NATIVE FISHING RIGHTS AND LIMITED ENTRY IN GUAM

MICRONESIAN ARCHAEOLOGICAL RESEARCH SERVICES

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AND LIMITED ENTRY

IN GUAM

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Western Pacific Regional Fishery Management Council

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Introduction

In 1988 the Western Pacific Regional Fishery Management Council (WPRFMC) determined that a limited entry program containing a system of preferential access rights reserved for native fishermen of Guam would be permitted under the Magnuson Fishery Conservation and Management Act of 1976 (MFCMA), as amended (WPRFMC 1988:1). The Magnuson Act requires that there be an historical basis to support any system of preferential access rights. In order to meet the relevant criteria of the MFCMA, the Council contracted with Micronesian Archaeological Research Services (MARS) to focus on two tasks: (1) to collect, catalog, and authenticate evidence which could provide a basis for giving preferential treatment or privileged status to fishermen who are descendants of the original inhabitants of Guam and (2) to explore the advantages and disadvantages of limited entry compared to more traditional management measures.

The major emphasis of the project has been on task 1, the accumulation and evaluation of existing evidence (archaeological, ethnological, historical) for preferential fishing rights for indigenous peoples of Guam. In spite of Johannes' (1988:10) judgment that in the Marianas "any form of limited entry for the purpose of fisheries management would have to be formulated without reference to local tradition," we were able to find local traditions regarding the pelagic and bottomfish fisheries of Guam. Evidence was sought regarding the offshore and deep sea species listed in Appendix A. These species include certain snappers, groupers, tunas, mahimahi, billfishes, jacks, sharks, crustaceans, and precious corals. In reality, there is no deep sea crustacean or deep sea precious coral fishery in the federal waters of Guam; therefore our work focused on the pelagic and bottomfish species within the EEZ (Exclusive Economic Zone), a band of ocean between 3 and 200 miles around Guam.

In pursuing task 1, four general areas of evidence were taken into consideration, to establish that

1) there was and is a set of historical fishing practices for the species identified in Appendix A in the areas now encompassed by federal waters in Guam;

2) there was and is a dependence by native people of Guam (or at least a significantly identifiable portion thereof) on the fish, crustaceans, and precious corals identified in Appendix A;

3) at least some dimension of the indigenous culture of Guam has in the past reflected and still reflects cultural, social, and religious values, traditions, and practices derived or based upon the fisheries for the species listed in Appendix A; and

4) there is present participation by native fishermen in Guam (together with non-native fishermen) in the fisheries of the species listed in Appendix A in the aforesaid areas.

For evidence areas 1-3, archival sources and archaeological reports in the libraries of the Univ. of Guam, the Nieves Flores Memorial Library, Guam, the Hawaii State Library, the National Marine Fisheries Service, and the B.P. Bishop Museum were consulted. The private libraries of several persons also provided additional sources. These sources were reviewed for relevant content, and an annotated bibliography was produced. There were no discontinuities in the

historical documentation of offshore fisheries use; all historical periods were covered by the sources consulted. In addition to archival sources, aged knowledgeable persons were consulted with respect to evidence area 3, and interviews with active fishermen were conducted regarding evidence area 4.

In pursuing the second set of tasks, limited entry was defined as a management tool for reducing total fishing effort in a fishery by restricting the number of fishermen (or fishing vessels) which participate in the fishery. The attitudes of fishermen and fisheries management professionals toward the effectiveness and desirability of limited entry for the off-shore resource species were solicited through individual and group interviews with fishermen and fisheries management officials in Guam. An evaluative report on limited entry as a management option has been prepared by a professional fisheries biologist with expertise in the Marianas.

The organization of the report is as follows. First there is a brief overview of the prehistory and history of Guam, which after 1898 follows a different trajectory from the rest of the islands in the Mariana archipelago mainly due to a difference in colonial administration. Next, the facts gathered for the four evidence areas are presented, with interpretive and evaluative comments. At the end of this section we provide brief summary answers to the questions posed in each evidence area. Following the presentation of evidence in the four evidence areas and concluding remarks is the evaluative report on the use of limited entry to manage Guam's fisheries. Appendices A and B and an annotated bibliography conclude the report.

Geographic Background

The prehistoric and historic fishing practices of the indigenous peoples of Guam are more easily comprehended when their geographic circumstances are considered. The islands of the Mariana archipelago are located between 13 and 20 degrees north latitude just west of the Marianas Trench, which marks the active subduction zone between the Philippine and Pacific tectonic plates. The islands are distributed along two north-south trending arcs (Figure 1). A third similarly trending submerged mountain chain, indicated only by reefs and banks, occurs 150-200 miles to the west of the two island arcs.

The northern arc of islands is made up of steeply sloping islands of recent volcanic origin (at least four contain active volcanoes) while those of the southern arc are predominantly large raised platforms of coralline limestone on much older volcanic bases, probably dating to the late Eocene (Tracey et al. 1964; Cloud et al. 1956). Prevailing winds are northeasterly, becoming variable during the summer months from the influence of the Asian monsoon. Thus waters on the eastern side of the archipelago tend to be rough except from about July through September. Waters in the lee of the larger islands tend to be calmer throughout the year.

The smaller northern arc islands have pockets of nitrogen-rich soil, and under favorable rainfall conditions can produce bumper crops of cultigens. The larger southern arc islands offer considerably more extensive areas of arable land as well as limestone forests containing lumber and other resources not found in the volcanic islands to the north. It is this contrast in agricultural potential which may have determined that prehistoric human populations were more numerous in the south, in spite of relatively rich fishing grounds in the north.

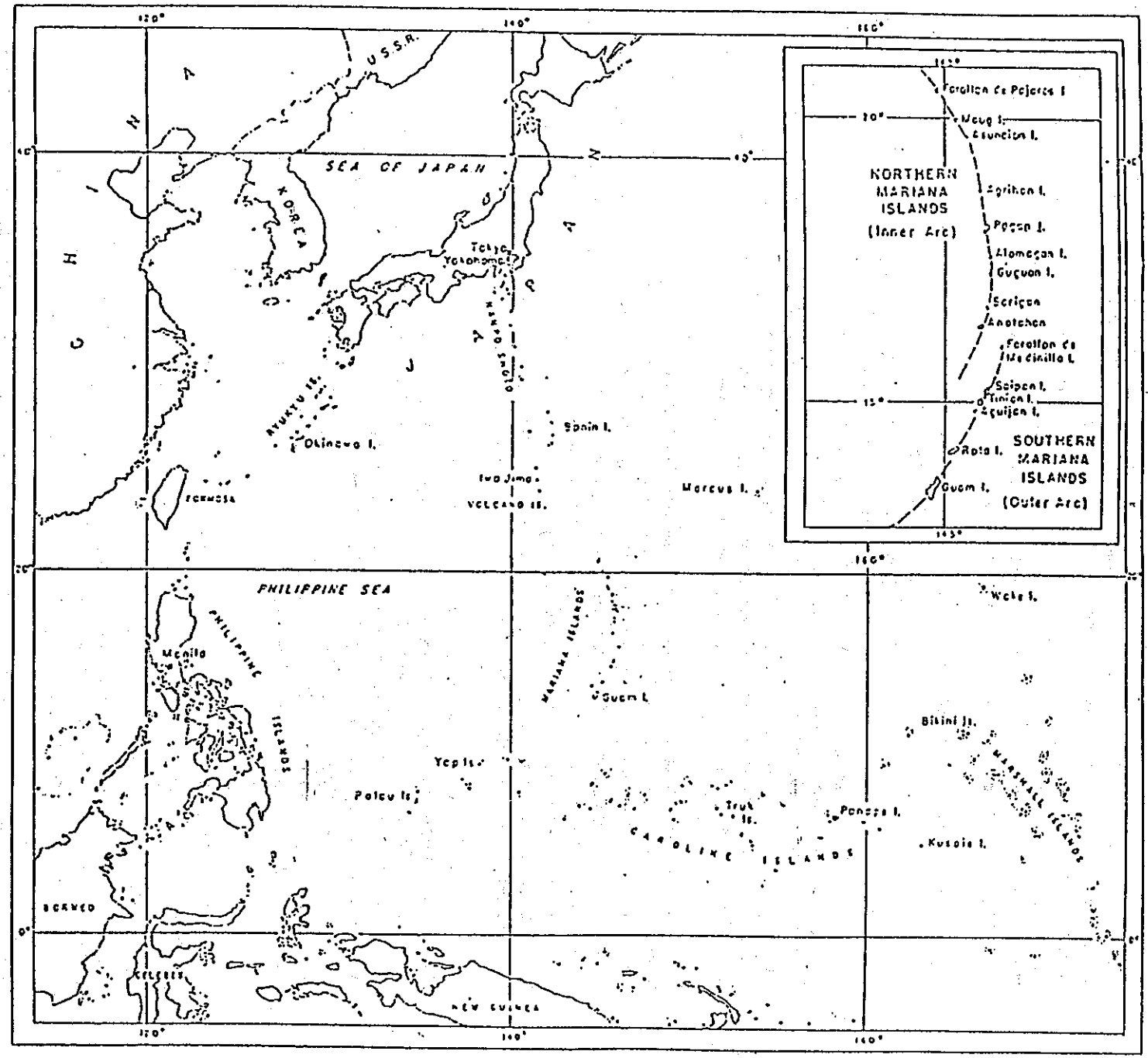


Figure 1. Location map of Mariana Islands in the western Pacific Ocean; inset shows northern and southern arcs (after Corwin et al. 1957:Fig.2)

Air temperatures rarely exceed 90 degrees F. nor drop below 70 degrees F., while annual rainfall decreases northward, from approximately 100 inches in Guam to about 70 inches at the extreme northern end of the Marianas chain. Tropical storms and typhoons are not uncommon, bringing a significant proportion of the annual rainfall. Since there is much variability in the frequency and occurrence of storms, there is much variation in annual rainfall from year to year. These uncertainties and a sometimes pronounced winter-spring dry season combine to make human existence on these islands, particularly with a pre-industrial (non-metal and non-fossil fuel based) technology, not as "easy" as first might be thought, in spite of the Marianas' tropical setting.

Guam is the largest and southernmost island in the Mariana archipelago (Figure 2). The topography and vegetation have been described in detail by Tracey et al. (1964). For the purpose here we can note that the southern half of the island consists of volcanic and limestone formations that form mountains, valleys, and rolling uplands, and that the northern half of Guam is a raised coralline plateau consisting mainly of Marianas Limestone. Various limestone forest communities once covered much of northern Guam while vegetation in the south included riparian forest, grasslands and Pandanus-grass parklands on volcanic hilltops and slopes and areas of limestone forest on the limestone-capped mountains on the western side of the island.

As in Saipan and Tinian, the beaches and reefs of Guam are bordered by fringing reef or erosional bench platforms of various widths and origins. Offshore barrier reefs with shallow lagoons have developed on the west and south coasts. In contrast, the islands of the northern arc have no extensive fringing reef platforms; usually the complex shorelines of these volcanic peaks drop steeply into the sea (for example, see Corwin et al. 1957), and any flat beaches are composed of volcanic sands or boulders. Numerous species of reef and bottomfish live in the northern island waters.

In addition to the fringing reefs associated with the larger islands and the coral communities forming on the steeper submerged slopes of the northern islands, offshore sea mounts and banks occur in the Marianas region. Some of these are several miles from the major islands, such as those lying in an arc 150-200 miles to the west (Figure 2). There are also closer isolated areas of partially submerged reefs, such as those between Guam and Saipan. These reefs attract a wide range of bottomfish. Another source of pelagic and bottomfish within the ocean are the floating logs which tend to attract an aggregation of fish.

The above geographic facts illuminate the picture of the kinds of indigenous fishing possible in Guam under pre-European Oceanic technologies (i.e., lacking iron and fossil fuels). Pursuit of reef fish inside lagoons and just outside fringing reefs would be possible using weirs, traps, spears, nets, and hook and line from paddling canoes. Fishing in the deeper waters at some distance beyond wide fringing reefs, for instance at relatively remote sea mounts and for trolling, would require the use of sailing canoes and various hook and line techniques. While seasonal and storm perturbations affect reef fish abundance and variety, the variety of techniques which can be practiced in inshore settings assure that some catch is more likely than no catch.

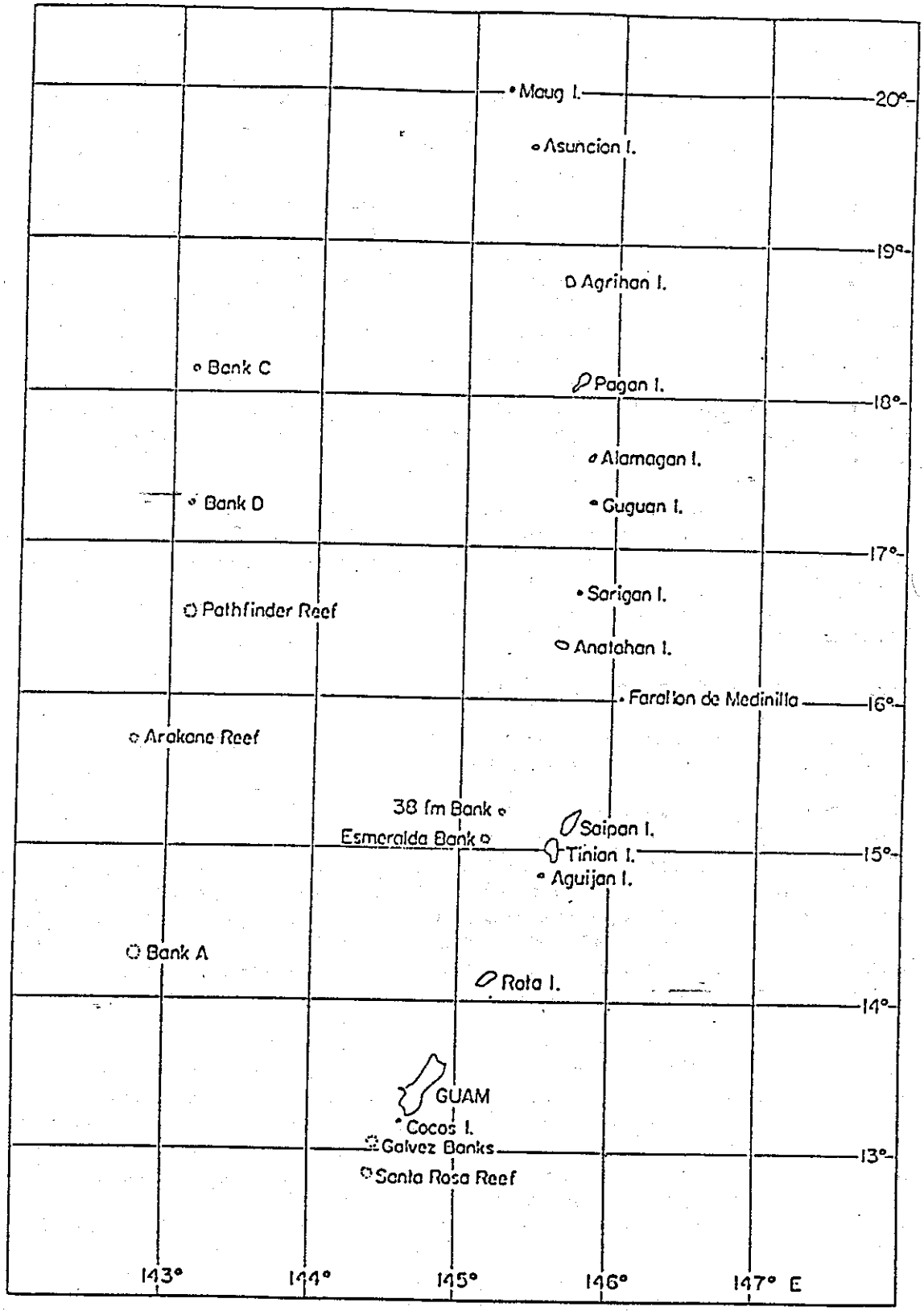


Figure 2. Mariana Islands and some offshore reefs and banks to the west (after Polovina et al. 1985:Fig.1)

Temporal and spatial patterns of pelagic and bottomfish occurrence would have played a role in determining when and with what technical devices these fish were exploited. For example, mahimahi begin to run in the southern Marianas in November and December (Amesbury et al. 1986:86) when the sea is not necessarily calm. Also, even though the tradewinds abate during the early summer when these fish may still be taken, summer is also the season when tropical storms are most likely. Given the need to minimize the danger and difficulties of ocean fishing under these conditions, Marianas fishermen may have had to miss part of the run, or only fish in the lee sides of the islands at this time. Also, given the fact that pelagic and bottomfish are very unevenly distributed within the vast ocean, intimate geographic knowledge of the location of sea mounts and reefs and fish migration routes as well as knowledge of the likely occurrence and patterns of movement of floating logs with associated fish would have been essential. In sum, sound biological and geographical knowledge based on familiarity with the region, and proven techniques and equipment which minimized the inherent danger to the fisherman while also maximizing the predictability of fish location probably characterized successful Marianas offshore fishing in prehistoric times.

When we consider the alternative, inshore fishing in lagoons and in other coastal settings, which can be practiced with less danger, fewer seasonal constraints, and more predictability, it becomes interesting to explain the development of indigenous offshore fishing practices. However, such a question is beyond the scope of this report and related discussion will be limited to relevant portions.

Prehistoric and Historic Overview

Prehistoric human settlement in the Marianas began some three thousand years ago (see Athens 1986; Bonhomme and Craib 1987 for recent assessments of early dates in the Marianas). As elsewhere in the archipelago, the archaeological evidence for 2nd millennium B.C. human occupation of Guam is equivocal although such claims have been made with respect to the Tarague site (Kurashina and Clayshulte 1981). The earliest reliable dates from Guam appear to be from a site in the Fonte River drainage on the island's west coast. Cordy and Allen (1986:193) report uncalibrated shell dates of 430 $\pm$ 80 B.C. and 530 $\pm$ 100 B.C. obtained from this site. The Trigo site, located on the east coast of Guam south of Ylig Bay but about which other information is lacking, is also early, dating to 360 B.C. (Shutler 1978:223, cited in Athens 1986:14).

The earliest archaeological deposits in the Marianas have been referred to the Pre-latte Period or Phase (Spoehr 1957). They have been found only in sandy coastal settings and are usually buried beneath later prehistoric occupation layers. Pre-latte deposits are often small in areal extent at sites where they have been found, in comparison with the areally more extensive, more abundant, and better known sites of the Latte Phase (Spoehr 1957). According to Spoehr (1957), the Pre-latte Phase ended and the Latte Phase began about A.D. 800, apparently continuing until the major cultural disruptions of the 17th Century.

Two often-noted differences in the technologies of the Pre-latte and Latte Phases are the dominance of Marianas Plain Ware in the ceramic assemblages and the presence of latte stones (thought to have served as building posts) in the latter phase. The Pre-latte Phase is characterized by a dominance of Marianas Red Ware and the absence of latte stones. Other differences between the two

occupational phases could be listed but the most important for the purpose here is the relative rarity of pelagic fish remains in Pre-latte deposits and their somewhat more common occurrence in coastal Latte Phase deposits along with the technological means of obtaining these species. The specific evidence for this generality will be considered later in the report.

In fact a very limited amount of information bearing on the question of prehistoric offshore fishing is presented in available reports of excavations in Pre-latte and Latte Phase sites in the Marianas. It should be noted, however, that throughout the prehistoric period of some three thousand years, the economy of these islands developed in the absence of commercial activities; that is, it was completely subsistence-oriented. Thus the archaeological remains of the prehistoric Mariana Islands adaptive system reflect human cultural responses to a very different set of constraints and opportunities than are operative today and have operated since a wage economy became prevalent on Guam. Further, the beginning of the end of this non-commercial cultural system can be attributed to Spanish colonization of the Marianas in the late 1600s and lasting until just before the turn of the 20th Century, when the United States took over Guam and Germany the islands of the CNMI.

European contact with the islands of the CNMI began with the explorer-adventurers such as Magellan, Legaspi, Loaisa, van Noort, van Spilbergen, and Dampier (extensive references to the original voyages and to secondary sources on these and other early expeditions can be found in Lessa 1975 and Hezel 1983). By 1565 Legazpi had formally claimed the Marianas for Spain but it was not until late in the following century that a colony was established in the islands at Guam. During the middle to late 17th Century, Spanish Catholic lay and professional religious arrived in modest numbers, bent on converting the indigenous population to their form of Christianity. By 1668 Spanish military forces had been sent to protect the colony and its religious folk (see, for example, Corte 1875; Thompson 1945; Carano and Sanchez 1964).

One of the most far-reaching effects of European colonization of the Mariana archipelago was a disastrous decline in the number of native Chamorros, from an estimated 40,000 persons in the late 17th Century to approximately 1,500 persons a hundred years later (Underwood 1973:Tables 1, 2). A significant part of the decline was from Spanish military attacks on native villages in Guam, Rota, Tinian, and Saipan, as well as "round-ups" of the residents of "Gani," the ancient name for the small volcanic islands to the north of Saipan (Freycinet 1829:230; Hezel 1986:13). Along with Guam's indigenes, the residents of Gani were forced to settle in a few parish villages on Guam. These harsh measures were accompanied by immediate flight from the European attacks and by several battles of resistance which however ultimately failed. By the turn of the 18th Century most of the survivors had been removed to Guam except the few who had escaped capture in Rota, a few more living in a missionary outpost in Saipan (finally closed in 1730), and probably some holdouts in the far northern islands (Hezel 1986:34, 31).

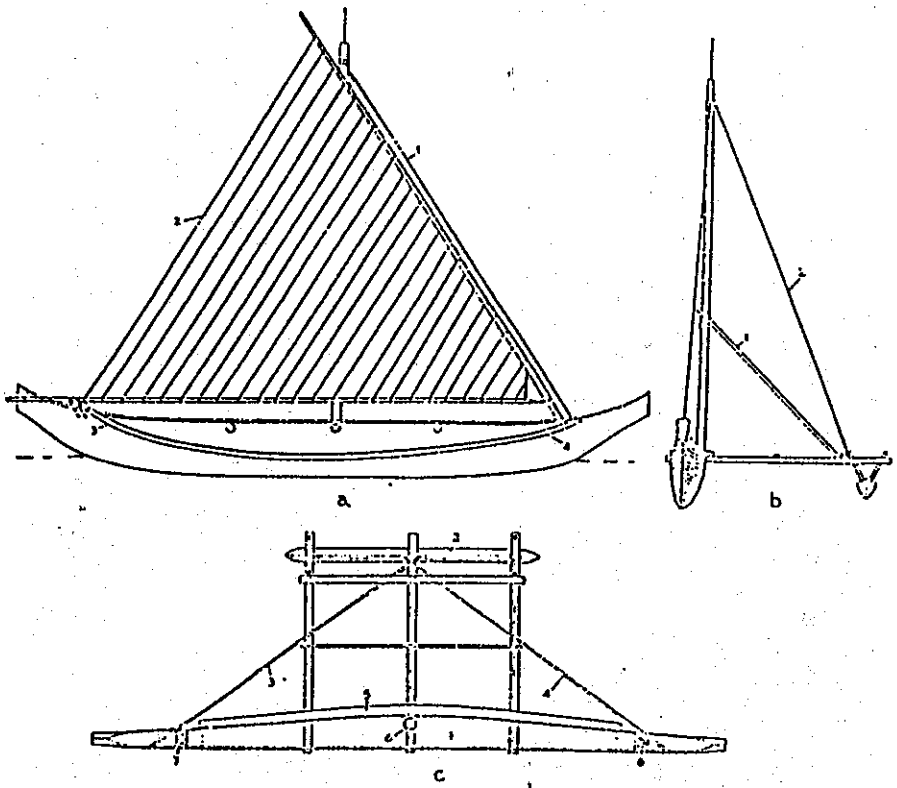
These tumultuous events seriously disturbed the native land tenure, farming, and fishing systems which had evolved over the millennia to suit the individual island habitats and social conditions. The Spanish "reduction" of the Marianas peoples (a policy whereby the indigenes were "reduced" to a few population clusters centered on a parish church in order that they might be more effectively instructed in the Catholic faith) caused severe economic hardship

that was to last for many years. Contributing in a synergistic fashion to the demise of the native population were several epidemics of newly-introduced diseases such as measles and influenza. The native Chamorros had no resistance, like their counterparts elsewhere in the Pacific and in California when confronted by these European scourges (Underwood 1973:16-18).

Once the defeated Chamorros had been forcibly concentrated on Guam, the Spanish continued to destroy their ocean-going canoes (see, for example, Garcia 1985:165, 272, 285, 303) known to the Europeans as "flying *proa*" or "*prau*." This was critical from the perspective of this report because ocean-going canoes were a major component of offshore fishing technology (see Figure 3). These actions apparently put an end to any fishing that was dependent upon swift movement over the ocean, or travel to distant banks. They also effectively stopped regular inter-island travel, although perhaps not suppressing it completely (see the discussion below of F. Garcia's [1985] history of Guam). Some large sailing canoes apparently still existed for Crozet (1783:204-211) to observe in 1772 (however, see Haddon and Hornell [1975:417] who believe Crozet's published description [1783] was cribbed from Dampier's observations of 1686 [Dampier 1906, Vol. 1:308-311] -- including repeating Dampier's error of saying the outrigger and curved side of the hull were on the lee side). Whether the loss of so many sailing canoes during the early Spanish colonial era had put an end by Crozet's time to fishing from canoes as well as to regular inter-island canoe travel by the Chamorros is not known. It can be surmised, however, that with the systematic destruction of both ocean-going canoes and of the large men's houses in and near which they had been maintained on shore, previous patterns of access to and use of the open ocean were significantly different by the 18th Century.

During the late 18th and ensuing 19th centuries, the native Marianas population recovered by fits and starts, coping with epidemics, typhoons, earthquakes, and food shortages (Underwood 1973). By the beginning of the 19th Century, European scientific exploratory voyages, for example, by Freycinet (1819), Dumont d'Urville (1828, 1835), Duperry (1826), Kotzebue (1821), and Lutke (1835), were undertaken in the Pacific and often included stops in the Marianas. The published journals, reports, and atlases resulting from these trips provide many ethnographic details of island life.

As we have suggested, indigenous lifeways in the Marianas had changed by the time the European scientific observers arrived to record them. In addition radical settlement pattern changes from small and relatively dispersed settlements to larger more permanent aggregations, demographic decline and slow recovery, racial admixture from immigrants from the Philippines and elsewhere, European and American plant and animal introductions altered the "effective environment" (those parts of the environment which directly impinge on the lifeways of the group) of the native Marianas peoples. Corn was promoted as a staple crop, along with the Mexican-style metate or grinding stone for processing the grain into tortillas. Rice was also grown extensively, utilizing rainfed uplands and the lowland marshes which had once probably supported the aroids *Colocasia* and *Cyrtosperma*. Philippine-style technology was imported for processing the large amounts of rice grown. Cattle were brought in and grazed freely in Tinian and Saipan and in parts of Guam, and Sambar deer from the Philippines roamed the larger Mariana islands (Eldredge 1988:135). These large mammals as well as domestic pigs, also introduced by the Spanish and many of which eventually became feral, may have adversely affected gardens and other



"Flying proa" of the Marianas Islands. *a*, view from leeward with sail set: 1, one of two stays supporting mast, the other hidden behind sail; 2, matting sail; 3, 4, running stays. *b*, head view, outrigger to windward: 1, mast shore; 2, shroud. *c*, plan: 1, proa; 2, "boat" at end of outrigger frame; 3, 4, braces from the ends to steady frame; 5, thin plank placed to windward to prevent shipping of water, to serve as seat for native who bales, and sometimes as rest for goods transported; 6, part of middle outrigger boom on which mast is fixed; 7, 8, horseshoe sockets, in one of which yard is lodged according to tack

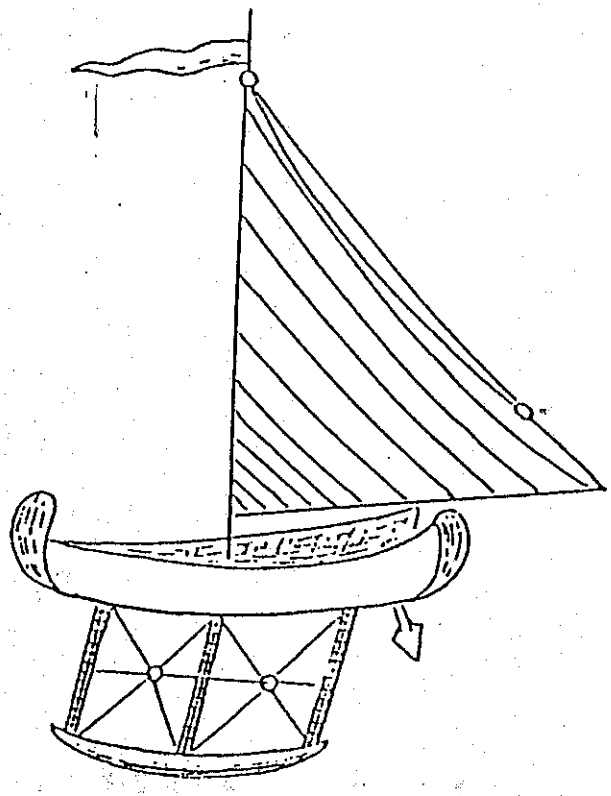


Figure 3. 18th Century drawings of Mariana Islands "flying *proa*," note banner atop mast in sketch on r (after Haddon and Hornell 1975:Figs. 300, 301)

unprotected resource-gathering areas, which in any case may have suffered neglect due to the emphasis on non-native staple crops.

More to the point, domestic and wild animals became a reliable land-based protein supply that had not been available prehistorically nor were they as difficult nor as dangerous to procure as pelagic fish. Thus even if sea-going craft were available, a probable shift away from the use of pelagic resources in light of more easily accessible introduced land animals can be anticipated for Guam in the Spanish colonial era.

The Re-Entry of the Carolinians

During the early 19th Century, people from the central Carolines, in what are now Yap and Truk States of the Federated States of Micronesia (see Figure 4), were encouraged by the Spanish government to settle in Saipan, Tinian, and Rota as well as in Guam (Underwood 1973:22-24, 29-30; Hezel 1983:106). These people came to the Marianas with a well-developed sea-faring tradition. At the time they were invited into the Marianas, they claimed to have been making regular trading voyages from the Carolines prior to the coming of the white men, prudently ceasing such trips after "having been witnesses themselves of their cruelty" (Kotzebue [1821], quoted in Hezel [1983:103]). Once assured of their safety in the Marianas, the Carolinians maintained small settlements in the larger islands and were employed by the Spanish to carry messages throughout the archipelago, as well as conveying farm products such as jerked beef to Guam (Hezel 1983:105, 107). Figure 5 depicts some Carolinian sailing canoes off Tinian during this period.

Regarding the use of sea-going canoes in the latter part of the Spanish era in the Marianas, Fritz states that in 1880 the Spanish prohibited the Carolinians from sailing among the Mariana Islands after some canoes had been wrecked at sea (Fritz 1986:24). Perhaps by this time the Spanish colonials in Guam no longer needed their unique transport services. In any case, this late 19th Century prohibition appears to mark the end of regular travel by sea-going canoes within the Marianas by Carolinians. However, they continued to live in small enclaves in these islands and to sail in their own canoes to and from the central Carolines. Unlike the unfortunate Chamorros, the Carolinians were able to retain their ocean-going sailing tradition while in Guam until their ouster by the Americans early in the 20th Century and in their home islands well into the 20th Century (Alkire 1965, 1978; Gladwin 1970; Lewis 1978; Thomas 1987).

The 20th Century

Guam was acquired in 1898 as a spoil of the Spanish-American war, and a year later the German empire acquired the other Mariana Islands to the north by purchase from war-weakened Spain. Shortly thereafter an account of the history and a general ethnography of the Mariana archipelago was compiled by the Saipan District Captain Georg Fritz (trans. 1986). Documents specifically applying to Guam and its resources began to appear under the auspices of the American administration, such as yearly governor's reports (naval from 1899-1949; appointed civilian from 1949-1970; elected from 1970-present).

Early in the American period some comprehensive works such as Safford's ***The Useful Plants of the Island of Guam*** (1905) and ***A Year on the Island of Guam*** (1910) supplied details of island lifeways by a natural historian. It is

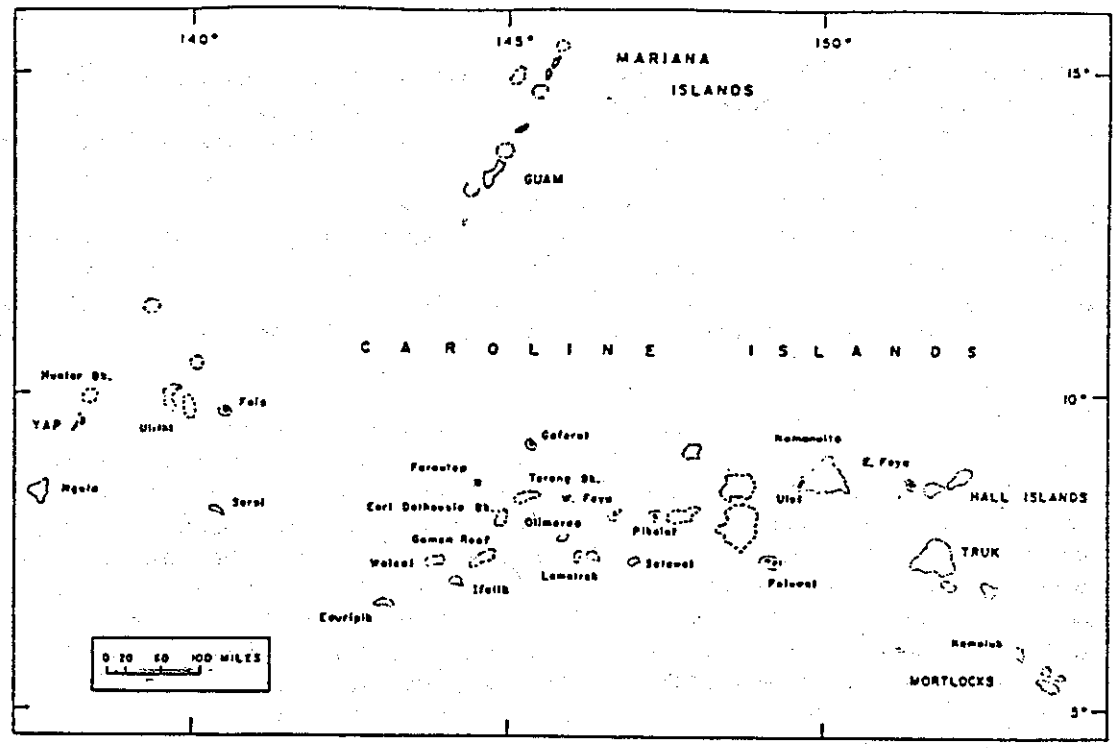


Figure 4. Location of the Mariana Islands with respect to the Carolines (after Barratt 1988a:Fig.1)

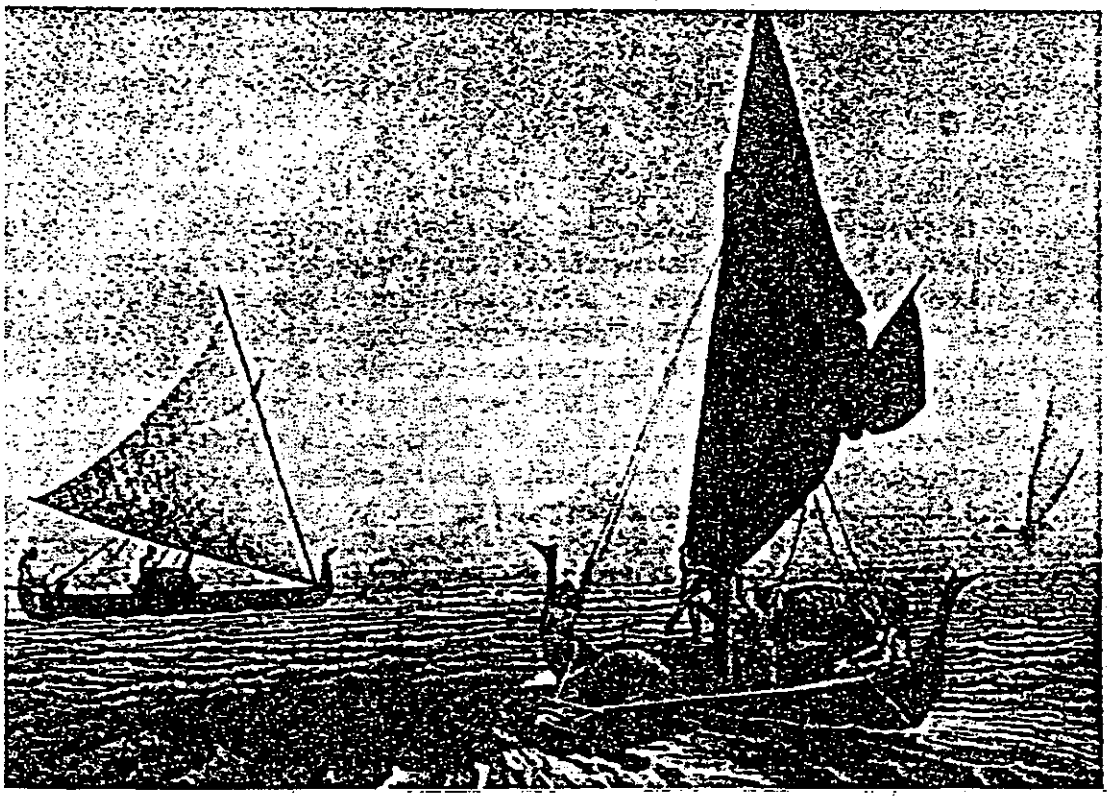


Figure 5. Carolinian sailing canoes off Tinian, ca. 1800 (after Barratt 1988a:Fig.2, a reproduction of a painting in Freycinet's Atlas of 1825)

apparent from these works 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. Netting and spearing were the primary methods used. There were some government efforts to encourage sports fishing on the open ocean but these appear to have appealed mainly to Americans. The government also held training programs to encourage local residents to participate in the offshore commercial fishery. Given that training was available, the primary deterrent to participation in such commercial endeavors was the lack of capital to purchase and maintain the necessary large boats and a reticence to be at sea overnight or longer.

The Japanese seized the German Marianas in 1914 and remained in control until the Americans captured the islands in the fierce battles of 1944. In December 1941, Japan had attacked Guam, beginning the Pacific war with the United States simultaneously with the attack on Pearl Harbor. During the next three years until the devastating American invasion, the native population of Guam was virtually enslaved by the Japanese, these conditions becoming especially acute by 1944. Those who could, escaped the *corvee* labor imposed by the occupying military forces by staying in remote locations and moving frequently to avoid detection. Obviously such a perilous situation precluded any safe offshore fishing by the Chamorros during the war years.

With the resumption of American civilian control after a five year long post-war naval regime, non-military government resource management programs were possible. A fish and wildlife proram for Guam began a few years later, eventually to become the Division of Aquatic and Wildlife Resources, now headed by Mr. Rufo Lujan. In the past, under Chiefs Ikehara and Kami, this agency received limited funding for the promotion of commercial fishing (P.L. 88-309 funds); however, emphasis was placed on aquaculture rather than on developing the offshore commercial fisheries. This funding source is no longer available but funds for the promotion of sports fishing (Dingle-Johnson funds) have recently increased and account for a large proportion of the division's activities.

As post-war wage work enabled the native population to acquire boats, outboard motors and other equipment needed for offshore fishing, this activity became and remains a popular form of recreation on Guam (Knudson 1987; Amesbury and Myers 1982; Amesbury et al. 1986). Typically a man will go out in his own boat (usually no longer than 16 feet) or in that of a friend or relative for a few hours of trolling and/or bottomfishing on the weekend or a holiday. The catch is generally shared among the fishermen; if there is an abundance, some of it may be sold "to pay for the gas."

The Four Evidence Areas

***Evidence Area 1*: that there was and is a set of historical fishing practices for the species listed in Appendix A in the federal waters around Guam.**

Nature of the Evidence The types of archival sources consulted include eye-witness reports; second-hand reports of eye-witness accounts; ethnographic accounts and lists of linguistic forms indicating familiarity with offshore fish and fishing practices; archaeological excavation reports describing prehistoric fish remains and fishing gear; and synthetic summaries of fishing practices and their associated technologies such as fish hooks and ocean-going canoes by

anthropologists, historians, and other scholars. Government reports from the various colonial regimes were also consulted for information on the participation of native peoples in the offshore fisheries of Guam.

Evidence for historical fishing practices in regard to the species listed in Appendix A is of three general types, historic documents which describe such practices, ethnographic studies containing information about customary fishing among the indigenous peoples of the Marianas, and archaeological reports from which inferences about fishing practices can be made.

The evidence gathered in this study generally supports the proposition that there was and is a set of historical fishing practices for the species in Appendix A (exceptions listed below) but it was rarely possible definitely to establish specific fishing practices separately for each species. Also it was not possible definitely to establish whether each species was taken beyond three miles from the island coastlines.

In many of the sources consulted, the evidence is inferential rather than direct. This is well exemplified in the case of archaeological reports wherein the data are subject to conflicting interpretations. Mainly this is due to a lack of precise understanding by archaeologists of the formation processes of the archaeological record and of the precise effects these processes exert on the spatial distribution of artifacts and food refuse in prehistoric sites. Also making for ambiguity in the interpretation of archaeological finds is that excavation and analytical techniques vary in their quality and comprehensiveness from project to project; some classes of information bearing on prehistoric fishing practices or fish consumption patterns may not be recovered at a given site due to the kinds of excavation and/or analytical strategies employed by the archaeologist.

Another problem encountered is incomplete reporting of finds; rarely are fish remains comprehensively described or even minimally classified as to families represented. Even when fishing gear such as shell fish hooks are reported from a site, their overall size and other physical dimensions are not always given. In such cases it is not possible to infer the size of the fish sought with such gear. Taking into account a variety of ethnographic evidence from the tropical Pacific and the biological habits of tropical marine fishes, Davidson and Leach (in Butler 1988:337-343) have suggested the most likely catching methods associated with particular fish families. They proposed that the demersal baited hook, pelagic lures, and harpoons were the principal methods of catching fish from the families with species listed in Appendix A.

In the case of eye-witness accounts, the credibility of the observer may be an issue; ambiguity and misunderstanding are often factors in cross-cultural accounts, for example, due to the European observer's unfamiliarity with native Micronesian cultural practices or with local fish species. Misidentification of species can occur in these descriptions, and/or the non-native eye-witness might have misinterpreted certain customary practices relating to fishing. In general, relatively less reliance should be placed on the observations of untrained observers such as missionaries', adventurers', and travelers' accounts and more on those of professional ethnographers and natural scientists, allowing for individual variations in the observer's natural sensitivity to and interest in the material. In the case of the Juan Pobre account of 1602 (Driver 1989) due to

the archaic writing style, it is not always clear who had made the original observation reported, the lay brother, Juan Pobre, or the Spaniard, Sancho.

Unfortunately for this project, professional observations on customary fishing practices in the Marianas did not begin until after considerable disruption of the indigenous Chamorro culture. Even in these later works, a writer might freely quote or discuss the observations of another writer on the same subject in such a way that it is not possible to discern who actually made the original observation. In one case, an author had borrowed from the writings of another so precisely as to have repeated the first writer's mistake regarding placement of the canoe outrigger.

During the 20th Century, we have few actual ethnographic studies but some compilations from which fishing practices can be inferred. A considerable amount of ethnographic material was collected and described by Hornbostel (1921-24; Thompson 1932), mainly for Rota, Saipan, and Guam, during the Japanese occupation of the Marianas (1914-1944). Also during this time a few Japanese ethnographers came to Micronesia along with other scientists who came to evaluate the area's resources and economic potential but they did not work in Guam. Recently some of the Japanese ethnographic reports have been translated but remain unpublished at the Bishop Museum in Honolulu. We reviewed the relevant translations at the Museum, finding only the paper by I. Yawata (1930) to directly pertain to the Marianas, and the paper by H. Hijikata (1941) to indirectly pertain to our subject, as he studied fishing methods in Satawal. There was a Carolinian community in Guam, presumably with some ties to Satawal, during the 19th Century but these people were relocated to Saipan shortly after the Americans took over the administration of Guam.

The evidence presented below has been organized as follows. First the archaeological site report data are presented, with interpretive commentary. In these discussions references are made to the pertinent ethnographic and ethnological literature. A review of the historical documentation of European observers is then presented. For the Spanish Period (1521-1898) the documentary evidence has been subdivided into reports which directly pertain to pelagic fishing and those which indirectly do so. For the ensuing colonial eras (Japanese, and pre-war and post-war American) the direct and indirect evidence is considered together.

Prehistoric Archaeological Evidence

Introduction

The Marianas archaeological record of some three thousand years of human occupation yields two general categories of data which can be used as a basis of inference about the practice of prehistoric fishing: the physical remains of marine fish, primarily certain skeletal parts, and fishing gear such as hooks, gorges, and harpoon heads.

An additional category of archaeological data, just now becoming available, derives from the chemical isotopic analysis of human skeletal material. These analyses can provide clues about prehistoric diet of the individuals whose bones are analyzed, particularly about the relative dependence upon marine resources from lagoonal or pelagic environments (DeNiro 1985; van der Merwe 1982; Walker and DeNiro 1986). Chemical isotopic analytical techniques in archaeology are

very new; therefore only recent studies contain this kind of data. So far no bones from Guam sites have been analyzed using these techniques but results should be forthcoming soon from a Latte era burial site in Agana (D. Moore pers. comm. 1989)

Archaeological fish remains are often imprecise indicators of the exact species taken by prehistoric fishermen. This is because the fish bones found in archaeological deposits are not distinctive at the species level; more often only the family or subfamily can be known for certain; occasionally a particular bone can be identified to genus; and with some exceptions, it is virtually impossible to distinguish among several species of a particular genus on the basis of bone morphology alone. Later in this report we present the recent findings of an expert in the identification of archaeological fishbone from two Guam sites, as well as the limited information found in published sources.

Generally, fishing gear is better-reported than are fish remains in the archaeological reports we consulted for this project, although there is a recent trend toward more comprehensive description of fish remains. We have confined our research to a consideration of those items which most likely reflect exclusively the taking of pelagic or bottomfish but it should be kept in mind that some gear, such as certain hooks and gorges, could have been used in the inshore areas as well, and that some species normally found in offshore habitats also frequent inshore settings and could have been taken there.

Fish Remains

Pelagic fish vertebrae have been found at the Tarague site in a beach area of northern Guam, "throughout the entire [occupational] sequence" (Kurashina 1987:7). Amesbury (n.d.1) examined over 7000 bone fragments of fish recovered from Tarague and reports, "a moderate number of very large vertebrae...with centrum diameter up to 25mm...Although not specifically identified, these vertebrae appear to be from pelagic fishes such as tuna, wahoo, and barracuda" (Amesbury n.d.1:4). Moore (1983:203-204) reports the finding of pelagic fish vertebrae from Tarague as well. The Tarague site spans the Pre-latte and Latte Phases. No inventory nor detailed analysis of all of the fish remains recovered from this site has been published.

Also in northern Guam, the NAVFAC Ritidian site dating to the Latte Phase yielded fish vertebrae which indicate the likely taking of offshore species (Amesbury n.d.2:2). Among these remains, 51 vertebral fragments estimated to be 20mm or more in diameter, and one whole vertebra was 19mm in diameter (Amesbury n.d.2:Table 3). These large vertebrae all came from an area within the site which also yielded the highest number of small vertebrae.

Reinman (1977:141) was unable to identify any pelagic fish remains in the (predominantly reef) fish bone assemblages he obtained from excavations at four coastal sites in southern Guam. Craib (1986:Table C) from the Pagat site excavations obtained remains of the following benthic and pelagic families, expressed as minimum numbers of individuals: Serridae (11), Epinephelidae (2), cf. Epinephelus (7), cf. Plectropoma (1), cf. Cephalophalus (1), Lutjanidae (3), Holocentridae (2), Pempheridae (1), Coryphaenidae (8), and Istiophoridae (2). Craib also stated that in the earliest (Pre-latte) level at the Pagat site, the fauna noted by Reinman (who worked at the site previously) was almost all fish

and turtle bone, and that "inshore fish predominate" in this early time period (Craib 1986:139).

At the Ylig Trench site dating to the beginning of the Latte Phase on Guam's east coast, Moore and Amesbury (1989) found a large fish vertebra identified as probably a marlin, and other large vertebrae identified as wahoo and shark. Thus on the basis of fish remains alone it appears that large fish were being taken from a variety of locations around Guam during the prehistoric period.

Fishing Gear

In Marianas artifactual assemblages fishing gear is overwhelmingly fragmentary; whole items are seldom found. In part this is due to quick decomposition in the moist ground of the materials used, such as wood and turtle shell, but it is probably also due to the fact that many of a site's archaeologically retrieved items are discards -- broken or worn-out pieces of equipment which have been disposed of along with other refuse. As noted above, items of highly perishable organic materials cannot survive long in the ground under tropical island conditions. The apparent non-survival of turtle shell is particularly unfortunate, as trolling lure barbs were apparently made of this material. In sum, the artifactual assemblage found by the archaeologist at a given location usually does not represent the full range of items used by the people who once occupied that site. Pompeii-like conditions of preservation and completeness at an archaeological site are exceedingly rare.

Granted the above truths, we considered the following items of fishing gear to indicate the practice of offshore fishing:

1. **bone "spear points," or "harpoon heads."** These items indicate the taking of large pelagic fish such as mahimahi (***Coryphaena hippurus***) and marlin (e.g., ***Makaira nigricans***). As pointed out by Davidson and Leach (in Butler 1988:340), marlin "are known to bask on the surface, and can then be approached and harpooned" (citing Tinker 1978:331, 333; Gosline and Brock 1960:261-265). This technique could have been practiced from a large canoe; without the noise and smell of a boat engine, approaching a large basking fish without startling it may have been fairly easy, although killing and landing a large specimen must have required the utmost skill and courage.

According to Reinman (1967:121-123), the fish spear is very common in Oceania including Micronesia, generally along the shore and in shallow water but also from canoes and when diving into deeper water. Citing Anell (1955:29), Reinman (1967:123) states that "garfish" are taken by spearing in Micronesia. Thompson (1932:52, Plate 11) reports fragments of three bone "spearheads" from prehistoric occupation sites collected by Hornbostel in the 1920s although no site provenience is given.

Reinman (1977:Fig.41, p.193) illustrates several bone spear or harpoon heads, mainly from two archaeological sites on the southeast coast of Guam. He cites a bone spearpoint fragment found at the Mochom site near Pagat, on the east coast of Guam excavated by the College of Guam and another collected at the Ypao Beach site on the coast of west-central Guam (Reinman 1977:118-119). Ray (1981:217, 219) reports a bone spear point from Latte Phase deposits at the Tarague site.

Recently a bone implement which could have been a spear or harpoon head was found at the Ylig Trench site on the east coast of Guam (Moore and Amesbury 1989:Plate 3).

2. **gorges.** Two types are known, straight and bent at an angle, generally a right or obtuse angle with one leg longer than the other. The ends are pointed and the line was attached to the center. Gorges from the Tarague site in Guam are illustrated in Figure 6.

Materials used include wood, mussel, pearl, and turtle shell, pandanus thorns, fishbone, and animal teeth. According to Anell (1955, cited in Reinman 1967:131), gorges in Micronesia are commonly used with coconut shell floats or short hibiscus wood sticks, weighted on one end, in order to catch flying fish, which in turn are used as bait for larger fish (such as mahimahi) caught by trolling. The gorge may also be trolled baited or unbaited behind a moving canoe; again the most frequently sought fish with this implement is the flying fish, the bent form of gorge being used.

Reinman (1967:131) states that within Oceania, gorge trolling is only found in Micronesia. Anell (1955:152) states that in the Marianas the gorge was made of mussel shell (cf. Reinman 1967:131, cited above). The presence of gorges in an archaeological assemblage may indicate the taking of large pelagic fish because of the association of gorges with obtaining flying fish for bait. The taking of flying fish by gorge trolling would have been followed on the same trip by trolling for pelagic fish using the fresh bait. Other techniques of taking flying fish, such as seasonal hand-netting from a moving canoe at night under torch light would have resulted in larger quantities at a time, but on these occasions, the fish would be consumed directly and/or preserved.

At Pagat, Craib (1986:215) recovered 31 shell gorges from the Latte Phase deposit at this coastal northeastern Guam site. At Tarague Ray (1981:223) also found numerous *Isognomon* shell gorges, mainly from Latte Phase deposits. Figure 6 shows shows some of the Tarague gorges and Figure 7 one from a burial in Tinian.

Reinman (1977:115) excavated 21 finished and 63 unfinished gorges from *Isognomon* shell from the Nomna Bay site in southeastern Guam.

3. **compound spinner hooks.** Compound spinner hooks consist of a shank resembling a fish's body or head and a pointed hook attached by lashing to the shank. According to Reinman (1967:138), these devices are used without bait and are trolled behind a moving canoe. Figure 8 shows drawings of examples of these hooks, from Guam and Satawal.

By their shape and color, they resemble a small fish and serve as a lure. This is the primary device for taking "bonito," which includes at least the skipjack tuna/bonita (***Katswonus pelamis***) listed in Appendix A. According to Reinman (1967:166, citing Thompson 1932, no page number given), "apparently a single specimen of a composite hook shank" was found by Hornbostel. This item may be one which was found on the surface in Guam; according to Thompson (1932:46), it was "composed of calcareous material, with two knobs at one extremity for attaching the line and two grooves at the other for securing the hook." This item is illustrated in Photo 1.

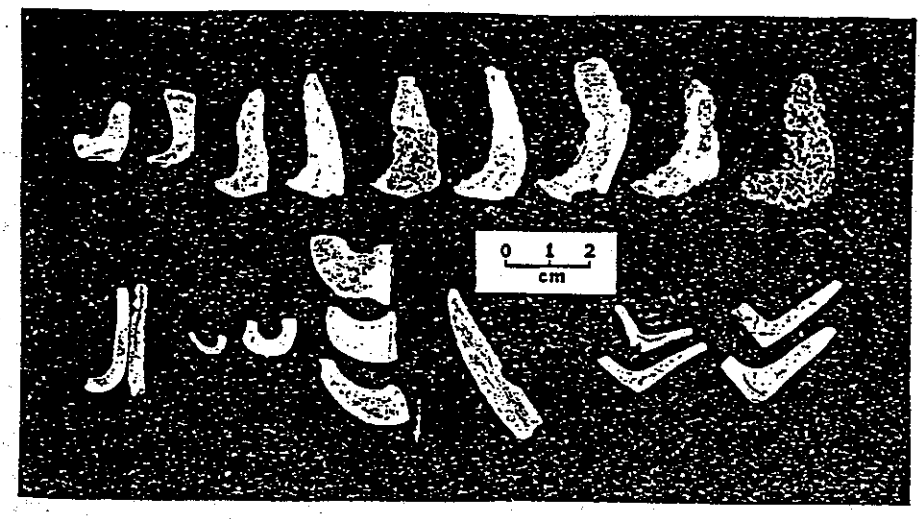
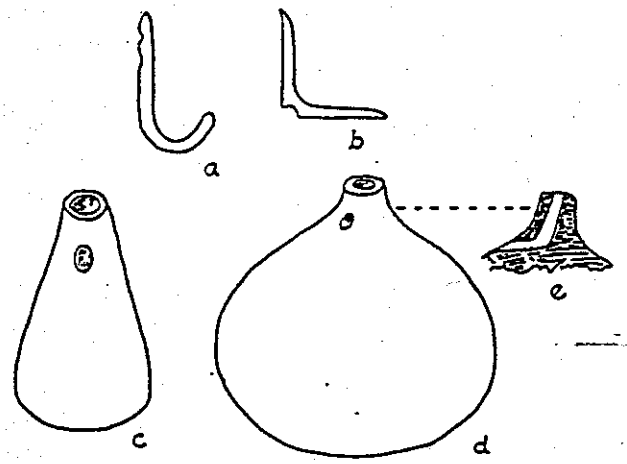


Figure 6. Archaeological specimens from the Tarague site, Guam; *Isognomon* shell fishhooks, blanks, gorges (after Amesbury et al. 1986:33)



Fishing implements. *a*, fishhook. *b*, fish gorge found with burial 30 inches below surface, Taga, Tinian. *c*, fishing stone of type 3, limestone: height, 2 2/5 inches; maximum diameter, 1 2/3 inches; diameter of top opening, 2 1/5 inches. *d*, fishing stone of type 4, limestone, Saipan: height, 3 inches; maximum diameter, 3/8 inch. *e*, cross-section of top of *d*.

Figure 7. Drawings of fishing implements from the Marianas; a,b: shell fishhook, shell gorge; c,d: fishing stones with hole drilled in top for line (after Thompson 1932:Fig.21)

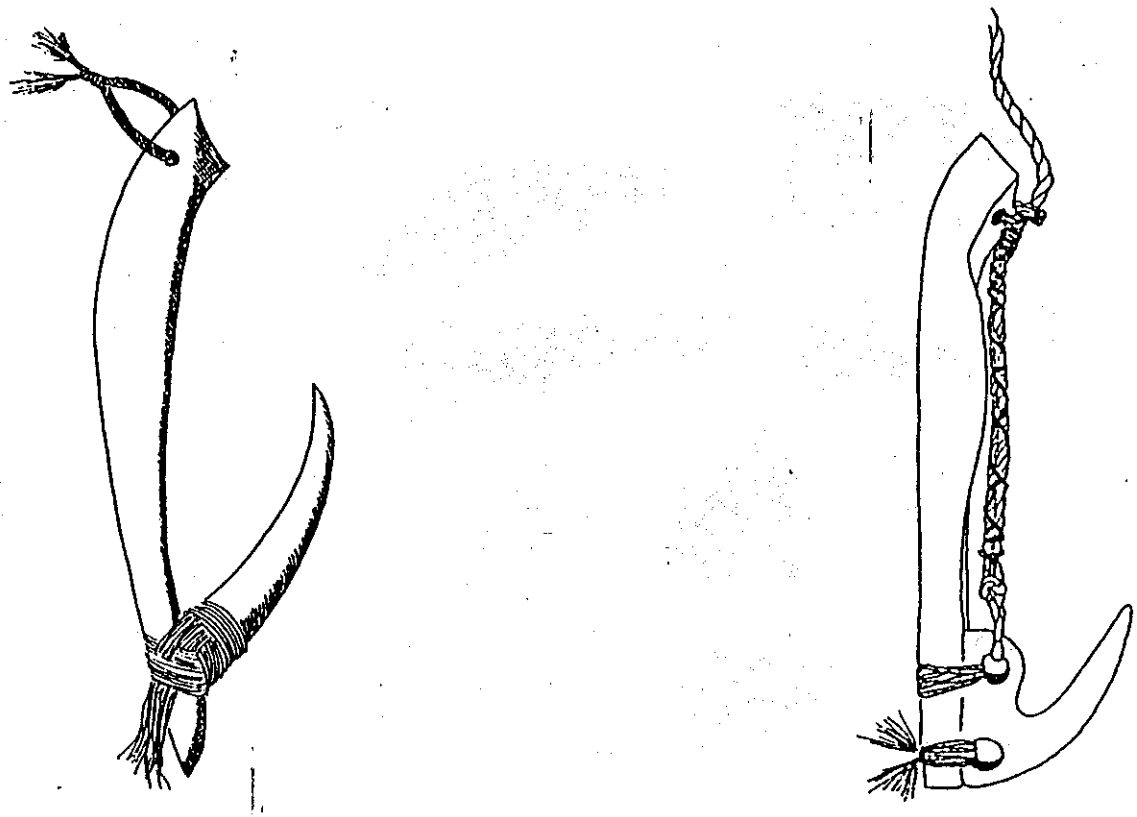


Figure 8. Drawings of composite hooks: l. from the Marianas (after Amesbury et al. 1986:Fig.1); r, from Satawal (after Gillett 1987:Fig.4)

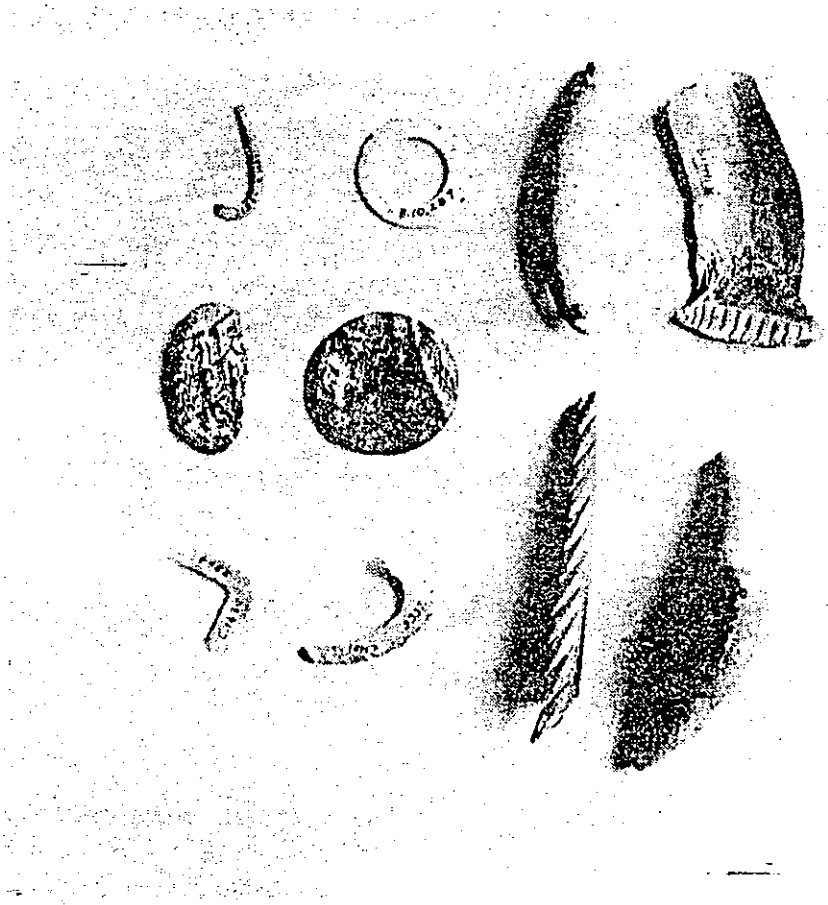


Photo 1. Shell and bone objects from Hornbostel Collection, Bishop Museum negative #18174; top row l-r: shell fishhook, shell ring, trolling hook shank, *Isognomon* shell knife; lower row l-r: shell gorge, shell hook, bone harpoon head or spear point, ornament

Ray (1981:217, 219) reports a human bone composite fishhook from Latte Phase deposits at the Tarague site. He suggests that some deep sea fish may have been taken during Pre-Latte as well as Latte occupations at Tarague, on the basis of the presence of these items, as well as from the presence of stone sinkers which were also found in Pre-Latte deposits (Ray 1981:227).

At two sites in Tumon, on the west coast of Guam, bone composite hook fragments and several shell gorges were found by J. Bath (pers. comm.) Thompson (1932:Plate 11,c) reports a shell gorge from the Dano site (location not specified) in Guam. Fourteen points from composite trolling lures were found at Pagat by Craib (1986:217); one clamshell shank fragment from a composite fish hook was also found (Craib 1986:219).

Reinman (1977:119, Fig. 41) reports a possible two piece hook point found in a Latte Phase deposit at the Nomna Bay site, southeastern Guam.

4. **sinkers.** Stone sinkers (*poio* in Chamorro) were used in connection with *hachuman* fishing, a specialized chumming technique for *Decapterus* dwelling at over 50 ft depth, done over a series of days in late summer from a paddling canoe (see Thompson 1932:47-48; Amesbury et al. 1986:8-10). Although this species is not listed in Appendix A, the *poio* fishing technique indicates native Chamorro use of the open sea at some distance from land, presumably over seamounts; see the 19th Century description in this report. Archaeological specimens of *poio*-type sinkers are reported by Thompson (1932:47 from Saipan, Table 1 from southern Marianas).

The *poio* device is illustrated in Photo 2, from the Hornbostel photograph collection at the Bishop Museum, Honolulu. Also illustrated are a grooved stone sinker (Photo 3), also from the Hornbostel collection, and drawings of fishing stones with holes drilled in the hollow top (see Figure 7). According to his notes, Hornbostel (1921-24) was not always able to purchase the indigenous artifacts still in the possession of, and often still in use by, Chamorro and Carolinian families in the southern Marianas where he worked. In such cases his wife Gertrude made ink drawings of the items, and sometimes watercolor illustrations.

From Pagat Craib describes fourteen pieces of worked limestone and shell which he interpreted as fishing weights (Craib 1986:219-220), one of which resembles the *poio* device. Five stone sinkers were reported by Ray from Tarague (Ray 1981:227-229), from both Pre-Latte and Latte levels.

Photo 3 illustrates a grooved stone sinker with line in place, from the Hornbostel Collection. Although this specimen was obtained in Rota it resembles archaeological finds on Guam, such as one found at the Toguan Bay site by Reinman (1977:99;Fig.31,d).

5. **wooden hooks.** According to Reinman (1967:138), large wooden hooks are used in Micronesia for taking sharks and *Ruvettus* and other deep-dwelling fish, several miles from shore. None was reported in the archaeological reports consulted for this project but it should be remembered that uncarbonized wood is seldom preserved in Marianas archaeological sites. It is possible that such wood items will be found in waterlogged depositional contexts in the future.

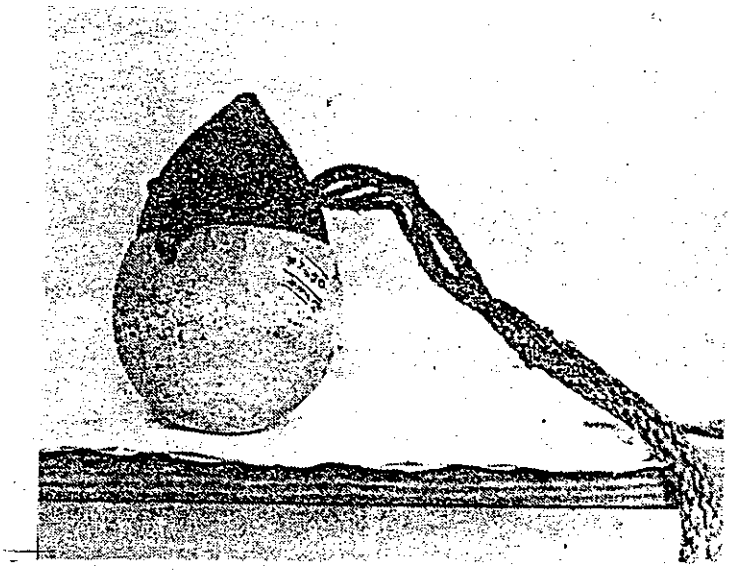


Photo 2. *achuman* (Decapterus, opelu) chumming device from Rota, called *poio*, made of limestone, coconut shell, coconut fiber cord; from Hornbostel Collection, Bishop Museum negative #18172

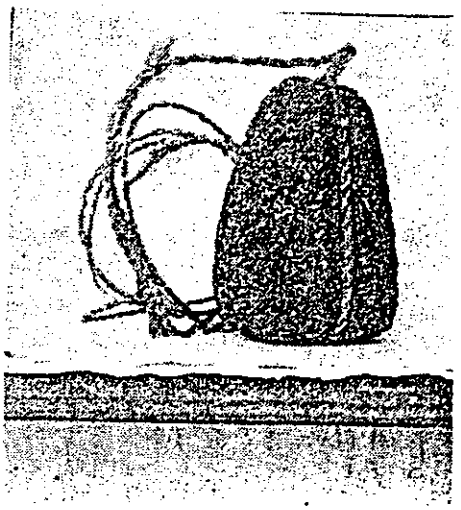


Photo 3. Stone sinker from Rota, Hornbostel Collection, Bishop Museum negative #18173

Historic Evidence: Spanish Period

SOURCES PERTAINING TO PELAGIC FISHING

Antonio Pigafetta--1521

Antonio Pigafetta (1969), Magellan's historian on the first expedition to circumnavigate the globe, recorded their "discovery" of the Mariana Islands in March 1521. Their stop at Guam was brief and hostile. The log of the pilot Albo (1971) shows that they arrived on March 6 and departed on March 9. The islanders entered Magellan's ships and stole from them. In particular, they stole a skiff from Magellan's ship. Magellan went ashore with 40 armed men, burned 40 or 50 houses and several boats, killed seven men, and recovered his skiff.

As Magellan's ships were leaving the island, the Chamorros followed them for a league in 100 or more boats. The islanders offered them fish, but instead threw stones. Pigafetta marveled at the skill with which the islanders maneuvered their boats.

In spite of the circumstances surrounding his visit, Pigafetta described the lives of the islanders. He observed that the people had flying fish and that the fish were caught from boats with hooks made of fishbone. He said, "The pastime of the men and women of that country and their sport is to go in their boats to catch those flying fish with hooks made of fishbones" (Pigafetta 1969:61).

The significance of Pigafetta's observation to this project is that flying fish are the main food of mahimahi (*Coryphaena hippurus*). This was demonstrated in a pelagic fish feeding study (Myers 1984:77,79) conducted on Guam from 1981 to 1983. Flying fishes (Exocoetidae) made up 74.5 percent by weight of the stomach contents of the mahimahi sampled. This means that it would be possible for a fisherman who was catching flying fish with a hook and line to also catch a mahimahi. We know from the following source that this was the case with the Chamorros of that time.

Fray Juan Pobre de Zamora--1602

Fray Juan Pobre de Zamora, a lay brother of the Franciscan order of Discalced Friars, was aboard a ship in the fleet which departed Acapulco, Mexico, on February 4, 1602 (Driver 1983). The fleet carried the new Governor of the Philippines, Don Pedro Bravo de Acuna. Governor de Acuna had learned in Acapulco of the shipwreck of the Santa Margarita at Rota a year earlier in February 1601, so he ordered the fleet to put in there where they recovered 21 survivors and an additional four from Guam.

Moved by a desire to see the people of Rota converted to Catholicism, Fray Juan Pobre and a companion jumped ship there. He remained on the island until October of that year when he departed on a Spanish ship bound for the Philippines.

While on Rota, Fray Juan Pobre was visited by a Spaniard named Sancho, one of three Spanish survivors of the Santa Margarita that had remained in the Marianas. Sancho had lived on Guam as a servant to a Chamorro master. Islanders

from Pago, Guam, brought Sancho to Tazga, Rota, where he visited for several days with Fray Juan Pobre and his companion. At the end of their visit, Fray Juan Pobre accompanied Sancho back to the village of Guaco, Rota, where he was to meet the villagers from Pago, Guam, who had brought him to Rota (Driver 1988). As the two slept at Guaco that night, Sancho was speared in the back. Nine or ten days later, in the month of August, Sancho died at the home of Fray Juan Pobre's master in Tazga.

As Chapter 70 of his account (Driver 1983), Fray Juan Pobre related what Sancho had told him concerning the customs of the people of the Marianas. Sancho told how the people fished for flying fish, mahimahi, billfish, and other large fish.

According to Sancho, the people of a village gathered as a group to fish for flying fish. They sailed out in their boats, each of which carried ten or twelve calabashes. Attached to each gourd was a thin cord with a two-pronged hook made of shell. One prong was baited with *carne de cos* (possibly *carne de coco* or coconut meat). The other prong was baited with a shrimp or small fish. All of the calabashes were put into the water at the same time. Each person watched his own, and when it wiggled, he knew he had hooked a flying fish. The fish were usually eight inches long but could be up to 16 inches. So many were caught that there was sufficient for everyone. Sancho compared the abundance of the catch to the sardine catch in Spain.

The first flying fish was eaten raw. The second was used to bait a large hook on a line which was cast over the stern of the boat. In this way the people caught many *dorados* (mahimahi), *agujas paladares* (possibly blue marlin), and other large fish. They did not eat shark, but were great enemies of it.

Sancho went on to relate a specific incident which illustrated many of the points he had mentioned before:

> My master, whom they called Sunama, went fishing far out to sea. After having eaten the first flying fish (*bolador*), and after having baited his hook with the second, as I described earlier, a very large blue marlin (*aguja paladar*) took the hook. His line was very thin and, as he did not want to break it, he hesitated to pull it in. Yet he was very anxious to land the fish; therefore, he very cautiously began playing and tiring it. This took a long time. Meanwhile, a large shark appeared and attacked the blue marlin in the midsection of its back. In order not to let go of his line, the *indio* allowed his boat to capsize. Then he tied the end of the line to the capsized *funei*, followed the line through the water to the shark, and diverted him from his catch. Then he brought the blue marlin back to his boat, righted the craft, and sailed home, flying a woven mat as a banner from the masthead. Once ashore, he began to tell us what had happened and, like a person who believes he has accomplished a great feat, very proudly strutted pompously along the beach.

Sancho explained that when the people returned from fishing, they displayed a banner symbolizing their catch. A large banner meant a large fish had been caught. He concluded his discussion of fishing by giving the Chamorro

equivalents for his Spanish names of fish. We have added the English and scientific names.

Spanish	Chamorro	English	Scientific
bolador	*gaga*	flying fish	family Exocoetidae
dorado	*botague*	mahimahi	*Coryphaena hippurus*
aguja paladar	*batto*	blue marlin	*Makaira nigricans*

Sancho also said the people of the Marianas "use the same kinds of nets and fishing tricks that our people use and many more" (Driver 1983:207). He said, "...these are the most skilled deepwater fishing people yet to have been discovered" (Driver 1983:208).

There are two things that should be noted about the translation of Fray Juan Pobre's writing. It was sometimes difficult for the translator to determine whether it was Fray Juan Pobre or Sancho speaking in Chapter 70. This was in part due to the fact that Fray Juan Pobre frequently spoke of himself in the third person (Driver 1983:205). The incident quoted above about Sancho's master fighting off a shark to land a billfish may actually have been about Fray Juan Pobre's master who was named Sunamo (Driver 1988:89) or Sunama (Driver 1988:91). If the incident was about Sancho's master in Pago, Guam, who was also referred to as Ama (Driver 1988:94), then both Sancho and Fray Juan Pobre had masters named Sunama. It may well be that the word "Sunama" was not a personal name, but a title meaning "Master." The Chamorro-English Dictionary (Topping et al. 1975) defines "ama" as "mistress, owner, boss." However, because of the ambiguity over who told the incident about his master, we do not know certainly whether the incident happened to a resident of Pago, Guam, or one of Tazga, Rota. In any case the incident is at least secondhand (if it was Fray Juan Pobre's master) or third hand (if it was Sancho's master).

The second thing to note regarding the translation of Fray Juan Pobre's account concerns the fish names. Dr. Steven S. Amesbury, who provided scientific names for the fish mentioned in Driver (1983), translated ***aguja paladar*** as billfish and added that it was probably the blue marlin (***Makaira nigricans***) since that is the most commonly caught billfish in the Marianas. After the first use of the term, the translator added "possibly blue marlin" (Driver 1983:208), but in the paragraph quoted above concerning the billfish caught by Sunama, the translator used the unqualified "blue marlin" (Driver 1983:209). We do not know that the fish was a blue marlin, only that it was a billfish.

Louis de Freycinet--1819

The Freycinet Expedition which arrived at Guam March 17, 1819, was a French scientific expedition which included the zoologists Quoy and Gaimard, the botanist Charles Gaudichaud-Beaupre, and the artist and writer Arago. The expedition spent several months in the Marianas, visiting Tinian and Rota as well as Guam.

Freycinet provided a relatively detailed account of the Chamorro tools and techniques used for fishing. Those that pertain to pelagic fishing are discussed here. A device called the ***poio*** used when fishing for ***atchoman*** was described (Freycinet 1824:436). The ***poio*** consisted of a hemispherical stone, flat on top

and three and a half or four inches in diameter, and a half coconut shell similar in size to the stone with a small opening in the top. Cords went through holes in the stone and coconut shell to hold them together. A loop or handle was added through the two holes in the stone, and a cord was attached which was long enough to allow the device to descend eight fathoms where the *atchoman* were found. Chewed coconut meat was put into the hollow coconut shell, and the device was used to attract the fish toward the surface where they could be taken in a net. The *poio* device was described by Hornbostel (1921-24; 1931) and is illustrated in Photo 2.

The particular net used was also described (Freycinet 1824:437). It was called *lagoa atchoman*, and it was similar to the nets known in France by the names of *chaudiere* or *caudrette*. The net was in the shape of a large bag with a circular opening. It was nine feet in diameter and four and a half feet long. The circle was made of *lodogao* wood (*Clerodendrum inerme*) an inch thick. Four cords attached to the circle came together in the center where the line was attached which allowed the net to descend to the necessary depth. Drawings of both the *poio* and the *lagoa atchoman* are included in Freycinet (and in the Hornbostel Collection there is a photograph of a man standing by one of these large nets).

Freycinet (1824:440-441) described the *atchoman* fishing as follows: The *atchoman* were caught beyond the reefs, one-half league to five leagues from land. Closer to land, he said, one would have caught none or almost none. The fishing began in August and continued until October when the fish were full grown.

The fisherman filled a *poio* with the chewed pulp of a young coconut and lowered the device on a line to a depth of six to eight fathoms. The fisherman shook the line from time to time dispersing the coconut meat into the water. The *atchoman* came in great numbers to eat the coconut. When the *poio* was empty, the fisherman took it out, refilled it, and continued the operation until evening.

The following morning, the fisherman returned to the same spot, but this time he lowered the *poio* one or two feet less deep than the previous day. He did this each day for a month and a half or two months except when bad weather prevented him. By then the *atchoman* were coming almost to the surface. Ordinarily this fish was caught at a depth of one fathom.

The process did not need to take so long unless the fisherman wanted a very abundant harvest. If he did not begin the operation until September when the fish were full grown, 15 days of feeding would have been sufficient. In that case, instead of gradually shortening the cord by one or two feet, he shortened it more each day.

With the *poio* at a depth of one fathom and always in motion, the fisherman or his helpers put the large *caudrette* (*lagoa atchoman*) into the water and slid it carefully under the *poio*. The net was lifted slowly and gradually until the circle which surrounded the opening came to the top of the water. The men took the net out of the water and threw the fish into their boat.

Then they began the same maneuver again. They could obtain a second and third catch on the same day. The fish were taken to the women who dried them in the sun with salt.

The 1943 unedited translation done for the Yale University Human Relations Area Files mistakenly translates the French to say that the fisherman could obtain two or three fish on the same day. However the French word "*capture*" is better translated "catch" here. The fisherman was able to obtain a second or third catch, meaning a second or third netful.

Freycinet (1824:441) added that this productive fishing technique, to which the ancient people devoted a certain number of hours each day, continued until the *atchoman* migrated. He said that it was by alignments taken from land that each boat fixed the limits of its fishing ground, although he added that at that time only the inhabitants of Rota followed this practice.

In the section concerning laws about fishing, Freycinet said that an *atchoman* fisherman would sometimes throw his *poio* into the water while crossing several fishing grounds. The fish would follow his canoe. When he arrived at his own ground, he would have a better catch. However, if the fisherman was caught, he would receive the death penalty. This would seem to imply certain legal conventions had been developed by the Chamorro which pertained to offshore fishing.

It is interesting to note the distance at which this type of fishing took place: one-half league to five leagues from land. The league has varied with time and place from about 2.4 to 4.6 statute miles. Two sources (Marden 1986:576-577) dating to the late 1500s state that an English sea league contains 2500 fathoms and a Spanish sea league contains 2857 fathoms, and that a fathom is six feet. One of the sources added that a Portuguese sea league is the same as the Spanish. This means that the English sea league was 2.47 nautical miles, while the Iberian sea league was 2.82 nautical miles. Currently, a French league equals four kilometers (Chevalley and Chevalley 1966) or 2.16 nautical miles. Based even on the most conservative equivalent, five leagues was more than 10 nautical miles offshore.

Knudson (1987), who estimated five leagues at 15 statute miles, feels that distance is excessive because of the difficulty of placing a small boat in the same spot that far from shore each day. However, it would be possible to place the boat in the same spot each day even at that distance from the shore if the spot were over an offshore bank, and that may have been the case according to the following informant.

Richard K. Sakamoto (personal communication) reports that *Decapterus* sp. are found at offshore banks such as 11-mile Bank, Galvez Bank, and Santa Rosa Reef, as well as parts of the Guam reef system such as Double Reef. Sakamoto came to Guam in 1966 under a contract with the Division of Fish and Wildlife (now the Division of Aquatic and Wildlife Resources) to provide training in small boat fishing methods and to survey the waters around Guam for fishery resources. He recalls that some *Decapterus* were caught during the exploratory fishing phase which began in January 1967, and that a Chamorro speaker from Guam told him the local name for the fish is *achuman*. Sakamoto's impression, from talking with local fishermen, is that *achuman* used to be more abundant around Guam than they are now, although they still occur here and recently have been

caught at Double Reef by Sakamoto's friend Masao Tenbata. Sakamoto says that repeatedly chumming an area where *achuman* occur will cause the fish to regularly return to this area.

Freycinet's (1824:443) description of fishing for flying fish is very similar to that of Fray Juan Pobre more than 200 years earlier. One difference is that Freycinet said the hooks used were made of iron rather than shell which had been used in the past. He gave the Chamorro name ***kinatchit gomahga*** for the device used, which consisted of a main line held by small calabashes and to which were attached lateral lines at intervals of six to nine feet. The moving calabashes signaled the fisherman that a flying fish had been hooked, and he caught it from his boat.

Freycinet (1824:443) also described fishing for what he called in French *l'anaho* (*dorade*?). The addition of the word "*dorade*" in parentheses may mean that he was talking about mahimahi (*Coryphaena hippurus*). The content of his description also indicates that he was talking about mahimahi, because he said that it was caught using a recently killed flying fish.

Felipe de la Corte y Ruano Calderon --1855-1866

Felipe Maria de la Corte y Ruano Calderon was the governor of Guam from May 1855 to January 1866. He was one of three 19th Century Spanish governors whom Carano and Sanchez (1964:141) found "stand out from the rest as having worked hard and well for the benefit of Guam." His administration consisted of a series of agricultural and economic experiments, and in his lengthy report, he concluded that the principal problem in Guam was poverty.

Concerning pelagic fishing, de la Corte (1970:143) made this statement: "In the contiguent seas there are considerable large fish, but as the natives never go to fish them beyond the reefs few fish are caught."

He did describe fishing within the reef for species available year round and for seasonal runs of fish. He also described fishing for ***adusman*** (Freycinet's *atchoman*). He said that the fish are fattened by the flaked coconut every day for one to three months and then caught in the net as described by Freycinet.

With regard to the amount of fish caught in this way, de la Corte reported, "With this operation they sometimes catch more than a ton of fish a day, and repeat the fishing for a month, around August" (Corte 1970:145). However, he went on to say, "...only certain old men practice this, and I do not think anybody does so nowadays." This raises a question, then, as to whether or not de la Corte ever saw that amount of fish harvested first hand or was told that amount concerning fishing in the past.

De la Corte (1970:145) also said, "Sharks abound and another fish called ***rompecandados*** (padlock breaker) which is more voracious than the shark," but he did not mention that either was fished.

Concerning navigation, de la Corte (1970:146) remarked, "In spite of the fact that on their discovery these natives created a reputation as good navegators (*sic*), and notwithstanding the fact that they individually have a good disposition as sailors, they do not at present exercise it whatsoever, on

the island since there is no boat capable of making a trip even to the nearest route." He reported there were three or four boats or "whale hunters' canoes" used for transporting goods from the harbor to Agana or for carrying unmilled rice from Inarajan or Merizo at harvest time. He said the islanders used small canoes or "galquides" for fishing, but added, "...they are so small, they cannot be used for anything other than going between the reefs, and thus nobody fishes beyond them." He said that in 1863 there were only 24 of these small canoes and concluded,"Consequently, we can say there is no navegation (*sic*) of any kind on the island."

Francisco Olive y Garcia--1884-1887

Francisco Olive y Garcia was the Spanish governor of Guam for less than a year beginning in November 1884. His notes pertain to the years 1884-1887. The section of Olive's report concerning fish is so similar to de la Corte's, one is tempted to conclude that he copied it from the former governor.

Like de la Corte, he said, "There is an abundance of large flavorful fish, but very little is caught because the people do not venture beyond the reef" (Olive y Garcia 1984:34). He described the same seasonal runs and the ***achuman*** fishing. Unfortunately, he did not credit the Chamorros who had invented the *poio* with the intelligence to use it. He said, "...since this requires patience, care, and intelligence--generally lacking in the Chamorros--we believe this is practiced only by an occasional person, especially on the island of Rota" (Olive y Garcia 1984:34).

Historic Evidence: Spanish Period

SOURCES INDIRECTLY PERTAINING TO PELAGIC FISHING

Miguel Lopez de Legaspi--1565

Miguel Lopez de Legaspi was the Spaniard who formally claimed Guam as a possession of Spain on January 26, 1565. Like Magellan's visit in 1521, Legaspi's visit was brief and ended in hostility. The diary (Abella 1965) of an unnamed traveling companion of Legaspi said that the fleet sighted land on January 22, and the ships anchored at Guam on January 23. On board was Fray Andres de Urdaneta who had visited Guam briefly with the Loaisa expedition in 1526. The day the ships anchored, Urdaneta delighted the Chamorros by speaking a few words he remembered in their language. However two days later as the vessels attempted to refill their water supply at the mouth of a cove, the islanders showered them with rocks and slingstones. The hostilities culminated in the murder of a ship-boy who had fallen asleep on land and the retaliation on the part of the Spaniards by killing a number of islanders and burning some houses and canoes. The ships sailed from Guam on February 3, less than two weeks after their arrival.

The author of the diary described the canoes of the islanders and their ability to use them (Abella 1965:19).

> Their canoes are very neatly and well made, sewed together with cord, and finished with a white or orange-colored bitumen, in place of pitch. They are very light, and the natives sail in them with their lateen sails made of palm-mats, with so much swiftness

against the wind or with a side wind that it is a thing to marvel at, and according to the expert sailors of our fleet they had never seen a sailing craft as light as these before; they have no prow nor stern; the men steer the boat by simply turning the end of the lateen-sail, and no matter how fast the boat went forward it turned backward making of the prow the stern. Indeed it is interesting to see the speed with which they navigate and the ease with which they change direction.

The author said that many canoes met them with six to twelve or more islanders in each canoe about two leagues from land on the day they sighted the islands. Over 400 boats came out to trade with them the day they anchored, and a larger number came the following day.

In describing large houses that he said served as arsenals for every *barrio*, the author (Abella 1965:36) stated, "Also to be seen therein were several large *proas* said to be used for interisland travel and to carry heavy cargo. All of them have a counterbalancing frame on the windward side in proportion to the size of the *proa*. With them sailing is made very safely without any danger of oversetting to windward."

With regard to fishing, Legaspi's companion (Abella 1965:36) reported, "The *Indios* are provided with plenty of fish which they catch with hooks and nets of which they have a variety." He added that the Spaniards had even seen the islanders who traded with them dive into the water and catch fish with their bare hands.

Fray Antonio de los Angeles--1596-1597

Fray Antonio de los Angeles was aboard the galleon **San Pablo** which arrived in the Marianas in 1596 as it made the crossing from Acapulco to Manila (see Schurz 1939). In his religious zeal, Fray Antonio jumped ship. He and two other Spaniards who left the galleon in an attempt to bring him back were dispersed among three islands and remained in the Marianas until the following year when they were picked up by Don Lupe de Ulloa y Lemos and taken to the Philippines. There the friar prepared a report of what he had seen for the King of Spain, Philip II. His report was used in the account (Driver 1977) available to the authors of this paper.

Unfortunately we do not know from this account on which island or islands Fray Antonio stayed, but what he said is mostly general enough to apply to more than one island of the Marianas. According to Fray Antonio, the occupation of the islanders is fishing. This would seem obvious but it contrasts with statements made about the people of Guam at a later date. Fray Antonio (Driver 1977:21) said that the people "barter with fish on the islands where it is not available. In exchange, they return with whatever they need but do not have on their own island." This is difficult to understand, since it is hard to imagine an island in the vicinity where fish are not available, but it is a reference to inter-island travel and trade.

This could be an example of a foreigner not understanding what he observes but describing it in terms of his own culture. Inter-island exchanges of food stuffs are common in the Pacific island cultures, as part of maintaining social and political relationships but have nothing to do with economic exchanges as

these are understood in the West. Fray Antonio also mentioned what seemed to be the ritualistic eating of a raw fish by a person about to die and those present with him, and the offering of fishing nets and hooks to idols.

Francisco Garcia--1668-1681

Francisco Garcia's *Life and Martyrdom of the Venerable Father Diego Luis De Sanvitores* (1985) includes a history of Guam from 1668 to 1681. The year 1668 marked the first Spanish attempt at colonization of the Marianas. Father Sanvitores and four other Jesuit priests, as well as some lay assistants, established a Catholic mission in Agana. In addition there was established a military garrison consisting of a captain and 32 soldiers (Carano and Sanchez 1964:64).

After an initial period of apparent success in converting the islanders to Catholicism, the mission met with hostility. Open rebellion on the part of the islanders toward the Spanish began in 1670, and Father Sanvitores was killed in 1672. Intermittent warfare continued between the Spanish and the Chamorros until 1695. Garcia recorded the early years of the Spanish-Chamorro wars, and although he mentioned fish or fishing only incidentally, the events he recorded indicate the decline of pelagic fishing.

On May 17, 1672 (Garcia 1985:164-165), a group of soldiers led by Captain Juan de Santiago left Agana to search for the murderers of Sanvitores and to punish other villagers who had assisted them. In Tumon, they did not find Matapang, the principal murderer of Sanvitores, but they burned his house, as well as a dozen more, and destroyed several boats. Garcia noted that this was a form of punishment the natives used against each other.

When Juan Antonio de Salas became the governor of Guam in June 1678, he sacked and burned rebellious villages including Tarague, Tupalao, and Fuuna. In the village of Agofan (located between Piti and Sumay), the governor burned the homes of those who fled but spared the homes of those who remained in the village. Garcia (1985:269) noted that, "...this kind treatment was not sufficient to reassure the *Indios*," and a few days later, some villagers from Agofan departed Guam for the island of Rota. The governor was chagrined by this development and with a native canoe overtook one of the fleeing canoes and made prisoners of its occupants. Garcia (1985:270) added, "This affair made such an impression on the people that for a long while no boats passed along that side of the Island for fear of being seized by the Governor."

In the fall of that year, the same governor burned the villages of Picpuc and Talofofo "with all the goods contained therein, including more than twenty *bancas*" (Garcia 1985:272). The following year he burned the village of Janum, and Garcia (1985:285) related, "Fifty boats that were taken as spoils of war were given to the friendly *Indios*" (villagers from Nisihan who had blocked the port of Janum to prevent the escape of the Janum residents by sea).

In 1680, during the first of his three terms as governor, Jose de Quiroga went to Rota to round up fugitives who had fled from Guam. In Rota he burned some villages where the "malefactors" had been received, and he ordered more than 150 fugitives returned to Guam. He then began the relocation of the islanders into larger settlements more accessible to his administration and to the priests. Garcia (1985:298-299) reported that a furious typhoon on November

11, 1680, destroyed every native house and wooden structure on the island, as well as nearly half the boats, but he added, "This storm served a useful purpose in destroying the houses of the *Indios*, thus facilitating the matter of gathering them into the larger villages."

Some consideration was given to the fishing industry in the relocation process, however (Garcia 1985:296-297). When Inapsan was selected as the site for a settlement in the eastern part of Guam, it was found that the river there did not have a good sand bar from which to launch boats, so a channel was made with some difficulty by breaking through the coral reef. Referring to Pago, Garcia (1985:297) said, "Here they established a large settlement, no less agreeable than the other (Inapsan), for it is served by a large river which cuts the village in two, and which has a mouth suitable for launching boats."

William Dampier--1686

William Dampier was a seaman aboard an English privateer commanded by Captain Swan which sighted Guam on May 20,1686. In his narrative of their round-the-world voyage, Dampier (1937:196) said it was well for the captain that they sighted land when they did because the ship was almost out of provisions and, as they learned later, the crew had planned to kill and eat the captain and any others responsible for the voyage.

Before they had anchored at Guam on the night of May 21, they were met by a priest and three islanders who mistook them for Spaniards. The priest was detained aboard ship as a hostage, and the following morning the islanders were sent to the governor of Guam with letters from the priest and from Captain Swan requesting provisions. A cordial exchange of gifts and letters followed until Captain Swan released the priest on May 30 and sailed from Guam on June 2, 1686. Although a Spanish galleon arrived in sight of Guam while Swan was anchored there, there was no hostile action between the English and Spanish ships.

Dampier (1937:206-207) provided a lengthy description of the Chamorro "*proes*" (*proas*) and gave the following reason for his description. "I have been the more particular in describing these Boats, because I do believe, they sail the best of any Boats in the World."

Concerning the islanders' sailing ability, he said, "The Native Indians are no less dextrous in managing than in building these Boats. By report they will go from hence to another of the Ladrone Islands about 30 leagues off, and there do their Business, and return again in less than 12 Hours. I was told that one of these Boats was sent Express to Manila, which is above 400 Leagues, and performed the Voyage in four Days time" (Dampier 1937:207).

Captain Woodes Rogers--1710

Captain Woodes Rogers commanded the British privateer **Duke** which, accompanied by the **Dutchess**, left England on August 1, 1708. Their voyage around the world concluded on October 14, 1711, and Woodes Rogers published his journal in 1712.

The ships anchored at Guam on March 11, 1710, and departed ten days later on March 21, 1710. Captain Woodes Rogers used the same ploy which Captain Swan had used in 1686. Pretending to be Spanish, he invited two Spaniards aboard

ship and detained one of them as a hostage while a letter was sent to the governor demanding provisions. The governor accommodated them with an abundance of food, and their visit was entirely friendly.

The governor also presented them with a "flying *proa*" which Woodes Rogers described in his diary (Rogers 1928:268-269). He took the boat back to London, thinking "it might be worth fitting up to put in the Canal in St. James's Park for a Curiosity, since we have none like it in this Part of the World."

George Anson--1742

George Anson left England on September 18, 1740 with a six-vessel squadron intent on assaulting the Spanish sea towns of South America and the South Seas and seizing the Manila galleon off Acapulco (Barratt 1988b). The voyage proved to be extremely costly in ships and lives, but Anson did indeed seize the treasure galleon **Nuestra Senora de Covadonga** off the Philippines in June 1743 before returning to England one year later. He had lost all the ships except the **Centurion** and more than 1300 men.

When the **Centurion** anchored on Tinian August 27, 1742, Anson found no permanent population, because the Chamorros had been moved to Guam. Instead he encountered a party of 25 to 35 people, Chamorros under the command of a Spanish sargeant, who had come from Guam to kill and cure beef for the garrison in Guam and for the galleon which would stop on her way from Acapulco to Manila. After an eventful two-month stay, the **Centurion** departed Tinian on October 21, 1742.

Anson, as well as a number of his junior officers, described the Chamorro *proa*. These descriptions and drawings are among the last in history. Haddon and Hornell (1975) have summarized the main features of the "flying *proa*" on the basis of the firsthand accounts.

Captain Crozet--1772

Captain Crozet became the leader of a French expedition sent to explore the South Seas when the original leader, Marion du Fresne, was eaten by cannibals in New Zealand (Crozet 1891:54). The Crozet expedition anchored at Guam on September 27, 1772, and did not depart until November 19, 1772. They were so well received by Governor Tobias that Crozet considered Guam a "terrestrial paradise" (Crozet 1891:82).

While Crozet's sailors convalesced on Guam, they amused themselves by fishing for freshwater fishes in the rivers (Crozet 1891:91). These Crozet considered excellent but said that the islanders did not eat them because they preferred saltwater fish. He noted that some of the saltwater fish were very "unwholesome" but added that the islanders knew which were unwholesome. It is possible Crozet was referring to ciguatera fish poisoning.

Crozet (1891:94-96) included a detailed description of the Chamorro *proas*, which he prefaced with this evaluation:

> In acquiring new knowledge by their contact with civilization, the islanders have at the same time preserved perfectly the art of making canoes received from their forefathers. In this respect they had nothing new to learn. It is quite certain that the invention of

the form of their craft would do honour to any boatbuilder amongst the most advanced maritime people. This form has not been copied from any model, for it differs from all those which have been given to sea-going vessels by any of the known peoples in different parts of the world.

Haddon and Hornell (1975:417) noted that Crozet was the last voyager to describe the Chamorros' "flying *proa*" but they questioned his description because it "coincides so closely with that of Dampier that it is impossible to resist the conclusion that Crozet had Dampier's account before him as he wrote and that he based his own almost entirely upon it." As proof of their conclusion, they cited the fact that Crozet repeated the unaccountable error of Dampier's in saying that the outrigger was on the lee side of the boat, rather than the windward side, as correctly reported by Pigafetta (1969), Anson (Barratt 1988b), and Rogers (1928).

A footnote in Crozet (1891:96), added by the translator H. Ling Roth, says that Dumont D'Urville (1830-33) wrote that at the time of his first visit to the Mariana Islands ~~in~~ May 1828, the islanders were no longer able to make these canoes and instead used similar ones from the Carolines. This statement was confirmed to Roth in August 1888 by Vice-Admiral E. Paris, who had been a midshipman with D'Urville.

Whalers--1800s

British and American whaling ships working in the Pacific made stops on Guam after each whaling season to rest and obtain fresh provisions. De la Corte (1970:67-68) reported visits by "30 or more ships a year for a 30 year period" beginning around 1823. According to Father Thomas McGrath, S.J., an expert on early whaling, at the University of Guam's Micronesian Area Research Center, the logs of the whaling ships contain no reference to native fishing.

Historic Evidence: American Period

William Edwin Safford--1899-1900

Safford was a Navy lieutenant who spent a year on Guam from August 1899 to August 1900 as an aide to Governor Richard P. Leary. In 1902 he resigned his commission in the Navy to become the assistant curator of the U.S.D.A. Office of Tropical Agriculture (Carano and Sanchez 1964:189), and in 1905 he published "The Useful Plants of the Island of Guam". In both that work and his diary, excerpts of which were published in the *Guam Recorder* from 1933 to 1936, Safford described fishing on Guam.

The fishing method Safford (1905:81-82; n.d.:236-238) described in most detail is the use of the fruit of ***Barringtonia speciosa*** to stupefy fish on the reef. This method of fishing was forbidden by the Spanish government because it destroys many fish too small to eat. However, the practice was revived when Guam became an American possession.

Concerning other methods of fishing, Safford (1910:238) wrote,

The natives do not now devote themselves to fishing so extensively as formerly, yet many of them have cast nets with which

they catch small fish swimming in schools near the beach, and a few have traps and seines. Today the large pool in which the poison (*Barringtonia*) was sunk was surrounded by seines. Among the fish we caught there were very few pelagic species. We got no bonitos nor flying-fishes. The custom of trawling for these is nearly obsolete. In the olden times one of the favorite sports of the natives was to go out under sail in their wonderful 'flying praos' trawling for bonitos. Wives accompanied their husbands and vied with them in managing the sails and in swimming and diving."

Safford (1905:83-89) also provided a list of what he called the principal fishes of Guam. He listed them by their Chamorro names but included the scientific names and descriptions of the fishes. All the fishes he listed can be found on the reef or in nearshore waters, although flying fish (*gahga*) also occur around offshore banks and at least one species of jack (*tarakito*) occurs in deep waters. Since Safford was a scientifically trained and observant individual who spent an entire year on Guam, his failure to list any offshore or deepwater fish species (with the possible exception of *tarakito*) is an indication that these species were not being harvested on Guam at the time.

Naval Government of Guam--1898-1950

In December 1898, President William McKinley issued an executive order placing Guam under the control of the Department of the Navy, and in 1899 the naval government was established under Captain Richard P. Leary as the first American governor of Guam. From 1901 through 1941 and from 1946 through 1950, the naval government issued annual, monthly, or quarterly reports on Guam. These reports provide some information on fishing during the American Period.

During the early years of the American Period, almost no mention was made of fishing in the annual reports. In 1904 Governor George L. Dyer (1904:2) wrote, "The people are purely agricultural..." and in another place (1904:17), "The people are, almost without exception, small farmers, raising only corn and sweet potatoes." In 1905 he said (1905:16), "This is purely an agricultural community."

The 1915 report (p.18) showed that 505 lbs. of preserved fish worth $45.10 had been exported to Manila in 1914. The 1918 report (p.18) listed ten cases of fish poisoning under admissions to the hospital. The 1932 report (p.54) listed one case of the use of dynamite in fishing under criminal cases, and under criminal cases in the 1933 report (p.61), there were two cases of fishing in a restricted zone. In other words, the Chamorro people were fishing, though not for much more than their own needs, and there is no indication they were fishing beyond the reef.

In 1934 (p.10) Governor George A. Alexander wrote that a fishing school was begun in October 1933 "to establish fishing beyond the reef." He said, "Twelve men from each village undergo a course of training for a period of 3 months. To prevent accident all fishing instruction is given within view of a fishing lookout at Orote Point. To give greater safety to such fishing parties are carried homing pigeons trained to bring back messages as may be necessary." Governor Alexander hoped that within a year or two there would be a sufficient number of trained men with power boats and proper fishing equipment to supply all the people of Guam with an abundance of fish.

The following year (1935:10), Governor Alexander reported on advances in the fishing industry. A Fish Warden had been appointed who was successful in curtailing the forays of thieves on fish weirs and traps. The Fishing School had been continued with 12 men from each seaside village undergoing three months of training in offshore fishing methods. Fishing inside the reef had improved over the year, but offshore fishing had not progressed due to a lack of suitable boats. Steps had been taken to procure boats from the Navy which would be reconditioned and distributed to the seaside villages. Governor Alexander added, "It is believed that when this plan is inaugurated off-shore fishing will be developed to an extent that will justify any governmental expenditures involved. At the present time this immense potential source of food supply lies practically untouched." The 1935 report (p.74) showed that $24,344.63 worth of fish had been imported. This exceeded the value of meat imported by nearly $9,000.

The 1936 (p.26) and 1937 (p.34) reports of Governor McCandlish contained the very same information on the deep-sea fishing classes. The Fish Warden instructed twelve men from seashore villages at a time. To safeguard the boats, a lookout was maintained at Orote Point. Each boat carried trained homing pigeons to carry messages in case of danger. After 1937 there was no more mention of the fishing school.

In the remaining pre-war reports from 1938 to 1941, the fisheries section was entitled only "Fishweirs" and was usually only one sentence about the number of licensed fishweirs. The 1941 report listed fishing under labor performed by prisoners (p.64) and also under recreation of enlisted men (p.137).

The post-war monthly reports of 1946 and 1947 and the quarterly reports of 1948-1950 provide information on the number of men deriving their living principally from fishing (Table 1). Although the reports do not give information on the race of the fishermen, for the most part the naval governors' reports are talking about the Chamorro people. When they talk about a person who is not a Chamorro, they frequently name the nationality or race of the individual. Chamorros from Guam comprised, by far, the majority of residents at that time. Although the non-resident population exceeded the resident population for all the periods in which number of fishermen is known, the non-residents would not have been engaged in fishing as an occupation. We know that because the naval security clearance prevented anyone from moving to Guam who was not employed, for example, by the U.S. military or civil service or by construction companies contracted by the military, etc. and the dependents thereof.

In order to obtain an understanding of the percentage of individuals engaged in fishing as an occupation and their likelihood of being Guamanian Chamorros, information about the population makeup of the island is presented (Table 2). These data show that at a time when more than 95 percent of the residents of Guam were Guamanians, somewhere between 71 and 302 men earned their living principally from fishing out of about 6,000 adult Guamanian males. If we assume that the fishermen were a representative sample racially of the total resident population, this means that between one and five percent of the adult Guamanian males earned their living principally from fishing.

The post-war reports of the naval governors also provide information on the amount of fish caught (Table 3). The reports distinguish between fish caught by

Table 1. Available Figures on Number of Men on Guam Deriving Their Living Principally from Fishing, 1946-1950.

Year	Jan. Feb. Mar.	Apr. May June	July Aug. Sept.	Oct. Nov. Dec.
1946			72 71 71	71 71 71
1947	75 75 75	97 97		
	<< 1ST QRTR >>	<< 2ND QRTR >>	<< 3RD QRTR >>	<< 4TH QRTR >>
1948			up about 150 to 289	302
1949				
1950		253 reduced to 211		

Table 2. Number of Adult (16 years and above) Guamanian Males (first line) and the Percentage of Guamanians in the Total Resident Population of Guam (second line) for the Time Periods for which Number of Fishermen is Known.

Year	Jan Feb Mar	Apr May Jun	Jul Aug Sep	Oct Nov Dec
1946				5,844
1947	5,862 5,871 5,870	5,880 5,903		97.48
	97.38 97.38 97.31	97.30 97.29		
	<<< 1ST QRTR >>>	<<< 2ND QRTR >>>	<<< 3RD QRTR >>>	<<< 4TH QRTR >>>
1948			5,907	6,014
1949			95.03	95.07
1950		6,469		
		95.35		

Table 3. Available Figures (in pounds) on Fish Caught on Guam, by Year, Month, Method (non-fish marine food products excluded).

Month	Method	1946	1947	1948	1949	1950
JAN	Traps		4,690	16,835	42,447	3,400
	Other		23,875	2,800	31,982	4,190
	Total		**28,565**	**19,635**	**74,429**	**7,590**
FEB	Traps		5,880	11,538	31,441	5,880
	Other		17,398	800	33,243	6,810
	Total		**23,278**	**12,338**	**64,684**	**12,690**
MAR	Traps		10,519	16,820	28,010	5,700
	Other		13,005	240	37,761	6,660
	Total		**23,524**	**17,060**	**65,771**	**12,360**
APR	Traps		8,107	10,324	2,115	6,150
	Other		46,020	46,290	9,542	6,950
	Total		**54,127**	**56,614**	**11,657**	**13,100**
MAY	Traps		8,705	8,885	11,688	5,500
	Other		6,795	6,372	15,865	23,950
	Total		**15,500**	**15,257**	**27,553**	**29,450**
JUN	Traps		18,063	15,352	8,665	5,600
	Other		13,370	11,611	6,840	7,060
	Total		**31,433**	**26,963**	**15,505**	**12,660**
JUL	Traps		18,025	36,100	10,020	
	Other		15,005	28,895	10,115	
	Total		**33,030**	**64,995**	**20,135**	
AUG	Traps		19,627	92,417	3,875	
	Other		19,823	35,340	11,695	
	Total		**39,450**	**127,757**	**15,570**	
SEP	Traps		14,940	34,802	18,560	
	Other		3,445	395,979	8,280	
	Total		**18,385**	**430,781**	**26,840**	
OCT	Traps		5,635	39,723	12,275	
	Other		10,870	43,663	9,440	
	Total		**16,505**	**83,386**	**21,715**	
NOV	Traps		16,221	37,442	7,180	
	Other		9,458	42,243	8,680	
	Total	**37,386**	**25,679**	**79,685**	**15,860**	
DEC	Traps	5,277		25,984	2,830	
	Other	35,610		30,009	8,220	
	Total	**40,887**		**55,993**	**11,050**	

traps and by other methods, but they provide no information on what the other methods were or what species of fish were being harvested.

The 1947 reports (June p.24; Sept. p.23; Oct. p.21; Nov. p.29) refer to two commercial fishermen equipped to do deep sea fishing. However, these reports invariably state that the fishermen were handicapped by a lack of qualified labor, mechanical trouble, or rough seas.

Civilian Government of Guam--1950 to the Present

In 1949 President Truman transferred the administration of Guam from the Secretary of the Navy to the Secretary of the Interior, and the transition to a civilian government was completed by July 1, 1950. The Organic Act, which took effect July 21, 1950, established Guam as an unincorporated territory of the United States and granted U.S. citizenship and a greater measure of self-government to the people of Guam. The presidentially-appointed civilian governors who served from 1949 through 1970 and the popularly-elected governors who have served since 1971 continued to produce annual reports. Fisheries statistics from the annual reports of the presidentially-appointed civilian governors are presented in Table 4. Information from the elected governors' reports is not presented here, as the Annual Reports of the Division of Fish and Wildlife are available for the same time period and contain more complete information.

The reports for the years 1954 and 1955 list the five most commonly caught species of fish. They are goatfish (*Upeneus saffordi*), mullet (*Mugil waigiensis*), porgie (*Lutianus bonhamensis*), skipjack (*Corangus ascensionis*), and siganas (*Siganas monahak*). None is an offshore species.

1956 is the first year in which a pelagic species (tuna) is counted, and 1959 is the first year for which a total trolling catch is included.

A report (Woodside et al. 1959) based on field work done on Guam in 1957 and 1958 concluded, "The present level of commercial fishing operation in Guam is inconsequential and wholly inadequate to meet the needs of the fresh fish consuming public. Except for the immediate inshore areas the fish resources in waters surrounding Guam have virtually been untapped." The report made recommendations for the development of an adequate commercial fishing industry.

The Division of Fish and Wildlife (later renamed the Division of Aquatic and Wildlife Resources) was officially established during fiscal year 1960, and from the 1960s on, the Division's Annual Reports include the results of the offshore fisheries surveys. These results are shown in Tables 5 through 8.

It must be noted that the data in these tables are not strictly comparable from one year to the next, because procedures for collecting and presenting the data varied from year to year. For example, some years only the Agana Boat Basin was actually censused; other years Merizo was also censused. The expansion formulas for arriving at annual estimates from the census results changed. Some years fishing derby statistics were included in the annual estimates and other years they were not. In some cases the tables in the reports contain information that differs from the information in the text.

Table 4. Fisheries Statistics taken from the Annual Reports of the Presidentially-Appointed Civilian Governors of Guam, 1950-1970. (Fiscal Years end June 30th, catch is given in pounds).

Year	Number of Men Engaged in Fishing	Fish Caught by Traps	Fish Caught by Other Methods						
							Turtle	Shellfish	TOTAL
1951	262	376,800	258,380				15,985	39,975	691,140
1952	315								559,620
1953	312								375,279
1954	312								405,164
1955									376,000

Year	Shallow-water Fish, Caught by Weirs	Shallow-water Fish, Caught by Other Methods	Manahac and Tiao			Tuna	Turtle	Shellfish	Total
1956	128,865	252,800	47,500			26,570	10,988	9,250	462,688*

Year	Weirs	Manahac	Mackerel					Total
1957		34,000	41,400					
1958	84,816		39,750					376,556

Year	Weirs	Other Methods	Manahac	Mackerel	Tiao	Trolling	Turtle	Crustacean	Total
1959	55,090	229,000	4,125	4,000	2,575	16,300	5,790	6,636	323,516
1960	75,896	218,900	21,900	12,450	4,750	13,700	7,101	4,948	359,645

Year	Weirs	Other Methods	Manahac	Mackerel	E'i'	Trolling	Turtle	Crustacean	Total
1961	92,085		17,778	156,960	6,400	15,000	5,479	1,710	295,412
1962	No statistics given								

Year	Weirs	Surround Net	Trolling	Total
1963	102,200	15,000	86,000	200,000*
1964				573,000
1965	No statistics given			
1966	No statistics given			

Year	Reef Fish	Rabbit Fish	Mackerel	Deep Sea Trolling	Total
1967	51,000	22,000	61,000	114,000	248,000

	Estimated Minimum Man-days Fishing	Total
1968	10,000	343,500
1969	No statistics given	
1970	No statistics given	

* The total given in the report is not the correct sum of the parts.

Table 5. Estimated Effort and Total Catch
for Trolling Around Guam

Fiscal Year	Beginning-Ending	<<< Estimated Effort >>> Person-hours	Boat-hours	Estimated Total Catch (in metric tons)
1988	10/1/87-9/30/88	200,276.1	57,364.9	341.7
1987	10/1/86-9/30/87	115,141.5	37,186.5	167.2
1986	10/1/85-9/30/86	130,599.3	47,984.1	222.6
1985	10/1/84-9/30/85	122,632.3	45,472.4	254.9
1984	10/1/83-9/30/84	101,752.0	35,775.7	233.0
1983	10/1/82-9/30/83	——	37,405	249.4
1982	10/1/81-9/30/82	37,892.3	13,977.1	94.3
1981	10/1/80-9/30/81	42,355.0	13,123.8	67.8
1980	10/1/79-9/30/80	21,090	8,170	46.5
1979	7/1/78-9/30/79	65,185.4	——	67.1
1978	7/1/77-6/30/78	48,645	18,163	84.9
1977	1/1/77-6/30/77	26,291.0	9,882.0	54.0
1976*	7/1/75-12/31/76	——	8,037	9.3
1975	7/1/74-6/30/75	——	4,519	15.6
1974	7/1/73-6/30/74	——	3,754	9.4
1973	7/1/72-6/30/73	——	3,547	30.1
1972	7/1/71-6/30/72	——	2,614	3.9
1971	7/1/70-6/30/71	——	3,830	11.3
1970	7/1/69-6/30/70	27,093**	——	17.5
1969	7/1/68-6/30/69	——	14,270	41.5
1968	7/1/67-6/30/68	——	——	——
1967	7/1/66-6/30/67	——	——	——
1966	7/1/65-6/30/66	——	——	——
1965	7/1/64-6/30/65	——	——	——
1964	7/1/63-6/30/64	——	——	——
1963	7/1/62-6/30/63	——	——	39.1

* annual estimates derived from 18 months of data
** unclear whether this figure denotes person- or boat-hours

Table 6. Percentages of the Estimated Total Catch for the Five Most Common Species Caught by Trolling Around Guam

Fiscal Year	FY Duration Beginning-Ending	*Acanthocybium solandri* (Wahoo)	*Coryphaena hippurus* (Mahimahi)	*Makaira nigricans* (Blue Marlin)	*Katsuwonus pelamis* (Skipjack Tuna)	*Thunnus albacares* (Yellowfin Tuna)
1988	10/1/87-9/30/88	11.2	42.8	8.8	23.3	9.3
1987	10/1/86-9/30/87	17.7	28.8	19.3	16.0	12.1
1986	10/1/85-9/30/86	36.0	25.9	8.1	15.7	10.2
1985	10/1/84-9/30/85	21.5	18.5	12.7	24.6	18.9
1984	10/1/83-9/30/84	7.1	8.0	11.0	48.9	20.7
1983	10/1/82-9/30/83	19.8	29.3	3.0	23.9	19.0
1982	10/1/81-9/30/82	16.5	27.8	7.1	27.4	17.4
1981	10/1/80-9/30/81	11	7*	8**	45	27
1980	10/1/79-9/30/80	5.5	40.6	8.1**	33.0	9.5
1979	7/1/78-9/30/79	8.6	22.6	12.5	27.9	24.3
1978	7/1/77-6/30/78	16.6	16.9	1.7	35.3	16.8
1977	1/1/77-6/30/77	——	——	——	——	——
1976	7/1/75-12/31/76	——	——	——	——	——
1975	7/1/74-6/30/75	29.9	12.0	35.9	7.3	8.1
1974	7/1/73-6/30/74	12.0	3.7	——	64.3	12.5
1973	7/1/72-6/30/73	27.6	7.8	5.0	32.7	23.2
1972	7/1/71-6/30/72	23.5	11.9	17.2	26.2	13.5
1971	7/1/70-6/30/71	7.2	3.8	58.3	6.2	12.8
1970	7/1/69-6/30/70	10.2	15.3	9.3	52.6	0.4
1969	7/1/68-6/30/69	11.9	20.2	——	34.4	26.2
1968	7/1/67-6/30/68	——	——	——	60.0	——
1967	7/1/66-6/30/67	——	9.4	34.2	30.1	3.4
1966	7/1/65-6/30/66	——	63.5	0.0	24.7	0.0

* Underestimated and unreliable
** Also includes *Istiophorus platypteris*

Table 7. Estimated Effort and Total Catch for Bottomfishing around Guam

Fiscal Year	FY Duration Beginning-Ending	Estimated Effort Person-hours	Boat-hours	Estimated Total Catch (metric tons)
1988	10/1/87-9/30/88	28,023.7	10,488.3	24.5
1987	10/1/86-9/30/87	11,922.9	4,836.1	11.7
1986	10/1/85-9/30/86	21,069.4	7,826.3	20.0
1985	10/1/84-9/30/85	37,929.6	14,356.4	39.6
1984	10/1/83-9/30/84	21,790.7	8,466.6	29.4
1983	10/1/82-9/30/83	——	7,591.6	20.1
1982	10/1/81-9/30/82	5,974.3	2,376.2	8.2
1981	10/1/80-9/30/81	3,803.1	1,553.4	5.4
1980	10/1/79-9/30/80	3,442	1,422	2.9
1979	7/1/78-9/30/79	5,003.8	——	5.5
1978	7/1/77-6/30/78	10,835	3,772	13.2
1977	1/1/77-6/30/77	3,769.92	1,413.72	2.5
1976*	7/1/75-12/31/76	——	1,837	1.3
1975	7/1/74-6/30/75	——	4,179	1.9
1974	7/1/73-6/30/74	——	3,821	1.7
1973	7/1/72-6/30/73	——	507	1.4
1972	7/1/71-6/30/72	——	4,435	1.8
1971	7/1/70-6/30/71	——	9,088	13.6
1970	7/1/69-6/30/70	2,171**	——	2.9
1969	7/1/68-6/30/69	——	3,171	1.4

* annual estimates derived from 18 months of data
** unclear whether this is person-hours or boat-hours

Table 8. Percentages of the Estimated Total Catch for Four Families of Fishes Caught by Bottomfishing Around Guam

Fiscal Year	FY Duration Beginning-Ending	Lutjanidae (Snappers)	Carangidae (Jacks)	Serranidae (Groupers)	Lethrinidae (Emperors)
1988	10/1/87-9/30/88	33.8	11.1	13.1	24.2
1987	10/1/86-9/30/87	20.4	10.3	12.5	44.1
1986	10/1/85-9/30/86	42.1	24.4	6.4	15.9
1985	10/1/84-9/30/85	27.5	5.6	11.1	44.0
1984	10/1/83-9/30/84	48.0	10.7	7.6	28.0
1983	10/1/82-9/30/83	34.9	2.0	17.4	24.3
1982	10/1/81-9/30/82	41.0	6.4	6.4	27.7
1981	10/1/80-9/30/81	*			
1980	10/1/79-9/30/80	*			
1979	7/1/78-9/30/79	*			
1978	7/1/77-6/30/78	*			
1977	1/1/77-6/30/77	———	———	———	———
1976	7/1/75-12/31/76	———	———	———	———
1975	7/1/74-6/30/75	26.8	0	4.0	**
1974	7/1/73-6/30/74	11.7	29.0	1.1	**
1973	7/1/72-6/30/73	70.7	0.4	3.0	**
1972	7/1/71-6/30/72	25.2	28.1	0.9	**
1971	7/1/70-6/30/71	94.7	0	2.3	**
1970	7/1/69-6/30/70	49.2	4.0	32.0	**
1969	7/1/68-6/30/69	40.8	0	25.2	**
1968	7/1/67-6/30/68	26.4	0	15.0	**
1967	7/1/66-6/30/67	37.2	12.8	29.5	**
1966	7/1/65-6/30/66	35.3	0	41.2	**

* The most abundant species were all Lutjanidae.
** not listed--probably combined with Lutjanidae

However, a reanalysis of the Division's data to make the information from one year comparable to another is beyond the scope of this project, and Robert Myers of the Division of Aquatic and Wildlife Resources is currently engaged in a reanalysis of the data for the last 12 years. Until that is completed, these figures are the best available and probably generally represent fishing on Guam. They are the only figures available which distinguish the types of fishing and the species of fish with which this project is concerned. The Annual Reports of the Division of Aquatic and Wildlife Resources do not contain any information on the race of the fishermen.

In general, the data presented show a large increase in both effort and catch for trolling and bottomfishing around Guam for the last 20 years. They also demonstrate the harvesting of certain of the species covered by the Fishery Management Plans of the Western Pacific Regional Fishery Management Council. These include the pelagic species *Acanthocybium solandri* (wahoo), *Coryphaena hippurus* (mahimahi), *Makaira nigricans* (blue marlin), as well as *Istiophorus platypterus* (sailfish). The other billfish species managed by the Council are seldom, if ever, recorded in Guam, and sharks are not a desirable fish in Guam. All of the families of bottomfish (snappers, jacks, groupers, and emperors) represented by the species covered by the Council's Fishery Management Plans are being harvested off Guam.

Additional Sources

The *Annual Report for the 1988 Pelagic Fisheries of the Territory of Guam* (Hamm et al. 1989a) presents two sets of data for the years 1979 through 1988. These are the data on commercial landings collected by the Western Pacific Fishery Information Network (WPACFIN) of the National Marine Fisheries Honolulu Laboratory and the creel survey data collected by the Division of Aquatic and Wildlife Resources (DAWR) of the Guam Department of Agriculture.

These data show a decline in commercial landings of pelagic species since 1985, with 1988 recording the lowest landings since 1982. At the same time the creel survey data show that the total estimated landings of pelagic species were at a record high in 1988 due to record high mahimahi landings. Detailed information on the catch, effort, species composition, etc. is included in the tables (Appendix A) and figures (Appendix B) of the report (Hamm et al. 1989a).

The *Annual Report for the 1988 Bottomfish Fishery of the Territory of Guam* (Hamm et al. 1989b) was based on the same two sets of data: the commercial landings data collected by WPACFIN and the creel survey data collected by DAWR. The 1988 commercial landings of bottomfish declined for the third year in a row to the lowest level since 1982. However the DAWR estimated total bottomfish landings increased in 1987 and 1988 after a large decrease in 1986. Detailed information on catch, effort, species composition, etc. for the years 1979 through 1988 is included in the tables and figures of the report.

A recent paper written for the Western Pacific Regional Fishery Management Council by Kasaoka (1989) details the ethnic background and other information about small boat fishermen. On Guam 35 of the most active fishermen at the Agana Boat Basin were interviewed during 1988. Of those, 18 or approximately one-half were Chamorro. Thirteen were Caucasian, two Korean, one Japanese, and one Filipino. None was Carolinian or Palauan. All were men ranging in age from 23 to 60. Twelve considered themselves full-time commercial fishermen, while 23

did not. Twenty-four of the men held other jobs and 11 did not. Twenty-one of the 35 men reported spending an average of 44 hours per week at the other job. The 35 men averaged 27 hours per week fishing. Thirty-four of the men averaged 13 years in commercial fishing.

Evidence Area 2 that there was and is a dependence by native fishermen of Guam (or at least a significant identifiable portion thereof) on the fish, crustaceans, and precious corals identified in Appendix A. We found no evidence for the exploitation of the deep water crustaceans or precious corals so the focus is on pelagic and bottomfish here.

Nature of the Evidence Essentially the same archival sources as consulted in Evidence Area 1 contain what evidence there is for a history of dependence upon pelagic and bottomfish. In addition to these sources, government annual reports related to the amount of fish produced and by whom were consulted and relevant results have been tabulated for this report. Since there is so much overlap in the information content of Evidence Area 1 and 2, it will not be repeated here and the reader is invited to consult the former section of this report.

Evidence Area 3: that at least some dimension of the indigenous culture of Guam has in the past reflected and still reflects cultural, social, and religious values, traditions, and practices derived or based upon the fisheries for the species listed in Appendix A.

Nature of the Evidence The sources of information regarding cultural values which related to the species in Appendix A were historic and ethnographic accounts as well as some information found in Knudson (1987). We found no evidence in this area regarding deep water crustaceans or precious corals.

A strong cultural value, apparently preserved from the past is the sharing of the fish catch with family, relatives, and friends. As Knudson (1987) points out, offshore fishing on Guam is primarily a recreational activity, with social aspects closely linked with personal relationships among family and close friends of the fishermen. Over the centuries of acculturation beginning with the Spanish conquest in the late 17th Century, the ancient social, political, ideological systems organization was lost. Along with this went the religious aspects of fishing, which tend to erode quickly under Christianization.

Evidence Area 4: that there is present participation by native fishermen of Guam (together with non-native fishermen) in the fisheries of the species listed in Appendix A.

Nature of the Evidence The evidence for present participation includes a recent study of "non-commercial" fishing on Guam (Knudson 1987) and a general review of fishing on Guam by Amesbury et al. (1986). These works review the history of fishing in Guam and depict the present situation. Amesbury et al. describe and illustrate many different fishing methods used in the past and present by fishermen of Guam.

Contemporary Participation in Offshore Fisheries

Amesbury et al. (1986:21) note that offshore fishing has been greatly influenced by the availability of power boats and sophisticated imported fishing gear. The main deep water bottomfish caught around Guam are the onaga, ehu, and

yellowtail kalikali, while lightly fished offshore banks yield large groupers such as *Epinephelus septemfasciatus* (Amesbury et al. 1986:75). Multiple hooked lines with swivels are used in bottomfishing. Lines may be baited with pieces of skipjack tuna and chumming is practiced. "Trolling is the most popular method of boat fishing on Guam," according to Amesbury et al. (1986:83). The species most often taken are mahimahi, skipjack tuna, wahoo, yellowfin tuna, and blue marlin. These fish are taken with baited or unbaited trolling lure hooks (Amesbury et al. 1986:90-91). Trolling with handline is more common to and from bottomfishing grounds while full-time trolling is more often done with rod and reel, although these items are more expensive.

Knudson found that most offshore fishing takes place to the west of the island (Knudson 1987:28). This is the area of calmer water as the prevailing winds are northeasterly, particularly in the winter and spring months. As in the CNMI, most fishermen go out only on day trips, and most boats are less than 30 feet long. Some fishermen go out one or two miles from land, to points or headlands, such as Ritidian Point or Pati Point. Other fishing trips involve a longer ride out to the banks areas south of Guam, ca. 30 miles away. In surveys of the offshore catch at Agana Boat Basin, Merizo, and the seaplane ramp at Apra Harbor (Knudson 1987:Tables 4,5), the offshore catch was greatest at the Agana Boat Basin and relatively small at the other two launching sites. The six day offshore yield during morning and afternoon observation periods was over 2000 kg at the Boat Basin but less than 60 kg at the sea plane ramp. Another comparison produced nearly 1600 kg at the Boat Basin and just over 60 kg at Merizo. Creel census data for one year, July 1984-June 1985, are presented in Table 9 (Knudson 1987:Table 6). Knudson estimates that offshore the fishery of Guam for the year's study is 124,402 kg. and that it appears to be rather more influenced by seasonal variations than the inshore fishery (Knudson 1987:94).

Regarding ethnic participation in the offshore fishery of Guam, Knudson found that 67% of the yield was being produced by Chamorros, while their percentage as an ethnic group in the total population of Guam is around 48. Table 10, reproduced from Knudson (1987:Table 30), depicts the details of ethnic group participation in Guam's inshore and offshore fisheries.

In the recently published statistical profile of Guam (Barcinas et al. 1988), the ethnic composition of Guam's population changed markedly after the end of World War II. Between 1920 and 1940, Chamorros constituted just over 90% of the total while between 1960 and 1980 this group dropped to 45.1% (Barcinas et al. 1988:Table 8.1). Thus if a limited entry program based on native fishing rights were instituted, the majority of the population of Guam (non-Chamorros) probably would be excluded.

Summary Answers to Questions Posed in the Four Evidence Areas

As noted in the Introduction, four general areas of evidence were to be taken into consideration. Here we briefly answer the questions posed by the four evidence areas as stated in WPRFMC (1988:1).

1) Was there and is there a set of historic fishing practices for the species identified in Appendix A in the areas now encompassed by federal waters in Guam?

According to an unbroken historical record, beginning with early explorer and adventurer accounts through governor's reports and other official documents,

Percent of Guam population, 1978	Cham 48		Filip 20		States 24		Micro 3		Korea 3		Japan 1		Other 2		Total Wt.
	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	Wt.	%	
OFFSHORE															
Banks areas:															
Commercial	1868	69	–	0	694	26	–	0	106	4	43	2	–	0	2711 kg
Non-commercial	1325	77	–	0	61	4	–	0	–	0	291	17	43	3	1720
Non-banks areas															
Commercial	965	54	40	2	668	38	–	0	46	3	21	1	31	2	1772
Non-commercial	1342	69	137	7	254	13	–	0	–	0	195	10	30	2	1956
Offshore total	5500	67	177	2	1677	21	–	0	152	2	550	7	104	1	8160
INSHORE															
Agana Boat Basin															
Commercial	14	21	–	0	50	79	–	0	–	0	–	0	–	0	64
Non-commercial	175	80	–	0	43	20	–	0	–	0	–	0	–	0	218
Shoreline, reefs, a.m.															
Commercial	–	0	68	100	–	0	–	0	–	0	–	0	–	0	68
Non-commercial	231	76	58	19	3	1	6	2	tr.	tr.	1	tr.	6	2	305
Shoreline, reefs, l.n.															
Commercial	–	0	–	0	7	14	39	86	–	0	–	0	–	0	46
Non-commercial	62	83	7	9	2	2	–	0	–	0	–	0	–	0	71
Inshore total	482	62	133	17	105	14	45	6	tr.	tr.	1	tr.	6	1	772

tr. = less than 0.5

Table 9. Measured yields (creel census) for various fishing areas by ethnic group

	Return Time																	
	a.m.							p.m.										
Total Jul 84-Jun 85	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	Average return 4-9 p.m.	Ratio, season average to total average
Total weight (kg)								131	414	363	410	641	736	2659	2792			
Observation days								23	23	28	46	46	46	46	41			
Average weight (kg)								6	18	13	9	14	16	58	68		32.95	1.00
Jul - Sep, 1984																		
Total weight (kg)								101	203	34	6	141	228	1163	763			
Observation days								12	12	12	12	12	12	12	12			
Average weight (kg)								8	17	3	1	12	19	97	64		38.33	1.16
Oct - Dec, 1984																		
Total weight (kg)											327	98	164	328	236			
Observation days											9	9	9	9	9			
Average weight (kg)											36	11	18	36	26		25.61	0.78
Jan - Mar, 1985																		
Total weight (kg)								11	201	153	38	111	145	615	3			
Observation days								3	3	8	10	10	10	10	5			
Average weight (kg)								4	67	19	4	11	15	62	1		18.27	0.55
Apr - Jun, 1985																		
Total weight (kg)	101	91	14					19	10	177	40	292	199	554	1790			
Observation days	7	7	7					8	8	8	15	15	15	15	15			
Average weight	14	13	2					2	1	22	3	19	13	37	119		38.33	1.16

Table 10. Total offshore creel census yield by hour of boat return
Agana Boat Basin, July, 1984 - June, 1985

as well as contemporary observations by fisheries biologists, economists, and anthropologists, interviews with fishermen and on-site visits to fishing boat landings, yes, there was and is a set of fishing practices in the island of Guam by which native peoples (Chamorro and possibly Carolinian) have successfully pursued offshore pelagic and bottomfish including at least some of the species listed in Appendix A.

The archaeological record indicates the taking of pelagic forms since the Pre-Latte era which began ca. three millenia ago. The archaeological record shows that offshore marine forms continued to be utilized during the subsequent Latte era, which began ca. A.D. 800 and ended with Western colonial contact in the mid-to late 17th Century. The historic era documents contain evidence that pelagic and bottomfish were taken by Chamorros throughout the Marianas including Guam until sailing canoes (an essential element in offshore fishing) were no longer available sometime in the late 18th Century. However, the Carolinians of the central Caroline Islands, who have been in the Marianas at least since the Spanish period and probably prehistorically as well, have an unbroken record of building and sailing canoes and using them in offshore fishing. We have not considered the Carolinian cultural practices in the present report, as their historically documented habitation on Guam was confined to one settlement for less than one hundred years, after which they were removed to Saipan. However, the possibility remains that prior to the historic period this ethnic group had utilized Guam's offshore marine species on trips to and from the Marianas from the central Carolines, as well as during their stays in the Marianas.

The Chamorros apparently resumed offshore fishing sometime during the early 20th Century, when they again had access to boats capable of going outside the reef. Today trolling and bottomfishing are popular recreational, and, to a lesser extent, commercial activities of the Chamorro people of Guam. More importantly, offshore fishing provides a subsistence supplement to Guam families, in combination with foods provided by gardening and through cash purchase from wages.

2) Was there and is there a dependence by native people of Guam (or at least a significantly identifiable portion thereof) on the fish, crustaceans, and precious corals identified in Appendix A?

Yes, there was and is a dependence on several of the fish listed in Appendix A but precise measures of the degree of dependence is difficult, particularly for the earlier time periods. Relative to the traditional Chamorro lifestyle, the Carolinians probably depended more upon offshore species than did the Chamorros.

Under aboriginal conditions, that is, prior to Europeanization, marine forms were the primary source of animal protein in the Mariana Islands. After the Spanish-enforced demise of the Chamorro sailing canoes late in the 18th Century, fishing for offshore species by the Chamorros was no longer possible but large land mammals (pigs, cattle, deer) brought by the Europeans became a readily available alternative. Thus for a time the relative dependence by Chamorros on marine- vs. land-based protein sources may have changed due to the prohibition of offshore fishing and the availability of the newly introduced mammals. However, in spite of the Chamorros access to large land mammals, inshore marine species continued to be harvested using a variety of traditional methods. The 20th Century saw the return of ocean-going craft to which Chamorros

had access and the resumption of offshore fishing in a mainly recreational context by these people. The Carolinians enjoyed uninterrupted access to offshore species, as they were permitted by the Spanish to retain their sailing canoes. Traditional subsistence practices of the Chamorros and Carolinians did not include the taking of deep water precious corals or crustaceans listed in Appendix A, nor are they a viable industry today.

3) Is there at least some dimension of the indigenous culture of Guam which in the past reflected and still reflects cultural, social, and religious values, traditions, and practices derived or based upon the fisheries for the species listed in Appendix A?

Yes, there are some dimensions of the indigenous culture of Guam which reflected and reflects such values, traditions and practices. Early historic descriptions exist of Chamorro customs associated with the capture and sharing of offshore fish, which had religious aspects as well as social aspects. Certain linguistic terms for offshore species persist, indicating the cultural preservation of knowledge of these forms, although knowledge of reef forms is more comprehensive. Homemade trolling lures manufactured from native plants are still known and are called by a local name. The widespread custom of sharing one's catch, regardless of whether it is of inshore or offshore forms, with relatives and friends remains strong among the Chamorros today. Providing fish, whether caught or purchased, is a regular part of social obligations among these people.

Interview Information

MARS staff interviewed eight Chamorro fishermen during a two and a half hour period (3:30-6:00 p.m.) on a Saturday at the Agana Boat Basin. Interviewees were asked about their fishing history, equipment used, and attitude toward limited entry based on native fishing rights. The latter issue will be presented elsewhere in this report.

Interviewees stated they fished by trolling as well as by hook and line for bottomfish. The boats they were using ranged in size from 16ft to 21ft long and had outboard motors ranging in power from 75hp to 140hp. The fishermen had learned to fish from friends or relatives, generally first learning inshore techniques when they were children and later learning how to fish outside the reef. They ranged in age from 26yr to 61yr.

As was found in the CNMI, a strongly enduring cultural dimension related to offshore fishing revealed in the interviews is the high value placed on sharing of the catch, and the importance of gifts of fish to relatives and friends. Such gifts are not limited to offshore fish; often they are made up of reef fish. Sometimes the type of fish procured for a gift is determined by the situation on the day of fishing. For example, going out in the afternoon, a man might troll for pelagic fish to give to a returning relative but not catch anything. As it got later and he still needed to provide a gift fish, he might then come in closer to shore to spear a fish instead. His gift that day would reflect the particular circumstances of that day's fishing, not necessarily a preference for reef fish. Similarly, fishermen might bottomfish in the morning when the water is calm and then switch to trolling in the afternoon, or as they return to shore. This pattern was also described by fishermen interviewed in the CNMI.

The Guam fishermen interviewed stated that they do not normally sell their catch but that they might sell a part of it if they had caught an abundance; each had a full-time job other than fishing. As was found in Knudson's (1987) study, non-commercial fishing from a boat generally takes place in the fisherman's spare time, such as on holidays and weekends. Actually certain fulltime work schedules allow for frequent and regular fishing episodes. For instance, one fisherman interviewed is a fireman who can fish during the week according to his regularly scheduled "off time." Retirees also have more time to devote to fishing than younger men still active in the labor force.

From interviews and other sources on the conduct of fishing on Guam it is apparent that practical considerations such as the wind and sea conditions, the size of the boat and motor, and the number and experience of fishermen going out on a boat are most important and that ritual abstentions, for example, or prescriptive avoidance of certain fish by certain categories of person, are not practiced on Guam. However, in spite of what might appear to be some cultural losses due to Europeanization over the last several hundred years, cultural preferences for fresh fish encompass offshore varieties, and techniques of preparation and ways of eating fresh fish still distinguish native Marianas peoples from non-natives. For instance cooking fish by direct roasting over the coals and consuming raw fish in the ***kelaguen*** style (marinated in lemon juice and hot peppers combined with onions and grated coconut meat) as well as eating fish sliced raw and dipped in a hot sauce of pepper-lemon juice and soy sauce, contrast with the usual fish preparations by Oriental peoples and by Americans from the mainland U.S.

4) Is there present participation by native fishermen in Guam (together with non-native fishermen) in the fisheries of the species listed in Appendix A?

Yes, there is present participation by both Chamorro and non-native fishermen in the pelagic and bottomfish fisheries in Guam, as indicated in statistics provided by the government. There is no exploitation by Chamorros of deepsea crustaceans or corals.

Discussion

Anthropological theory or the lack thereof plays an important role in determining the accuracy and comprehensiveness of interpretation of the facts derived from the written sources consulted during the project. Without an acceptable theory of human adaptation, we are left with common sense or *ad hoc* reasoning as to why a particular practice ever existed, ceased to exist, or continued. For example, the evidence developed during this project indicates an apparent tendency throughout prehistory and historic times for Mariana Island native groups to have relied more on inshore fish species than offshore ones, although the latter definitely were taken. It is evident that these people possessed the technical means to fish in both settings, namely ocean-going canoes and a variety of hooks, lures, and other suitable devices and techniques. In addition, pelagic and bottomfish species were and are socially significant.

From a Western cultural perspective common sense might suggest that it was simply easier to obtain inshore species, and it probably was; yet this surmise does not explain why native Marianas people bothered to fish outside the reef at all. *Ad hoc* reasoning, again based on notions from Western culture, might

or for sport. Similarly it could be suggested that pursuing large fish was motivated by a desire for prestige. It may be true that people desire variety and sport and prestige but such theoretically unwarranted explanations are always limited by the facts at hand at the moment. For example, if it is found through more archaeological excavations that the native exploitation of offshore species increased over time, then by such reasoning one would have to explain why the desire for variety or sport or prestige did not manifest itself at once but rather apparently only gathered strength as the years passed by. Yet as pyschological characteristics of the human species, such desires are always present in human populations and thus are not expected to vary directionally through time. If the converse pattern were eventually documented, namely, that the taking of offshore species decreased through time, there would still be the problem of why psychological tendencies were differentially expressed as time passed on. Similarly, archaeological comparative studies may eventually establish that offshore species were exploited at different rates at different sites of the same time period; in fact such a complex pattern is beginning to emerge in the archaeology of the Marianas. If we grant its validity for the sake of argument, then the desire for variety/sport/prestige explanatory notion fails to account for this pattern of spatial variation in the taking of these species, again assuming such desires are always potential in human populations. To propose otherwise, that the differential expression of such desires just happens to coincide with temporal or spatial patterning in offshore species exploitation, is to strain even the most credulous.

On the other hand, an ecologically informed anthropological theory applied to these problems anticipates that, given the inarguable difficulties and expenses of offshore fishing, especially when inshore alternatives existed, there would be an increase in reliance on larger, deep water fish through time only if and as the higher costs of obtaining the offshore forms were offset by significant benefits to certain sectors of society for which the possession and distribution of offshore fish were essential. Under this theory, once the conditions giving rise to a relatively high level of utilization of offshore species ceased to occur, namely when there was no longer a significant offsetting benefit for enduring the difficulties and expenses of offshore fishing, it should have ceased, other things equal (which they rarely are, but the qualification seems necessary here for the sake of demonstrating the point).

Conditions favoring the increased pursuit of offshore fish might include a rise in socio-political complexity linked to high human density and attendant competition for resources. As socio-political relations become more complex, they tend to be legitimized by prescriptive behavior such as obligatory food and wealth exchanges. Procurement of culturally defined "prestigious" pelagic fish can become essential in this context. According to this argument, pelagic fish would never be the primary source of marine protein and evidence for their capture for "prestige" purposes should correlate with later time periods when human population size had grown to some critical size threshold.

Spatial variations in archaeological fishbone assemblages showing differential use of offshore species at the same general time period could be explained as a function of an internally differentiated settlement system. For example, some sites may have been occupied only during certain seasons, such as leeward sites from which offshore fishing forays could be undertaken, especially during the calm months of the year. In contrast to the socio-political explanation, evidence for pelagic fishing should indicate more reliance on

offshore species for "every day" consumption, and in this case there should be no correlation with larger population size or lateness in time.

Using as a guide a theoretical framework which can anticipate a range of variability in kinds of sites and in the differential use of a given site over time, one might perform a variety of analyses of archaeological fish bone assemblages, in which not only the presence or absence or relative numbers or weights of offshore fish remains could be meaningfully interpreted but other attributes of these assemblages, such as body size ranges, species diversity, or skeletal parts missing and represented could be investigated and shown to be the expected outcomes of regular relationships among several causal variables. Appropriate analytical methods which would definitely distinguish between various causal factors such as socio-political versus geographic factors have not yet been developed. But at least we can anticipate these problems and work toward their solution. Ethnographic observations recorded in the past and made in the present can stimulate archaeological thinking about these topics.

Anthropological theory can generate expectations for the future as well as hypotheses about the past or about the "ethnographic present." The monetary economics of offshore fishing is but one aspect of an anthropological understanding of human behavioral regularities including attitudes. As with other systemic phenomena, cultural organization is not atomistic but reflects the sometimes complex linkages between the physical and social environments within which a cultural system and its human participants are embedded and have evolved.

As Knudson (1987) has shown, on Guam there are many factors constraining the participation by indigenous peoples in the commercial fishery, including wage work during the work week and family strategies of economic risk-reduction (relative to benefits available) that require frequent participation in non-commercial, reciprocal exchanges involving fresh fish, as well as the relatively high costs of imported equipment and fuel. In Guam locally caught fish are often sold or otherwise distributed informally. The recipients are mainly friends, neighbors, and relatives. The personal nature of at least a part of the local market on Guam would seem to restrain the price asked and paid, although the presence of much imported fish at relatively low prices appears also to reduce the amount local fishermen can charge for their catch. We found that inshore species are preferred in reciprocal (non-commercial) exchanges involving other food stuffs such as meat and for general consumption in Guam.

Answers to the Questions, Who is a Native of Guam ? and How Many Individuals Would be Affected by a Limited Entry System?

The following information is presented in an attempt to answer the questions "Who is a native of Guam?" and "How many individuals would be affected by a limited entry system which gives preferential access rights to native fishermen of Guam?" These suggestions are based on MARS staff's understanding of the issues involved. In a separate document we present a legal opinion by Dr. Maivan Lam, an attorney at the Univ. of Hawaii Law of the Sea Institute.

Guam's Draft Commonwealth Act which was approved by the voters of Guam in 1987 and presented to the United States Government in February 1988 defines the indigenous Chamorro people of Guam as "all those born on Guam before August 1, 1950, and their descendants" (Article 1, Section 102a). (August 1, 1950 is the

date of the Organic Act of Guam.) Although the Draft Commonwealth Act has yet to be approved by the federal government and will almost certainly be amended before it is approved, it seems likely that this definition of the indigenous Chamorro people will stand or will be only slightly amended, because there is a somewhat similar definition of the native peoples of the Commonwealth of the Northern Mariana Islands in the Constitution of the CNMI (Constitutional Convention 1986:Article XII, Section 4).

The 1980 census (U.S. Dept. of Commerce 1983) found the population of Guam to be 105,979. The report of the census gives a breakdown of the population by sex, age, election districts, and places. Although a question was asked regarding ethnicity, no ethnic breakdown was reported.

Another report (Barcinas et al. 1988) analyzes the 1980 census data on ethnicity, however the report states that the analysis "should be treated as little more than tentative" (Barcinas et al. 1988:134). That is because the analysis was complicated by the fact that respondents could give more than one ethnic identification (many people gave two or more responses). Also there were codes for various Pacific Island and Asian groups, but there was no code for "white." The ethnic breakdown arrived at is as follows: Chamorros 47,825; Filipinos 22,447; Whites 26,901; and Others 8,806 (Barcinas et al. 1988:134).

The 1990 census will probably determine more accurately the number of Chamorros on Guam.

Limited Entry Seen from a Variety of Perspectives

Limited entry is seen by fisheries professionals as one of a range of management options which are aimed at limiting effort in a given fishery so as to maintain the biological integrity of the fish stocks. According to fisheries biologist S.S. Amesbury (personal communication 1988 and see below), the principal advantage of limited entry over other traditional effort limitation options is that it can "promote economically rational use of stocks" (see Samples and Sproul n.d.) by maximizing profits to the participants in the fishery and reducing the tendency of the fishery to become "overcapitalized." From this perspective, which is by no means the only legitimate one, the principal disadvantage of limited entry is that it may exclude fishermen from the fishery who wish to participate and who would be able to under other management options. For example, based on the Polovina et al. (1985) study, a limited entry system to regulate stocks in the bottomfish fishery in the CNMI need not involve more than 15 boats. Since many more boats now participate, such a program would exclude a large proportion of the native fishermen. If the goal of the limited entry program is to maximize profits for native fishermen while maintaining the biological integrity of the fishery, it appears that it could work. However, if the goal is to maximize overall satisfaction among members of society, most of whom are engaging in offshore fishing on a part-time, often recreational basis, then such a program would probably fail for being so exclusive.

Recognizing this problem, economist P.A. Meyer (Meyer Resources, Inc. 1987) attempted to show the "non-market value" or "worth that the fishermen associate with their activity over and above dollars received or spent" in the Hawaiian "recreational" fisheries. He found Hawaiian fishermen's responses valued their

recreational fisheries at $239 million from direct expenditures of $24 million (Meyer Resources, Inc. 1987:Tables 18, 20).

Another point that should be mentioned is that foreign and domestic purse seiners and gill netters, presently not prohibited from fishing within three miles of the island, could pose a serious threat to local offshore fishing. Ostensibly these boats are taking only unregulated tuna; however, it is clear that other species of fish and other marine life such as mammals and birds are casualties of the rather indiscriminate netting process. Particularly at risk from purse seining are the non-migratory species which are attracted to floating logs and other aggregating objects, as purse seiners target these devices in order to take tuna. In addition to the practical problems of trying to catch only tuna when other species are in an aggregation, competitive maneuvers on the part of purse seiners threaten fish stocks. For example, floating logs are sometimes removed by a ship in order to prevent competitors in the area from capturing the associated fish aggregation, or one log might be removed to force fish to go to another one nearby for more convenient capture by one boat. Aside from the problem of mass wasting of marine wildlife not targeted yet still entrapped in the large gill nets ("walls of death" which can be 60 feet wide and 30-40 miles long), when these nets are lost or discarded at sea they still continue to entrap and kill indiscriminately (see Guam Coastal Management Program 1989:4). It is apparent from these facts that gill netting and purse seining as practiced today could have a significant negative effect on the future ability of local fishermen to obtain a reasonable catch offshore. This is a matter needing further empirical study throughout the Marianas.

Interview Information

The results of two sets of interviews related to limited entry on Guam are available for presentation in this report. The first set of interviews was conducted by a student at the Univ. of Guam Marine Laboratory under the supervision of Steven S. Amesbury at the Agana Boat Basin over the period May-July 1988. Most of the information obtained in these interviews has been presented in Kasaoka (1989), and the ethnic composition, ages, and time spent fishing of the interviewees were noted above in the discussion in Evidence Area 1. Roughly half the respondents identified themselves as Chamorro. Relevant here but not reported in the Kasaoka paper were Guam fishermen's responses to a question regarding limited entry for the bottomfisheries of Guam (S.S. Amesbury pers. comm. 1989). Twenty-five of the 35 fishermen interviewed responded to this question, which asked their opinion of a limited entry plan that would require licensing as a requisite for entering these fisheries. The question did not mention the basis on which the fishermen would be licensed, such as native fishing rights.

The second set of interviews was conducted on Sept. 2, 1989, specifically for this project. The MARS interviews were aimed at eliciting in their own words the opinions of local Chamorro fishermen regarding the desirability of limited entry based on the concept of native fishing rights, in the pelagic and bottomfish fisheries.

Both sets of interviews revealed generally negative reactions toward limited entry whether or not native fishing rights were explicitly mentioned as the basis. Most of the fishermen who responded expressed a willingness to allow anyone who resides on Guam, regardless of ethnic affiliation, to fish in the

EEZ, as long as they do not use large commercial boats and either long lines or drift nets. At the same time there was expressed the strong feeling that large commercial operations, especially long-liners either local or foreign, should be kept out of the EEZ because "they are ruining the fishing for all us little guys." Several interviewees noted the difficulty of enforcing a limited entry program in Guam's EEZ, and some mentioned that few fishermen actually fish for bottomfish beyond three miles of shore (S.S. Amesbury pers. comm. 1989)

Three of the eight fishermen interviewed by MARS staff at Agana Boat Basin were not experienced in offshore fishing but were just beginning to learn; two of these said they would favor a "Chamorros only" limited entry program and one had no opinion. The remaining five did not favor a "Chamorros only" program; rather they stressed the multi-ethnic composition of the present non-commercial fishermen and that these people's rights should be protected by excluding the large commercial operators such as long-liners and purse seiners. These interviewees felt that the latter operations were adversely affecting the catches of the non-commercial fishermen, and they all noted a decline in the apparent numbers of fish offshore of Guam in the past two or three years.

In the next section of the report is an evaluation of limited entry as a management alternative for Guam's offshore fisheries, seen from the perspective of a fisheries biologist with expertise and extensive experience in the Mariana Islands fisheries. This evaluation will be seen to differ in outlook but not in overall conclusions to be drawn from the Guam fishermen interview responses. It is included here because it was felt that informed opinion and scientifically reasoned arguments from the biological standpoint are very important in making resource management decisions.

EVALUATION OF LIMITED ENTRY AS A MANAGEMENT ALTERNATIVE FOR THE OFFSHORE FISHERIES OF GUAM

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INTRODUCTION

Limited entry or "access management" is a fishery management tool which operates by restricting the number of participants in a fishery. This tool can be employed to accomplish the following effects:

1) Limited entry can restrict the total fishing effort expended in a fishery if the amount of effort expended by permitted entrants is also controlled (by some means or another). Restriction of total fishing effort may be desirable to accomplish one or more of the following goals:

a) to reduce fishing mortality on a resource stock to prevent overfishing and stock decline;

b) to achieve the optimum effort level for harvesting MSY;

c) to reduce effort below that necessary to achieve MSY in order to achieve maximum economic yield;

d) to increase the profits of the participants in the fishery; e.g., halving the number of participant but allowing them to double their effort may increase the profits of these participants (while, of course, eliminating the participation and profit-making of the other half of the fishermen);

e) to eliminate a fishery which is deemed undesirable for some reason. This can be accomplished by making fishing permits non-renewable or non-transferrable or through scheduled retirement of permits.

2) Limited entry can be used to allocate fishing rights to some particular group of fishermen. This can be accomplished by establishing criteria for obtaining permits which favor certain groups. Among the reasons this might be done are the following:

a) to restrict the fishery to some sector, such as commercial, recreational, or subsistence;

b) to restrict the fishery to users of particular fishing methods;

c) to give preferential rights to fishermen with a history of past participation in the fishery;

d) to give preferential rights to a group with special cultural or economic ties to the fishery;

e) to restrict the fishery to the most productive or most efficient fishermen;

f) to maintain diversity in the fishery by allocating various proportions of the total number of permits to different categories of fishermen.

More than one of these objectives may be achieved in a given fishery by the proper design of the limited entry program.

Of course limited entry is not the only management approach that can be used to achieve the fishery objectives listed above; there are other ways to limit effort and there are other ways by which fishing rights can be allocated. Fishery management in any particular situation, then, requires that the objectives of the management effort be defined (and prioritized) and then that various management options be evaluated for their effectiveness in achieving the management objectives. Any management measures selected will have to be tailored to the specific problems to be solved.

In this paper, the advantages and disadvantages of limited entry will be evaluated for the offshore (EEZ) fisheries of the Territory of Guam.

The procedure which will be followed in this evauation is first to evaluate the present conditions of the fisheries in terms of biological, economic, and social factors. Then, some possible management objectives, based on consideration of current fishery conditions, will be proposed. Finally, limited entry will be evaluated vis-a-vis other management options with regard to their efficacy in achieving the management objectives.

OFFSHORE FISHERIES OF GUAM

There are essentially two offshore fisheries (fisheries that take place at least in part in the EEZ) in the waters of Guam: 1) pelagic trolling fisheries that target tunas, mahimahi, marlin, wahoo, and similar species and 2) bottomfish handline fisheries that target deep-dwelling snappers, groupers, jacks, and emperors. These fisheries are are, at least nominally, under the purview of the Western Pacific Regional Fishery Management Council. The Western Pacific Council has also developed Fishery Management Plans (FMP's) for two other offshore fisheries,

precious corals and deep-water crustaceans (spiny and slipper lobsters), but offshore fisheries for these two groups do not currently exist in Guam. In the absence of fisheries for these latter two resource groups and in the absence of any data to indicate that harvestable stocks of these groups exist in the EEZ around Guam, there is no reasonable basis for evaluating any particular management regimes for them, and so they will not be considered further.

Potentially harvestable stocks of deepwater shrimps (Heterocarpus spp.) were investigated by the University of Guam Marine Laboratory in the mid-70s (Wilder, 1977). A resource survey carried out by the National Marine Fishery Service in 1982-1984 (Polovina et al., 1985) indicated that annual equilibrium yields for Heterocarpus species for Guam and the banks to the south (Galvez and Santa Rosa) could amount to approximately 24 mt/year. However, despite a few attempts to harvest these shrimps commercially on Guam, no fishery for them currently exists. Should such a fishery develop, data collection efforts should be undertaken so that the fishery could be appropriately managed. At the present time there is little basis for evaluating management alternatives for this resource.

PELAGIC FISHERIES OF GUAM

The pelagic fishery is the most productive fishery on Guam. Virtually all the fishing is done by trolling (although ika-shibi techniques are used occasionally by a very few fishermen), and fishing takes place within both the Territorial Sea and the EEZ. Two additional pelagic fishery operations have bases in Guam but presumably do not actually fish within the Guam EEZ; these are the U.S. tuna seiners, which fish in equatorial waters, and the Asian (Japanese, Taiwanese, and Korean) longline fleets which operate in the waters of the Federated States of Micronesia.

Biological Condition of Pelagic Fish Stocks

The major species caught in the Guam trolling fishery are yellowfin and skipjack tuna, mahimahi, wahoo, and blue marlin. Species caught in significantly lesser amounts are barracuda, rainbow runner, and sharks. Sharks have little if any commercial value on Guam, although both barracuda and rainbow runner are sold and eaten.

The stocks of these species which are harvested by Guam's fishermen are presumably wide-ranging stocks, of which only a small proportion occur within Guam's EEZ for only a part of their life history. Tagging studies have suggested that this presumption may not always be entirely the case for tunas, and there have been very few studies which would either confirm or

deny this presumption for the other pelagic species under consideration. The best scientific information currently available, however, indicates that the proportion of the stock of each of these pelagic species available for harvest by Guam's domestic fishermen is but a small part of the total stock. Therefore, any evaluation of the biological condition of pelagic fish stocks in the Guam EEZ must be based on a consideration of the condition of the larger Pacific stocks of these species.

Blue Marlin

Dr. Robert Skillman has prepared a draft assessment of stocks of Pacific billfishes (Skillman, R. A. Status of Pacific Billfish Stocks, unpubl.). He concludes that Pacific blue marlin (which are considered in his analysis to belong to a single stock centered at the equator with seasonally varying poleward extensions) are currently being overfished, but he also suggests that the condition of this stock is improving. He estimates that the MSY for Pacific blue marlin is about 20,000 to 24,000 metric tons.

Offshore fishery data collected and analyzed by the Guam Division of Aquatic and Wildlife Resources (DAWR) indicate that the annual Guam trolling catch of blue marlin has ranged from 6 to 32 mt over the period from 1982 to 1988. Thus the Guam blue marlin catch amounts to approximately 0.09% of the MSY for the entire Pacific stock.

Mahimahi and Wahoo

The stock structure of mahimahi and wahoo in the Pacific is not known, and estimates of MSY for these species have not been made. Recorded annual Pacific harvest for mahimahi during the period 1982-1985 ranged from about 15,000 to 22,000 metric tons (Oceanic Institute, 1988); the Guam catch of mahimahi from 1982 to 1988 ranged from 19 to 146 mt, about 0.45% of the recorded Pacific-wide harvest.

Tunas

Yellowfin and skipjack tuna are the largest pelagic fish resources harvested in the western Pacific. The harvest of skipjack tuna in the central and western Pacific has risen over the last two decades, reaching approximately 600 thousand metric tons by the mid-80s. There is no indication that Pacific skipjack stocks are near full exploitation, although the growth of the western Pacific purse-seine fishery may change this assessment (Kleiber, 1987).

Western Pacific stocks of yellowfin tuna are also though to be less than fully exploited, but the longline fisheries which

harvest larger, deep-dwelling yellowfin are thought to be more mature than the purse-seine fisheries which harvest smaller, surface-dwelling fish (Au, 1987). Annual harvest of yellowfin tuna in the western Pacific has been around 175,000 to 210,000 metric tons from 1981 to 1985 (Au, 1987).

Guam's trolling harvest of skipjack tuna has ranged from 36 to 79 metric tons during fiscal years 1986 to 1988, wih a mean of 47 metric tons per year. This is approximately 0.008 % of the annual central and western Pacific skipjack tuna harvest. For the same period, Guam's annual trolling harvest of yellowfin tuna has averaged 25 metric tons (20 - 32 metric tons), approximately 0.013 % of the annual western Pacific harvest of this species.

Because of the limited impact that Guam's domestic fisheries could conceivably have on the conditions of the stocks of these pelagic species, there seems to be no biological reason for imposing any restrictions on the harvest of these species by Guam's domestic trollers.

Economic Condition of Fishery

Guam's trolling fishery consists of several not clearly differentiated sectors. A few fishermen fish full-time and sell most of their catch. Many others are primarily part-time recreational fishermen, but they also sell some of their catch to defray trip expenses. Almost all fishermen retain part of their catch for home consumption or to share with relatives and friends. A new and growing sector is commercial charterboat fishing.

Results of a recent survey of the economics of offshore fishing on Guam were summarized by Kasaoka (1989). The survey included data from 35 offshore fishermen on Guam for whom trolling for pelagic species (tuna as well as marlin, mahimahi, wahoo, and others) was the most important fishery. Among the findings were the following:

a) annual fixed costs per fisherman averaged $10,196;

b) annual operating costs per fisherman averaged $10,776;

c) annual revenue from fish sales per fisherman averaged $13,957.

These data suggest that the average offshore fisherman on Guam loses $7,015 per year (not including vessel depreciation). If this is, in fact, the case, offshore fishing on Guam cannot be considered to be an economically healthy industry. In fact, most offshore fishing on Guam is probably recreationally motivated, and any income generated from fish sales just helps to defray

some of the costs of the recreational activity.

Charterboat fishing is a growing activity on Guam. This appears to be an economically viable industry as income is generated by charter fees paid by customers in addition to income from fish sales. Few data are currently available on the economics of the charterboat industry on Guam, but the Guam Department of Commerce is undertaking such a study which should provide useful information within a year or so.

Marketing of the catch of domestic trolling-caught fish is presently in somewhat of a turmoil. One of the biggest impacts on the sale of locally caught pelagic fish is the competition provided by the foreign longline fleets and by the U.S. tuna seiners. Fish from both of these fleets are sold to retailers on Guam. Relatively low prices and consistent availability have allowed these fleets to pre-empt many of the markets previously supplied by Guam's domestic fishermen.

A recurring marketing problem for domestic trollers is the highly seasonal variation in abundance of several of the important pelagic species:

a) The vast majority of mahimahi is taken during the four months of January to April; very little is caught at other times of the year.

b) The availability of blue marlin, on the other hand, is virtually restricted to the months of June to October.

c) Although available year-round, wahoo is most frequently caught during November and December.

Although the timing of seasonal runs of pelagic fishes is well known, the strength of the run in any given year is unpredictable. During years when the run is strong, the management of the Guam Fishermen's Cooperative Association has lowered fish prices and set ceilings on the amount of fish they would buy from the fishermen. Despite these actions, the Coop has frequently ended up with more fish than it could market profitably. During times of low fish availability, the Coop has been unable to obtain enough fish and has lost markets and customers as a result. The fishermen are also affected by fluctuations in availability. Their income is reduced when fish are scarce (because alternate sources of fish as well as non-fish substitutes prevent a compensatory rise in fish prices). When fish are very abundant, prices drop. The fact that fishermen are able to catch more fish often does not compensate for the drop in prices, because marketing opportunities do not grow proportionately.

There seem to be some considerable economic problems facing commercial trolling fishermen. Commercial charterboat operators

appear to be doing quite well, however, and this sector seems to have further development potential. Economics does not play as important a role among recreational fishermen who are primarily motivated by non-commercial considerations (although they would no doubt like to receive as high prices as possible for those fish they do sell). Subsistence is not a major factor in the trolling fishery, although most fishermen do retain some of their catch for home comsumption. The cost of small-boat trolling is probably prohibitive for any significant dependence on this fishery for subsistence.

There may be some economic justification for reducing the catch of pelagic species during times of great fish abundance to avoid flooding the market and reducing prices to the fishermen. Perhaps a better alternative, however, would be to develop better marketing arrangements for the fish so that surpluses on the Guam market could be shipped elsewhere for sale.

Social Aspects of the Fishery

All sectors of the trolling fishery on Guam are open to any fisherman who can afford the costs of entering it. These costs are quite variable, e.g., initial purchase costs for boats presently in the fishery range from $3,200 to $200,000, and so entry into the fishery is available to almost any potential fisherman on Guam.

Participants in the fishery are primarily Chamorros and "Statesiders" (Caucasians), but other ethnic groups including Koreans, Japanese, and Filipinos are also involved.

The majority of Guam's trolling fishermen can be categorized as recreational fishermen. Most have other employment, and most fishing is done on the weekends and holidays. Although it is sometimes difficult to make a clear distinction between recreational and commercial fishermen on Guam, because even recreational fishermen sell some of their catch, the recreational component of this fishery is obviously important.

Existing Management Efforts

Guam does not require a fishing license for any of its fisheries, and there are no fishing regulations in place which are applicable to the trolling fishery. A Fishery Management Plan (FMP) for pelagic species in the U.S. EEZ of the Western Pacific Region (which includes the EEZ around Guam) has been developed by the Western Pacific Regional Fishery Management Council and implemented by the U.S. Department of Commerce. This FMP regulates foreign fishing for pelagic species in the region but has no regulations applicable to the local trolling fishery

on Guam.

The Guam DAWR collects data on the trolling fishery through its offshore fishery survey. Data on catch and effort are collected from fishermen returning to port. These data are analyzed and summarized in the DAWR annual reports. Commercial data are also collected through the WPACFIN program. This program gathers sales receipts from the Guam Fishermen's Coop and other dealers, and the data are summarized periodically (Hamm and Quach, 1988).

Management Objectives for Guam's Offshore Trolling Fishery

The Territory of Guam Fishery Development and Management Plan (Amesbury and Callaghan, 1981) sets out objectives for development and management of fisheries for the island. For small-boat fishing, of which trolling is the major component, the Plan states the following:

> Overall development goals for small-boat fishing are to increase the supply and quality of seafood for local consumption and to decrease Guam's dependence on imported fishery products; to increase employment and investment opportunities in commercial fishing; to supplement family real income through the harvesting of seafood for home consumption; to enhance recreational fishing opportunities for sport fishermen; to supplement Guam's attractiveness to tourists by providing charterboat fishing opportunities for visiting sport fishermen; and to improve the safety of small-boat fishing in general.

Thus, management efforts for offshore pelagic species on Guam should endeavor to accomplish the following objectives:

a) to the extent possible, maintain the abundance and availability of pelagic fish stocks around the island;

b) to provide opportunities for productive and profitable commercial trolling fisheries;

c) to maintain opportunities for local fishermen to harvest fish for home consumption;

d) to enhance opportunities for recreational trolling fisheries;

e) to encourage and maintain charterboat fishing operations, particularly those related to Guam's developing tourism industry;

f) to the extent possible, improve the safety of small-boat fishing.

Evaluation of Limited Entry and Other Management Strategies for Offshore Trolling on Guam

Recent evaluations have indicated that skipjack and yellowfin tuna stocks in the western Pacific do not appear to be overharvested; however the development of purse seining in the region could change that assessment. The Pacific stocks of blue marlin are perhaps at a level where substantial increases in harvesting effort might lead to stock declines. Little or no data are available for the stock condition of mahimahi, wahoo, and the other species taken by Guam's fishermen in the EEZ. However, the amount of these species taken by Guam fishermen is so miniscule compared to Pacific-wide harvests, that even complete cessation of trolling in Guam's waters would have no measurable affect on the stock size of these species. There would, thus, seem to be little justification for any management measures whose only effect was limiting fishing effort by Guam's trolling fishermen. No such effort limitations are likely to improve the catches of Guam's fishermen or those of fishermen elsewhere.

Neither would effort limitations improve the economic return of the fishery in the long run. In fact, the results would likely be the opposite. If effort or catch limitations were imposed during times of unusually high abundances of these species, the price that fishermen could get for those fish caught would probably improve somewhat, but such intervention in the local fishery seems inappropriate at present for the following reasons:

a) Other sources of fish are available on Guam, so there is a limit to price variation due to local harvest levels;

b) It is not presently possible to predict large runs in advance, so any fishing limitations during major runs would have to be instituted after the run is underway and then becomes recognized as an unusually large one;

c) Even though the Coop may be unable to handle an overabundance of fish, local fishermen have usually been able to work out other arrangements (e.g., marketing the fish themselves on the side of the road) to dispose of their catch.

d) If fishermen decided to reduce their catch to keep prices up, it would be more appropriate for them to work out these arrangements among themselves than to have limitations imposed by the government;

e) Those who fish primarily for recreation would probably value the opportunity to fish more highly than they would

value stable prices for the fish they caught.

f) Charterboat operators, who make most of their income from charter fees paid by their customers, would put more value on unrestricted opportunities to carry out charters than they would on the price of the fish in the market.

Thus, although fish prices are of importance to all fishermen, there are other, even more important considerations for many of Guam's trolling fishermen. And even for commercial trollers, the catch improvement by restricting fishing is unlikely to be measurable (if any improvement would occur at all). There does not appear to be any economic justification for limiting effort in the trolling fishery.

The trolling fishery is open to anyone who chooses to and is financially able to acquire the necessary boat and gear. As no one is presently excluded from the fishery, there seems to be no need to establish preferential fishing rights for any individuals or groups. Allocation of fishing rights preferentially to one group of fishermen could only be accomplished by denying fishing rights to other groups.

There is no evidence that trolling catches on Guam are inversely related to fishing effort expended by local trollers, i.e., that reduction of fishing effort, by whatever means, would improve the catch rate relative to the effort remaining, and so any denial of fishing rights to one group would not increase the catch rates of those permitted to remain in the fishery.

If recreational fishermen were entirely satisfied with recreational rewards and could be induced to release their catch or, at any rate, not to sell it, commercial fishermen might benefit by having greater opportunities to sell their catch during times of fish glut. During times of fish scarcity, however, markets such as the Coop suffer from a lack of product and would be hurt by such a practice. Since recreational fishermen do sell their catch to defray some of their costs, many would not be enthusiastic about this proposal.

While the catch of local trollers probably has no measurable impact on the catch of purse-seiners and longliners, the converse may not be the case.

The purse-seiners (both U.S. and foreign) presumably do most of their fishing in equatorial waters, but they are not excluded by U.S. law from fishing in the EEZ around Guam, because the U.S. has no regulatory regime for purse-seine tuna fishing in the western Pacific. The U.S. fleet has been unwilling to report their fishing activities to the NMFS or to the Western Pacific Regional Fishery Management Council, and so there is no way to know exactly how purse-seine fishing is distributed within the

region nor the exact composition of the catch. Surface-dwelling yellowfin and skipjack tuna make up the majority of the catch, and it seems that there is also some unquantified bycatch of other surface-dwelling pelagic species such as marlin and mahimahi. These are the same species harvested by Guam's trolling fishermen.

The foreign long-line fleets presumably fish in the waters of the FSM (in the case of the Japanese) or in international waters or the waters of Palau (in the case of the Taiwanese, who do not have current fishery agreements with the FSM; Williams, 1989). The Forum Fisheries Agency (FFA) accumulates and publishes data on the fishing activities of vessels permitted to fish in the EEZs of member nations, but as yet no studies have been carried out to determine whether these longline fleets have any effects on Guam's local fisheries. A major target of the longliners is yellowfin tuna, but the stocks harvested are deeper-dwelling ones, and it is not clear how these deep stocks interact with surface schools of yellowfin. Bigeye tuna and marlin are also caught. Foreign longliners cannot legally fish in the Guam EEZ without obtaining a permit from the NMFS, carrying an observer, and reporting their fishing activity and catch.

There seems to be a growing interest among U.S. fishermen in entering the longline fishery in the waters around Guam. This would add a new sector to Guam's domestic fishery and could spark additional controversy about the allocation of pelagic species among different fishery sectors on island.

There is also growing concern about the potential impacts of drift gillnetting on the stocks of many pelagic species. There is very little known about the pelagic gillnet fisheries in this region, but what is known about this type of fishing in other parts of the Pacific appears to bode ill for other users of pelagic resources.

Conclusion

There seem to be no overriding reasons for instituting any management measures for the Guam domestic trolling fishery at the present time.

There is a need for much more data on the purse-seine, longline, and pelagic gillnet fisheries that operate in the region and their impacts on local trolling fisheries.

It should be noted that the small-boat fishermen of Guam feel strongly that some sort of restrictions should be imposed on the purse-seine fleets and longline fleets that work out of Guam. The complaints of the Guam fishermen are two:

a) These fleets catch fish (either within or outside the Guam EEZ) that would eventually be catchable by local trollers. Thus catches by Guam's fishermen are reduced because of catches by these outside fishing operations.

b) These fleets sell their discards or bycatch on Guam, thus denying markets to local fishermen.

Local fishermen interviewed are virtually unanimous in their opinion that something should be done to prevent these adverse impacts on local fisheries.

The Western Pacific Regional Fishery Management Council should continue to urge the U.S. purse-seine fleet to release information on its by-catch of pelagic management unit species to improve the data base for management of these species and to allay presumably groundless fears that the purse seine fleet is fishing in the Guam EEZ thereby reducing the potential catch by local fishermen. Similarly, the Council should continue efforts to improve fishery surveillance and enforcement in the Guam EEZ to ensure that foreign longline fleets are not fishing illegally in the Guam EEZ.

It might be appropriate to restrict fishing by purse-seiners, pelagic gill netters, and foreign longliners from the Guam EEZ in order to protect local pelagic fisheries. None of these large-scale fisheries currently claim to operate in the Guam EEZ and so would not be disadvantaged by such restrictions.

There may be opportunities for developing domestic pelagic longline fisheries on Guam. This would create a need for further evaluation of fishery interactions among local pelagic fishery sectors and perhaps a need for some means of allocating fishing opportunities among these groups. Heated controversy has arisen in Hawaii between longliners and other domestic pelagic fishermen, and such problems could spread to Guam. As domestic longline fisheries have not yet materialized on Guam, it is difficult to evaluate possible management options for such a fishery. However, efforts should begin forthwith to gather data on longline fisheries and their impacts on other pelagic fisheries so that appropriate management regimes can be developed should the need arise.

BOTTOMFISH FISHERIES ON GUAM

Bottomfish fishing is the second most important offshore fishing method used in Guam. Most of the bottomfishing takes place around the island of Guam within the Territorial Sea, but some bottomfishing is carried out on various offshore banks within the EEZ.

Biological Condition of Bottomfish Stocks

Several species of deepwater snappers of the genera Pristipomoides, Etelis, and Aphareus as well as species of jacks (Caranx), groupers (Epinephelus), and emperors (Lethrinus) are the principal targets of the Guam bottomfish fishery.

During 1982 to 1984, the NOAA ship Townsend Cromwell carried out an extensive survey of bottomfish stocks throughout the Marianas archipelago (Polovina et al., 1985). Analysis of the data from these cruises indicated a maximum sustainable yield (MSY) for bottomfish throughout the archipelago (and the western seamounts) of 109 mt/yr. They estimated bottomfish MSY for Guam and the banks to the south (Galvez Banks and Santa Rosa Reef) to be 25.8 mt/yr.

Data from the Guam Division of Aquatic and Wildlife Resources offshore fishery survey indicate that over the period from 1982 to 1988, the Guam bottomfish catch has ranged from a low of 8 mt in 1982 to a high of nearly 40 mt in 1985; the catch in the most recent year (1988) was 24 mt. The bottomfish catch is closely related to the amount of fishing effort expended in any given year, but there has also been a decline in bottomfish CPUE in the last few years; CPUE in terms of boat-hours and in person-hours was lower in 1988 than in any of the previous years. An analysis of the Guam offshore fishery survey data currently in progress (S. Amesbury, in prep.) suggests that the MSY for bottomfish around Guam may be in the range of 45 to 65 mt/yr, twice or more the estimate of Polovina et al. The difference in the two estimates is likely due to the inclusion of emperors (Lethrinidae) in the DAWR data and in Amesbury's MSY estimate and the exclusion of this group from the Polovina et al. MSY estimate.

It appears that the Guam bottomfish catch is approaching or at MSY (and may have exceeded MSY in past years). Although precise data are not available, it seems likely that most bottomfishing effort is expended in the waters close to Guam (as opposed to the banks to the south), and so bottomfish may be being overharvested in the waters near Guam.

While little is known of larval life history, patterns of recruitment, and adult fish movements among pinnacles and slope habitats, it has been generally thought that overfishing can reduce bottomfish stocks in localized areas and that it may take some time for these areas to recover. This, in fact, appears to have happened at Haputo Pinnacle off the west coast of Guam (Ikehara, Kami, and Sakamoto, 1970).

Management of bottomfish in the Guam EEZ and adjoining Territorial waters may be needed to prevent fishing effort from

exceeding that sufficient to harvest MSY. It would also be appropriate to redirected fishing effort away from heavily fished areas to less heavily fished ones. A significant increase in bottomfishing effort could lead to depletion of local stocks.

Economic Condition of Bottomfish Fishery

The study of the economics of Guam offshore fishermen summarized by Kasaoka (1989) included bottomfish fishermen, but because almost all bottomfish fishermen also troll, it is difficult to analyze the economics of bottomfishing separately. It is likely the case, however, that the general lack of profit in the Guam offshore fishery is also true for those who bottomfish.

The Guam Fisherman's Coop is currently paying $2.00-2.25 per pound for bottomfish. This is the same price it is paying for wahoo and mahimahi (blue marlin is being bought for $1.00 per pound). Depending upon the true MSY for this fishery, the potential value of the Guam bottomfish fishery may be between $114,000 and $286,000.

The Guam DAWR offshore fishery survey data indicate that bottomfish catch rates on Guam average around 1 kg/person-hr of actual fishing time. At $2.00 per pound, this works out to $4.40 per person-hour. This is only slightly above the minimum wage and doesn't take into account any costs of fishing (which average $122 per trip exclusive of annual boat maintenance and other business costs; Kasaoka, 1989).

Most fishermen on Guam do bottomfishing only occasionally, for recreation and to catch fish for home consumption. There are a small number who bottomfish more regularly to catch fish to sell, and these fishermen have higher than average catch rates (G. Davis, pers. comm.).

Management measures that lead to reduced bottomfishing effort could improve catch rates, and measures to control additional effort could prevent further declines in catch rate. Thus there are some economic reasons for managing effort in the Guam bottomfish fishery.

Social Aspects of the Bottomfish Fishery

Bottomfishing is not practiced as widely as trolling on Guam. Of the 35 respondents in the small-boat economic survey (Kasaoka, 1989), 23 indicated that they did some bottomfishing (and 34 indicated that they did some trolling). The Guam Division of Aquatic and Wildlife Resources estimated that annual bottomfishing effort during 1982-1988 ranged from 2,376 to 14,356

boat-hours; during the same period, trolling effort ranged from 13,977 to 57,365 boat-hours per year, about 4 1/2 times as much as bottomfishing effort.

Most of the fishermen who indicated in the economic survey that they bottomfish on Guam are Chamorros and Caucasians.

Existing Management Efforts

The Western Pacific Fishery Management Council has prepared a Fishery Management Plan for Bottomfish in the Western Pacific Region (including Guam). The plan is of the "framework" variety and calls for the collection of data and for monitoring the fishery but does not include any specific management measures for the bottomfish fishery around Guam.

Because most of the bottomfish fishing grounds and most of the bottomfish resource around Guam is in Territorial waters, any management effort on the part of the Council would have to be mirrored by local regulations to be effective.

The Guam DAWR collects catch and effort data on the Guam bottomfish fishery through its offshore fishery survey program. Commercial data from the Guam Fishermen's Coop and other dealers are gathered by the WPACFIN program (Hamm and Quach, 1988).

Management Objectives for Guam's Offshore Bottomfish Fishery

The fishery management objectives for small-boat fishing set out in the Territory of Guam Fishery Development and Management Plan are cited above. For bottomfishing these would be the following:

a) to the extent possible, maintain the abundance and availability of bottomfish stocks around the island;

b) to provide opportunities for productive and profitable commercial bottomfish fisheries;

c) to maintain opportunities for local fishermen to harvest bottomfish for home consumption;

d) to enhance opportunities for recreational bottomfish fishing;

e) to the extent possible, improve the safety of small-boat fishing.

Evaluation of Limited Entry and Other Management Strategies for Bottomfishing on Guam

If the Polovina et al. (1985) estimate of Guam's bottomfish MSY is accurate, current levels of bottomfishing effort are harvesting very close to MSY. If the more optimistic MSY estimates of 45,000 to 65,000 kg/yr are correct, the current level of fishing could increase two-fold or more before MSY is reached. In either case, management of this resource should be considered to prevent overharvesting.

Limited entry is a management tool that could be used to control fishing effort to stabilize it at a level sufficient to harvest at MSY or at some lower level to improve the profitability of the fishery.

Analysis of bottomfish catch rates suggests that MSY could be harvested by about 5 to 20 full-time bottomfishing boats (depending upon whether the Polovina et al. MSY or the more optimistic MSY is the correct one). At the catch rates indicated by Polovian et al. (1.5 kg/line-hour with an average catch of 7.3 mt/vessel) and current bottomfish prices on Guam ($2.00/lb), these boats would gross approximately $32,120 per year, but could do better if the price of bottomfish increased dramatically or if they were able to achieve catch rates substantially higher than average (in which case, of course, a much smaller number of boats could harvest MSY).

The much larger number of fishermen who presently catch bottomfish primarily for recreation or for home consumption could be allowed to remain in the fishery under a limited entry scheme (as the fishery is not presently overharvested) if their bottomfish fishing effort did not increase, but if the price of bottomfish improved significantly and these fishermen were persuaded to invest more effort into bottomfishing, there could be a large overcapacity in the fishery.

Perhaps a procedure which allowed access for recreational and subsistence fishermen but which limited the number of commercial fishermen (i.e., those who are allowed to sell their catch) could be designed. Such a scheme could serve the dual purposes of conserving the stocks as well as preserving the diversity of the present fishery.

However, in considering such a scheme, the following issues would have to be addressed:

1) At historical catch rates and existing prices, full-time bottomfishing may not be economically realistic. The costs of administering a limited entry program might exceed the value of the fishery.

2) Most bottomfishing grounds are within territorial waters with perhaps a third of the stocks being on banks beyond

three miles from Guam. Jurisdictional issues would have to be addressed before a successful limited entry program could be implemented.

3) Most subsistence and recreational fishermen have traditionally sold part of their catch in excess of their immediate needs to defray some of their trip costs. Would these fishermen be unfairly disadvantaged by a limited entry scheme?

Among other alternatives for managing the bottomfish fishery on Guam are catch limits, size limits, area restrictions, effort limitations, and taking no action.

Taking no action has certain advantages: it is inexpensive, it avoids conflicts over jurisdiction and between privileged and excluded fishermen, and it has worked so far. If the fishery doesn't change significantly, this would probably be the preferred alternative. Should participation and effort in the fishery expand significantly, however, in response to higher prices for fish or more effective fishing methods, some management measures would need to be implemented.

Catch limits could be effective once a reliable value for MSY has been established for the fishery. This would require monitoring of the bottomfish catch (which the Guam DAWR does now through a port sampling system). Two disadvantages of catch limits are these:

1) The burden of catch limits falls on the commercial fishermen who depends on large catches and continued freedom to fish to survive.

2) Catch limits encourage underreporting of catch. The Guam DAWR fishery survey is one which the fishermen now voluntarily agree to. Such cooperation would dwindle if fishermen realized that their future right to fish was being diminished by every fish brought in for counting.

Overfishing is frequently signalled by decreasing sizes of fish landed. Thus far, analysis of fish size frequency has not been carried out for the Guam bottomfish fishery. Such an analysis could indicate the need for establishing minimum size limits for bottomfish. It would be difficult to enforce minimum sizes for bottomfish caught by subsistence or recreational fishermen without a greatly expanded enforcement effort, but it would be relatively easy to establish minimum sizes for commercial sale and enforce these at the markets. This would discourage commercial fishing in areas where fish size had diminished. This is a management tool that would be easy to use and might well preclude the need for other management measures. The Guam DAWR has some data on the sizes of bottomfish caught on

Guam, and it would be very valuable to work up this data to evaluate minimum size limits as a management option for this fishery.

Area restrictions could be used to redirect effort away from overfished areas to areas with less fishing pressure. A possible approach would be to restrict larger boats and/or commercial boats from fishing in waters near the island, preserving these areas for small-scale subsistence and recreational fishermen. This would entail a considerable enforcement burden to determine where fishermen were fishing, however. It would, of course, restrict opportunities for commercial bottomfish fishermen to make money, especially during times of bad weather when the offshore banks would be inaccessible.

Various possible effort limitations include gear restrictions, limits on landings per trip, and limited number of fishing trips per year. Certain types of gear, such as bottom trawls and set-nets are restricted in the EEZ by the Fishery Management Plan for Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region prepared by the Western Pacific Regional Fishery Management Council. Parallel restrictions for territorial waters should be considered by the Guam government. Generally, effort restrictions work preferentially against the commercial fisherman who needs to be as efficient and productive as possible to survive economically. Restrictions on catch per trip and trips per year would be difficult to enforce on Guam.

Conclusion

In summary, the management alternatives that seem most appropriate for the Guam bottomfish fishery at present are the following:

1) Take no action unless warranted by a more detailed consideration of the MSY for bottomfish stocks around Guam or unless a significant increase in participation in the fishery occurs.

2) Should the considerations above warrant action, examine size-frequency data for bottomfish species harvested on Guam to evaluate the usefulness of instituting minimum salable sizes for bottomfish species harvested locally.

3) If establishing minimum commercial size limits does not appear to be an effective management option, then consideration should be given to instituting a limited entry scheme for commercial bottomfish fisheries.

Because the bulk of the bottomfish resource and the bottomfish fishing activity occurs within territorial waters, the

Territory of Guam should assume the iniative in these management efforts with support from the Western Pacific Regional Fishery Management Council. This will assure opportunities for the concerned fishermen to have adequate input into the management deliberations and will enhance compliance with any management measures adopted.

LITERATURE CITED

Amesbury, S. S., and P. Callaghan. 1981. Territory of Guam Fisheries Development and Management Plan. Government of Guam. 99p + appendix

Au, D. W. 1987. Western Pacific yellowfin tuna fisheries. In: N. W. Bartoo (ed.) Tuna and billfish summaries of major stocks. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Center. Administrative Report LJ-87-26.

Hamm, D. C., and M. M. C. Quach. 1988. Fishery statistics of the western Pacific. Southwest Fisheries Center Administrative Report H-88-4.

Ikehara, I. I., H. T. Kami, and R. K. Sakamoto. 1970. Exploratory fishing survey of the inshore fisheries resources of Guam. Proc. of the 2nd CSK Symposium, Tokyo. pp. 425-437.

Kasaoka, L. D. 1989. Summary of small boat economic surveys from American Samoa, Guam and the Northern Mariana Islands. Southwest Fisheries Center Administrative Report H-89-? 29p + appendix

Kleiber, P. 1987. Central and western Pacific skipjack tuna. In: N. W. Bartoo (ed.) Tuna and billfish summaries of major stocks. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Center. Administrative Report LJ-87-26.

Oceanic Institute. 1988. Hawaiian mahimahi: current market analysis and marketing strategies for increased production. Oceanic Institute, Honolulu. 85p + appendices

Polovina, J. J., R. B. Moffitt, S. Ralston, and P. M. Shiota. 1985. Results of the resource assessment investigations of the Mariana archipelago. Southwest Fisheries Center Administrative Report H-85-7. 22p.

Wilder, M. J. 1977. Biological aspects and fisheries potential of two deep water shrimps Heterocarpus ensifer and

Heterocarpus laevigatus in waters surrounding Guam. M.S. thesis in Biology, University of Guam, Mangilao. 79p.

Williams, K. 1989. Guam fresh tuna longline transshipment study. Phase 1. Fishery description. Unpublished report to Guam Department of Commerce. 35p.

APPENDIX A

PELAGIC FMP SPECIES

GUAM/NORTHERN MARIANA ISLANDS	
POPULAR/COMMON NAME	SCIENTIFIC NAME
Blue marlin	Makaira nigricans
Striped marlin	Tetrapturus audax
Black marlin	Makaira indica
Broadbill swordfish	Xiphias gladius
Sailfish	Istiophorus platypterus
Spearfish	Tetrapturus angustirostris
Mahimahi	Coryphaena hippurus & C. equiselis
Tosuno/Ono/Wahoo	Acanthocybium solandri
Oceanic whitetip shark	Family Carcharhinidae
Tiger shark	Family Carcharhinidae
Silky shark	Family Carcharhinidae
Blacktip shark	Family Carcharhinidae
Galapagos shark	Family Carcharhinidae
Thresher shark	Family Alopiidae
Hammerhead shark	Family Sphyrnidae
Great white shark	Family Lamnidae (Isuridae)
Mako shark	Family Lamnidae (Isuridae)

CRUSTACEAN FMP SPECIES

GUAM/NORTHERN MARIANA ISLANDS	
POPULAR/COMMON NAME	SCIENTIFIC NAME
Spiny lobster	Panilirus spp.
Slipper lobster	Scyllarides sp.
Deep-water shrimp	Heterocarpus sp.

TUNA SPECIES

GUAM/NORTHERN MARIANA ISLANDS	
POPULAR/COMMON NAME	SCIENTIFIC NAME
Yellowfin tuna	Thunnus albacores
Bigeye tuna	Thunnus obesus
Albacore tuna	Thunnus alalunga
Skipjack tuna/bonita	Katsuwonus pelamis
Kawakawa/black skipjack tuna	Euthynnus affinis

APPENDIX B

Herein are selected pages from the "Check-List of Guam Fishes" (Kami et al. 1968), from the "Check-List of Guam Fishes, Supplement I" (Kami 1971), and from "Check-List of Guam Fishes, Supplement II" (Kami 1975). They are included here because they contain Chamorro names for some of the species or families listed in Appendix A, which indicates a familiarity with these fish on the part of native peoples of Guam.

Epinephelus fasciatus (Forskal) [GADAO]
Two specimens, 170 and 190 mm. TL., Umatac, March, 1963.
Epinephelus medurensis (Gunther) [GADAO]
One specimen, 375 mm. TL., Ritidian Point, April 17, 1966.
One specimen, 420 mm. TL., Facpi Point, December 2, 1966.
Epinephelus elongatus Schultz
One specimen, 375 mm. TL., Cocos Island reef, October 26, 1965.
Epinephelus maculatus (Bloch)
One specimen, 155 mm., Guam. Fowler (1925: 9).
Epinephelus daemetii Gunther
One specimen, 6.5 inches, Guam, July 12, 1900. Seale (1901: 76–77).
Note: *E. daemetii* probably a misspelling by Seale of *E. dameli* (Günther). Weber and de Beaufort (1931: 44–45) includes Guam in the distribution of this species.
Cephalopholis obtusaurus Evermann and Seale [GADAO]
Two specimens, 160 and 165 mm. TL., Orote Point, December 10, 1966.
Cephalopholis urodelus (Bloch and Schneider) [GADAO]
Two specimens, 180 and 222 mm. TL., Tarague, August 3, 1964.
Cephalopholis argus (Bloch and Schneider) [GADAO]
One specimen, 290 mm., Merizo lagoon, March 31, 1967.
Cephalopholis igarashiensis Katayama
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One specimen, 143 mm., Agat, February 3, 1965.

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Two specimens, 190 and 200 mm. TL., Apra Harbor, December 28, 1966.

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(Dolphins)

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One specimen, 1,253 mm., reef off Cocos Island, March 14, 1966.

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One specimen, 570 mm., between Umatac and Merizo, April 17, 1967.

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Six specimens, 65 to 83 mm. TL., Agana boat channel, August 10, 1966.

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One specimen, 314 mm., Guam, date unrecorded.

Acanthocybium solandri (Cuvier) TOSUN
Head only. Guam, date, unrecorded.
One specimen, 37 pounds, Ritidian, December 10, 1966. Guam Fishing and Boating Association record.
One specimen, 26 pounds, Uruno, December 10, 1966. Guam Fishing and Boating Association record.

Thunnus albacares (Bonnaterre)
One specimen, 595 mm. TL., between Merizo and Orote Point, April 7, 1967.

Gymnosarda nuda Gunther
One specimen, 890 mm. TL., between Merizo and Orote Point, April 7, 1967.

FAMILY ISTIOPHORIDAE
(Sailfishes and Marlins)

Istiophorus orientalis (Schegel)
One specimen, 103 inches, one-half mile off Cette Bay.

Makaira ampla Royce
One specimen, 76 inches, FL., Facpi Point, May 26, 1967.

FAMILY ACANTHURIDAE
(Surgeonfishes)

Acanthurus achilles Shaw

Two specimens, 95 and 136 mm, east of Tarague Beach, (C. E. Beach), September 25, 1969.*

Acanthurus mata (Cuvier and Valenciennes) [HUGUPAU]

One specimen 217 mm, Merizo lagoon, May 21, 1969.

Acanthurus pyroferus Kittlitz [HUGUPAU]

One specimen, 124 mm, NW reef off Cocos Island, March 29, 1968.

Acanthurus thompsoni (Fowler) [HUGUPAU]

Four specimens, 47 to 139 mm, NW reef off Cocos Island, June 30, 1968.

Ctenochaetus binotatus Randall [HUGUPAU]

Two specimens, 71 and 75 mm, NW reef off Cocos Island, March 29, 1968.

Ctenochaetus hawaiiensis Randall [HUGUPAU]

One specimen, 167 mm, Agana outfall, March 1970.*

Naso vlamingi (Valenciennes)

One specimen, 322 mm, off Cetti Bay, March 19, 1970.

Paracanthurus hepatus (Linnaeus)

Two specimens, 35 and 57 mm, Orote, July 16, 1968.*

Zebrasoma scopas (Cuvier)

One specimen, 73 mm, Agana Bay, October 10, 1967.*

One specimen, 98 mm, north of Haputo Pt. (Double Reef), July 28, 1968.

FAMILY ALOPIDAE
(Thresher Sharks)

Alopias pelagicus Nakamura [AGNU]

One specimen, 755 mm, to notch, TL. 1,740 mm, Hospital Pt., November 8, 1967.*

FAMILY ANGUILLIDAE
(Fresh-Water Eel)

Anguilla bicolor McClelland

One specimen, TL. 374 mm, Fonte River, February 18, 1969.*

FAMILY ANOMALOPIDAE
(Lantern-Eye Fishes)

Anomalops kaptoptron Bleeker

One specimen, 242 mm, Merizo, March 23, 1969.

Cirripectes fuscoguttatus Strasburg and Schultz
One specimen, 72 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Ecsenius opsifrontalis Chapman and Schultz
One specimen, 30 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Entomacrodus striatus (Quoy and Gaimard)
Seven specimens, 22 to 72 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Fallacirripectes minutus Schultz
Two specimens, 17 and 18 mm, north of Haputo Pt. (Double Reef), December 6, 1969.*
Istiblennius periopthalmus (Cuvier and Valenciennes)
Nineteen specimens, 36 to 97 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Runula tapeinosoma (Bleeker)
One specimen, 64 mm, Ipao Beach, July 24, 1967.

FAMILY CANTHIGASTERIDAE
(Sharpbacked Puffers)

Canthigaster janthinopterus (Bleeker)
One specimen, 28 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

FAMILY CARACANTHIDAE

Caracanthus unipinnus (Gray)
One specimen, 20 mm, Umatac, December 27, 1969.

FAMILY CARANGIDAE
(Pompano or Jack Crevally)

Caranx helvolus (Forster)
Four Specimens, 245 to 292 mm, Haputo Pt., May 15, 1968.
Decapterus pinnulatus (Eydoux and Souleyet) [ACHUMAN]
Three specimens, 220 to 320 mm, Galvez Banks, October 25 and 26, 1967.
Naucrates ductor (Linnaeus)
One specimen, 252 mm, Haputo, January 28, 1971.
Seriola songoro Smith
One specimen, 563 mm, Umatac, March 11, 1970.

FAMILY CHAETODONTIDAE
(Butterfly Fishes)

Centropyge heraldi Woods and Schultz [ABABANG]
One specimen, 67 mm, NW reef off Cocos Island, May 28, 1968.
Centropyge multifasciatus Smith and Radcliffe
One specimen, 57 mm, reef off Cocos Island, Guam, April 7, 1970.

Two specimens, 45 and 56 mm, NW reef of Cocos Island, March 15, 1968.

Chromis leucurus Gilbert [FOMHO]

One specimen, 48 mm, NW reef off Cocos Island 25, 1968.

One specimen, 51 mm, NW reef off Cocos Island, May 28, 1968.

Chromis ternatensis (Bleeker)

Three speciemns, 33 to 39 mm, Tanguissan Pt., February 25, 1970.*

Chromis vanderbilti (Fowler)

Five specimens, 24 to 34 mm, NW reef of Cocos Island, June 30, 1968.

Specimens deposited at Bishop Museum, BPBM 8752.

Chromis xanthochir (Bleeker) [FOMHO]

One specimen, 88 mm, NW reef off Cocos Island, January 25, 1968.

One specimen, 76 mm, NW reef of Cocos Island, February 21, 1968.

Pomacentrus jenkinsi Jordan and Evermann [FOMHO]

Three specimens, 21 to 39 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

Pomacentrus traceyi Schultz

Two specimens, 22 and 35 mm, north of Haputo Pt. (Double Reef), December 6, 1969.*

FAMILY PSEUDOCHROMIDAE

Pseudogramma polyacantha (Bleeker)

Three specimens, 21 to 39 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

Pseudoplesiops revellei Schultz

One specimen, 28 mm, north of Haputo Pt. (Double Reef), December 6, 1969.

Pseudoplesiops rosae Schultz

One specimen, 18 mm, north of Haputo Pt. (Double Reef), December 6, 1969.

FAMILY SCARIDAE
(Parrotfishes)

Bolbometopan gibbus (Ruppell)

One specimen, 125 mm, Merizo, May 14, 1969.

Scarus lepidus Jenyns

One specimen, 253 mm, South of Uruno Pt. June 28, 1968.

Specimen deposited at Bishop Museum, BPBM 9251.

FAMILY SERRANIDAE
(Groupers)

Epinephelus hexagonatus (Bloch and Schneider) [GADAO]

One specimen, 180 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

Epinephelus fuscoguttatus (Forsskal) [GADAO]

One specimen, TL. 340 mm, Apra Harbor, April 26, 1968.

Epinephelus microdon (Bleeker) [GADAO]

One specimen, 405 mm, Orote Pt., February 1, 1967.

Epinephelus corallicola Cuvier and Valenciennes [GADAO]

Two specimens, 223 and 288 mm, NW reef off Cocos Island, December 21, 1967.

Promicrops lanceolatus (Bloch)

One specimen, 980 mm, Haputo Pt., April 23, 1971.

FAMILY SPHYRNIDAE
(Hammerhead Sharks)

Sphyrna lewini (Cuvier, Griffith and Smith) [KILUUS]

One specimen, TL. 1,417 mm, Anae Island, April 25, 1968.

FAMILY SYNGNATHIDAE
(Pipefishes)

Doryrhamphus melanopleura (Bleeker)

None specimens, 24 to 41 mm, Marine Hole, October 4, 1969.*

Dunckerocampus dactyliophorus (Bleeker)

Three specimens, 21 to 39 mm, south of Tanguissan Pt. (NCS Beach), June 23, 1968.

Ichthyocampus diacampus Schultz

One specimen, 27 mm, south of Uruno Pt., June 27, 1968.

Specimen deposited at Bishop Museum, BPBM 8758.

Ichthyocampus kampeni Weber

Two specimens, 55 and 56 mm, north of Haputo Pt. (Double Reef), December 6, 1969.*

FAMILY SYNODONTIDAE
(Lizardfishes)

Synodus englemani Schultz

One specimen, 63 mm, NW reef off Cocos Island, June 30, 1968.

FAMILY TRICHONOTIDAE

Chalixodytes tauensis Schultz

Eight specimens, 28 to 43 mm, Marine Hole, October 4, 1969.*

APPENDIX

FAMILY ACANTHURIDAE

Acanthurus guttatus Bloch and Schneider

One specimen, 115 mm, Merizo, July 4, 1967.

FAMILY BLENNIIDAE
(Blennies)

Cirripectes sebae (Cuvier and Valenciennes)
Twelve specimens, 30 to 48 mm, Rizal Beach, September 7, 1974.

Enchelyurus caeruleo-punctatus Herre
One specimen, 22 mm, Tanguisson, May 6, 1970.*

Meiacanthus atrodorsalis atrodorsalis (Gunther)
One specimen, 44 mm, Haputo Pt. (Double Reef), December 6, 1969.
Seven specimens, 40 to 48 mm, Tanguisson, February 25, 1970.

Petroscirtes mitratus (Ruppell)
One specimen, 24 mm, Apra Harbor, April, 1970.*

Plagiotremus laudandus (Whitley)
One specimen, 45 mm, Haputo Pt. (Double Reef), December 6, 1969.

Omobranchus rotundiceps obliquus (Garman)
Three specimens, 14 to 35 mm, Apra Harbor, July 14, 1969.

FAMILY BRANCHIOSTEGIDAE
(Tilefish)

Hopolatilus starcki Randall and Dooley
One specimen, 102 mm, holotype BPBM 7298, fringing reef of Cocos Island, June, 1968.
One specimen, 99 mm, paratype BPBM 7297, Haputo Pt., June 27, 1968.
Randall and Dooley (1974).

FAMILY BROTULIDAE

Brosmophyciops pautzkei Schultz
One specimen, 46 mm, Tanguisson, September 16, 1972.*

FAMILY CARCHARHINIDAE
(Sharks)

The information on sharks is based on Bryan (1973) and personal communication with Mr. Bryan.

Carcharhinus albimarginatus (Ruppell) [HALUU]
One specimen, T.L. 775 mm, Alupang Island, March 24, 1973.

Carcharhinus falciformes Muller and Henle [HALUU]
One specimen, T.L. 2260 mm, Amantes Point, August 6, 1971.
One specimen, T.L. 2030 mm, Orote Point, March 23, 1972.

Carcharhinus galapagensis Snodgrass and Heller [HALUU]
One specimen, TL 1150 mm, Tarague Beach, August 25, 1971.
One specimen, TL 2530 mm, Orote, October 23, 1971.
Two specimens, TL 2390 and 2640 mm, Orote, October 24, 1971.
One specimen, TL 2340 mm, Hospital Point, November 28, 1971.

Epinephelus fasciatus (Forskal) [GADAO]
Two specimens, 170 and 190 mm. TL., Umatac, March, 1963.
Epinephelus medurensis (Gunther) [GADAO]
One specimen, 375 mm. TL., Ritidian Point, April 17, 1966.
One specimen, 420 mm. TL., Facpi Point, December 2, 1966.
Epinephelus elongatus Schultz
One specimen, 375 mm. TL., Cocos Island reef, October 26, 1965.
Epinephelus maculatus (Bloch)
One specimen, 155 mm., Guam. Fowler (1925: 9).
Epinephelus daemetii Gunther
One specimen, 6.5 inches, Guam, July 12, 1900. Seale (1901: 76-77).
Note: *E. daemetii* probably a misspelling by Seale of *E. dameli* (Günther). Weber and de Beaufort (1931: 44–45) includes Guam in the distribution of this species.
Cephalopholis obtusaurus Evermann and Seale [GADAO]
Two specimens, 160 and 165 mm. TL., Orote Point, December 10, 1966.
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Two specimens, 180 and 222 mm. TL., Tarague, August 3, 1964.
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Euthynnus affinis (Cantor)
One specimen, 314 mm., Guam, date unrecorded.

Acanthocybium solandri (Cuvier) TOSUN
Head only. Guam, date, unrecorded.
One specimen, 37 pounds, Ritidian, December 10, 1966. Guam Fishing and Boating Association record.
One specimen, 26 pounds, Uruno, December 10, 1966. Guam Fishing and Boating Association record.

Thunnus albacares (Bonnaterre)
One specimen, 595 mm. TL., between Merizo and Orote Point, April 7, 1967.

Gymnosarda nuda Gunther
One specimen, 890 mm. TL., between Merizo and Orote Point, April 7, 1967.

FAMILY ISTIOPHORIDAE
(Sailfishes and Marlins)

Istiophorus orientalis (Schegel)
One specimen, 103 inches, one-half mile off Cette Bay.

Makaira ampla Royce
One specimen, 76 inches, FL., Facpi Point, May 26, 1967.

FAMILY ACANTHURIDAE
(Surgeonfishes)

Acanthurus achilles Shaw
Two specimens, 95 and 136 mm, east of Tarague Beach, (C. E. Beach), September 25, 1969.*

Acanthurus mata (Cuvier and Valenciennes) [HUGUPAU]
One specimen 217 mm, Merizo lagoon, May 21, 1969.

Acanthurus pyroferus Kittlitz [HUGUPAU]
One specimen, 124 mm, NW reef off Cocos Island, March 29, 1968.

Acanthurus thompsoni (Fowler) [HUGUPAU]
Four specimens, 47 to 139 mm, NW reef off Cocos Island, June 30, 1968.

Ctenochaetus binotatus Randall [HUGUPAU]
Two specimens, 71 and 75 mm, NW reef off Cocos Island, March 29, 1968.

Ctenochaetus hawaiiensis Randall [HUGUPAU]
One specimen, 167 mm, Agana outfall, March 1970.*

Naso vlamingi (Valenciennes)
One specimen, 322 mm, off Cetti Bay, March 19, 1970.

Paracanthurus hepatus (Linnaeus)
Two specimens, 35 and 57 mm, Orote, July 16, 1968.*

Zebrasoma scopas (Cuvier)
One specimen, 73 mm, Agana Bay, October 10, 1967.*
One specimen, 98 mm, north of Haputo Pt. (Double Reef), July 28, 1968.

FAMILY ALOPIDAE
(Thresher Sharks)

Alopias pelagicus Nakamura [AGNU]
One specimen, 755 mm, to notch, TL. 1,740 mm, Hospital Pt., November 8, 1967.*

FAMILY ANGUILLIDAE
(Fresh-Water Eel)

Anguilla bicolor McClelland
One specimen, TL. 374 mm, Fonte River, February 18, 1969.*

FAMILY ANOMALOPIDAE
(Lantern-Eye Fishes)

Anomalops kaptoptron Bleeker
One specimen, 242 mm, Merizo, March 23, 1969.

Cirripectes fuscoguttatus Strasburg and Schultz
One specimen, 72 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Ecsenius opsifrontalis Chapman and Schultz
One specimen, 30 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Entomacrodus striatus (Quoy and Gaimard)
Seven specimens, 22 to 72 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Fallacirripectes minutus Schultz
Two specimens, 17 and 18 mm, north of Haputo Pt. (Double Reef), December 6, 1969.*
Istiblennius periopthalmus (Cuvier and Valenciennes)
Nineteen specimens, 36 to 97 mm, south of Tanguissan Pt. (NCS Beach), October 9, 1968.
Runula rapeinosoma (Bleeker)
One specimen, 64 mm, Ipao Beach, July 24, 1967.

FAMILY CANTHIGASTERIDAE
(Sharpbacked Puffers)

Canthigaster janthinopterus (Bleeker)
One specimen, 28 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

FAMILY CARACANTHIDAE

Caracanthus unipinnus (Gray)
One specimen, 20 mm, Umatac, December 27, 1969.

FAMILY CARANGIDAE
(Pompano or Jack Crevally)

Caranx helvolus (Forster)
Four Specimens, 245 to 292 mm, Haputo Pt., May 15, 1968.
Decapterus pinnulatus (Eydoux and Souleyet) [ACHUMAN]
Three specimens, 220 to 320 mm, Galvez Banks, October 25 and 26, 1967.
Naucrates ductor (Linnaeus)
One specimen, 252 mm, Haputo, January 28, 1971.
Seriola songoro Smith
One specimen, 563 mm, Umatac, March 11, 1970.

FAMILY CHAETODONTIDAE
(Butterfly Fishes)

Centropyge heraldi Woods and Schultz [ABABANG]
One specimen, 67 mm, NW reef off Cocos Island, May 28, 1968.
Centropyge multifasciatus Smith and Radcliffe
One specimen, 57 mm, reef off Cocos Island, Guam, April 7, 1970.

Two specimens, 45 and 56 mm, NW reef of Cocos Island, March 15, 1968.

Chromis leucurus Gilbert [FOMHO]

One specimen, 48 mm, NW reef off Cocos Island 25, 1968.

One specimen, 51 mm, NW reef off Cocos Island, May 28, 1968.

Chromis ternatensis (Bleeker)

Three speciemns, 33 to 39 mm, Tanguissan Pt., February 25, 1970.*

Chromis vanderbilti (Fowler)

Five specimens, 24 to 34 mm, NW reef of Cocos Island, June 30, 1968.

Specimens deposited at Bishop Museum, BPBM 8752.

Chromis xanthochir (Bleeker) [FOMHO]

One specimen, 88 mm, NW reef off Cocos Island, January 25, 1968.

One specimen, 76 mm, NW reef of Cocos Island, February 21, 1968.

Pomacentrus jenkinsi Jordan and Evermann [FOMHO]

Three specimens, 21 to 39 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

Pomacentrus traceyi Schultz

Two specimens, 22 and 35 mm, north of Haputo Pt. (Double Reef), December 6, 1969.*

FAMILY PSEUDOCHROMIDAE

Pseudogramma polyacantha (Bleeker)

Three specimens, 21 to 39 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

Pseudoplesiops revellei Schultz

One specimen, 28 mm, north of Haputo Pt. (Double Reef), December 6, 1969.

Pseudoplesiops rosae Schultz

One specimen, 18 mm, north of Haputo Pt. (Double Reef), December 6, 1969.

FAMILY SCARIDAE
(Parrotfishes)

Bolbometopan gibbus (Ruppell)

One specimen, 125 mm, Merizo, May 14, 1969.

Scarus lepidus Jenyns

One specimen, 253 mm, South of Uruno Pt. June 28, 1968.

Specimen deposited at Bishop Museum, BPBM 9251.

FAMILY SERRANIDAE
(Groupers)

Epinephelus hexagonatus (Bloch and Schneider) [GADAO]

One specimen, 180 mm, south of Tanguissan Pt. (NCS Beach), June 29, 1968.

Epinephelus fuscoguttatus (Forsskal) [GADAO]

One specimen, TL. 340 mm, Apra Harbor, April 26, 1968.

Epinephelus microdon (Bleeker) [GADAO]

One specimen, 405 mm, Orote Pt., February 1, 1967.

Epinephelus corallicola Cuvier and Valenciennes [GADAO]

Two specimens, 223 and 288 mm, NW reef off Cocos Island, December 21, 1967.

Promicrops lanceolatus (Bloch)

One specimen, 980 mm, Haputo Pt., April 23, 1971.

FAMILY SPHYRNIDAE
(Hammerhead Sharks)

Sphyrna lewini (Cuvier, Griffith and Smith) [KILUUS]

One specimen, TL. 1,417 mm, Anae Island, April 25, 1968.

FAMILY SYNGNATHIDAE
(Pipefishes)

Doryrhamphus melanopleura (Bleeker)

None specimens, 24 to 41 mm, Marine Hole, October 4, 1969.*

Dunckerocampus dactyliophorus (Bleeker)

Three specimens, 21 to 39 mm, south of Tanguissan Pt. (NCS Beach), June 23, 1968.

Ichthyocampus diacampus Schultz

One specimen, 27 mm, south of Uruno Pt., June 27, 1968.

Specimen deposited at Bishop Museum, BPBM 8758.

Ichthyocampus kampeni Weber

Two specimens, 55 and 56 mm, north of Haputo Pt. (Double Reef), December 6, 1969.*

FAMILY SYNODONTIDAE
(Lizardfishes)

Synodus englemani Schultz

One specimen, 63 mm, NW reef off Cocos Island, June 30, 1968.

FAMILY TRICHONOTIDAE

Chalixodytes tauensis Schultz

Eight specimens, 28 to 43 mm, Marine Hole, October 4, 1969.*

APPENDIX

FAMILY ACANTHURIDAE

Acanthurus guttatus Bloch and Schneider

One specimen, 115 mm, Merizo, July 4, 1967.

FAMILY BLENNIIDAE
(Blennies)

Cirripectes sebae (Cuvier and Valenciennes)
Twelve specimens, 30 to 48 mm, Rizal Beach, September 7, 1974.

Enchelyurus caeruleo-punctatus Herre
One specimen, 22 mm, Tanguisson, May 6, 1970.*

Meiacanthus atrodorsalis atrodorsalis (Gunther)
One specimen, 44 mm, Haputo Pt. (Double Reef), December 6, 1969.
Seven specimens, 40 to 48 mm, Tanguisson, February 25, 1970.

Petroscirtes mitratus (Ruppell)
One specimen, 24 mm, Apra Harbor, April, 1970.*

Plagiotremus laudandus (Whitley)
One specimen, 45 mm, Haputo Pt. (Double Reef), December 6, 1969.

Omobranchus rotundiceps obliquus (Garman)
Three specimens, 14 to 35 mm, Apra Harbor, July 14, 1969.

FAMILY BRANCHIOSTEGIDAE
(Tilefish).

Hopolatilus starcki Randall and Dooley
One specimen, 102 mm, holotype BPBM 7298, fringing reef of Cocos Island, June, 1968.
One specimen, 99 mm, paratype BPBM 7297, Haputo Pt., June 27, 1968.
Randall and Dooley (1974).

FAMILY BROTULIDAE

Brosmophyciops pautzkei Schultz
One specimen, 46 mm, Tanguisson, September 16, 1972.*

FAMILY CARCHARHINIDAE
(Sharks)

The information on sharks is based on Bryan (1973) and personal communication with Mr. Bryan.

Carcharhinus albimarginatus (Ruppell) [HALUU]
One specimen, T.L. 775 mm, Alupang Island, March 24, 1973.

Carcharhinus falciformes Muller and Henle [HALUU]
One specimen, T.L. 2260 mm, Amantes Point, August 6, 1971.
One specimen, T.L. 2030 mm, Orote Point, March 23, 1972.

Carcharhinus galapagensis Snodgrass and Heller [HALUU]
One specimen, TL 1150 mm, Tarague Beach, August 25, 1971.
One specimen, TL 2530 mm, Orote, October 23, 1971.
Two specimens, TL 2390 and 2640 mm, Orote, October 24, 1971.
One specimen, TL 2340 mm, Hospital Point, November 28, 1971.

ANNOTATED BIBLIOGRAPHY

Abella, D.

1965 "Legaspi Claims Marianas for Spanish Throne." Pacific Profile 3(1):18-20,34-36.
Abella's translation of a portion of the diary of an unnamed traveling companion of Legaspi. Records Legaspi's visit to Guam in 1565.

Albo, F.

1971 "Derrotero del Viage de Fernando de Magallanes en demanda del estrecho, desde el paraje del cavo de San Agustin (escrito por Francisco Albo)" In Coleccion De Documentos y Manuscriptos Compilados por Fernandez de Navarrete, Vol.16, Museo Naval, Madrid. Nendeln, Liechtenstein.
The log of Magellan's pilot. Records Magellan's stop at Guam in 1521.

Alkire, W.

1965 Lamotrek Atoll and inter-island socioeconomic ties. Illinois Studies in Anthropology 5. Univ. of Illinois Press, Urbana.
Describes Carolinian socio-political organization considered in its environmental context.

1978 Coral islanders. AHM Publishing Corp., Arlington Heights.
Descriptive summaries of indigenous societies on coral islands in the Pacific, including Micronesia.

Amesbury, S.S.

n.d.1 Analysis of the fish remains from the Tarague archaeological excavation. Unpublished ms., files of the authors. 14pp.
Provides evidence for pelagic fish consumption during the Latte period on Guam.

Amesbury, S.S.

n.d.2 Fish remains at the NAVFAC Ritidian site. Unpublished ms., files of the authors. 8pp.
Provides evidence for pelagic fish consumption during the Latte period on Guam.

Amesbury, S.S. and R. Myers

1982 Guide to the coastal resources of Guam: Vol.1, The fishes. Univ. of Guam Marine Laboratory Tech. Rept. 173.
Pictorial guide to Guam's fishes; used in this project to elicit local names for fish.

Amesbury, S.S., F.A. Cushing, and R.K. Sakamoto

1986 Fishing on Guam. Univ. of Guam Marine Laboratory Contribution 225, Univ. of Guam Press, Mangilao.
Survey and summary of traditional and modern fishing on Guam, concise historical review; many illustrations.

Anell, Bengt
1955 Contribution to the history of fishing in the southern seas. Stud. Ethnograph. Upsal. 9, 249 pp.

Athens, J.S.
1986 Archaeological investigations at Tarague Beach, Guam. Report prepared for Base Civil Engineering, 43rd Strategic Wing, Andersen AFB, Guam. J. Stephen Athens, Archaeological Consultant, Honolulu.
Extended discussion of problems with early radiocarbon and shell dates from Marianas archaeological sites.

Barcinas, P.R., M.J. Levin, C.L. Naval (eds)
1988 Guam's people: "A continuing heritage," A statistical profile of the Territory of Guam. Interagency Committee on Population, Government of Guam.

Barratt, Glynn
1988a Carolinian contacts with the Islands of the Marianas: The European Record. Micronesian Archaeological Survey Report 25, Saipan.
A history of Carolinians in the Mariana Islands, has historic illustrations showing sailing canoes.

1988b H.M.S. Centurion at Tinian, 1742: The Ethnographic and Historic Records. Micronesian Archaeological Survey Report 26, Saipan.
The account of Anson's stay on Tinian. Includes descriptions of the Chamorro "flying *proa*".

Bonhomme, T. and J. Craib
1987 Radiocarbon dates from Unai-Bapot, Saipan: Implications for the prehistory of the Mariana Islands. Journal of the Polynesian Society 96:95-106.
Critical discussion of radiocarbon and shell dates in Marianas.

Bowers, N.M.
1950 Problems of resettlement on Saipan, Tinian, and Rota, Mariana Islands. Unpublished Ph.D. diss. Univ. of Michigan.

Butler, B.B. (ed)
1988 Archaeological investigations on the North Coast of Rota, Mariana Islands. Southern Illinois Univ. at Carbondale, Center for Archaeological Investigations No. 8.
Report on several excavations on Rota; contains article by Davidson and Leach on prehistoric fishing techniques; presents evidence for pelagic fishing in prehistoric Rota.

Carano, P. and P.C. Sanchez
1964 A complete history of Guam. Charles E. Tuttle Co., Rutland, Vermont.
Reviews the voyages to Guam and the governors of Guam, as well as the other events of Guam's history.

Chevalley, A. and M. Chevalley
1966 Concise Oxford French dictionary. Oxford University Press, London.
First published in 1934.
Gives the length of a French sea league.

Cloud, P.E. Jr., R.G. Schmidt and H.W. Burke
1956 Geology of Saipan, Part 1: General Geology. Geological Survey Professional Paper 280-A. Washington, D.C.
Background for understanding environmental conditions in Marianas relevant to prehistoric cultural adaptations including offshore fishing.

Commission on Self Determination
1988 Guam's Draft Commonwealth Act. Presented to U.S. Government February 1988.
This document contains a possible means of determining who would be considered a native of Guam for purposes of a limited entry program.

Constitutional Convention
1986 Constitution of the Commonwealth of the Northern Mariana Islands. In CNMI Commonwealth Code, Volume 1, by Commonwealth Law Revision Commission.
This copy of the Constitution notes the Amendments made by the 1985 Constitutional Convention.

Cordy, R. and J. Allen
1986 Archaeological investigations of the Agana and Fonte River basins, Guam. Report prepared for U.S. Army Engineer Division, Pacific Ocean, Ft. Shafter, HI. J. Stephen Athens, Ph.D., Archaeological Consultant, Honolulu.

Corte y Ruano Calderon, Felipe de la
1970 Descriptive and Historical Report on the Mariana Islands. Translation Courtesy of Mircronesian Area Research Center, Univ. of Guam, Mangilao.
Report of the Spanish governor of Guam from 1855-1866; discusses fishing on Guam.

Corwin, G., L.D. Bonham, M.J. Terman, and G.W. Viele
1957 Military geology of Pagan, Mariana Islands. Chief Engineer, U.S. Army Japan.
Provides geological and historical background on land and sea use in the Marianas.

Craib, J.L.
1986 Casas de los antiguos: Social differentiation in protohistoric Chamorro society, Mariana Islands. Unpub. Master's thesis, Univ. of Sydney.

Crozet, Captain
1891 (1783) Crozet's voyage to Tasmania, New Zealand, the Ladrone Islands, and the Philippines in the Years 1771-1772. Translated by H. Ling Roth. Truslove and Shirley, London.
The account of a French expedition that stopped on Guam in 1772. Contains the last description of the Chamorro *proa*.

Dampier, William
1937 A New Voyage Round the World. Adam and Charles Black, London.
(1906) Account of a seaman aboard a British privateer that stopped on Guam in 1686. Describes the Chamorro *proa*.

DeNiro, M.J.
1985 Postmortem preservation and alteration of in vivo bone collagen isotope ratios in relation to paleodietary reconstruction. Nature 317:806-809.
Discusses use of isotopic analysis on bone to infer diet.

Division of Aquatic and Wildlife Resources
(formerly Division of Fish and Wildlife)
1965- Annual Report. Department of Agriculture, Mangilao, Guam.
1988 Reports contain the results of the offshore fisheries surveys as well as other work done by the Division.

Division of Fish and Wildlife (Guam)
1960- Quarterly Progress Report. Department of Agriculture, Mangilao,
1965 Guam.
The reports of the early years of the Division.

Driver, Marjorie
1977 The Account of a Discalced Friar's Stay in the Islands of the Ladrones. Guam Recorder. 7:19-21.
An account based on a report by Fray Antonio de los Angeles concerning his stay in the Marianas 1596-97. Discusses fishing.

1983 Fray Juan Pobre de Zamora and His Account of the Mariana Islands. Journal of Pacific History 18(3):198-216.
Fray Juan Pobre's 1602 stay on Rota. Includes Sancho's discussion of fishing.

1988 Fray Juan Pobre de Zamora: Hitherto Unpublished Accounts of His Residence in the Mariana Islands. Journal of Pacific History 23(1):86-94.
Additional information on Juan Pobre's 1602 stay on Rota.

1989 Fray Juan Pobre in the Marianas, 1602. Micronesian Area Research Center, Univ. of Guam.
Combines into one booklet the translations first published in 1983 and 1988, cited above.

Dumont D'Urville, J.S.C.
1830- Voyage de la Corvette l'Astrolabe (1826-29). Paris.
33 Includes Dumont D'Urville's first visit to the Marianas in 1828.

Duperry, I.
1826 Voyage autour du monde, execute par ordre de roi, sur la corvette de Sa Majeste la Coquille, pendant les annees 1822, 1823, 1824 et 1825. (six vols., atlases). A. Bertrand, Paris.
European traveler to western Pacific, describes lifeways of indigenous peoples.

Eldredge, L.G.
1988 Case sudies of the impacts of introduced animal species on renewable resources in the U.S.-affiliated islands. In Barry C. Smith, ed., Topic reviews in insular resource development and management in the Pacific U.S.-affiliated islands. pp.118-146. Univ. of Guam Tech. Report 88.
Discussion of non-native plant and animal introduction into the Micronesian area.

Freycinet, Louis de
1824 Voyage autour du monde. Pillet Aine, Paris. (Unpublished translation by Sylvia Cheng, Micronesian Area Research Center, University of Guam, Mangilao.)
Contains a lengthy and detailed description of Chamorro fishing tools and techniques.

1943 Voyage autour du monde. Pillet Aine, Paris. Unedited translation, Yale University Human Relations Area Files, New Haven. This translation contains an error in the quantity of the ***atchoman*** catch.

Fritz, G.
1986 The Chamorro: A history and ethnography of the Marianas. Translated by Elfriede Craddock. Edited by Scott Russell. Div. of Historic Preservation, Saipan.
Written by the District Officer of the German Marianas in the early 1900s. Discusses fishing and navigation.

Garcia, F.
1985 The life and martyrdom of the venerable Father Diego Luis de Sanvitores. Translated by Margaret Higgens. Nieves M. Flores Memorial Library, Agana.
A history of the early years of the Spanish-Chamorro Wars. Contains references to the harsh treatment of the Chamorros by the Spanish.

Gladwin, T.
1970 East is a big bird. Harvard Univ. Press, Cambridge.
Anthropological study of traditional canoe navigation among the Puluwatese (Central Carolines).

Gosline, W.A. and V.E. Brock
1960 Handbook of the Hawaiian fishes. Univ. of Hawaii Press, Honolulu.
Catalog of fishes, cited in Davidson and Leach 1988.

Guam Coastal Management Program
1989 "Impact of drift gill-nets on marine resources," Man, land and sea, News of Guam and her ocean environment 1(5).

Haddon, A.C. and J. Hornell
1975 Canoes of Oceania. Bishop Museum Press, Honolulu.
Includes descriptions of the Chamorro ***proa***.

Hamm, D.C., M.M.C. Quach, R. Tokunaga, and G.W. Davis
1989a Annual report for the 1988 pelagic fisheries of the territory of Guam. In draft of Second annual report for the fishery management plan for the pelagic fisheries of the western Pacific region covering 1988 and earlier years. pp.45-87. Prepared for Western Pacific Regional Fishery Management Council, Honolulu.
Reports on status of the pelagic fisheries in Guam; shows present participation in these fisheries.

Hamm, D.C., M.M.C. Quach, and G.W. Davis
1989b Annual report of the 1988 bottomfish fishery of the territory of Guam. Appendix 4 in draft of 1988 annual report: Bottomfish and seamount groundfish fisheries of the western Pacific region. Prepared for Western Pacific Regional Fishery Management Council, Honolulu.
Reports on status of bottomfish fishery in Guam; shows present participation in this fishery.

Hanson, D.B.
1989 Skeletal biology of prehistoric human mortuary remains from the Duty Free Site, Garapan Village, Saipan. Unpublished report prepared for the Duty Free Shoppers, Ltd., Saipan, and the CNMI Historic Preservation Office.
Chemical isotopic analyses of human bones from Rota for information on prehistoric diet.

Hezel, F.X.
1983 First taint of civilization. Univ. of Hawaii Press, Honolulu.
Includes extensive bibliography and description of early encounters between native peoples of the Carolines and Europeans.

1986 Unpublished ms., files of the authors.
A early history of the Catholic Church in the Northern Mariana Islands; contains details on population size and economic activities of native peoples.

Hijikata, H.
1941 Fishing methods of Satawal Island. Jap. Jour. Anthrop. 56(6):310-326.
Details fishing techniques by Satawalese (Carolinians), including pelagic fishing.

Hornbostel, H. G.
1921-24 Unpublished field notes deposited with the Bernice P. Bishop Museum, Honolulu.
Includes photographs, drawings, maps, and notebooks on Mariana Islands lifeways in 1920s.

Johannes, R.E.
1988 The role of marine resource tenure systems (TURFs) in sustainable nearshore marine reousrce development and management in U.S.-affiliated tropical Pacific islands. In (B.D. Smith, ed.) Topic reviews in insular resource development and management in the Pacific U.S.-affiliated islands. Univ. of Guam Marine Laboratory Tech. Rpt. 88, pp.1-28.
Author concludes that Mariana Islands traditional culture no longer intact enough to use as a basis for limited entry.

Kasaoka, L.D.
1989 Summary of small boat economic surveys from American Samoa, Guam and the Northern Mariana Islands. Southwest Fisheries Center Administrative Report H-89- .
Includes ethnic background of present day fishermen.

Knudson, K.E.
1987 Non-commercial production and distribution in the Guam fishery. Contract WPC-0983, Western Pacific Regional Fishery Management Council, Honolulu.
Includes a brief history of fishing and gives details on local participation in Guam's fishery.

Kotzebue, O. von
1821 A voyage of discovery into the South Sea and Beering's Straits...in the Years 1815-1818. 3 vols. Longman and Brown, London.
Some description of early 19th century native lifeways in the Caroline Islands.

Kurashina, H.
1987 Results of an interdisciplinary research project at Tarague, Guam. Paper presented at the Micronesian Archaeological Conference, Sept. 9-12, 1987.
Contains the statement that pelagic fishing evidence was found throughout the prehistoric sequence at Tarague.

Lessa, W.A.
1975 Drake's Island of Thieves. Univ. Press of Hawaii, Honolulu.
Extensive bibliography of early European explorations in western Pacific.

Lewis, D.
1972 We, the navigators. Australian National Univ. Press, Canberra.
Description and study of Carolinian navigation.

Lutke, F.
1835 Voyage autour du monde, execute par ordre de Sa Majeste l'emperieur Nicolas Ier, sur la corvette le Seniavine, dans les annees 1826, 1827, 1828, et 1829. Part 2: Partie Historique, 2 vols. Firmin Didot:Paris (reprinted by Da Capo/Amsterdam: N. Israel).
Scientific voyage into the Pacific, some description of Caroline Island native lifeways.

Marden, Luis
1986 "The First Landfall of Columbus." National Geographic. 170(5): 572-577.
Gives the length of English and Iberian sea leagues.

Meyer Resources, Inc.
1987 Report on resident fishing in the Hawaiian Islands. Developed for Natonal Marine Fisheries Service, Honolulu.
Economic study of fishing by native Hawaiians; provides methods for estimating "non-market value" of fisheries.

Moore, D.R.
1983 Measuring change in Marianas pottery: The sequence of pottery production at Tarague, Guam. Unpub. Master's thesis, Univ. of Guam.
Mentions the presence of pelagic fishing gear in prehistoric deposits on Guam.

Moore, D.R. and J.R. Amesbury
1989 Archaeological investigation of the Ylig Trench, Yona, Guam. Report prepared for Juan Tenorio and Associates and the Public Utilities Agency of Guam, Micronesian Archaeological Research Services, Guam.
Report of excavations which revealed bones of large pelagic fish in prehistoric cultural deposit on Guam.

Myers, Robert F.
1984 Pelagic fish feeding study. Aquatic and Wildlife Resources Division Annual Report--Fiscal Year 1984. Department of Agriculture, Mangilao, Guam.
Demonstrates that flying fish are the principal food of mahimahi.

Olive y Garcia, Francisco
1984 Mariana Islands: 1884-1887. Translated and annotated by Marjorie G. Driver, Micronesian Area Research Center, Univ. of Guam, Mangilao.
Section on fishing appears to be copied from de la Corte.

Pigafetta, Antonio
1969 Magellan's voyage: A narrative account of the first circumnavigation. Vol. I translated and edited by R. A. Skelton. Yale University Press, New Haven.
Describes the events of Magellan's "discovery" of the Marianas in 1521 and the Chamorros they encountered.

Ray, E.R.
1981 Material culture of prehistoric Tarague Beach, Guam. Unpub. Master's thesis, Arizona State Univ., Tempe.
Report on excavations at Tarague site in northern Guam including pelagic fishing gear.

Reinman, F.R.
1967 Fishing: An aspect of Oceanic economy: An archaeological approach. Fieldiana: Anthro. 56(2):102-208.
Reviews aboriginal fishing technologies in Oceania including the Mariana Islands.

1977 Archaeological survey and preliminary test excavations on the island of Guam, Mariana Islands, 1965-1966. Misc. Pub. No. 1, Micronesian Area Research Center, Univ. of Guam.
Reports findings including some pelagic fishing gear in prehistoric cultural deposits on Guam.

Rogers, Captain Woodes
1928 A cruising voyage round the world. Longmans, Green and Co., New York.
Describes the Chamorro *proa* in 1710.

Safford, W.E.
1905 Useful plants of the island of Guam. Contributions from the United States National Herbarium, Vol. 9. Smithsonian Institution, Washington, D.C.
Includes a discussion of fishing on Guam and a list of fishes with Chamorro names, scientific names, and descriptions.

1910 A year on the island of Guam: Extracts from the note-book of a naturalist on the island of Guam. Typescript copy of Safford's diary as published in the Guam Recorder from 1933-36.
Contains a description of fishing with *Barringtonia*.

Sakamoto, Richard K.
1989 Personal communication. Interview March 1989.
Interview identifies *achuman* as *Decapterus* and reveals where the fish is found around Guam.

Samples, K.C. and J.T. Sproul
n.d. Potential gains in fleet profitability from limiting entry into the Northwestern Hawaiian Island commercial lobster trap fishery. Southwest Fisheries Center Admin. Rpt.H-87-17C. Honolulu.

Schurz, W.L.
1939 The Manila galleon. E.P. Dutton and Co., New York.
A detailed history of the Manila galleon which stopped at Guam in the late 17th century.

Shutler, R.
1978 Radiocarbon dating and oceanic prehistory. Archaeol. and Phys. Anthro. in Oceania 13(2-3):215-228.
Gives dates of Mariana Islands prehistoric occupation.

Spoehr, A.
1957 Marianas prehistory: archaeological survey and excavations on Saipan, Tinian, and Rota. Fieldiana: Anthropology 48. Chicago Natural History Museum, Chicago.
Standard reference on Mariana Islands archaeology; contains some information on pelagic fishing gear found.

Thomas, S.D.
1987 The last navigator. Henry Holt and Company, New York.
Personal account of young man's learning from master Carolinian navigator.

Thompson, L.M.
1932 Archaeology of the Mariana Islands. Bernice P. Bishop Museum Bulletin 100, Kraus Reprint Co., New York.
Systematic presentation of many of the items in the Hornbostel ethnographic and archaeological collection made in the 1920s in Rota, Tinian, Saipan, and Guam.

1945 The native culture of the Mariana Islands. Bernice P. Bishop Museum Bulletin 185, Honolulu.
Gives details of the lifeways of the Mariana Islands Chamorros, mainly reconstructed from earlier observations; details on fishing.

Tinker, S.W.
1978 Fishes of Hawaii. Hawaiian Service, Honolulu.
Descriptive catalog of fishes, cited in Davidson and Leach 1988.

Topping, Donald M., Pedro M. Ogo, and Bernadita C. Dungca
1975 Chamorro-English Dictionary. University of Hawaii Press, Honolulu.
Used for translation.

Tracey, J.F., S.O. Schlanger, J.T. Stark, D.B. Doan, and H.G. May
1964 General Geology of Guam. Geological Survey Paper 403-A, Washington, D.C.
Provides general environmental background information on Mariana Islands relevant to conditions of offshore fishing.

Underwood, Jane H.
1973 Population history of Guam: Context of microevolution. Micronesica 9(1):11-44.
Discusses Chamorro and Carolinian population history reconstructed from old documents.

U.S. Dept. of Commerce (Bureau of the Census)
1983 1980 Census of Population. Vol. 1--Characteristics of the Population, Chapter B--General Population Characteristics, Part 54--Guam.
The 1980 census of Guam gives a breakdown of the population by age, sex, and locality, but not by race.

van der Merwe, N.J.
1982 Carbon isotopes, photosynthesis and archaeology. Amer. Scient. 70:596-606.
Discusses theoretical background and new analytical techniques for inferring prehistoric diet from archaeological materials.

Walker, P.L. and N.J. DeNiro
1986 Stable nitrogen and carbon isotope ratios in bone collagen as indices of prehistoric dietary dependence on marine and terrestrial resources in southern California. Amer. Jour. Phys. Anthro. 71:51-61.
Example of the application of a new analytical technique for bone to infer prehistoric diet.

WPRFMC
1988 Request for proposal, Native fishing rights in Guam and the Commonwealth of the Northern Mariana Islands. Western Pacific Fishery Management Council, Honolulu.
Provides basis for present study.

Woodside, D.H., M. Takata, and J.R. Woodworth
1959 An appraisal of the current situation and developmental potential for a program of fish and wildlife management on Guam. Division of Fish and Game, Board of Commissioners of Agriculture and Forestry, Territory of Hawaii.
Evaluation of fish and wildlife situation just prior to the official establishment of the Division of Fish and Wildlife.

Yawata, I.
1930 Fish-shaped fishhooks in Micronesia. Japan. Jour. Anthro. 45(4):151-163.
Translated ms, abstracted In Abstracts of translated Japanese articles: Anthropological research in Micronesia under the Japanese Mandate, 1908-1945. Dept. of Anthro., B.P. Bishop Museum, Honolulu.
Gives comparative data collected in the pre-war period on Micronesian fishing lures.