 1996 to 1997 and further declined in 1998 (Hamnett and Anderson, 2000). The Guam Department of Commerce reported that fleet expenditures in Guam in 1998 were about \$68 million, and a 1994 study estimated that the home port and transshipment industry employed about 130 people (Hamnett and Pintz, 1996). Volatility and the steady decline since 2001 are evident in Guam Bureau of Statistics and Plans data on weight of transshipped fish (Fig. 6).

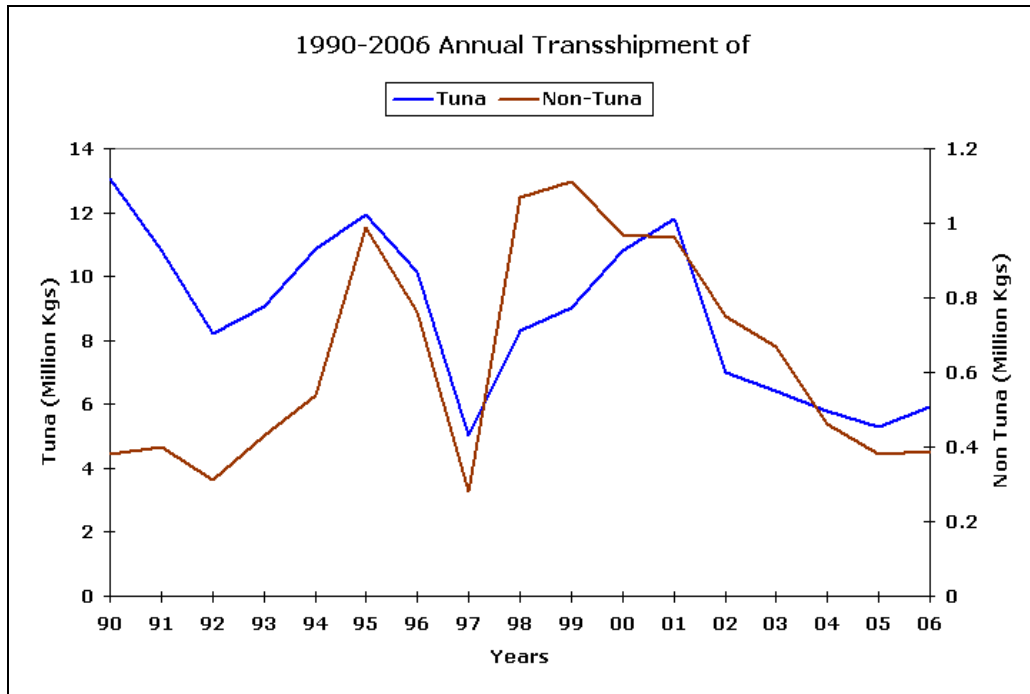


Figure 6.--Trends in transshipment activity (note use of separate scale to show the much smaller levels of non-tuna transshipment activity).

As recently as 2001, Guam’s Comprehensive Economic Development Strategy (CEDS) had hoped that transshipment would play a greater role in its economy. The CEDS contained goals for fisheries, mostly directed toward the support activities of these large-scale commercial fleets:

Guam needs to provide our own local people with the resources and incentives necessary to enter the fishing industry. We also need to diversify our economy through the development of other assets that are available to us. To expand Guam’s competitiveness and encourage growth of the industry’s contributions to the island’s economy, this strategic plan has identified and made recommendations to address immediate opportunities and mitigate unnecessary constraints. Guam presently has a \$150 million fisheries industry. Successful implementation of these policies can triple this sector of our economy and

produce a \$450 million industry providing our people with new jobs and business opportunities. (CEDS, p. 67).

Recent trends in transshipment activity demonstrate a smaller, not a larger, economic role (Fig. 6); transshipment of tuna dropped from nearly 12 million kgs in 2001 to less than 6 million kgs in 2006 (Guam Bureau of Statistics and Plans, 2007). The Port of Guam appears to have lost much of its competitive advantage compared to alternative transshipment locations in the western Pacific and elsewhere, a trend that may not be reversible (Stock, 2006).

Given the estimate of Guam's total economic activity as \$3.4 billion (in 2002), commercial domestic fisheries make a relatively minor contribution to the Guam economy; the social and cultural importance of fisheries in Guam dwarfs their commercial value. As stated in a strategic planning document, Vision 2001/2005:

The commercial value of the industry is just one component of the importance fisheries plays in the lives of Guam's people. It is estimated that the prehistoric settlement of Guam occurred 2500 years ago, and throughout the history of the island, there is perhaps no other natural resource that is as fundamentally critical to the quality of life for the people of Guam as the benefits we derive from our surrounding ocean...it is the island marine resources which provide the greatest natural potential for economic self-sufficiency. (Gov. of Guam, 2001)

## **Economic Outlook**

The current outlook for Guam's economy has been characterized as "brighter than in several years" (First Hawaiian Bank, 2006) mainly as a result of the planned military buildup. Because the two most important sectors of Guam's economy (military and tourism) operate independently of each other, together they can impart some stability over time (First Hawaiian Bank, 2006). As a result, Guam's economic growth is expected to increase "well into the double digit range" over the next decade, and the unemployment rate is expected to fall. Guam's real estate sector is recovering from the recession early in the 2000s. Even though inflation could increase at similarly high rates and congestion "in various forms" could develop (including traffic), Guam's standard of living is expected to improve (First Hawaiian Bank, 2006).

However, a recent article in Pacific Magazine (March 1, 2007) painted a more pessimistic picture of the near future. The article concluded that the coming of the Marines would be a positive economic contribution, but only if Guam can "get its house in order" first.

The article pointed to continuing problems funding the Guam public school system, declines in commercial port revenues, airport revenues, and revenues to the government's general fund, coupled with debts in the government employees' retirement fund and ongoing issues with paying bills associated with the Guam public school system.

## HISTORICAL OVERVIEW OF FISHING ON GUAM

The first people to arrive in Guam, at least 3500 years ago, were skilled fishermen (Amesbury and Hunter-Anderson 2003; Amesbury, 2006). Proof of fishing skills of the indigenous people of Guam is found in archaeological excavations, which yield fish bones of pelagic as well as inshore marine species. Amesbury and Hunter-Anderson (2003) provide an archaeological and historical overview of the major historic periods in Guam (Table 1).

Table 1.--Prehistoric and historic periods in Guam.

Prehistoric Period	1500 BC–AD 1521
Spanish Period	AD 1521–1898
First American Period	1898–1941
Japanese Occupation Period	1941–1944
Second American Period	1944–Present

In the late prehistoric period (AD 1000–1521), Guam supported an aboriginal culture (whose present-day descendants call themselves Chamorro or Chamoru) based on agriculture, fishing, and gathering. Dispersed settlements were of different sizes and made up a semi-mobile, archipelago-wide settlement system adapted to irregular rainfall and frequent typhoons.

Prior to the arrival of Europeans in Guam, the Chamorro inhabitants possessed large sailing canoes (*proas*) that allowed them to fish on offshore banks (Amesbury and Hunter-Anderson, 1989). The manufacture of these canoes was monopolized by the *matua* (noble caste), the deep-sea fishermen and interisland traders within Chamorro communities (Jennison-Nolan, 1979a).

Contact between the indigenous inhabitants of Guam and Europeans began with Magellan's stop at Guam in 1521. However, no permanent Spanish colony was established until the latter part of the 17<sup>th</sup> century. Estimates of the indigenous population size at the time of the arrival of the Spanish vary between 50,000 and 85,000.<sup>5</sup> The Chamorro people suffered a tremendous decline in population during the ensuing 100 years. Active warfare carried out by the Spanish colonizers and the scourge of introduced diseases decimated the population. During this period, the population of native Chamorros declined to approximately 1500 (Underwood 1973 cited in Amesbury et al., 1989).

The Chamorros fought to maintain their own customs and beliefs; open rebellion against the Spanish began in 1670 and continued for 25 years. Chamorro weaponry

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<sup>5</sup> Estimates include: 65,000 – 85,000 people on Guam (<http://ns.gov.gu/people.html>); Chamorro population of 50,000 throughout the Mariana Archipelago (<http://www.doi.gov/oia/Islandpages/gumpage.htm>); estimated Chamorro population at that time of nearly 75,000 (<http://www.everyculture.com/No-Sa/Commonwealth-of-the-Northern-Mariana-Islands.html>)

ultimately proved to be no match for that of the Spaniards and by 1698, a Chamorro-Spanish peace was reached (Jennison-Nolan et al., 1979).

During the late 1600s and early 1700s, the large, oceangoing canoes of the Chamorros were systematically destroyed by the Spanish colonizers, and the Chamorros were forcibly relocated into parishes organized around churches to concentrate the indigenous population in a few settlements, thereby facilitating colonial rule as well as religious conversion (Amesbury and Hunter-Anderson, 1989). The relocation disrupted prehistoric patterns of settlement and community development, thereby breaking connections with marine resources. After the enforced demise of the sailing canoes, fishing for offshore species was no longer possible and reef fishing predominated.

During the late 1700s and the 1800s, Carolinians sailed their oceangoing vessels between the Carolines and Guam to engage in trade, and a Carolinian community was established in 1816 on Guam until it was abandoned in 1901 (Moore et al., 1988). When the population of Guam was reduced by epidemics in 1849 and 1856, attempts were made to increase the population by importing Carolinians and others; more than a thousand Carolinians were subsequently living in the Marianas, although it is unknown how many of these lived on Guam (Moore et al., 1988). The Carolinians fished as well as farmed and raised animals. One of their fishing implements was a double-pointed spear, and in 1885 they used one oceangoing craft for fishing expeditions until it was abandoned; then they either used more modern boats or fished the lagoon and reefs.

In the late 1880s, the Spanish governor of the Mariana Islands wrote of Guam that “inside the reef (indigenous people) catch different varieties (of fish) all year long.” The Governor also noted the importance of the seasonal arrival of rabbitfish (*manahak*) in inshore areas (“the populace then appears en masse to fish”), which is still an important event in Guam’s reef fishery in modern times (Amesbury and Hunter-Anderson, 2003).

Following the Spanish-American War in 1898, the U.S. Navy took control of Guam. From then until 1950, the people of Guam were classified as U.S. nationals, not U.S. citizens (Jennison-Nolan et al., 1979). The U.S. colonial government held training programs to encourage local residents to participate in offshore commercial fishing (Amesbury and Hunter-Anderson, 1989). However, residents were deterred from this endeavor by a lack of capital to purchase and maintain boats of sufficient size.

An early 20<sup>th</sup> century report noted that Chamorro dependence on the reef was not as great as in other Pacific Islands because they had become essentially an agricultural people (Safford, 1905). Wage work became available to the local population very early in the American period and by 1911 about 80 percent of the population lived either wholly or in part on imported food (Thompson, 1947). The 20<sup>th</sup> century has seen continuing declining use of inshore marine resources as an important dietary component. Amesbury and Hunter-Anderson (1989) concluded that “in the decades prior to the Second World War, inshore but not offshore fishing was part of the subsistence base of the native people.” One document they reviewed was a list of the “principal fishes of Guam”

written by a scientifically trained naval officer. Nearly all the fishes listed were reef-associated.

During WWII, Guam became the only populated U.S. soil to be occupied by another country, remaining in Japanese hands for two and a half years. Control of the island came under the Imperial Japanese Navy in March, 1942. Chamorros were allowed to remain on their farms and trade for products they needed, but were forced to learn Japanese language and customs; English was forbidden. In early 1944, the Japanese Army returned to Guam, instigating a stricter form of government—the *kaikontai*. Social activities were prohibited, schools closed, and Chamorros were forced to work long days in the fields, repair or build airstrips and defense installations, and dig cave shelters. During the World War II occupation by the Japanese military, Guam returned to subsistence activities and reciprocal exchange of goods (Jennison-Nolan, 1979b), so shore fishing probably intensified although there is limited information for these years.

Shortly after the end of World War II, the U.S. military assisted several villages in developing an inshore commercial fishery using nets and traps (Anonymous, 1945). Post-World War II wage work enabled some fishermen to acquire boats with outboard engines and other equipment for offshore fishing (Amesbury and Hunter-Anderson 1989). Since then, Guam's inshore fisheries have shifted from an exclusively subsistence focus to an artisanal fishery that blends subsistence, recreational, and commercial purposes (Hensley and Sherwood, 1993). The first year that a pelagic fish species was included in the catch reports of the postwar Guam civilian government was 1956. Until then, all catch reports were of reef-associated species (Amesbury and Hunter-Anderson, 1989). As recently as the 1970s, relatively few people in Guam fished offshore, even on the protected leeward side of the island, because boats and deep-sea fishing equipment were too expensive for most people (Jennison-Nolan, 1979a).

The Guam Fishermen's Cooperative Association (GFCA) began operations in 1976 and was incorporated in 1977. After the GFCA established a small marketing facility at the Public Market in Agana, fishermen were no longer forced to make their own individual marketing arrangements after returning from fishing trips (AECOS, 1983). Today, the GFCA's membership includes 164 full-time and part-time fishermen and it processes and markets (retail and wholesale) an estimated 80 percent of the local commercial catch (Duenas, 2007). As will be described later, GFCA's activities are not limited to its members but are designed to provide benefits for fisheries resources and the broader Guam community.

Fisheries on Guam are managed by the Guam Division of Aquatic and Wildlife Resources (DAWR) in conjunction with the Western Pacific Regional Fishery Management Council, which has jurisdiction over the Guam Exclusive Economic Zone (EEZ) extending from 3 to 200 miles offshore.

## COMMUNITY DEPENDENCE ON FISHING AND SEAFOOD

Over the centuries of acculturation, beginning with the Spanish conquest in the late 17th century, many elements of traditional Chamorro culture in Guam were lost. But certain traditional values and attitudes have persisted, melding with elements of Western culture to form contemporary local life and custom.

Fishing in Guam continues to be important not only in terms of contributing to the subsistence needs of the indigenous Chamorro population but also in preserving their history and identity. Fishing has assisted Chamorros and immigrant cultures in keeping alive what remains of the maritime attributes of their traditional culture, maintaining their connection to the sea and its resources.

High value is placed on sharing one's fish catch with relatives and friends. The social obligation to share one's fish catch extends to part-time and full-time commercial fishermen (Amesbury and Hunter-Anderson, 1989). In a study conducted by Rubinstein (2001), nearly all fishermen (96 percent) reported that they share fish regularly, giving fish to family (36 percent), friends (13 percent) or both (47 percent). A majority (53 percent) said they did not give fish to people other than family and close friends; of those who did occasionally, the main recipients were church fiestas (32 percent) and other church events or organizations (20 percent).<sup>6</sup> This pattern of distribution reflects Guam's long and well-entrenched Catholic tradition.

A 2005 survey of Guam households found that out of the fish consumed by households, a little more than half (51 percent) was purchased at a store or restaurant and 9 percent was purchased at a flea market or from a roadside stand. Nearly one-quarter (24 percent) of the fish consumed was caught by the respondent or an immediate family member, and an additional 14 percent was caught by a friend or extended family member (Beukering et al., 2007).

Given the small size of Guam, dispersal of fishery participants and extensive community networks for sharing locally caught fish, it is likely that the social benefits of fishing are experienced by most of the island's long-term residents. It is likely that extensive social networks are created by or sustained through sharing of fish.

Fish play a role not only in providing protein but in maintaining cultural events and identities. The people of Guam participate in many banquets throughout the year associated with neighborhood parties, wedding and baptismal parties, wakes and funerals, and especially the village fiestas that follow the religious celebrations of village patron saints (Pinhey et al., undated). All of these occasions require large quantities of fish and other traditional foods (Rubenstein, 2001). Sometimes fish are sold to earn money to buy gifts for friends and relatives on important Catholic religious occasions such as novenas,

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<sup>6</sup> Indigenous Chamorros were 41 percent of the sample, followed by 18 percent Micronesian, 27 percent Euro-American, and 7 percent Filipino.



births and christenings, and other holidays (Amesbury and Hunter-Anderson, 1989). Even when fish are purchased informally by friends, neighbors or relatives of the fisherman, the very personal nature of the marketing tends to restrain the asking price.

Immigrants from the Federated States of Micronesia (FSM) and Palau also require fish for a variety of cultural events, and they frequently bring them from Palau and FSM because those fish are preferred to the same species from Guam.

When asked why they went fishing, Rubinstein’s (2001) sample of offshore fishermen revealed three motivations. The predominant motivation (65 percent) emphasized the personal enjoyment derived from fishing; a number of respondents within this category, especially Chamorros and other Micronesians, emphasized the sense of cultural identity they derive from fishing. A second motivation (18 percent) was consumption of fish by the family. The final motivation (16 percent) was income derived from fishing. More than half (51 percent) of the respondents claimed multiple motivations, and, frequently, respondents who indicated that recreation was their primary motivation said they provided fish to family and friends.

Annual seafood consumption in Guam is estimated to be about 60 lbs per capita (Amesbury, 2005-2006). A large proportion of fish consumed on Guam is believed to be imported. A recent survey found that 57 percent of the fish consumed by Guam households reportedly came from inside or outside Guam reefs, while 43 percent was reported as being imported from the U.S. mainland or other Pacific islands (Beukering et al. 2007). The total proportion of imported fish consumed on Guam may be higher because restaurants and hotels (and perhaps military bases) are assumed to rely more on imported fish. Data related to dependence on fish for food are shown in Table 2 below.

Table 2.--Indicators of dependence on fishing and seafood.<sup>7</sup>

Year (Reference)	Per capita consumption of seafood (lb)	% households participating in fishing
Late 1940s	365 (CNMI)	
1975 (Klimek, 1975)		65
1980	60	
1983 (AECOS, Inc.)	56	
2002	57 (estimates for three villages only)	
2005 (Beukering et al., 2007)		45

<sup>7</sup> Source: Amesbury (2005-2006) unless otherwise cited.

Seafood consumption is lower than it was historically, as is probably the sharing of fish and its role in maintaining social networks. While some families in the less urbanized areas continue to supplement their diet by fishing and farming, no existing communities can be said to be completely dependent on local fishing as a source of food.

Westernization of Guam, particularly since World War II, not only completed the change from a subsistence to wage-based economy but contributed to dramatic changes in eating patterns, including lower seafood consumption. This has contributed to significantly higher rates of obesity (Pinhey, Rubenstein and Colfax, 1997) and a greater prevalence of diabetes mellitus among Guam's indigenous Chamorros (Pinhey, Heathcote and Craig, 1997).

The cultural importance and tradition of fishing is being passed on to younger residents not only through continued family practices but also through more organized mechanisms. One of these is the Annual Fisherman's Festival "Gupot Y Peskadot" at the Fisherman's Co-op building. This day is designed as a family experience, with seafood tasting and a variety of ocean-themed activities for children. The annual Kids' Fishing Derby, first held in 1994, continues to be sponsored by Guam Division of Aquatic and Wildlife Resources (Photo 1).



Photo 1.--Kid's fishing derby participants show their catch.

Another example is a 4-H Fishery Workshop, sponsored by the University of Guam in cooperation with the U.S. Department of Agriculture and many other partners. The workshop, which lasts 3 weeks, is designed to give participants basic knowledge of tides, currents, phases of the moon, oceanography, marine sciences, water pollution, the environment and water safety, and fishery economics and marketing. Coupled with hands-on experience in these varied aspects of fishing is a broader 4-H curriculum that emphasizes skills to enable students to become active, successful members of society. In 2006, the program exposed participants to both traditional and modern fishing techniques such as net fishing, spearfishing, trolling, fishing safety, and the lunar cycle and its effects on fishing (Photos 2 and 3).

In summary, fishing in Guam continues to be important not only in contributing to the subsistence needs of the Chamorro and other residents but in preserving their histories and identities. Knowledge of how fish are distributed and consumed locally is crucial to an understanding of the social and cultural significance of fishing on Guam.



Photo 2.--4-H program participants practice chenchulu fishing.



Photo 3.--4-H program participants change location to another reef section while practicing chenchulu fishing.

### **SHORELINE AND INSHORE FISHING**

In prehistoric times, Guam's inhabitants were dependent on inshore fisheries for a large portion of their subsistence (Jennison-Nolan et al., 1979). A detailed cultural code guiding when, where and who participated in shoreline fishing likely existed in prehistoric times (Amesbury, 2006).

Despite a general decline in fishing from the 1700s into the 20<sup>th</sup> century (Amesbury and Hunter-Anderson, 1989), inshore fisheries were active in the pre-World War II period. According to a government survey (Office of Strategic Services, 1942), there were at least 200 outrigger canoes used for inshore fishing in various locations around the island. This number is believed to be conservative. Canoes were used to set fish nets in seine dragging operations and to maintain fish weirs and traps located in deeper waters of bays. Other prewar fishing activities included gleaning of shells and clams, spearing, pole and line fishing and throw netting (Jennison-Nolan, 1979b). Fishing at this time remained a cooperative effort, as evidenced by the practice of sharing of canoes and fishing tackle in several municipalities prior to World War II (Jennison-Nolan, 1979b).

In addition, the throw net (*talaya*) was made with varying mesh dimensions and could be adapted for catching a variety of reef fish. The *chenchulu* was a long nylon net requiring the cooperation of several people to catch *atulai* (bigeye scad) and other schooling fish. The *lagua* was a short net held in place by two fishermen, while others beat the water with coconut fronds to chase juvenile rabbitfish (*manahak*, family *Siganidae*) and goatfish (*ti'ao*, family *Mullidae*) into the waiting net (Jennison-Nolan, 1979b). On the Agat coast and probably other areas, the use of *chenchulu* and *lagua* involved a long-established system for dividing the catch; half went to the net owner or to the owners of the canoe and net together. Of the remaining half, one-third was allocated to swimmers who herded the fish toward the net and the other two-thirds to other helpers, such as net holders and watchers (Jennison-Nolan, 1979b).

The number of people engaged in shore fishing during the 1970s was still surprisingly large, especially considering that about 90 percent of the food consumed on the island was being imported (Jennison-Nolan et al., 1979). In an island-wide random sample of 180 Guam households surveyed by the University of Guam in 1975, 65 percent reported some participation in fishing (Klimek, 1975), which was presumably shore fishing as a result of the low level of boat ownership at the time.

Catch-per-unit-effort (CPUE) in Guam's shore-based fisheries for reef fish (pole, spear, cast net, surround and gill net) declined sharply in the 1980s and has not recovered according to inshore creel surveys conducted by the Guam Division of Aquatic and Wildlife Resources (Porter et al., 2005). Offshore (boat-based) catches of reef-associated fish have remained relatively constant since 1992, whereas inshore catches that accounted for the majority of the reef fish harvest during the 1990s presently account for the minority of the total harvest.

The most notable trends in inshore fishing methods are an increase in spearing over the last 10 years and a decline in cast netting. Much of the traditional harvest on Guam is from pulse fishing that targets seasonal runs of juvenile rabbitfish, goatfish, bigeye scad (*atulai*, *Selar Crumenophthalmus*) and jacks family (*i'e*, family *Carangidae*). Spear fishermen who access offshore waters by swimming from shore or boats are generally satisfied with fish catch rates on reef slopes. Spear fishermen report that they are still catching fish but say they must "work harder" to maintain catch rates (Borja, 2006). Offshore spearing effort is restricted when the ocean is rough.

Post-World War II immigration of people from other Micronesian islands and from Asian countries increased the harvest and consumption of small invertebrates not commonly eaten by indigenous people (e.g., sea cucumbers, very small crabs, mollusks of the families *Bursidae* and *Fasciolaridae*). It also amplified the use of destructive fishing methods (such as chlorine) for a period and reinforced the historical preference for smaller fish that may not have reached sexual maturity.

Vaughn (1999) conducted a detailed study of the inshore fishing behaviors and spatial patterns of the three largest resident fishing cultures on Guam: Chamorro, Micronesian and Filipino. He found that Chamorros comprised about  $\frac{3}{4}$  of the 260

fishing parties he encountered, concluding that the Chamorro fishing culture usually dominated the fisher population of the reef areas. Micronesians constituted about 17 percent of the fishing parties and Filipinos about 7 percent. Vaughn (1999) documented a number of contemporary reef fishing methods on Guam, including gleaning, hand line, rod and reel, *talaya* (cast net), *tekken* (gill net), *chenchulu* (surround net), and spearfishing.

From his observations, interviewing and historical review, Vaughn (1999) concluded that explicit rules governing permanent marine ownership do not exist on Guam but that Chamorro fishermen maintain a strong identification with village and municipal space. This village relationship included the reef during the early part of the 20<sup>th</sup> century but that has since largely disappeared.

Still, the concept of marine tenure remains and manifests itself in a system of “pliant tenure” (a vestige of traditional marine tenure) recognized by the resident fishing cultures on Guam. While any reef area is publicly accessible, fishermen act according to a system of temporary ownership or pliant tenure of reef area (Vaughn, 1999). The Chamorro concepts of marine tenure also include feelings about village, municipal, and regional tenure but these ideals do not surface in negotiating social distance while on the reef (Vaughn, 1999).

Pliant tenure operates through informal negotiation of access and space on inshore fishing grounds that are public domain (Vaughn, 1999). Because boundaries are transitory under pliant tenure, Chamorro fishermen using the same general area at the same time will regulate the social distance between them to maintain appropriate distance—but could have a difference of opinion of what that distance should be. Misunderstandings also can result when private property is unmarked, so permission to access the reef is not sought. In such cases, Vaughn (1999) notes that “Typically an offended fishing party will cordially inform the disrespectful fisher of the violation and then promptly collect the fishing equipment and depart. There is often no reason to fish when the control of relative space necessary for adequate fishing is no longer possible.”

Not just Chamorro, but fishers from every ethnic group come to understand and follow prescribed rules of spatial behavior that center on the temporary control or ownership of reef space (Vaughn, 1999). In other words, although the intricacies of pliant tenure are the spatial expression of Chamorro values, immigrant fishers incorporate these values and adhere to the established system of marine tenure. This does not mean that patterns of fishing do not differ both within and across ethnic groups, as will be explained.

Vaughn (1999) described fishing patterns of three primary groups of fishermen: Chamorros, Micronesians, and Filipinos. Chamorro fishermen interviewed by Vaughn showed several patterns of fishing. Some fishermen selected spots primarily within their municipality, although they felt comfortable fishing in neighboring areas. Other fishermen exhibited a more dispersed fishing pattern, fishing areas some distance from their residence. A third pattern was evident for Chamorro fishermen who were born and

raised in one area but now lived elsewhere; they fished reefs associated with both of these municipalities. Fishermen living in landlocked areas tended to fish the reefs closest to their village.

To Chamorros, other factors play a greater role in the decision of where to fish than any perceptions about marine tenure (Vaughn, 1999). One was travel distance, along with the particular characteristics of the roads traveled, such as the ability to observe fishing locations along the way. A critical consideration is level of pollution believed to be present on a given reef, as well as existing environmental conditions (such as tides, currents, and wind speed and direction), perceptions of the health of the fishery, and the potential for conflict with other fishermen or criminal activity in the area. Chamorros use their knowledge about relationships among sea creatures and conditions to decide where to fish: “Using knowledge about the fishery inclusive of how preferred target species will react to daily, monthly, and annual shifts in the physical environment is the chief criteria used by Chamorro fishers when deciding on a fishing location.” (Vaughn, 1999, p. 93)

Jennison-Nolan et al. (1979:28) noted that fishing practices are “understood in terms of residence and place fished. In times past, one had to fish (and hunt and collect plant foods) in one’s own district; today we see a survival of that behavior in the practice of fishing most often in one’s own village or within five miles of home....” Chamorro fishermen operate with a symbolic attachment and natural sense of belonging to specific reefs or fishing sites (Vaughn, 1999). During interviews, “Frequently fishers would inform me about how they fished with their father and grandfather at certain places on the reef. Fishing spots had histories comprised of abundant catches, and both past and present fishing partners, and also served as gauges for environmental change” (Vaughn, 1999:100).

Regional identity is significant in establishing residential ties that are used to access private coastal property and reach fishing grounds on the reef. Fishermen residing in southern villages rely on kin and residential bonds to access private coastal property but also extend the residential tie to unknown residents in other southern villages.

For example, southern fishermen understand that they will be accepted elsewhere in southern Guam because residents comprehend an extra-municipal identity (Vaughn, 1999). Residents from other areas of Guam, however, are discouraged from shore fishing along southern coasts, sometimes because of vandalism of their vehicles (Rosario, 2006). The southern villages of Merizo and Umatac are probably the only remaining villages on Guam that have been inhabited continuously since prehistoric times and were relatively isolated from the mainstream of developing wage economy in the first half of the 20<sup>th</sup> century (Jennison-Nolan et al., 1979). As a result, there remains a generalized respect for family, community and environment that strongly influence shore fishing activities. That is why fishermen of Merizo were bothered by commercial fishermen from other villages using their reef space to catch fish for market in the 1930s (Thompson, 1947).

Micronesians exhibited fishing patterns differing from those of Chamorros. Vaughn (1999) observed most of the 44 Micronesian fishing parties at night while they



were spearfishing rather than during the day. They regularly fished in areas distant from their residence. Although spearfishing over the reef front at night was the dominant method observed, the Micronesian fishing groups observed also used gleaning, hand lines, rod and reel, and a variety of nets at various locations on the reefs. Some fishing parties consisted of groups of men, women and children, each of whom would use a different method within the same general fishing area. Some of these fishers obtain seafood lower down the seafood chain, such as sea cucumbers and some species of shellfish not typically harvested by Chamorros.

Although Micronesians understand that the reef areas are considered public resources, they are reluctant to access a beach that abuts private property, and they avoid foreshore areas near property that is clearly private (such as areas marked by signs or fences). Some of the Micronesians interviewed by Vaughn described verbal disputes with Chamorro fishermen at a variety of locations; some Micronesians described how they would seek a Chamorro fisherman to accompany them and wait by their car while they fished to deter conflict and protect their vehicle. To avoid these conflicts, Micronesians observed by Vaughn accessed fishing areas through public lands, which they viewed as neutral territory.

Filipinos exhibited a dispersed fishing pattern similar to that of the Micronesians, but Vaughn (1999) noted that they tended to have residences concentrated in the northern areas of Tamuning and Dededo rather than the dispersed residences of the Micronesians, so they fished more within the northern region. The Filipinos, who engage primarily in net and line fishing, reported much lower levels of conflict with Chamorro fishermen than those described by Micronesians.

Based on creel surveys of fishermen in the mid-1980s, about one-quarter to one-third of the inshore catch was sold. The remainder entered noncommercial channels (Knudson, 1987). Reef fish continues to be important for social obligations, such as fiestas and food exchange with friends and families. One study found a preference for inshore fish species in noncommercial exchanges of food (Amesbury and Hunter-Anderson, 1989). The local harvest of reef fish is insufficient to meet demand, and there are substantial imports from the Federated States of Micronesia and the Philippines.

## **Current Inshore Fishing Issues**

### **Reduced Fishing Access and Resulting Cultural Impacts**

Based on a map developed by the Guam Fishermen's Cooperative Association, a substantial proportion of Guam's coast is presently inaccessible for shore fishing (Fig. 7). Loss of inshore marine resources and reduced coastal access are viewed by fishermen as threatening the perpetuation of indigenous cultures and communities in Guam. The decline in subsistence fishing is a significant issue to Chamorros because teaching local fishing methods to younger generations by elders is one of the principal ways of perpetuating cultural identity and practice (Beukering et al., 2007). The group labor



involved in some forms of fishing (e.g., *chenchulu*) and widespread distribution of the catches reinforce family cohesion and communal identity (Vaughn, 1999).



Figure 7.--Fishermen’s access to shoreline areas (Source: GFCA, 2006).

Vaughn (1999:19) warns that “A resurfacing of municipal tenure is unlikely as village life continues to become more fragmented and individualized. At present, Chamorros are in transition from a concept of municipal ownership over resources and the space used to acquire those resources.” As village cohesion faded, pliant tenure emerged as the chief form of marine tenure on Guam. “Pliant tenure persists but will likely disintegrate as the idea of marine tenure becomes more foreign amongst new fishers” Vaughn (1999:119).

Without safe places to teach traditional fishing techniques, fishermen fear that cultural harvest practices are less likely to be sustained and passed on to future generations. These practices could be further jeopardized when the U.S. buildup of military personnel and families on Guam during 2008–2013 adds substantially to the demand for ocean activities, competing with subsistence fishing and degrading inshore fisheries habitat.

### **Marine Preserves**

The government of Guam established five marine preserves in 1997. The size of the preserves varies but all preserves extend from 10 m above the mean high tide mark to the 600-ft depth contour. Dip netting, gill netting, drag netting, surround netting, spear fishing, the use of gaffs, shell collecting, and gleaning are prohibited in all five marine reserves.

Trolling is allowed in all preserves from the reef margin seaward but only for pelagic fish. Bottomfishing may be conducted seaward of the 100-ft contour in Tumon Bay Marine Preserve. Limited fishing is allowed in Tumon Bay, Pati Point and Achang Reef Flat Marine Preserves. In Tumon Bay, hook and line fishing and cast net (*talaya*) fishing from shore and along the reef margin are permitted for certain species. All other fishing methods are prohibited. From shore, catch is limited to rabbitfish, juvenile goatfish, juvenile jacks, and convict tangs (*kichu*, family acanthuridae). All other fish must be released immediately. Cast net fishing along the reef margin is allowed for rabbitfish and convict tang only.

There are no species restrictions for fishing in Pati Point Marine Preserve, although fishing methods are limited to hook-and-line from shore. Limited cultural takes are permitted in Achang Reef Flat Marine Preserve adjacent to the village of Merizo for seasonal runs of juvenile rabbitfish and bigeye scad. No fishing is allowed in Piti Bomb Holes (Photo 4) and Sasa Bay Marine Preserves (Porter et al., 2005). The fishing advisory for PCB-contaminated coastal waters near the Orote Dump has resulted in a de facto fishing exclusion zone (Porter et al., 2005). PCB-contaminated fish have been found in Cocos Lagoon after apparently having been eaten for years by residents of Merizo. Merizo leaders are concerned that if Cocos Lagoon is closed to fishing and Achang reef flat remains a Guam marine preserve, Merizo villagers will be unable to harvest fish locally.



Photo 4.--Sign showing prohibited fishing techniques in Piti Bomb Holes Preserve; the pier structure is part of Fish Eye Marine Park, a popular tourist destination.

Chamorro fishermen report they have been displaced from their home fishing grounds in Tumon Bay by a marine reserve and Agana Bay by tourist watercraft activities and other places where elders have traditionally taught their children and grandchildren to fish (Photo 5). Many fishermen argue that only small “aquarium fish species” have become more abundant in areas designated as marine reserves and that larger fish are now more visible in the reserves because they have been tamed by tourist fish feeding, although there currently are no data available to confirm or refute this belief.

These fishermen believe that marine reserves have eliminated the very people (i.e., fishermen) who care the most about marine resources, while leaving reserve areas open to nonfishing impacts by transients engaging in jet skiing, sport diving and other tourist activities. An “eco-permit” process was developed by the government of Guam to address the impacts on marine preserves by nonfishing activities, but it has not yet been implemented, leaving many fishermen frustrated and feeling “singled out” by regulations as they watch tourists trample reef habitat (see Photo 4 for one example). Some fishermen are skeptical that recreational uses in reserves will ever be regulated because tourism is critical to the Guam economy. They believe that the tourism industry has the political will and power to resist any such regulatory efforts. As a result, the issue for fishermen is not just one of access, but also of equity. In their view, ocean tourism is not

a nonconsumptive activity just because fish are not extracted; access and space are consumed and there are impacts to water quality, fish, and coral reef habitat.



Photo 5.--Lone fisherman (on shore at far left) amidst the beach-goers at Tumon Bay, one of Guam's five marine preserves.

The government of Guam is one of five island governments (led by Palau) in the Micronesia region cooperating with nongovernmental environmental organizations in the "Micronesia Challenge." The governors of Palau, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia and Guam have entered into a Declaration of Commitment to "effectively conserve at least 30 percent of the nearshore marine and 20 percent of the terrestrial resources across Micronesia by 2020." If the government of Guam's participation in the "Micronesia Challenge" leads to the establishment of additional marine preserves around the island, subsistence fishermen could face further reduction of the coastal area open for fishing.

### **Marine Habitat Degradation**

Sediment discharge and terrestrial runoff from mountainous southern Guam watersheds are the principal anthropogenic threats to nearshore water quality and coral reef ecosystems in that area (Golabi et al., 2005; Khosrowpanah et al., 2002). The effects of land runoff on stony corals appear to be cyclical, with no long-term change in live coral distribution patterns in Fouha Bay (Rongo, 2004). Corals recolonize areas closer to the river mouth during dry periods but die back as a result of runoff and sedimentation

during wet periods (Rongo, 2004). Seaweed and seagrass beds are also affected by terrestrial runoff.

Community leaders state that commercial jet ski operations in east Agana Bay and removal of an intertidal green seaweed species *lumot* (family *Enteromorpha*, the primary food of the *dagge*<sup>8</sup>) by beach raking at low tide along the shores of east Agana and Tumon bays have major adverse effects on shallow marine habitat (Blas, 2005). A 2005 survey of 400 Guam households found that residents are most concerned about the effects of pollution and its threat to Guam's coral reefs (Beukering et al., 2007). The same survey found that residents generally support a ban on small-mesh nets and night SCUBA spearing, although they perceive this as less of a concern. Chamorros in particular are apt to base their fishing decisions, in large part, on perceptions of water quality (Vaughn, 1999).

### **Lack of an Inshore Fishermen Organization**

As mentioned, Guam has a municipal level of government made up of 19 villages with elected mayors. Most mayors see the value of maintaining subsistence fisheries to perpetuate Chamorro cultural practice and identity. There is, however, no overall blueprint for a coordinated course of actions to mitigate current threats, let alone to prepare for heightened threats to fishing associated with U.S. military population buildup on Guam.

More importantly, there is currently no shoreline organization comparable to the scope or force of the GFCMA which primarily represents and facilitates commercial offshore fishing on Guam (although some inshore fishermen are GFCMA members). Resistance to government of Guam marine preserves provides an incentive for creating an organization of shore fishermen, but no formal group has emerged. Some have suggested that the GFCMA extend its coverage to inshore fishermen and issues, while others have discussed the development of a separate organization.

## **OFFSHORE FISHING**

As described previously, pelagic fishing during the prehistoric period and the first 200 years of the Spanish period depended on the flying proa, the large oceangoing sailing canoe (Amesbury, 2006). In the early 17th century, a Spaniard described the Chamorros as "...the most skilled deep-water fishing people yet to have been discovered" (Driver, 1983:208). Once the Spanish destroyed the Chamorro sailing canoes in the early 1700s, the Chamorro people no longer fished for pelagic species on a large scale (Amesbury, 2006).

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<sup>8</sup> This is the life stage of the rabbitfish following the *manahak*.

From 1933 to 1937, the U.S. naval government established a fishing school to train Chamorros to fish beyond the reef. Twelve men at a time were trained for a period of 3 months. Offshore fishing failed to develop, however, because of a lack of boats (Amesbury, 2006). After World War II, cash was scarce but as the economy improved in later years, local people began to buy boats and outboard motors for trolling (Amesbury, 2006). As recently as the early 1970s, relatively few people in Guam fished offshore, even on the protected leeward side of the island, because boats and deep-sea fishing equipment were prohibitively expensive for most people (Jennison-Nolan, 1979b).

An economic boom that began in the late 1980s and continued through most of the 1990s led to an increase in the number of small fishing boats which are trailerable and under 30 ft in length (Amesbury, 2006). During that period, Guam developed a small-boat fishery that conducts trolling and bottomfishing mostly within 30 miles of shore. Offshore fishing typically involves small boats and 1- to 2-day fishing trips. Five pelagic species made up 90–95 percent of the trolling catch: mahimahi, skipjack tuna, wahoo, blue marlin and yellowfin tuna during the period 1980–2005 (Amesbury, 2006).

Since the 1970s, the offshore fishery has been monitored with a dockside creel census conducted by the Guam Division of Aquatic and Wildlife Resources (DAWR). In 1982, WPacFIN began working with staff of DAWR and with local fish dealers to obtain information on commercial landings through voluntary use of “trip ticket” invoices provided by WPacFIN. Monthly and annual summary reports by species are generated after completing all editing, adjusting, and quality control activities for the commercial landings data. Each table contains information on the pounds, value, and the average price per pound for each species or species group. Each monthly report contains a subtotal for the sum of all species combined for that month. Annual reports contain the estimated total landings for each species and the estimated total recorded landings for all species for the calendar year. Included with the estimated commercial landings summary reports are graphs of some of the important statistics. These analyses are presented in annual Fisheries Management Plan reports of the Council (<http://www.pifsc.noaa.gov/wpacfin/guam/dawr>). The creel data reflect significant seasonal catch variations for several pelagic species (Amesbury and Babin, 1990; Anon., 1999).

Guam fisheries of the mid-1980s were characterized by Knudson (1987) as including (1) a small number of true commercial fishermen, (2) subsistence/recreational fishermen who regularly sell part of their catch, (3) a large number of subsistence fishermen who rarely sell any of their catch, and (4) a substantial number of recreational fishermen. Guam’s commercial fishery is therefore the product of many relatively small sales by a large number of semicommercial fishermen. Offshore fishery resources were underutilized at the time of the study, whereas inshore resources were heavily utilized (Knudson, 1987). About 40 percent of the catch was commercial and 60 percent noncommercial. At the time of the research, the threshold catch that triggered commercial sale of fish was about 25 kg per trip. This generated enough revenue for offshore fishermen (operating boats) to pay for fuel costs. Catches below 25 kg were far more likely kept by the fisherman for personal use (Knudson, 1987).

Guam’s small-boat domestic fishery of the 1990s (typically under 22-foot vessels) evolved to a somewhat larger class (typically under 30-foot vessels) with expectations of a further increase in fishing vessel size unless constrained by high fuel costs (GFCA, 2004). About 7 percent of the fleet was made up of charter vessels berthed in marinas with full-time captain and crews. The other vessels were mostly small craft towed to launch sites (Anon., 1999). Most offshore fishing was conducted by Guam residents from owner-operated vessels, but charter boats were used by tourists and residents associated with the U.S. military (Myers, 1993).

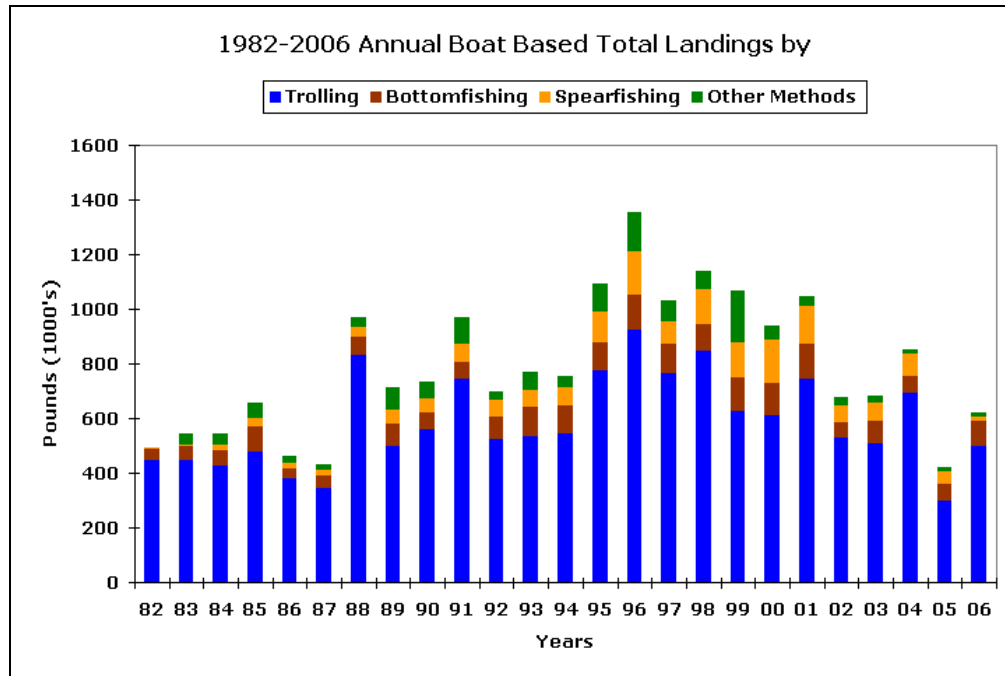


Figure 8.--Trends in boat-based landings, by method.

Boat-based landings have been dominated by fish that were caught with trolling gear, followed by bottomfishing and spearfishing, and other methods (Fig. 8; WPacFIN, 2007). In 2006, out of 622,000 lbs caught by fishermen using boats, 80 percent were landed by trolling, 15 percent by bottomfishing, 3 percent by spearfishing, and 2 percent by other methods.

Trends in CPUE, as measured by pounds of fish caught per hour fished, vary from year to year across the 1982 – 2006 time period but show no clear upward or downward trend over time (Fig. 9; WPacFIN, 2007).

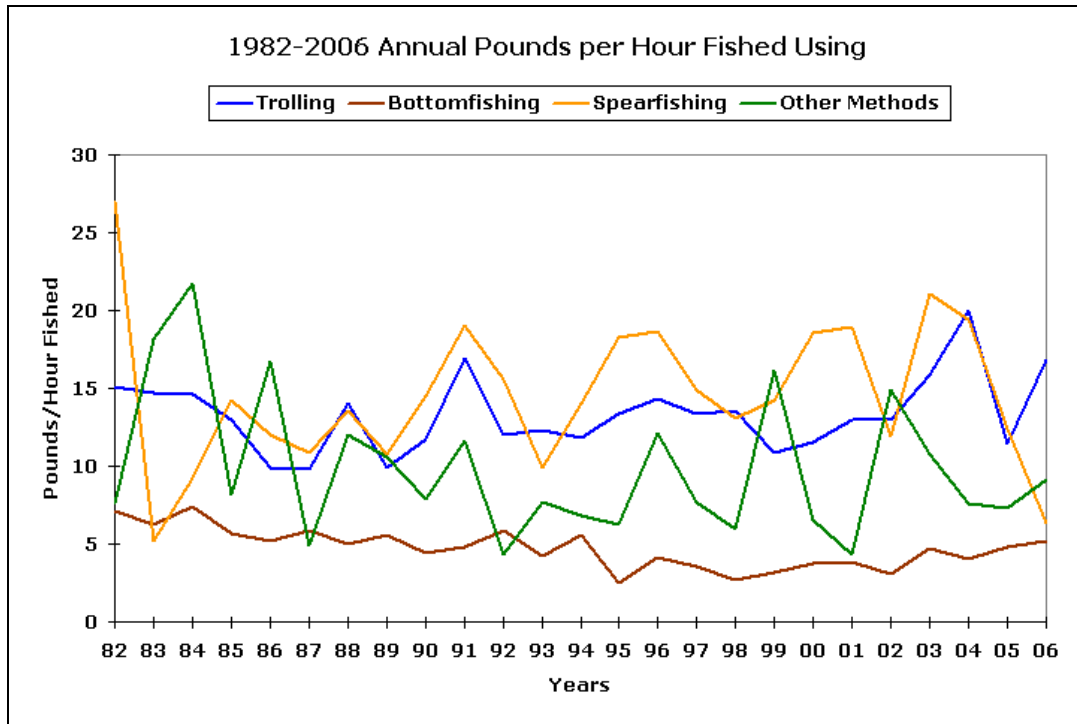


Figure 9.--Trends in catch-per-unit-effort (CPUE), by method.<sup>9</sup>

Offshore fishery is more heavily influenced than inshore fishery by seasonal variations in weather. Trolling and bottomfish fishing effort is greatest during the summer months (May to September), when sea conditions are generally much calmer and the offshore banks are accessible. Galvez Bank is fished most heavily as it is closest to shore. Other banks, such as White Tuna, Santa Rosa and Rota, are only fished during good weather conditions (Green, 1997). One larger vessel, the F/V *Galaide*, has been refurbished for offshore longline fishing and for bottomfishing at distant offshore banks. This active Guam boat is the only vessel currently registered for use with a general longline permit by the NMFS Pacific Islands Regional Office.

The Agana Boat Basin, centrally located on the western leeward coast, is the island's primary launch site for boats fishing areas off the central and northern leeward coasts and the northern banks. Most commercial trolling activity operates out of this location. The Merizo boat ramp, Seaplane Ramp in Apra Harbor, Umatac boat ramp, and Agat Marina sites provide access to the southern coast, Apra Harbor, Cocos Lagoon, and the southern banks. The Agat Marina, located between the Agana Boat Basin and the Merizo boat ramp, provides fishermen from the northern and central areas using trailered boats with a closer and more convenient launch site to the southern fishing grounds.

<sup>9</sup> The CPUE reported for spearfishing has been questioned and may not be accurate because night diving from small boats is not adequately measured.



A small boat launching ramp near the mouth of Ylig River on the east side of the island is used by offshore fishermen from eastern and southern villages who harvest reef and shallow-water bottomfish for subsistence and sale. When the ocean is not too rough, this ramp provides good access to windward areas for trolling. Creel interviews are not conducted at the Ylig River landing site, but relative effort at the site is accounted for in the current offshore creel program of the Guam Division of Aquatic and Wildlife Resources. In 2006, the Inarajan Boat Ramp was developed to provide access to the island's southern waters. The public launching ramp area includes a paved parking area, a floating loading dock, shore protection and access to power, water and telephone utilities. However, DAWR effort counts at this site reflect its infrequent use.

### **Pelagic Fishing**

In 2006, an estimated 386 small boats participated in Guam's pelagic fishery (WPRFMC, 2007); up about 8 percent from 2005 and up from an estimated 200 boats in 1982. These boats made an estimated 6414 fishing trips in 2006, with number of trips in a downward trend from a high of just more than 16,000 in 1996 (WPRFMC, 2007). All or nearly all trips consist of 1 day, averaging about 5 hours.

Pelagic fish catch from troll fisheries historically account for about 80 percent of the island's recorded boat-based fisheries commercial harvest (Fig. 5). Harvest levels fluctuated between 1982 and 2006, peaking at about 922,000 lbs in 1996; the 2006 level was just less than 500,000 lbs. These figures reflect the numbers of trolling fishing trips taken over the same time period, which was 6500 trips in 2006, down from the peak of 16,000 trips in 1996. Both landings and trips show a somewhat steady decline over the past 10 years. However, the CPUE as measured by annual pounds per hour fished has not shown a similar downward trend for trolling, ranging from about 15 lbs/hour in 1982 to nearly 17 lbs/hour in 2006, with a high point of 20 lbs/hour in 2004.

Mahimahi, wahoo, billfish, and skipjack and yellowfin tuna comprise most of the Guam commercial troll landings. From 1980 to 2006, landings of wahoo varied from a low of about 14,000 lbs in 1980 to a high of 72,000 lbs in 1985 and 1994 and about 34,000 lbs in 2005 and 2006. This is comparable to totals for billfish, which ranged from a low of 16,000 lbs in 1982 to a high of 81,000 lbs in 1989, with landings of about 24,000 lbs in 2005 and 2006. Landings of mahimahi have been higher, ranging from a low of 19,000 lbs in 1981 to a high of 174,000 lbs in 1998; commercial landings of mahimahi were more than 100,000 lbs in 7 years during this time period. Landings of mahimahi were 81,000 lbs in 2005 and 58,000 lbs in 2006.

Among the tunas, commercial landing rates have been highest for skipjack, ranging from about 21,000 lbs in 1987 to 132,000 lbs in 2001; catch has dropped recently to 34,000 lbs in 2005 and 40,000 lbs in 2006. Commercial landings of yellowfin, the other main tuna species landed by fishermen on Guam, ranged from about 20,000 lbs in 1980, 1989, and 2006 to a high of about 57,000 lbs in 1993 and 1998.

Skipjack tuna (known locally as bonita) is not a preferred species for many Guam seafood consumers. The species is more popular in Palau and the Federated States of Micronesia (FSM). The demand for bonita has increased on Guam with growing immigration of Micronesian Islanders. Bonita is supplied to numerous small markets on Guam by Micronesian fishermen who are independent of GFCA and who do not use ice to preserve their bonita catches. Substantial amounts of bonita are also imported by these markets from Chuuk state in the FSM.

A study of pelagic fishermen which collected data from 340 separate fishing trips by 97 fishermen (Rubinstein, 2001) provides insight into Guam's small boat fishing. The sample from that study was believed to reflect the sociocultural and geographic diversity of Guam, as well as the unique characteristics of the fishers as a subset of Guam's general population. The geographic distribution of interviewees included residents of 16 villages. The mean length of village residence was 17 years, indicating a fairly long-term population, although the range was from less than 1 year to 69 years. All but two were men, and neither of the two women were Pacific Islanders.

Many of the interviewees reported using more than one fishing method during a single trip, often trolling and bottomfishing on the same outing. While trolling was the most common method of fishing, occurring on 70 percent of the trips, bottomfishing occurred on 30 percent of all trips. Almost three quarters of the fishermen were either sole owners or co-owners of a boat, of which 20-footers with outboards were the most common boats owned (Rubenstein, 2001).

When asked whether they sell fish, how often, and how much they earn from selling fish, more than half (58 percent) reported that they sell portions of their catches. Their answers reveal a bimodal distribution reflecting two different motivations for selling. At the lower end of the range, fishermen who sold fish one to four times per month (53 percent) were mostly seeking to recover some of the cost of fishing and boat ownership. At the upper end, those who sold fish eight or more times per month (36 percent) were more likely selling to make a profit. The median monthly earnings from fish sales were \$300, and as fish are sold three times per month (median), Guam fishermen were selling an average of \$100 of fish per trip, or between 36 and 50 pounds of fish, according to current average market prices (Rubenstein, 2001).

The majority of fishermen (69 percent) earned less than \$500 monthly from fish sales and were categorized as primarily recreational or subsistence fishers. A number reported that infrequent fish sales subsidized the cost of fishing equipment and fuel. Finally, the 22 percent of pelagic fishermen who earned more than \$1,000 per month were viewed primarily as commercial fishermen who relied on fishing for their income (Rubenstein, 2001). Considering that WPacFIN commercial landings data show a decline in inflation-adjusted revenue per trolling trip since the early 1980s, although relatively stable since 1996 (WPacFin, 2007), the fact that trolling continues is a reflection of the other income available to commercial fishing households, as well as existence of a reliable market (GFCA).

The ethnic distribution of fishermen found in Rubinstein's (2001) study reflected Guam's cultural and economic patterns, with indigenous Chamorros accounting for the largest proportion (41 percent) of pelagic fishermen in Guam, which corresponds to the proportion of the Guam population that claimed Chamorro ethnicity in the 1990 Guam census. Other Micronesians (mainly from Palau and the Federated States of Micronesia) were overrepresented in the fishery, forming 18 percent of the fishing population but 6 percent of the general population. Guam's Euro-American population also was overrepresented, comprising 27 percent of the pelagic fishermen compared to 18 percent of the general population. Asians were underrepresented; Filipino fishermen comprised 7 percent of the pelagic fishing population but 23 percent of the general population, while other Asians (mainly Chinese and Japanese) accounted for 3 percent of the pelagic fishing population but 13 percent of the general population (Rubenstein, 2001).

Guam pelagic fishermen appeared on average to be more affluent (median household income of \$50,000) than the general population (median household income of \$30,755). However, these averages masked differences in subgroups. Micronesian fishermen had a median household income of only \$20,000, and also had larger households (mean household size of 6.9), compared to the island-wide average (mean household size of 4.2) (Rubenstein, 2001).

### **Bottomfishing**

Guam's bottomfish fishery has two distinct components that can be separated by depth and species. The deepwater component (500–700 ft) consists primarily of snappers and groupers of the genera *Pristipomoides*, *Etelis*, *Aphareus*, *Epinephelus*, and *Cephalopholis*. The shallow-water component (100–500 ft) makes up a larger portion of the total bottomfish harvest and is made up of reef-dwelling snappers, groupers and jacks of the genera *Lutjanus*, *Lethrinus*, *Aprion*, *Epinephelus*, *Variola*, *Cephalopholis* and *Caranx*.

During the 1980s and 1990s, bottomfish fishing around Guam was a highly seasonal small-scale commercial, subsistence, and recreational fishery. The majority of the participants in the bottomfish fishery operated vessels less than 25 ft long and primarily targeted the shallow-water bottomfish complex (WPRFMC, 2002). The shallow-water component is the larger of the two in terms of participation because of the lower expenditure and relative ease of fishing close to shore (Myers, 1993). The commercially oriented high-liner vessels tend to be longer than 25 ft, and their effort is usually concentrated on the deepwater bottomfish complex. Some participants in the shallow-water component seldom sell their catch as they fish primarily for recreational or subsistence purposes (WPRFMC, 2002), but others have sold, especially during the peak in the shallow-water bottomfishery in the 1980s and early 1990s.

Deep bottomfishing gear consists of a long vertical line with a bag of chum (chopped fish), a series of baited (often with pieces of skipjack tuna) hooks, and a weight at the end. When the hooks reach the appropriate depth, the line is jerked to release the chum (Amesbury and Myers, 1982). Spin-casting reels are often used for catching the

species occurring in the shallower waters, and electric reels, which may have multiple hooks per line, are used to catch deeper-dwelling fish (Myers, 1993).

From 1996 through 2000, the estimated ex-vessel value of commercial bottomfish landings varied substantially from year to year, ranging between \$18,000 and \$112,000. The variation appears due primarily to shifts in the proportion of the catch that was sold (rather than to shifts in total landings), as well as to substantial year-to-year variation in prices, which could be largely a result of shifts in species composition (WPRFMC, 2002).

High liners have generally been responsible for the peaks in the commercial bottomfish landings, as was the case in 1983, 1985, 1994, 1998, and 1999. The nearly 300 percent increase in the 1994 commercial harvest of bottomfish management unit species and revenue compared with 1993 is the result of high liner vessels entering the fishery during 1994. The 39 percent reduction in Bottomfish Management Unit Species harvest (BMUS, species formally managed under WPRFMC Fishery Management Plans) and 56 percent decline in commercial harvest for 1995 are best explained by the absence or reduced effort of about six high liners who combined landed an average of 18 percent of the total BMUS harvests between 1992 and 1996, and 68 percent of the unexpanded commercial landings for the same period. Harvest records for these six high liners indicate a 45 percent reduction in 1995 of their total bottomfish harvest; from 13,349 pounds in 1994 to 6,023 pounds in 1995. High-liner activity in Guam's bottomfish fishery has remained low since the mid-1990s (WPRFMC, 2002).

Bottomfish account for about 10–15 percent of the island's recorded boat-based fisheries harvest over the long term (Fig. 5). Harvest levels between 1982 and 2006 ranged from about 129,000 lbs in 1996 to a low of about 91,000 lbs in 2006. These figures reflect the numbers of bottomfish trips taken over the same time period, which was 3400 trips in 2006, down from the peak of over 9000–10,000 trips in 1995 and 1998. Both landings and trips show a decline over the past 7 years. However, the CPUE as measured by annual pounds per hour fished has not shown a similar downward trend; there was a steady decrease from about 7 lbs/hour in 1982 to 2.5 lbs/hour 1995, and a slow but steady increase since then, to just over 5 lbs/hour in 2006.

### **Sport Fishing**

As Guam's tourism industry grew in the 1980s, a fleet of marina-berthed charter vessels (average length 27 ft) developed, which were used by tourists and residents associated with the U.S. military (Myers, 1993). Charter fishing operates out of Hagatna Marina and Agat Marina. Initially, the focus was only on trolling for pelagic fish. Many of the charter operators had once been full-time commercial fishermen who viewed the sport sector as a way of maintaining or increasing income while reducing risk and being less physically demanding (Davis, 2001).

Guam's charter fishing fleet, which is considered a commercial fleet, trolls for pelagic fish, but both deepwater and shallow-water bottomfish are also important target

species, using light rod and reel gear to catch small reef and bottomfish species. The charter fleet attracted an estimated 3 percent of visitors to Guam in 1998 (Gov. Guam, 2001).

The charter fleet in 1998 consisted of about 12 core boats, 30–50 ft in length, mostly 30–36 ft and powered by twin diesels (Eads, 2001). The charter boats made multiple 2-hour to 4-hour trips daily. Two types of charter bottomfish fishing trips were organized. The more typical charter boats involved three to six patrons, while the larger “party-boat” vessels carried as many as 30 patrons on a single trip. These larger vessels consistently fish in the same general area and release most of their catch, primarily small triggerfish, small groupers, and small goatfish. They occasionally keep larger fish and use a portion of the catch to serve as sashimi for their guests. Most bottomfish charters operate out of the Agat Marina and primarily target the shallow-water bottomfish and reef fish complexes (WPRFMC, 2002).

In 2006, pelagic charter fishing vessels made about 2000 trips and caught about 67,000 lbs of pelagics consisting of mahimahi and followed closely by skipjack tuna and wahoo (WPRFMC, 2007). This was about half the level of noncharter trolling trips but less than 1/6 of the non-charter pounds landed (charter trips are of shorter duration).

Charter fishing also has been a component of the bottomfish fishery, accounting for about 15–20 percent of all bottomfishing trips from 1995 through 2000. Guam DAWR estimated 1700 charter trips in 1999 totaling 4000 hours of bottomfishing. From an effort of 35,000 gear-hr and a total catch of 13,000 lbs, the catch rate was estimated at 0.38 lbs per gear-hr.

Clubs, tournaments, and related events are other aspects of sport fishing. Aside from the the Marianas Underwater Fishing Federation, a spear fishing club, there are few organized sport fishing clubs or groups on Guam. Previously, a small number of clubs were organized along ethnic lines by Japanese and Korean residents of Guam, but these have disbanded. The Guam Boating Association, consisting of several hundred members, functioned as a fishing club for about 10 years but then disbanded (WPRFMC, 2007).

The Guam Fishermen’s Cooperative Association sponsors the annual Guam Marianas International Fishing Derby with support from the business community. In recent years, participation in the derby has been averaging 70 vessels and 300 fishermen. The derby, partnered with the Fishermen’s Festival, is a family event where prepared seafood samples are offered along with exhibits from various organizations promoting awareness of the environment and marine resources. The 12<sup>th</sup> Derby and 9<sup>th</sup> Fishermen’s Festival were held on separate weekends in August 2007. The Third Annual Marianas Underwater Fishing Federation Competition was held by the Marianas Spear fishing Derby on August 4, 2007. Two-person team competitors launched from the Gregorio Perez Memorial Marina at 6 a.m., and returned by 3 p.m. A total of 15 teams competed in the derby; 13 teams from Guam and two from Saipan.

## **Guam Fishermen's Cooperative Association**

The Guam Fishermen's Cooperative Association (GFCA) is a central component of Guam's contemporary offshore fishing industry that continues to pursue and broaden its original mission of providing marketing services, fuel, and ice for its small-boat fishermen members. GFCA's influence has become pervasive, providing a variety of benefits not just to its members, but for fisheries conservation, marine education, and the greater Guam community.

Prior to the establishment of the GFCA, which was formed in 1976 and incorporated in 1977, commercial fishermen sold fish catches at farmers markets and roadside in various locations. The cooperative was formed to assist its small-scale fishermen members in marketing their catch. From the 1980s to the present, imported shallow-water reef and bottomfish from other islands throughout Micronesia were priced lower than that for local fish in the Guam market. The GFCA counters this price competition from imported fish by emphasizing the higher quality of fresh local fish landed by GFCA members. The GFCA purchases all of the fish caught by its members, as long as the catch meets established standards for quality and safety.

The GFCA began operations with a volunteer manager and little working capital or equipment, retailing iced fish from a small market stall at the Agana Public Market (AECOS, 1983). In 1980, the GFCA acquired a chill box and ice machine and began to wholesale as well as retail fresh fish. A consultant funded by the Pacific Tuna Development Foundation began training GFCA employees and improving business management. By the end of 1983, the GFCA was operating from a new facility adjacent to the Agana Marina and had 85 members who accounted for an estimated 85 percent of the commercial fish landings on Guam (AECOS, 1983).

The most current description of the GFCA is found in its 2004 business plan (GFCA, 2004). The GFCA is a private nonprofit corporation organized as a cooperative under government of Guam law. The local fishermen who maintain membership in the GFCA are shareholders with equal shares of the cooperative's assets. As of June 2007, the GFCA employs 22 workers (compared to five employees in 1995) and one manager under the supervision of the president and Board of Directors. All operations are located on a two-acre lot with a 65-year lease from the government of Guam. The property is reclaimed land adjacent to the busiest small boat marina on Guam and is located in the heart of the business-government center of Hagatna (Photo 6).



Photo 6.--Guam Fishermen's Cooperative Association complex at Hagatna Marina.

GFCFA membership increased from 40 in 1995 to 164 as of July 2006. Membership consists of virtually all of Guam's commercial offshore fishermen who are residents of every district on Guam (Fig. 10), thus showing the GFCFA's island-wide geographic influence. Participants in the small-scale offshore fisheries targeting pelagic and bottomfish species are not concentrated in specific locales but reside in towns throughout the island (Rubinstein, 2001).

A major GFCFA competitor closed in 2003 after its facility was severely damaged in Super typhoon Pongsona; three high-liner fishermen who were formerly working with this competitor subsequently became GFCFA members. Noncommercial fishermen "who would never sell their fish catches" generally do not join the GFCFA.

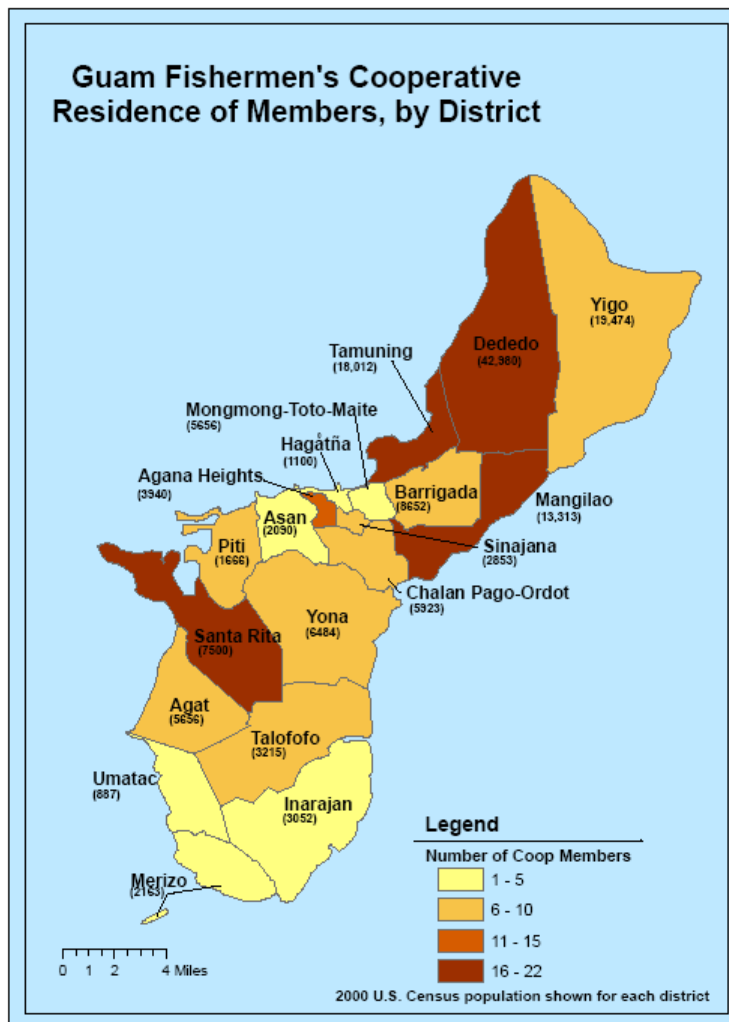


Figure 10.--Residency of members of Guam Fishermen's Cooperative Association, by district.

The GFCA has shown continued growth in sales revenues, now more than \$1.9 million per year, under the present GFCA management team that took over in 1996. GFCA's revenue has not been as sensitive to the recent economic recession on Guam as that of other island businesses. In a declining island-wide economy from 1997 to 2002, GFCA's total receipts increased, substantially improving the financial stability of this organization. The GFCA marketing strategy has adjusted to the island economic downturn by offering less expensive cuts and portions to the public, as well as making use of all parts of the fish.



The clientele has expanded over the years so that the GFCA presently serves local consumers (through fish and ice retailing), local restaurants and government institutions (through fish wholesaling), other nonprofit indigenous and religious organizations (through charitable donations), most Hagatna Marina vessel operators (through fueling), as well as providing marketing services, fuel, and ice for its own membership.

GFCA's existing facility processes approximately 250,000 pounds of seafood annually. In 2006, the GFCA purchased an estimated 30 percent of all reef and bottomfish and 70 percent of all pelagic fish landed on Guam by local fishermen (Duenas 2007). GFCA sales presently account for only about 5 percent of seafood value consumed on Guam because of the predominance of imports.

The GFCA price structure for fish catches provides an incentive for fish conservation (Photo 7). Catches of less than 100 lbs for several fish species (skipjack tuna, marlin, wahoo) receive the highest price, with reduced prices per pound for larger catches. GFCA markets multispecies catches of its members, so there is little waste or bycatch.

<u>MAHI:</u>		
FIRST 200 lbs.	=	\$1.75 lb.
2 <sup>nd</sup> 200 lbs.	=	\$1.50 lb.
THEREAFTER	=	\$1.25 lb.
<u>WAHOO:</u>		
FIRST 100 lbs.	=	\$2.00 lb.
THEREAFTER	=	\$1.50 lb.
<u>BONITA:</u>		
FIRST 100 lbs.	=	\$1.25 lb.
2 <sup>nd</sup> 100 lbs. (UP TO 300 lbs.)	=	\$0.75 lb.
300 lbs. plus	=	\$0.50 lb.
<u>MARLIN:</u>		
UNDER 125 lb.	=	\$1.25 lb.
UNDER 250 lb.	=	\$1.00 lb.
OVER 250 lb.	=	\$0.75 lb.
*GILLED/GUTTED	=	+\$0.25 lb.
*H/G	=	+\$0.33 lb.
<b>**ALL FISH IS SUBJECT TO GRADING**</b>		
<b>FISH TICKET WILL BE ADJUSTED</b>		
<b>ACCORDINGLY</b>		

Photo 7.--GFCA price structure.

A primary GFCA service is the retailing and wholesaling of ocean-caught fish and aquaculture products of local origin to the general public (cash sales), local restaurants, and government institutions (credit sales). More than 1000 pounds per day are sold whole, filleted, steaked, chopped, and as convenience ready-to-eat items (Photo 8; Photo 9). All fish handling, storage and processing are conducted under a “Hazard Analysis Critical Control Point (HACCP) system, as required by the federal government. The GFCA also buys a limited amount of imported salmon for retail sale at its store.



Photo 8.--Value-added products for sale at the GFCA market.

An average of 5000 pounds of ice per day are sold to members (credit sales) and the general public (cash sales). An estimated 30,000 gallons per month of fuel and lubricants are sold to members and Hagatna Marina tour boat operators (cash and credit sales). Discounted fuel products are sold to GFCA members and other marina users from a dispensing system located next to the eastern bulkhead of the marina (ARC Environmental Services, 2006). The GFCA does not openly compete with private businesses in supplying ice and fuel. Ice is sold to GFCA members and the general public only to cover a general shortage from private sources on Guam. Fuel sales are focused on GFCA members and Hagatna Marina tenants, who benefit from GFCA passing through savings from volume purchasing. The GFCA is required to be involved in marine fueling at the marina as a condition of its property lease from the government of Guam.



Photo 9.--Additional products for sale at the GFCA market.

The GFCA has four long-term business goals (GFCA, 2004):

- Become a more reliable supplier of local seafood products to Guam consumers.
- Continue to improve the quality of domestic fish products and further differentiate them from low-value and potentially unsafe imported seafood.
- Increase domestic pelagic fish production sufficiently that Guam will be allocated a reasonable share of tuna harvest quotas established under the international management regime of the Western and Central Pacific Fisheries Commission (the temporary allocation for bigeye tuna is 2,000 metric tons, the same as for other island areas where domestic pelagic fisheries are in the early stages of development).
- Shift consumer preference more toward pelagic fish species and away from less abundant reef species.

Additional objectives to benefit the entire community were adopted by the GFCA board of directors (Resolution 003-03) on April 8, 2003:

- Develop a sustainable fishery program to ensure the perpetuation of cultural fishery practices within the confines of a fishery management plan.
- Develop a safety program for all the practitioners in the fishery and promote protective measures for nontargeted or protected species, allowing for some cultural take of traditional species.
- Reduce the impact of pollution and coastal fishing on the inshore coral ecosystem as well as the offshore ecosystem and promote conservation and protective measures for resource sustainability.
- Encourage the residents of Guam to replace the inshore fishery with the deepwater fishery and demonstrate the feasible alteration of cultural and economic values.
- Develop a mid-scale pelagic fishery program to replace the fishers of distant water fishing nations.
- Develop and implement strategies to lessen interaction between local fishers – subsistence, recreational, small scale and mid-scale commercial fisheries.
- Discourage the use of high impact technology on the fishery such as: gill nets, purse seine, free-floating fish aggregation devices and the use of over 2,500 hooks per set by longline.

The GFCA strives to be a member of the greater Guam community, providing benefits not just to fishermen but to residents throughout Guam:

- Efficient receiving and stable prices for fresh fish landings by members with price premiums available for good catch handling and quality.
- Largest supplier of fresh seafood to local consumers and exclusive supplier to the local hospital.
- Seafood HACCP (“Hazard Analysis and Critical Control Point”) system to ensure safe seafood for GFCA customers.
- Availability of convenience, ready-to-eat packaged seafoods, such as trays of *sashimi*, *kelaguen* and *poke*.
- Regular testing of reef fish for possible ciguatoxin and of pelagic fish for possible scombrototoxin to protect consumers of GFCA products. Also, free testing of

suspect non-GFCA products whenever requested by the Guam Department of Health and Sanitation.

- Consistent supply of ice for chilling fish and public use. The GFCA produces and sells ice only to supplement other sources on Guam.
- A focal point for community activities such as derbies, cooking competitions and seafood festivals, dissemination of educational materials on marine resources, vessel safety and seafood preparation, public meetings on resource management issues, communications via radio base to relay information and coordinate rescues. The GFCA has operated the Guam Marianas International Fishing Derby since 1995 and the Guam Fishermen's Festival since 1998.
- A policy of purchasing local origin products that benefits 40 small businesses on Guam.
- Regular donation of seafood for village functions and charitable activities.
- Assistance to victims of periodic typhoons with emergency supplies of ice and fuel.

In addition to its other activities, the GFCA has become a voice for Guam fishermen in the policy arena. As Guam is faced by challenges such as the planned military buildup, GFCA will be working to ensure that the concerns of fishermen are incorporated.

## **Offshore Fishing Issues**

### **Entry of Fresh Tuna/Marlin from Foreign Tuna Transshipment**

A periodic issue is the entry of fresh tuna and marlin into local markets—fish rejected during fresh tuna transshipment operations by Japanese and Taiwanese longline vessels unloading fish at the Port of Guam. Most Guam hotels and supermarkets obtain fresh tuna from this source, and a mobile fish wagon also markets these products.

Guam commercial fishermen cannot produce sufficient tuna to supply these outlets. However, in the 1990s, many buyers purchased this fish but few properly chilled the product, leading to incidents of histamine poisoning. In 2000, the GFCA sponsored a Hazard Analysis Critical Control Point (HACCP) training workshop open to the government of Guam Port and Health agencies, fish dealers handling foreign fish, and others. Thereafter, most foreign-caught tuna and marlin entered the local economy after processing by one company applying best manufacturing practices, sanitation, and HACCP controls. This has reduced the incidence of histamine poisoning from the relatively high levels of the late 1990s. However, at least one foreign longline fleet has

started to deliver low-quality frozen mahimahi and wahoo to Guam that directly competes with the high quality fish of the same species marketed by GFCA.

### **Shark Predation**

Perusal of the voluntary data reports provided by Guam offshore fishermen indicates significant loss of catch and gear from sharks. The problem is particularly strong at some banks, such as Rota Banks. Oceanic white tip sharks that have taken up residence on offshore banks can be extremely aggressive in taking catch and damaging fishing gear.

### **Fish Aggregation Devices (FADs)**

Nearly all of the FADs that formerly existed in the waters surrounding Guam have been lost. Another issue is that untethered FADs deployed by purse seiners occasionally drift into Guam waters and become entangled on offshore banks or inshore reefs.

### **Fishery Data Collection**

No special fish dealer license is required to sell fish in Guam, nor are there any mandatory reporting requirements for catching or selling fish. Instead, this information is obtained through voluntary cooperation of fishermen with the creel surveys and dealer reporting systems of the DAWR and WPacFIN as described earlier in this report. These existing long-term efforts have recently been supplemented by a Volunteer Fishery Data Collection Pilot Project initiated in late 2004 by the WPFRMC, GFCA and DAWR to collect detailed information on fishing effort and catch, including bycatch. Full implementation of this pilot project would require additional resources.

### **Longline Closure around Guam**

A 50-nmi exclusion zone exists for longline (and purse seine) vessels around the island of Guam and its offshore banks. The Council also established a control date of December 6, 1990, for the possible future regulation of a longline fishery should one develop. The longline closure was implemented by the Council in 1992 through Amendment 5 to the Pelagics Fisheries Management Plan in response to Guam fishermen's concerns, after seeing increases in longline activity based in Hawaii, that longline activity in Guam could occur and have potential to conflict with trolling and bottomfishing activities by Guam fishermen.

Through the Council's Community Demonstration Project Program, designed to facilitate indigenous fishing communities' participation in fishing in the western Pacific, the GFCA obtained and refurbished a 53-ft vessel to be used for training GFCA members in longline fishing, to assess the feasibility of small-scale longline fishing activity based out of Guam. However, the 50-nmi exclusion is hampering the GFCA training efforts

because it requires the vessel to venture unnecessarily far from shore for training purposes.

At its 138<sup>th</sup> meeting in June 2007, the Council decided to recommend that a trial longline operation focused on training and assessment of commercial feasibility should be pursued under the auspices of the Community Development Program (CDP). The Council specified that this CDP should operate outside a closed area of approximately 12 miles around the island of Guam, with additional 5-mile closed areas around all offshore banks. The Council also specified that the trial operation be monitored to document any conflicts with the troll and charter sectors, and be subject to a sunset clause.

### **GFCA Expansion**

Two production factors are most limiting to the GFCA: (1) the lack of capacity to handle an increasing local supply of fish, and (2) inconsistent catch quality. At times, insufficient capacity has forced the GFCA board to limit new membership. Years of deterioration and damage from Super typhoon Pongsona (December 2002) have undermined the structural integrity of the existing GFCA facility. The walls and partitions are weak and interior flooding occurs after heavy rains (ARC Environmental Services, 2006).

The GFCA board of directors has decided to demolish the existing structure and construct a replacement in the same location. The new 20,000 sq. ft. facility will include expanded fish processing and storage areas, as well as tenant spaces within the two-story configuration. A new facility in the present location will take advantage of the long-term 65-year lease arrangement for the present site of GFCA created through Public Law 27-24 (2003) and on an additional adjacent acre for the same time period, maintaining the advantages of customer familiarity with the current location.

With expanded capabilities, the amount processed is projected to increase by 25 percent, or about 60,000 pounds annually. Inquiries from fresh fish distributors in Hawaii, the continental U.S. and as far away as Europe indicate considerable export potential for Guam fresh fish if it is of high quality.

The GFCA's new facilities would be equipped with ice-making equipment with an output of at least 6 tons per day. A waterfront operation would service marina tenants and the 400 + people who frequent the marina daily. At present, approximately 30,000 gallons of fuel is pumped monthly by the GFCA. This is projected to increase by 300 percent to meet members' increasing needs and fuel use in the GFCA's offshore pelagic fisheries training.

GFCA has developed proposals to expand services into other areas:

- revitalize Hagatna and Agat Marinas under a partnership with the government of Guam Port Authority;

- acquire a multipurpose vessel to augment the offshore rescue capabilities of the Guam Fire Rescue and Guam Police Harbor Unit Department; and to cooperate with scientists in research on banks and seamounts along the West Mariana Ridge;
- establish a revolving low-interest loan fund to assist small-boat fishermen unable to obtain conventional bank financing to make vessel repairs and purchase fishing gear, with a loan limit of \$5,000 per fisherman; and
- encourage the Guam Economic Development Authority to provide disaster relief funding to Guam’s fishing industry to assist in recovery after typhoon damage.

These actions, assuming they occur as planned, will strengthen the role of the GFCA as an important local fisheries institution, as well as improve its ability to provide benefits to the entire Guam community.

## CONCLUSIONS

Guam is indeed a fishing community, as evidenced not only by its traditional ties to the sea and fishing but by the continued cultural importance of fishing as an activity and food source. The GFCA links boat-based fishermen from across the island, while pliant marine tenure provides shoreline fishermen from across the island with access to shoreline fishing areas.

Based on current data, it makes sense to view all of Guam as a fishing community rather than to suggest that it be subdivided into smaller units for the purposes of NS8. Although differences in fishing patterns exist within Guam that could be differentially affected by fishing regulations, such as differences in fishing by ethnic groups, gear types, and so on, they do not appear to exhibit the place-based specificity called for by NS8. Guam’s villages are not distinct fishing communities, except possibly when residents come together to harvest seasonal runs of manahak, atulai, ti’ao, i’e and other schooling fish. We have also identified some distinctions of southern villages in Guam, but currently they do not seem to justify dividing the island into two fishing communities. Offshore fishermen from all villages of Guam come together in the GFCA “fishing community” but there is no comparable umbrella organization for subsistence shoreline fishermen.

A particular area of interest is Guam’s resiliency as a fishing community. In this sense, resiliency refers to the ability to sustain participation in fishing activities and thereby maintain critical elements of the culture of Chamorros as well as those of Guam’s many immigrants who have ties to fishing and the sea. As a community, Guam has demonstrated resiliency in the ability to recover from the typhoons that regularly sweep across the island. As a fishing community, recovery from the many social and environmental perturbations has perhaps been slower, and trends also suggest less



community dependence on seafood. However, further evolution of the GFCA as a fisheries and community institution is a key indicator of increased resiliency.

The ability of fishermen and community residents and leaders to participate in fisheries management and in particular to maintain access to shoreline and marine resources is less certain. Many practitioners believe that the time for villages to take effective action in managing local marine resources may be running out, recognizing that future generations of islanders will need fish; but they will also need to remember how to fish. Some solutions such as “no take” marine reserves have been proposed as having the long-term potential to replenish reduced fish populations. These same solutions, however, restrict opportunities for traditional subsistence fishing practices. The basic dilemma is that, in the process of long-term fish stock recovery, traditional arts of fishing may be lost because there are fewer places to practice these arts. This issue has divided the managed (i.e., fishermen) and the managers (government agencies), creating confrontational attitudes on both sides. Barriers to communication, trust, and mutual learning often exist between stakeholder groups and scientific/administrative elites (Bass et al., 1995; Stewart et al., 2004).

As the marine resources base and the practice of traditional Chamorro fishing methods decline around Guam, dependence on imported foods increases among the indigenous population. In addition, traditional Chamorro fishing practices are at risk because of a lack of opportunities for elders to teach young generations. The result is the risk that Chamorro youth will become further disconnected from nature, traditional food sources and their own culture.

The opportunities for comanagement envisioned as part of the transition to an ecosystem-based approach to fisheries management appear to be a fruitful avenue in bridging these existing gaps through adaptive management; a continuous cycle of problem identification, solution design and implementation, action, monitoring and evaluation, reflection and revision. This iterative process offers a means of building mutual cooperation, confidence, and trust through practical actions. Working with partners on adaptive management strategies is also a way of demonstrating community commitments and abilities.

Another new avenue for cooperation for addressing coral reefs and associated fisheries is the Guam Coral Reef Initiative Coordinating Committee which, in August 2002, began the process of identifying the main threats to local coral reefs on which to focus local action strategy efforts for future years. The process expanded the network of stakeholder groups working on coral reef issues to members of the Guam Watershed Planning Committee (a group of local, federal, and nongovernmental agencies involved primarily with watershed restoration), the University of Guam Marine Laboratory and Water and Environmental Research Institute, and The Guam Visitors Bureau and the tourism industry. The strategies address land-based sources of pollution that affect coral reefs, fisheries management, lack of public awareness of the need for coral reef conservation, and recreational misuse and overuse. This effort, with funding and participation from NOAA, stems from the U.S. Coral Reef Task Force. In 2002, the task

force identified the need for more focused local action to reduce threats to coral reefs through development of local action strategies in each of the seven states and territories that possess significant coral reef resources.

As mentioned, many believe that Guam as a fishing community is at a critical junction, where paths to decreased or increased resiliency are available. This report has identified several potential indicators to monitor over time, which would let interested parties know the ways in which Guam is becoming more or less resilient as a fishing community. Following is a list of these indicators, which we hope will serve as a starting point for discussions by Guam's fishing community.

- 1. Abundance and diversity of fish and other harvested species** (and the species and habitats on which they depend). These biophysical variables are being discussed through existing efforts such as the local area strategies and are not further explored here, where the emphasis is on community-level socioeconomic issues.
- 2. Access to shoreline resources.** Access to fishing locations is just as important as the availability of fish and other harvested species. Further reductions in fishermen's access to shoreline, and especially to preferred shoreline areas, could substantially affect community residents' ability to fish or collect marine products. It could concentrate fishermen in a smaller area, leading to increased competition for fish, increasing the risk of local depletion and social conflict. If restricted areas include preferred fishing sites and/or seasons, there might be few or no substitute sites available on the island so the experience as well as the fishing location would be lost. Reductions in access could conceivably lead to erosion of fishing culture, for example, as people have fewer places to teach their children, or to provide fish for cultural events.

Changes in access levels could be measured using miles of shoreline in each of the access categories compiled for Guam. Categories could include: military reservation; stretches with no or highly limited public access because of private land ownership; marine reserves or conservation areas where fishing is restricted; marine reserves or conservation areas where fishing is prohibited; cliff areas having no or severely limited access to the water; and areas where fishing is allowed but where substantial use conflicts with other activities is present. A temporal component can be added where necessary. For example, another category could include beach closures because of pollution, or seasonal closure areas. Analyses would consist of measuring changes from existing (2006) conditions (see Figure 10), once a final version of those existing conditions was developed. It would also be valuable to map conditions back into the past to gain an idea of previous trends, instead of viewing 2006 as a "baseline."

- 3. Status of GFCA.** GFCA is a critical institution for sustaining offshore fishing activity, conserving resources, and providing community-wide benefits that

will extend to non-fishermen. Key aspects to monitor include membership levels and composition, status of the new building and expansion of services, volume and types of purchases and sales, and its role as a political entity.

Another key aspect includes the efforts of the GFCA and associated communities to address the military buildup. The possible effect of this buildup on the Chamorro fishing community was discussed extensively at the annual general membership meeting of the Guam Fishermen's Cooperative Association on January 27, 2007. The general membership instructed GFCA's board of directors to convene a gathering of Chamorro practitioners to serve as a catalyst for community-based actions to prepare for additional threats to indigenous fishing practices and grounds associated with the military buildup.

After hearing a presentation from GFCA's president Manuel P. Duenas II about the success of the "Puwalu" series of gatherings to galvanize native Hawaiian resource practitioners to coordinate and take action (WPRFMC, 2007), GFCA's membership recommended that the board of directors consider how Puwalu might be adapted to the needs of Chamorro fishing communities. The goal would be to focus on the needs, interests, knowledge, values, and capabilities of indigenous populations and use these factors as starting points in the design and evolution of community-based management strategies. The native Hawaiian example serves as a model to encourage more widespread community organization, mobilization, and participation in fisheries management and also to encourage ecological thinking about local marine resources as a foundation for strategic action. If such an action is initiated, it could address issues other than the impacts to fishing caused by the military buildup, thus becoming an important institution for fisheries in its own right.

4. **Level and type of organization among shoreline fishermen.** Currently there is no organization for shoreline fishermen comparable to the GFCA, leaving inshore fishermen without an organized capacity to represent their interests. Whether the GFCA expands its scope to include greater attention to inshore fishing and membership by inshore subsistence fishermen, or whether a new institution is developed, may be critical to the sustainability of inshore fishing on Guam and would therefore be a good indicator of the status of Guam as a fishing community.
5. **Attitudes of fishermen toward marine protected areas (MPAs).** Important aspects of this process to track include development of any new MPAs, their restrictions on fishing, and the extent to which fishermen believe they have been involved as partners in MPA location and management. The status of the eco-permitting process is also critical from both a substantive and procedural perspective: whether the process occurs; whether any restrictions on recreational uses are developed; whether improvements in fisheries habitat result; and the extent to which the process reduces or increases conflicts between fishermen and other recreational users. The ability of fishermen to

use MPAs for specific purposes such as teaching younger fishermen and/or utilizing seasonal runs will also be an important factor. All of these characteristics of MPAs have the potential to affect fishermen's attitudes towards (and acceptance or rejection of) MPAs.

Tourist ocean sports activities and traditional shore fisheries are considered incompatible activities by many Guam residents. There may be opportunities, however, to link them in positive ways. One survey of Japanese visitors found that 21 percent expressed interest in participating in a Chamorro food festival and 22 percent in a Guam cultural festival if these opportunities were available on Guam; another study found similar proportions of interest among Korean tourists (Visitguam.com, 2006)

This has encouraged the planning of a "manahak festival" at Tumon Bay to expose visitors to a traditional Chamorro seasonal fishing practice and culinary experience (Rosario, 2006). Some shoreline fishermen hope that by showing that fishing and tourism can be compatible—or even mutually beneficial—that the festival could open the potential for expanding fishing use in reserves (such as limited fishing during culturally important runs).

- 6. Progress toward community-based management.** Pliant tenure provides a cultural base for revitalization of responsible fishing behavior through community agreement and control. The time for Chamorro fishing communities to take effective action in managing local marine resources may be running out; Vaughn (1999:119) states: "Pliant tenure persists but will likely disintegrate as the idea of marine tenure becomes more foreign amongst new fishers."

A report prepared for the Council's 129<sup>th</sup> meeting (Bartram et al., 2005) presented information relevant to development of community-based management initiatives for inshore fishery ecosystem management. The report notes that community-based management of marine resources has the potential to support increased local accountability for resource conditions and enforcement of regulations and to break down barriers to successful comanagement. The report recommends better use of fishermen's knowledge in locating and designing marine reserves, better integration of fishermen's knowledge with science-based knowledge, education and outreach programs to foster more responsible fishing, community participation in control of terrestrial runoff, and allowing teaching of traditional fishing practices in some of the marine reserve areas.

A related aspect of community-based management that could be tracked over time is the ability and willingness of fisheries managers and scientists to incorporate fishermen's local knowledge into management and research strategies. For example, local divers are reporting an upsurge of crown-of-thorns starfish and are seeing evidence of local pockets of coral bleaching

(Borja, 2006). Such observations can serve as catalysts for both scientific research and management attention.

Currently there are informal community-based management arrangements but no formal mechanisms tied to ecosystem conditions such as watersheds and runoff. The Council's ecosystem advisory committees or other forums may meet this need. Based on interviews with Guam fishermen and other information, Bartram et al. (2005) recommended that bottomfish management activities in the offshore banks south of Guam be devolved from the Council to Guam's boating community for a 3-year trial period. The proposed action would provide practical experience in adaptive management for Guam's offshore fishing community.

The purpose of the trial is to determine if decentralized management (community-based management or comanagement with the Council) has advantages over federal management of Guam's southern banks or possibly other eco-management regions, including some in the EEZ of the CNMI. Evaluation and feedback from the trial would follow the adaptive management approach. The community-based management activities would include offshore bank-specific bottomfishing trip data collection, surveillance of vessel activity (fishing and non-fishing) and cooperative research focused on bottomfish reproduction (with the University of Guam Marine Laboratory).

If necessary for bottomfish conservation, voluntary guidelines for harvesting would be established by the community and enforced through peer pressure by exerting social authority of the group rather than legal authority of government agencies. Such guidelines could be applied to specific banks (or bank groupings) at specific times (e.g., peak spawning periods) for particular bottomfish species. GFCA is already implementing a voluntary fishing trip limit on onaga catch for bottomfish vessels. GFCA leadership believes that voluntary measures can be effective with strong leadership; members can be removed for violations, thereby losing their benefits such as the ability to market their products through GFCA, reduced gas and ice prices, and product discounts.

- 7. Effects of military buildup.** The addition of some 21,000 military personnel and dependents to Guam over the next 6 to 8 years makes it critical to address any resulting impacts on the local quality of life, especially as it relates to fishing and other marine activities. Currently the government of Guam has a process (the Civilian/Military Task Force) designed to address the positive and negative effects of military buildup on Guam's population, economy, and resources. One variable to monitor is the extent to which the concerns of and impacts to fishermen are successfully incorporated into and resolved by this process.

- 8. The role of and recovery from natural hazards.** To better understand the role of humans and fishing communities in ecological change, it is important to have a more thorough understanding of the role of natural forces in change. Records show that Guam has been subject to a variety of environmental events that have the potential to affect fishing sustainability, including typhoons and super typhoons, and El Niño years. Coral bleaching events have not been a problem to date. Recovery from these events when they occur may play a key role in resilience of Guam as a fishing community. The Mariana Archipelago is an area of high natural perturbation even compared to many other Pacific island groups.

Marine resource monitoring and modeling can be confounded by the effects of natural perturbations, sometimes triggering false alarms to managers. Fisheries management needs to more fully consider the spatial and temporal variability of marine resources in conjunction and in context of land-sea linkages. The role of typhoons and El Niño in structuring the Mariana Archipelago ecosystem is particularly important, as is the need to more fully consider the ecological function of different types of bottom habitats. For example, fish refuge is provided by wave-protected areas, complex bottom habitat, corals, seaweeds and seagrass, not only by marine protected areas.

*Future updates to this report, expected to be completed at least every 5 years, will describe Guam's responses to these challenges and trends affecting Guam's status as a fishing community. Monitoring the institutional, socioeconomic, and cultural aspects of fishing will continue to be just as important as monitoring fish populations and habitat in Guam's ability to sustain itself as a fishing community. Readers are encouraged to provide the authors with their perspectives on additional information relevant to telling the evolving story of Guam as a fishing community, for possible incorporation into future drafts.*

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