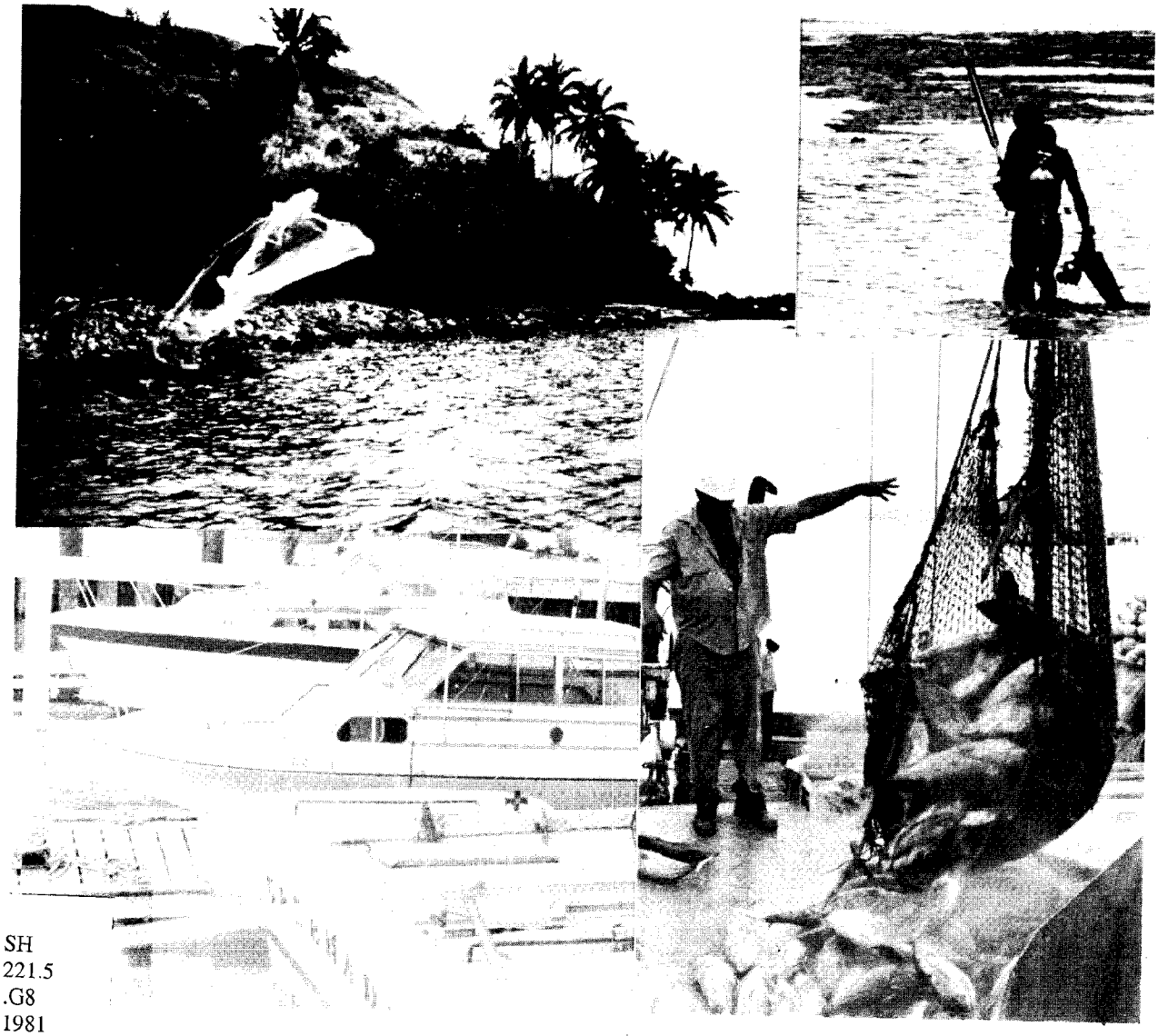
TERRITORY OF GUAM FISHERIES DEVELOPMENT AND MANAGEMENT PLAN



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Development Fishery Management Plan

October 1981

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TERRITORY OF GUAM

FISHERIES DEVELOPMENT AND MANAGEMENT PLAN

Prepared By

Steven S. Amesbury and Paul Callaghan

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MAY 1981

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PAUL M. CALVO
GOVERNOR

Territory of Guam
OFFICE OF THE GOVERNOR
AGANA, GUAM 96910
U.S.A.

MESSAGE FROM GOVERNOR PAUL M. CALVO

A major goal of my Administration has been to encourage economic growth within the private sector of the Territory, taking Guam's unique social and cultural traditions into consideration, along with its geographical location within the Mariana's Archipelago.

Fisheries development has been identified as one of this Administration's economic priorities. However, if the Territory is to realize the greatest benefits from the development of its living marine resources, a rational approach to their development and management must be adhered to; and the opportunities for participation in the fishing industry must be open to all sectors of Guam's population.

For this reason, I am giving my full endorsement to the Territory of Guam Fisheries Development and Management Plan as an element of the Guam Comprehensive Development Plan. The Fisheries Plan provides for the orderly development of Guam's limited fisheries resource base within a framework that does not go beyond the resources and capability of the Territorial Government.

Realization of both the immediate and long-range goals of the Plan will require cooperation and effort on the part of both Territorial and Federal agencies, as well as the emerging commercial fishing industry. I am confident, however, that the goals set forth in the Plan are attainable and in the best interests of the Territory of Guam.

PAUL M. CALVO

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PREFACE

Under Executive Order 79-6, Governor Paul M. Calvo established the Guam Marine Fisheries Advisory Council (GMFAC) and charged it with the responsi-bility of preparing a Fishery Development and Management Plan for the Territory. This plan will ultimately be integrated into the Comprehensive Economic Development Plan, currently being prepared under the auspices of the Guam Department of Commerce. The Fishery Development and Management Plan will also become an integral part of efforts by the Pacific Basin Development Council (PBDC) to develop fisheries in the U. S. Pacific Islands. Funds are presently being earmarked by the Department of Commerce, NOAA, and NMFS to enable PBDC to incorporate the fisheries development plans of all island members into an Overall Pacific Fishery Development Plan.

The aims of the Territorial Fishery Development and Management Plan are to address the problems of development and management of fishery resources in the waters around Guam and to recommend implementation programs which are appropriate to the social and economic resources of the Territory. Attention is paid to fishery developments involving the utilization of Guam as a fishing base for foreign and U. S. mainland fishery industries, but, recognizing that the major decisions regarding such developments will be made by interests outside of Guam, the primary emphasis of the Plan has been on development programs which the Territory itself can implement and manage.

In preparing this plan we have tried to achieve the goals set out in the Statement of Principle adopted by the Guam Marine Fisheries Advisory Council on August 15, 1979;

> "The Territory of Guam, by virtue of its geographical location, its environmental richness, its social and cultural heritage, its level of economic development, and its business, labor, technical, and educational resources, has the potential for the development of a diverse, broad-based, and economically productive fishery industry.
>
> "For the Territory to realize the greatest benefits from the development of its fishery resources, it is essential that opportunities for participation in the fishery industry be open to all sectors of Guam's population. This broad participation can best be achieved by the encouragement of sound, balanced development among various scales of fishery endeavors:
>
> (1) small-scale subsistence, artisanal, and recreational fisheries,
>
> (2) medium-scale, locally-based commerical fisheries, and
>
> (3) large-scale industrial fisheries involving considerable capital investments.

"In formulating its Fishery Development and Management Plan, the Guam Marine Fisheries Advisory Council will be guided by this principle of balanced development to assure the citizens of Guam abundant opportunities of participation in Guam's fishery industry."

The realization of this Plan will require a coordinated effort by the Government of Guam and the private sector. The Guam Marine Fisheries Advisory Council, constituted as it is of representatives of the principal fishery-related agencies and organizations on island, and open to public input, can be effective in overseeing the implementation of the Plan and in ensuring that fishery development on Guam provides the greatest possible benefits to the people of Guam.

The Plan calls for a significant commitment of time, money, and resources. We feel that this commitment is amply justified by the potential benefits to the people of the Territory, both present and future, that can be realized through the proper development and management of Guam's fishery resources.

STEVEN S. AMESBURY

PAUL CALLAGHAN
University of Guam

ACKNOWLEDGEMENTS

The authors of the Territory of Guam Fisheries Development and Management Plan owe a debt of gratitude to many people who made the preparation of this plan possible.

We wish first to thank Mrs. Betty Guerrero, Director of the Bureau of Planning, who made funds available, through the Guam Coastal Management Program, for the preparation of this plan. Mr. Harry Kami, Chief of the Division of Aquatic and Wildlife Resources, Department of Agriculture, administered the funds and was very supportive in many ways. We wish also to thank the University of Guam Marine Laboratory for its support in the drafting of the plan. All of the members of the Guam Marine Fisheries Advisory Council contributed ideas to this plan and supported its preparation. We would like specifically to thank Mr. John Eads, President of the Guam Fishermen's Cooperative Association, for his input; many of the ideas in this plan originated with him. Mr. Patrick McMakin prepared much background material on fisheries development on Guam which was of great value in the final plan preparation. The numerous preliminary drafts of the plan were typed by Mrs. Teresita Balajadia, Mrs. Elaine Faria, and Miss Cathy Sablan. The final draft was typed by Mrs. Janet C. Blas and Mrs. Barbara C. Purugganan.

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CHAPTER I

THE TERRITORY OF GUAM

The Marianas Archipelago forms a 700-mile long chain consisting of 14 major islands having a combined land area of 370 square miles and a population of less than 150,000 (see figure 1-1). The Territory of Guam, lying at 13.27 N latitude, is the southern-most, largest, and most populous island in the group. From Guam, the Marianas chain stretches northward between the longitudes of 144.40 E and 146.04 E to the island of Farallon de Pajaros at 20.33 N latitude.

The Marianas are divided into two political entities - the U. S. Commonwealth of the Northern Mariana Islands (CNMI) and the U. S. Territory of Guam. The southern-most island of CNMI, Rota, lies only 40 miles north of Guam. There is scheduled air service between the islands of Guam, Rota, Tinian, and Saipan. Inter-island trading or fishing vessels provide sporadic service between these islands and Anatahan, Sarigan, Alamagan, Pagan, and Agrihan. The islands of Guam and Saipan are linked by telephone and telex to overseas communication networks. Guam is serviced by several international airlines on a daily basis (Guam Growth Council, 1980).

The Territory of Guam is located 1550 miles south-southeast of Tokyo, 1600 miles east of Manila, and 3700 miles west-southwest of Honolulu (see figure 1-2). The island is approximately 30 miles long and 4 to 8.5 miles wide, having an estimated land area of 214 square miles (see figure 1-3). The northern portion consists of a limestone plateau rising to an elevation of 850 feet and containing a freshwater lens which provides the island's major source of fresh water. The southern region is of volcanic origin with several rivers, protected bays, a lagoon, and highlands rising to 1300 feet. Apra Harbor, located on the western side of the island, serves both military and commercial activity and is considered one of the best natural harbors in the Western Pacific (Guam Growth Council, 1980).

Guam's climate is tropical with an average temperature of 81° Fahrenheit. Rainfall averages 85 inches a year with 75 percent of the rain falling between the months of June and December (see Table 1-1). Easterly trade winds predominate throughout most of the year and are generally strongest during the period from December to May. During these times small boat fishing is often restricted to nearshore areas on the lee (west) side of the island. The east side of Guam and the offshore bank areas are most accessible to small boats during the summer months, although it is during the summer and fall that tropical storms and typhoons are most likely to occur (see Table 1-1). Weather conditions are an important determinant of local fishing activities on Guam; small-boat fishing effort during any particular month is more influenced by weather than it is by resource availability.

Centuries of immigration have resulted in a cosmopolitan ethnic and cultural mixture among Guam's approximately 105,000 population. Most recent estimates indicate an ethnic composition of the resident civilian population as follows: 62 percent Chamorro, 21 percent Filipino, 8 percent Caucasian, 3

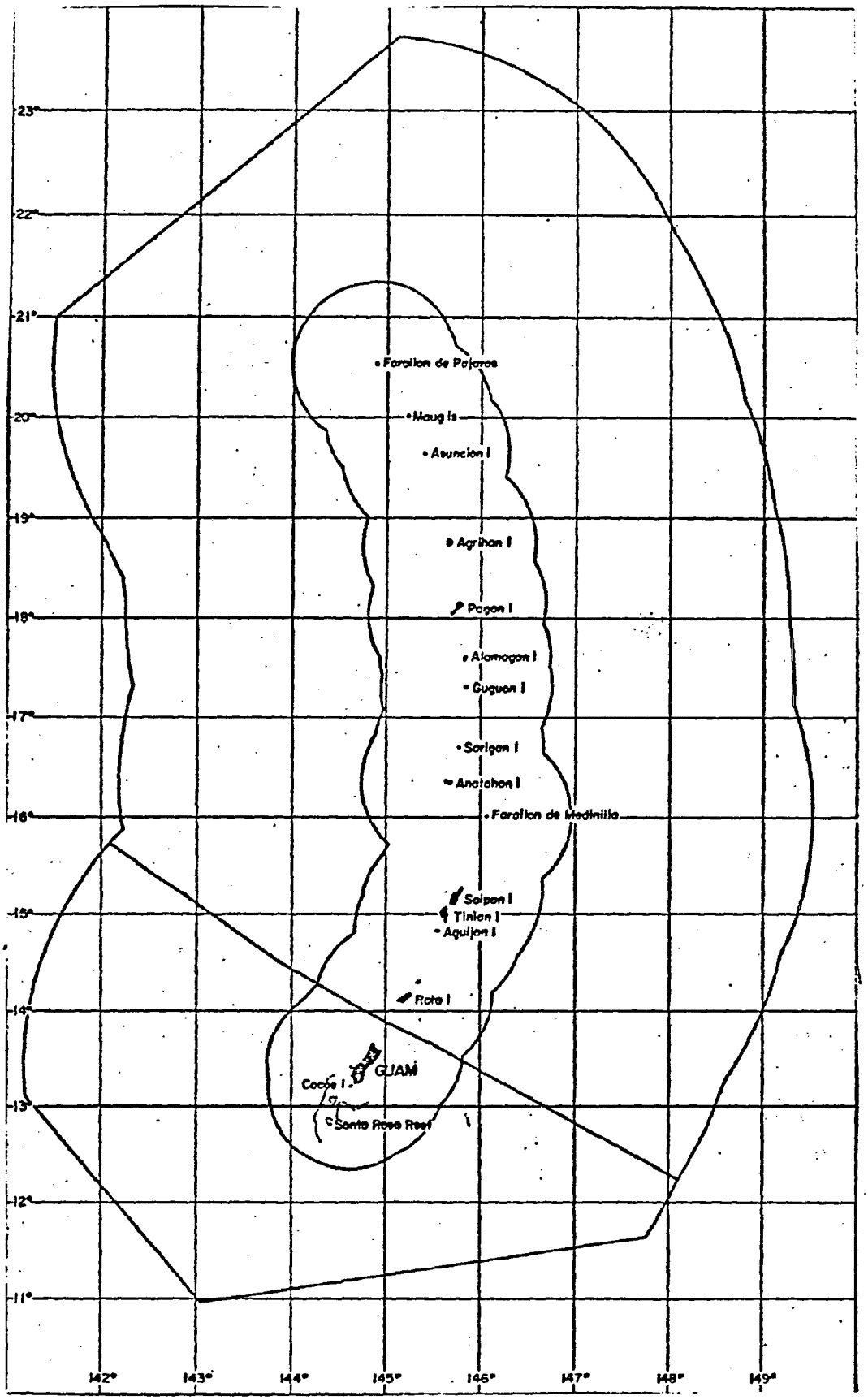


Figure 1-1. The 50-mile limits and the Fishery Conservation Zone around Guam and the Northern Mariana Islands.

1/ Continued on next page.

1/ Source: Marian Y.Y. Yong and Jerry A. Wetherall, Estimates of Catch and Effort by Foreign Tuna Longliners and Baitboats in the Fishery Conservation Zone of the Central and Western Pacific, 1965-77, Southwest Fisheries Center Administrative Report No. H-80-4 (Honolulu: Southwest Fisheries Center, 1980): Figure 4.

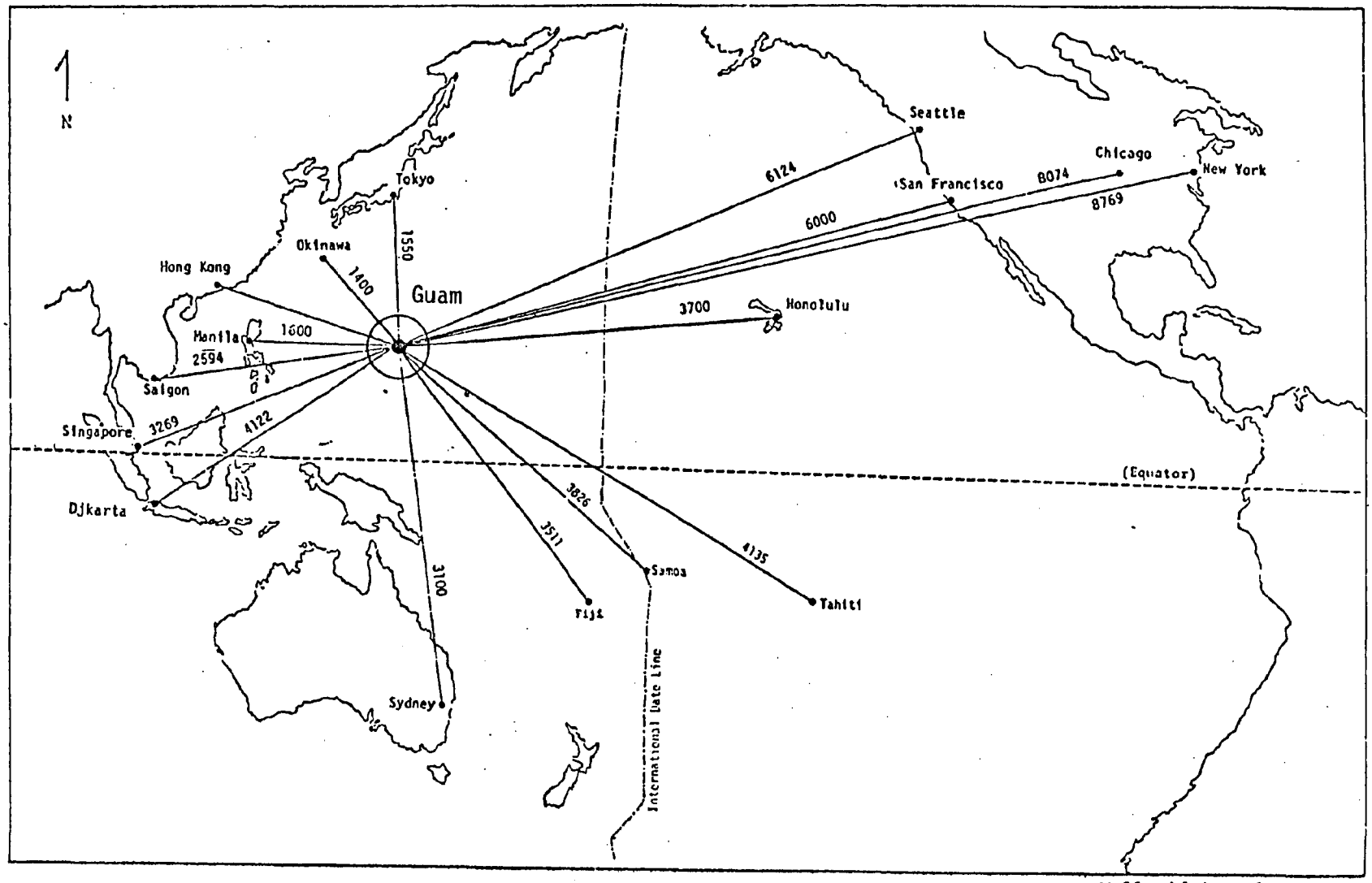


Figure 1-2. Guam and Pacific Rim Distances

Source: Guam Growth Council, Community/Business Profile: Territory of Guam, 1980

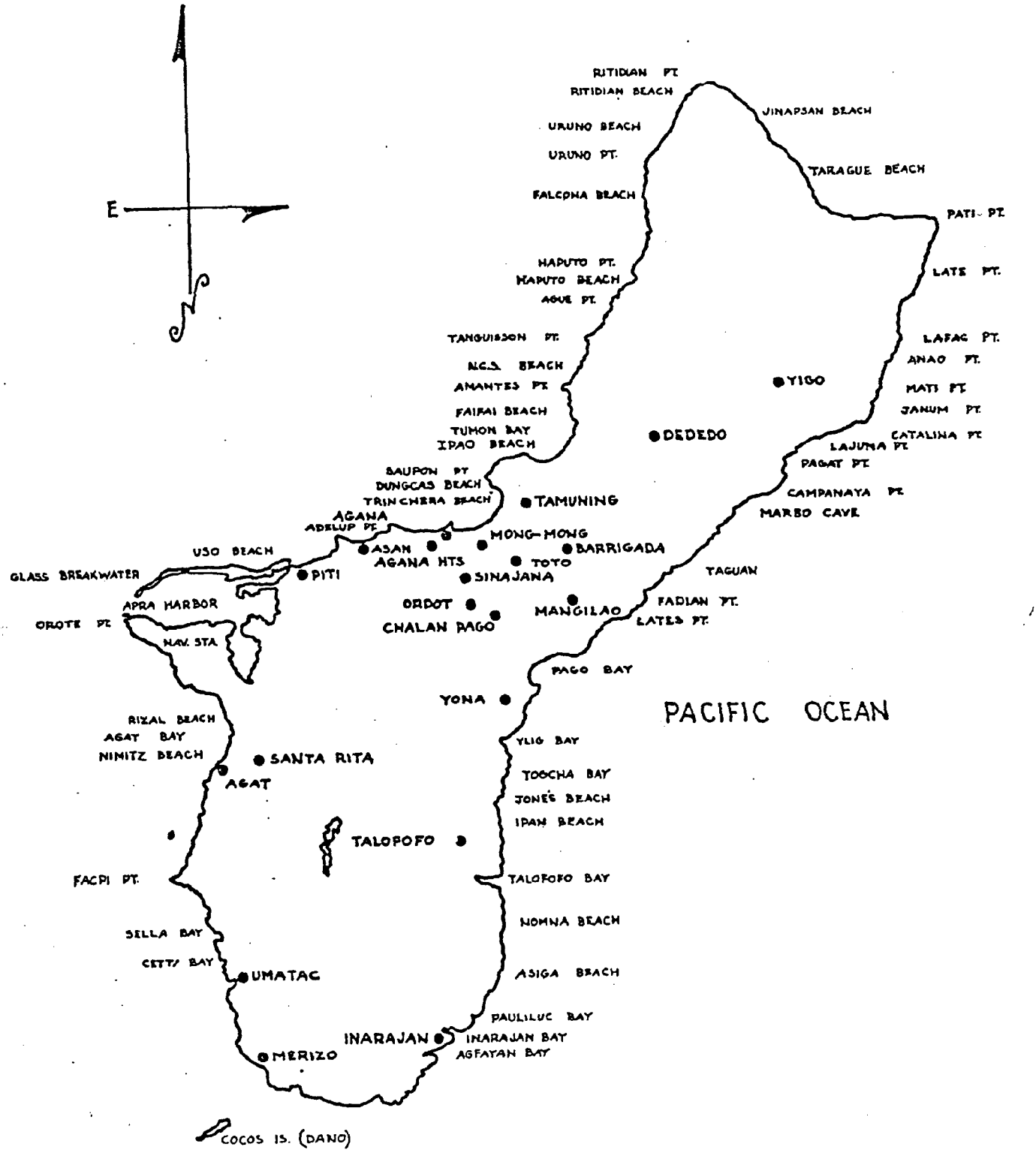


Figure 1-3. General Site Locator Map: Bays, Beaches, Points, and Other Coastal Features.

Source: Jane Jennision - Nolan, Guam: Changing Patterns of Coastal and Marine Exploitation, University of Guam Marine Laboratory, Technical Report No. 59, November 1979, figure 1-3.

percent Micronesian and the remainder a mixture of Japanese, Chinese, Korean, and other ethnic backgrounds (Guam Department of Commerce, 1979). Guam's population grew by 32 percent between 1970 and 1980; a significant portion of the growth was the result of immigration from the Philippines, other Asian countries, Micronesia, and the U. S. Almost half the island's population is 19 years of age or younger.

The civilian labor force is estimated at 35,000 with a current unemployment rate of approximately 7 percent. The civilian labor force does not include members of the armed forces, civilians living on military bases, nonimmigrant aliens, and persons under 16 years of age. In addition to the civilian labor force, there are from 3,000 to 5,000 nonimmigrant alien workers on temporary H-2 visas working primarily in the construction and agricultural sectors. In January 1980 payroll employment on Guam amounted to 33,000, of which 55 percent were adult males, 38 percent were adult females, and 7 percent were teenagers (Guam Department of Labor, 1980).

Table 1-2 presents a summary of employment by industry and provides some insight into the relative importance of various sectors of the economy. Note that the federal and local governments together employ 47 percent of all payroll employees. The relatively high employment in local government can be partially explained by the fact that the power, water, telephone, sewer services, garbage collection, some public construction and housing, the commercial port, hospital, air terminal, and educational institutions are run directly by the Territorial Government.

Private sector economic activity on Guam can be inferred from the following facts (Guam Growth Council, 1980): There are 31 firms which have payrolls larger than 100 employees. These firms are concentrated entirely in the construction, manufacturing, retail, service, and visitor industry sectors. There are 14 major hotels having a combined capacity of 2,514 rooms. The island has 5 radio and 3 television stations, 11 commercial banks, and 2 savings and loan institutions. There are several engineering and architectural firms, 85 members of the Guam Bar Association, and 75 practicing civilian physicians.

Guam became an unincorporated territory with the passage of the Organic Act by the U. S. Congress in 1950, and all citizens of Guam became citizens of the United States at that time. A Governor, Lieutenant Governor, and unicameral Legislature are locally elected. The judiciary consists of a Federal District and a Territorial Superior Court. Guam has a single elected representative in the U. S. House of Representatives who has committee and subcommittee voting power, but no vote on the floor. U. S. citizens of Guam cannot vote in U. S. presidential elections.

Table 1-3 provides a territorial government income and expense summary for the year 1978. The essential importance of federal financial aid to the island should be noted. Residents of Guam pay income taxes which are identical to federal income taxes paid by all U. S. citizens. The Territorial government is responsible for tax collection, and the proceeds remain in Guam. The U. S. Internal Revenue Service refunds to the Territory any taxes which it collects on earned income from the island.

Table 1-1
Monthly Average Weather Conditions on Guam

Month	Average[1] Temperature	Average[2] Rainfall	Average[3] Relative Humidity	Experienced[4] No. of Typhoons and Tropical Storms 1948-1975	Average[5] Windspeed and Direction
January	79.6	4.87	77	0 (1)	8.2 E
February	79.5	2.99	76	0 (1)	10.2 NE
March	80.0	2.79	77	0 (1)	9.0 E
April	80.9	3.62	77	3 (1)	8.9 E
May	81.3	5.61	78	2 (2)	8.3 E
June	81.8	4.91	79	0 (3)	6.4 E
July	81.4	9.48	82	1 (5)	5.1 E
August	81.2	12.4	83	3 (5)	4.8 E
September	81.2	13.28	83	5 (5)	4.7 E
October	81.3	2.32	81	3 (16)	6.2 E
November	81.2	8.29	81	6 (10)	7.8 E
December	80.5	4.86	78	2 (1)	9.1 E

[1]degrees Fahrenheit

[2]inches

[3]percent

[4]These numbers represent the total number of typhoons (tropical storms in parentheses) which passed within 180 nautical miles of Guam from 1948 through 1975, aggregated by month of occurrence. Winds in excess of 75 miles per hour are considered typhoon force.

[5]Miles per hour; data from 1961-1964 and 1970-1971.

Sources: Guam Growth Council, Community/Business Profile, Territory of Guam January 1980: V-26; Fleet Weather Central/Joint Typhoon Warning Center, Tropical Cyclones Affecting Guam. FLEWEACEN Tech. Note JTWC 75-3; Environmental Data and Information Service, NOAA, Local Climatological Data, Annual Summary with Comparative Data, 1978, Guam, Pacific, U.S. Department of Commerce.

Table 1-2
Payroll Employment on Guam by Economic Sector, January 1980

Sector	Employment	Percent
Federal Government	6,700	20
Territorial Government	9,000	27
Private Sector	17,300	53
Public Administration	9,400	28
Services	8,800	27
Trade (Wholesale & Retail)	7,000	21
Transport and Public Utilities	2,700	8
Construction	2,600	8
Manufacturing	1,200	4
Finance, Insurance and Real Estate	1,200	4
Agriculture and Fisheries	100	-

Source: Guam Department of Labor, Bureau of Labor Statistics, Guam Employment-January 1980: p.3.

Table 1-3
Revenue and Expenditure Summary for the General Fund--Territorial Government of Guam.

Fiscal Year 1978
(In thousands of dollars)

Revenue Source	Amount	Percent of Revenue		Amount	Percent of Expenditures
Income Tax	60,554	45.3	Education	48,549	33.9
Gross Receipts Tax	25,824	19.3	General Government	23,305	16.3
Real Property Tax	1,799	1.3	Public Health	16,673	11.6
Other Taxes	3,110	2.3	Federal Grant Exp.	15,463	10.8
Other Local Revenue	2,945	2.2	Public Safety	12,111	8.4
Federal Grants	39,589	29.6	Capital Improvement	6,110	4.3
			Economic Development	3,619	2.5
			Other	17,460	12.2
Total Revenue	$143,821		Total Expenditures	$143,290	

Source: Guam Department of Commerce, Annual Economic Review, 1979: p. 10.

CHAPTER II

HISTORY OF FISHERIES ON GUAM

According to radiocarbon dating studies, the Mariana Islands, including Guam, were inhabited by 1327 BC. These original inhabitants were probably seafarers of Asian origin who, over generations, migrated through the Philippines, Western Caroline Islands and perhaps Japan, before arriving in the Marianas. These early settlers were undoubtedly joined by many subsequent migrations over the centuries before western contact. These travelers brought with them the technologies of rice cultivation, pottery making, fishing, and canoe building (Jennison-Nolan, 1979).

Since Guam is a high island with fertile soil and lush river valleys, pre-contact food production was primarily horticultural and gathering in nature. Finfish and other edible aquatic fauna provided the major source of animal protein. Canoe building and sailing had developed to a sophisticated level by the time of early Spanish contact. Large voyaging canoes allowed trade, commerce, and fishing throughout the Marianas and probably into the Carolines. Precontact population estimates run as high as 100,000; thus, subsistance fishing and agricultural activity provided adequate food supplies for a population not greatly different from today's.

Prehistoric and early contact information on fishing activities is very sparse; however, fishing methods were most likely quite similar to those used by other Micronesians inhabiting similar high islands. The size of hooks and other fishing gear found in archaeological sites indicates that Chamorros fished well beyond the reefs for large fish, both demersal and pelagic (Jennison-Nolan, 1979).

Ferdinand Magellan arrived in Guam in 1521 and was followed by Spanish colonization. As Spanish influence over the island increased during the 19th century, interisland trade was curtailed and the large ocean-going canoes fell into disuse; however, the population continued to fill protein needs by fishing in waters surrounding the island. The first recorded attempt to develop a commercial fishery in Guam was undertaken during the governorship of Villalobos which began in 1828. He attempted to encourage the production of tortoise shell, mother-of-pearl, and beche-de-mer (dried sea cucumber). Results of this effort are not known; however, there appears to be no evidence of lasting success (Jennison-Nolan, 1979).

Guam was ceded by Spain to the United States in 1898. The rest of the Marianas was sold to Germany and, in 1917, mandated to Japan by the League of Nations. By the outbreak of World War II the Japanese in the northern Marianas had increased commercial fishery production to an annual high of 8 million pounds (Orbach, 1980). With the exception of the Japanese occupation during World War II, Guam was administered for five decades by the U. S. Navy. Little or nothing was done during this time to develop commercial fishing. In 1950 the U. S. Congress passed the Organic Act which established an elected civilian government and transferred authority over the Island from the Navy to the Interior Department. The governor was appointed by

the Secretary of Interior until 1970 when amendment of the Organic Act allowed for a locally elected governor.

Under naval rule, Chamorro society became increasingly dependent on a monetary economy. By 1911, one-fourth of the employable Guamanian men worked for the Navy; however, extended family subsistance fishing activities were of major economic importance until well after World War II (Jennison-Nolan, 1979). Due to the lack of long-distance voyaging craft most fishing was done fairly near shore. Nets were used to catch manahac and atulai. Fish weirs were constructed in bays. Portable and permanent traps were used along the seaward reef slopes and within the lagoons. Throw nets were used to harvest small fish along the shallow reef and lagoon margins. Spearfishing was practiced by day and by night using torches made of coconut spathes. It is well-documented fact that divers from many Pacific islands can fish effectively at depths of 60 to 90 feet; there is no reason to believe that the Chamorros were any different. Use of hook and line fishing from small inshore canoes was probably quite prevalent. Such fishing was probably carried on in waters shallower than 300 feet. Several local plants were used to prepare a narcotic which could be used to stun fish in shallow tidepools (Jennison-Nolan, 1979).

During the pre-war period, few fish were sold on the monetary market except in Agana, the center of population. The continued importance of subsistance fishing is underscored by a government survey in 1941 which reported a conservative estimate of 200 outrigger canoes scattered in various locations around the island. "Mr. Jose Lizama Charfauros of Agat recalls an average of at least one canoe and usually more for every third household in the pre-war village of Agat where he has lived all of his seventy-eight years" (Jennison-Nolan, 1979). When the joint effort of several fisherman, families, or villages was needed for the harvest, catches were divided among the group in respect to the varying amounts of capital, labor, or perceived resource ownership contributed to the production effort. Such a share system persists even today for the harvest of atulai (Trachurops crumenopthalmus) and manahac (Siganus spinus). The catch was divided among the extended family and provided a supplement to whatever monetary income existed within the group. Fish was also bartered and used to repay obligations and fulfill family or community obligations during funerals, marriages, and fiestas.

As Guam has been forced more and more into a monetary economy, a greater proportion of the fish harvest has been entering commercial markets. Although subsistance fishing is not as prevalent in Guam as it once was, it can be said with some certainty that the majority of fish caught by local fisherman does not enter the monetary market. The funerals, marriages, christenings, and fiestas still exist much as they have for hundreds of years. For large segments of the population, fishing still provides supplementary income, family nutrition, recreation, and "an integral part of family and community life and reinforcement of cultural traditions" (Orbach, 1980).

CHAPTER III

CURRENT FISHERIES ACTIVITY ON GUAM

A. The Socio-Economic Importance of Fisheries

The importance of fishery commerce to the economy of Guam cannot be judged on the basis of its contribution to gross island product or employment. In the first place, gross island product statistics are not currently maintained by the government. Gross receipt information is available on an annual basis; however, the broad categories used do not allow separation of transactions associated solely with fishery commerce. In the second place, employment statistics are not kept in fine enough detail to allow summary of employment associated with harvest, wholesale, and retail fishery commerce. Thirdly, there are no comprehensive data on commercial fish landings or sales. Finally, even if the above information did exist, it would provide a gross understatement of the socio-economic impact of subsistence, recreational, and part-time commercial catches which do not enter monetary markets.

Given the lack of sufficient hard data, the importance of fisheries must be judged subjectively on the basis of the few existing studies, evidence from similar island economies, and the opinions of knowledgeable informants.

In Guam, the mean family money income for 1977 was estimated at $16,405 (DOC GUAM, 1979). If we assume an average annual tax rate of 11 percent, the average family disposable income becomes $14,621. Average annual household spending on fishery products was estimated for the same year at $586 (Callaghan, 1977). Dividing this number by the disposable income indicates that the average household spends 4 percent of its disposable income on fishery products. By comparison, in the United States during 1977, fish consumption as a percentage of disposable personal income was estimated at .79 percent (Perm and Crews, 1979).

In a survey of 127 fish-consuming households (Jennison-Nolan, 1979), 49 indicated that at least one member goes fishing. These 49 households contained 103 fishermen ranging in age from 10 to 64 years, 80 percent of whom indicated that they spent at least one day a week fishing. None of the respondents considered themselves a commercial fisherman, yet reported catches by the 46 households averaged 72 pounds and ranged from 2 to 1000 pounds per month. Most fishing activities were shoreside or near-shore oriented. Although none of the fishermen respondants owned a boat, many of them had access to boats owned by others.

Aerial surveys carried out by the Guam Division of Aquatic and Wildlife Resources further serve to underline the importance of small scale recreational and subsistence fishing on Guam (Division of Aquatic & Wildlife Resources, 1979). During FY 1979, 21 survey flights were made in a small, fixed wing aircraft following a prescribed course around the perimeter of the island. These flights were conducted on 10 weekends and 11 weekdays, and averaged 1.5 hours in duration during late morning and early afternoon. They resulted in the sighting of 858 inshore fishermen and 228 offshore fishermen in 195 boats. The sighting of 858 probably reflects a minimum of activity since subsistence and recreational fishing is concentrated on weekends and oriented to prevailing tidal conditions.

It is currently difficult to determine the number and type of fishing vessels on Guam. Registration of vessels is carried out by the Department of Public Safety. Section 8995.3 of the Guam Code requires registration and numbering every three years. There is no system set up to retire registered vessels that have subsequently been sunk, abandoned, or destroyed. If a vessel is not re-registered after three years, the registration number is supposed to be available for reassignment; however the current practice is to wait 1 to 2 years before reassigning a number. A further complication arises from the fact that vessels documented under federal law are not required to apply for registration and numbering by local authorities. Therefore, simply reviewing the registration files will not provide accurate information on number and type of active vessels. There are presently some 1001 vessels listed in the registration files at the Department of Public Safety (Planning Information Section, Bureau of Planning, 1979, unpublished). Most recent estimates by the Department of Public Safety indicate that of the 1001 registered vessels, 349 are inoperable or sunk, 50 are sailboats, and the remaining vessels are operational craft used in subsistence, recreational, or commercial activities (Guam Department of Commerce, 1980 unpublished).

Currently on Guam there are 4 major sporting goods dealers specializing in diving and fishing gear and 6 major boat and boating supply firms. Based on brief owner interviews, retail sales of diving and fishing gear are estimated at $900,000 annually, and sales of boats and boating supplies are estimated at over $1,150,000 annually.

In a study of 386 non-charter recreational-commercial vessels based in Kailau-Kona, Hawaii, the net recreational-commercial benefits were estimated at $1,117,000 per annum. These benefits average $2,894 per vessel (Western Pacific Regional Fishery Management Council, 1979). Extrapolating to Guam without adjusting for differences in fish prices, factor costs, catch rates, or effort, and making the conservative assumption of a 400-vessel fleet, the net recreational-commercial benefits of such fishing in Guam are estimated at over $1,157,000.

Table 3-1 presents recent estimates of the type, value, and number of full-time commercial fishing vessels on Guam. These estimates were made by the Guam Fishermen's Cooperative Association and represent the best available data. Most of these vessels are constructed of fiberglass by major U. S. companies. There are currently no steel hulls being used in the domestic fishery. Most boats have limited overnight accommodations; vessels over 25 feet are primarily moored, while the majority of the rest are trailered. About 90 percent of the larger vessels (over 25 feet) have VHF radio and approximately 70% of the smaller boats carry CB radios. Recording depth sounders are found on all vessels over 25 feet and on about one third of the smaller boats.

Most of the fishing vessels listed in Table 3-1 are master-owned by local residents who have owned a series of progressively larger boats. The smaller boats carry crews of one or two. Up to four fishermen are employed on the largest vessels. Surface trolling and bottom fishing with electric or hydraulic reels are the primary techniques employed. Three vessels engage in some longlining and deep trapping and two vessels regularly engage in night fishing.

Table 3-1
Estimated Number, Type, and Value of Full-Time Commercial Fishing Vessels on Guam - 1979*

Estimated Number	Type	Estimated Dollar Value Per Unit
8	gasoline outboard 18-21'	11,000
4	gasoline inboard 18-21'	20,000
5	gasoline inboard 21-24'	21,000
3	gasoline inboard 24-36'	35,000
5	diesel inboards 20-25'	35,000
5	diesel inboards 30-42'	50,000

*The above listing does not include boats used in part-time commercial, subsistence, and recreational fishing, but does include charter vessels used to fish commercially when no charters are available.

Source: John Eads, Guam Fishermen's Cooperative Association (unpublished interview)

B. Market Structure and Distribution

A diagrammatic model of Guam's seafood marketing and distribution system appears in Figure 3-1. Sources of seafood products can be divided into three general categories: local-caught landings, imports, and foreign-caught landings. The latter category refers to landings of tuna and "incidental catch" by foreign and U. S. vessels, not based in Guam, but calling at Guam Commercial Port. The category of imports refers to fresh, frozen, packaged, or canned seafood products which arrive on the island via scheduled surface or air carriers. The category of local-caught landings refers to fish caught by locally-based subsistence, recreational, or commercial fishermen within the FCZ around Guam.

The ultimate users of seafood products are categorized as local households or visitors. The visitor category is served by commercial hotels and restaurants. Many households also consume seafood products by eating at local restaurants or through federal (school lunch) programs or military exchanges and restaurants. Exports of seafood products are omitted from Figure 3-1 for the sake of simplicity. They are relatively insignificant and will be discussed further in section C of this chapter.

Transaction modes occurring along the various distribution channels of Figure 3-1 can be classified as monetary exchange, barter exchange, or reciprocal exchange. Monetary transactions refer to the exchange of fish products for money. Barter refers to the exchange of fish products for other goods and services. Reciprocity refers to friendly gifts or transfers within the extended family or village in order to fulfill social responsibilities and cultural obligations.

Intermediary organizations which import, store, process, and distribute seafood products are grouped into two general categories in Figure 3-1: wholesale and retail. These categories have considerable overlap since many enterprises operate on wholesale and retail levels simultaneously.

C. Use of Fishery Products

Household Consumption

There is no time-series information on consumption patterns of commonly caught fish in Guam. The only published evidence on this topic comes from two cross-sectional studies, both done in 1977. The first is based on a random survey of 1054 households, stratified by village population (Callaghan, 1977). The second is based on a smaller sample of 127 fish-consuming households (Jennison-Nolan, 1979). Although these two studies are not strictly comparable, they appear to support the general conclusions presented below.

At least 90 percent of the households surveyed indicated that they eat fish products. Consumption frequency of fish and seafood products averages between 6 and 8 meals per month, but frequencies vary widely between households and ethnic groups. At least 34 percent of the households would like to eat fish more often than they presently do, and 81 percent indicated a preference for fresh fish over canned, frozen, dried, or smoked. Fish under 7 inches in length were preferred by 19 percent of the respondents. Some 60 percent

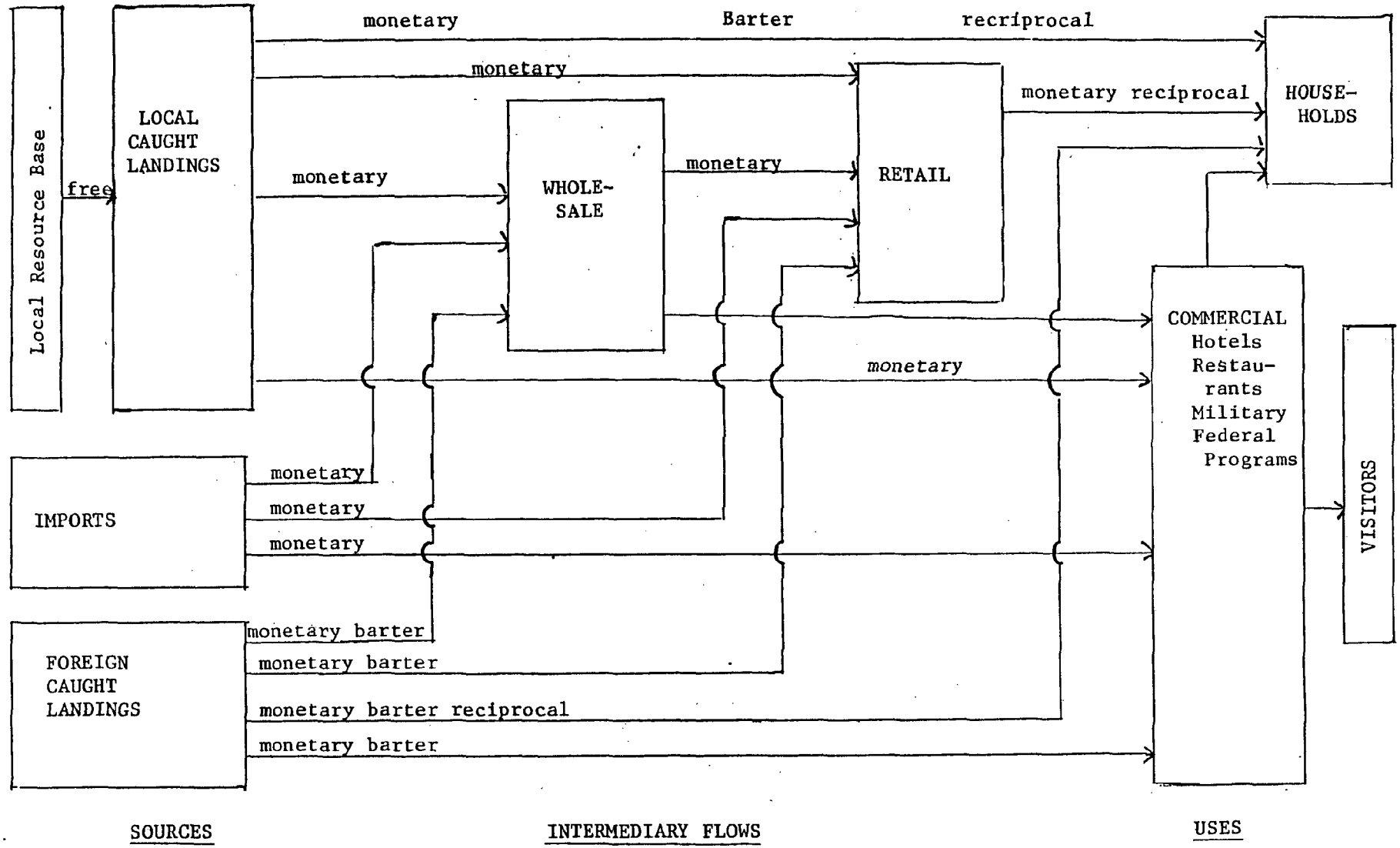


Figure 3-1. Distribution Channels for Transaction Modes for Seafood Products Marketed in Guam.

preferred fish between 7 and 14 inches in length, while 14 percent preferred larger fish, and the remainder expressed no preference.

Household spending on seafood products is estimated to average around $586 per year in Guam, with spending apportioned approximately 31 percent for canned, 26 percent for frozen, 36 percent for fresh, and 7 percent for dried and smoked products. The United States consumption of fish products amounted to $47.66 per capita in 1977 (Penn & Crews, 1979). If we assume an average household size of 5, Guam's per capita consumption amounts to $117.11 or almost 2.5 times the national average.

Table 3-2 presents estimated household spending patterns on fish products by ethnic group. It must be remembered that Table 3-2 is an under-estimate of total fish consumption since it does not include fish acquired through nonmonetary transaction. The study by Jennison-Nolan (1979) reported that only 45 percent of the respondants indicated that their fish products were entirely bought at the store. The importance of subsistence fishing and nonmonetary transfer is further supported by the fact that 44 percent of the fishermen indicated that they eat some of their catch and give some of it away (Jennison-Nolan, 1979). Hawaii's per capita utilization of fishery products is estimated for 1977 at 58.6 pounds (Hudgins, 1980). Whereas approximately 8 percent of the civilian resident population of Hawaii is foreign-born from Asian countries, over 20 percent of Guam's population was born in Asia. Given the fact that Asian countries have substantially higher rates of fish consumption than the United States, there is every reason to believe that Guam's per capita utilization of fishery products is even higher than that of Hawaii.

Commercial Consumption

Published data on the purchase of fishery products by hotels and restaurants on Guam is non-existent. One unpublished survey was done by students from the University of Guam during the Fall of 1979 (Callaghan, unpublished). The survey covered seven hotel and two non-hotel associated restaurants. These nine restaurants had a combined maximum seating capacity of 3,500, and the seven hotels represented 1,787 rooms out of a total island hotel room capacity of 2,514 (Guam Growth Council, 1980). Table 3-3 presents a summary of information collected in the survey; however, the results should be considered only rough estimates. There are 48 non-fast food restaurants listed in the telephone yellow pages. Much more work needs to be done in this area.

Exports

Guam has virtually no fishery exports (except for cultured eels). Although some small exports do appear in the official statistics (Guam, Department of Commerce, 1979), these items represent transshipments of seafood products through Guam. Little value, other than transfer and storage value, is added on the island. Most of these shipments are destined for the Northern Marianas or the Trust Territory. Between October 1978 and September 1979, $106,480 worth of seafood products were imported into the Northern Marianas from Guam (Orbach, 1980).

Table 3-2

Estimated Seafood Product Spending Patterns of Households on Guam by Ethnic Group.

Ethnic Group	Percent of Total Population*	Av. Annual Spending (Dollars)	Most Frequently Purchased Products Canned	Fresh	Frozen
Filipino	21.2	830	Sardines Tuna	Milkfish Shrimp	Milkfish Shrimp
Japanese	1.8	631	Tuna Sardines	Tuna Other	Shrimp Tuna
Guamanian	62.1	599	Sardines Tuna	Rabbitfish Mackerel	Mackerel Rabbitfish
Chinese	1.2	514	Sardines Tuna	Milkfish Shrimp	Other Tuna
Micronesian	3.4	451	Tuna Sardines	Other Tuna	Tuna Mackerel
Korean	1.6	349	Tuna Sardines	Other Shrimp	Other Tuna
Caucasian	8.1	226	Tuna Sardines	Snapper Other	Shrimp Processed

*As published by Guam Department of Commerce in 1979 Annual Economic Review

Source: Paul Callaghan, Some Factors Affecting Household Consumption of Seafood and Fish Products on Guam, Government of Guam, Bureau of Planning, Economic Planning Division Technical Report No. 77-3.

Table 3-3
Monthly Purchases of Fresh and Frozen Fishery Products by Nine Restaurants on Guam - As Determined by Oral Interview In 1979

Fishery Product	Monthly Purchase (in pounds)	Average Price Paid Per Pound (in dollars)	Estimated Monthly Expenditure (in dollars)
Tuna[1]	3,035	1.43	4,340
Shrimp[2]	1,940	6.39	12,397
Lobster[3]	1,625	7.64	12,415
Salmon[4]	200	3.27	654
Other Finfish[5]	1,230	1.76	2,164
Non-Finfish[4]	220	4.08	898
TOTAL	8,245		32,868

[1]Primarily yellowfin

[2]Frozen; preferred in 16-20/lb. or 26-30/lb. (headless)

[3]Frozen; preferred in the 8-10 oz. tail category

[4]Entirely imported

[5]Includes: lapu-lapu, mackerel, mahimahi, wahoo, parrotfish, onaga, rainbow runner, and blue marlin; preferred boneless fish over 20 lbs.

D. Source of Fishery Products

Imports

Consistent time-series data on fishery product imports is not available on Guam. The most recent and reliable information exists for the first nine months of 1979 (Guam Department of Commerce, unpublished), and is presented in Table 3-4. Based upon these data, the Guam Department of Commerce estimates 1979 imports at 4.5 - 5.0 million pounds with a declared value of $6,512,338. They further estimate 1979 imports of fresh, chilled or frozen fish at 2.5 million pounds having a declared value of $1,447,000. Ignoring beginning and ending inventories, these estimates imply a utilization rate for total imports in the realm of 39.2 pounds per capita, and a utilization rate for imported fresh, chilled and frozen fish of 20 pounds per capita.

Local Landings

The Division of Aquatic & Wildlife Resources conducts creel censuses on a random basis at various locations throughout the island (Division of Aquatic & Wildlife Resources, 1979). Estimates based on these surveys indicate that 35,536 people spent 190,642 hours harvesting 424,456 pounds of fish during FY 1979. Some 68 percent of this catch resulted from offshore trolling, bottomfishing and diving. The remaining 32 percent resulted from a variety of inshore activities including netting, diving, hook-and-line fishing, etc. These estimates represent local landings of about 3.4 pounds per capita.

Foreign-Caught Landings

Tuna fishing vessels from Japan, Korea, Taiwan and the United States frequently call at the Commercial Port of Guam. Since May 1974, over 60,000 metric tons of tuna has been transshipped through Guam to U. S. canneries in Hawaii, Los Angeles, San Diego, and Puerto Rico. A large number of foreign fishing vessels also call at the Port for fuel, provisions, and repair (Callaghan and Simmons, 1980).

As indicated in Figure 3-1, some fish from these vessels finds its way into the local market. The exact quantities are unknown. It is legal for tuna caught anywhere in the world to be landed for sale in Guam by vessels of any nation (see Section G of this Chapter). Fish other than tuna can be landed by foreign vessels only if caught outside the U. S. FCZ. American vessels may land any species for sale in the local market, no matter where it is harvested.

E. Transshipment, Provisioning and Repair

The Commercial Port of Guam is situated on 33 acres of land bordering the deep water, well-protected anchorage of Apra Harbor. The volume of general cargo processed through the Commercial Port increased by 69 precent between 1970 and 1978. During 1978, 827 vessels called at the Port, and over 744,000 metric tons of cargo was processed (Guam Department of Commerce, 1979). The facility has 2,725 feet of dock space and 1.5 million square feet of covered area. Dillingham Corporation, located nearby, provides modern repair facilities and a floating drydock capable of lifting vessels of 1,000 gross tons or up to 200 feet in length. The Port is served by

Table 3-4
Value of fish product imports to Guam by country of origin: January through December, 1979 (dollars)

Country	Fish Fresh, Chilled and Frozen		Fish Salted, Smoked and Dried		Shellfish Fresh & Frozen		Fish in Airtight Containers		Total Import	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
United States	241,291	8.7	57,333	16.1	553,134	19.4	518,703	34.1	1,370,461	21.0
Japan	567,079	20.3	247,070	69.5	290,727	10.2	908,399	59.8	2,013,275	30.9
HongKong & Taiwan	279,138	10.0	14,313	4.0	22,518	0.8	44,118	2.9	360,087	8.5
Philippines	1,419,414	50.9	23,554	6.6	934,555	32.8	46,838	3.1	2,424,361	37.2
Other Countries	281,210	10.1	13,466	3.8	47,878	1.7	1,600	0.1	344,154	5.3
TOTAL	2,788,132	42.8	355,736	5.5	2,848,812	43.7	1,519,658	23.3	6,512,338	100.0

Source: Guam Department of Commerce.

two east-west carriers--U. S. Lines and U. S. President Lines. A north-south link between Japan and Australia is provided by Daiwa Lines (Guam Growth Council, 1980).

Since May, 1974, over 60,000 metric tons of tuna have been transshipped by the Port. During 1978, transshipments have averaged 892 metric tons per month; however, there has been great variation in monthly activity. This variation does not appear to be related to normal seasonal patterns of tuna abundance around Guam (Callaghan and Simmons, 1980).

Tuna transshipments through Guam consist primarily of skipjack which is destined for United States canneries in Hawaii, Los Angeles, San Diego or Puerto Rico. Most tuna discharged at the Port is brought to Guam in either carrier vessels (reefers from Palau or Papua New Guinea) or purse seine vessels. Pole-and-line and longline vessels have seldom transshipped tuna through Guam. Aside from an occasional United States seiner, most fishing and carrier vessels are either foreign-built or fly foreign flags. Such vessels are permitted to unload fish in Guam under a Bureau of Customs regulation--Marine Circular No. 124 (1953).

During the period February through August, 1979, an intensive investigation of tuna transshipment activity was undertaken (Callaghan and Simmons, 1980). During this time 165 fishing and carrier vessels entered the Commercial Port. Vessels arriving for purposes other than transshipment or transfer of tuna accounted for 83 percent of the arrivals and represented cumulative deadweight tonnage of 26,000 metric tons. Non-transshipping vessels were largely of Japanese registry and called mainly for bunkerage, water, and supplies. The average length of stay was 2.9 days.

A total of 21 vessels transshipped 6190 metric tons of tuna during the sample period. Purse seiners represented 52 percent of all transshipping vessels. The remainder were carriers. Longline or pole-and-line vessels did not transship during the sample period.

The average transshipping vessel remained in port for 10.5 days and spent an average of $56,954 on a variety of private and public goods and services. These expenditures average $193 per metric ton, or $3,361 per container. The public sector (primarily the Commercial Port of Guam) received 8.5 percent of these expenditures while the private sector received 91.5 percent. It should be noted, however, that 75 percent of these expenditures were paid to shipping firms for outbound container freight charges and to oil companies for fuel. Expenditures in these two areas probably have very low multiplier effects within the Guam economy.

It was discovered that expenditures per vessel are directly related to the amount of tuna discharged as well as to the size and nationality of crews. Evidence indicates that under present conditions a 10 metric ton per month increase in transshipment will result in the creation of one additional man-day of stevedore employment.

During the discharge process, vessel crews work in the hold separating frozen tuna and loading them into nets or buckets which are lifted dockside and emptied into refrigerated containers. The containers are filled to an

average weight of 18 metric tons. Containerized tuna is then shipped out of Guam on scheduled commercial carriers.

Under present conditions, single-hold discharge operations result in an average discharge rate of 12.7 metric tons per hour. Discharge from two holds simultaneously results in an average discharge rate of 16.0 metric tons per hour. The official standard rate charged by the Port for stevedore services and demurrage is $6.00 per short ton. It is estimated that implementation of minor improvements in the existing discharge process can increase discharge rates above 20 metric tons per hour, while at the same time reducing port costs per ton of tuna transshipped.

E. Small Boat Infrastructure

There currently exist three locations on Guam at which small and medium size boats can be moored. These include Agana Boat Basin, Apra Harbor and Merizo Lagoon (see figure 1-3). The Agana Boat Basin is located on the northwest coast in the center of Agana Bay. It was constructed immediately after World War II from the rubble of the destroyed city of Agana. Access from the Philippine Sea is provided by a channel though the reef with a depth of approximately 15 feet and a width of 120 feet. Two inner basins contain 32 floating slips, and an outer basin provides a small anchorage for larger boats. Agana Boat Basin has a launching ramp but no fueling facilities or other infrastructure.

Merizo lagoon on the southern tip of Guam is a natural anchorage with no man-made breakwaters. The access channel has an eastward exposure, is several hundred feet wide, and ranges in depth from 80 feet at the mouth to 30 feet within the lagoon. Facilities at Merizo include a privately owned fuel pier, launching ramp, marine railway, and several private docks. Besides large commercial port and Navy facilities, Apra Harbor has a small launching ramp and deep water anchorage.

None of the harbors on Guam provide adequate storm protection. Should a major storm occur, small boats must be hauled out or crowded into a very small portion of the Piti Channel in Apra Harbor. With the exception of the fuel pier in Merizo, all vessel supplies (fuel, water, ice, etc.) must be trucked from downtown Agana to the fishing boats. Launching ramps at locations other than the three mentioned harbors are extremely inadequate or non-existant. Hauling-out facilities are available for vessels less than 50 feet in length at the marine railway in Merizo or by use of a rented crane using slings at Agana Boat Basin. Larger vessels must use the Dillingham facilities in Apra Harbor. All three harbors have inadequate dock space and only Agana Boat Basin has slipways. All vessels over 45 feet (including the entire sailboat fleet) are moored at anchor and serviced by dingy.

G. Impact of Federal Laws

The most important Federal laws impacting on fisheries development in Guam are the Shipping Act of 1916, the Merchant Marine Act of 1920, and the Fishery Conservation and Management Act of 1976. Also of importance are various rules, regulations, interpretations, and decisions made by agencies

of the Federal Government. Only the U. S. Congress can change public laws; however, the Secretaries of Commerce, Justice, Labor, Transportation, Treasury, Defense and State, as well as the Office of the President, are given certain administrative, regulatory, and enforcement powers which may impact the fisheries of Guam.

The Fishery Conservation and Management Act of 1976 (FCMA), Public Law 94-265, provides for the conservation and management, by the federal government, of all fishery resources within the U. S. Fishery Conservation Zone (FCZ). The Act also establishes eight Regional Fisheries Management Councils whose responsibility it is to develop Fishery Management Plans (FMP) controlling the harvest of resources within FCZ. Other purposes of the Act include encouragement of international agreements concerning highly migratory species, promotion of domestic commercial and recreational fishing, and development of fisheries for under-utilized species (Singh, 1979).

The FCZ around Guam extends from the seaward boundaries of the territorial sea (3 nautical miles) to 200 nautical miles from shore. The only species which are excluded from regulation under FCMA are tuna. This exclusion rests on the argument that tuna are highly migratory, and in the course of their life cycle, reproduce and migrate over great distances, moving into and out of the national waters of many nations.

Under the FCMA, the Department of State, in cooperation with the Department of Commerce, negotiates a Governing International Fishery Agreement (GIFA) with foreign nations wishing to fish within the U. S. FCZ. The GIFA is subject to Congressional review. Once a GIFA is in force, the foreign nation submits a vessel permit application for each vessel to the Department of State, which forwards it, along with recommendations, to the Assistant Administrator for Fisheries of the National Marine Fisheries Service (NMFS), an agency of the Department of Commerce. NMFS, after receiving input from the Regional Fishery Management Councils and consultation with the Department of State and the Coast Guard, may approve the permit application.

As previously mentioned, the Regional Fishery Management Councils have responsibility for preparation of FMP's which regulate both domestic and foreign harvest of fishery resources within the FCZ. These FMP's must be approved by the Secretary of Commerce and published in the Federal Register before taking affect. In the absence of an FMP, the Secretary of Commerce may prepare and implement a Preliminary Management Plan (PMP) which will remain in force until approval of an FMP.

With respect to the FCZ around Guam, there are currently in force one FMP for precious corals and one PMP for billfish. The U. S. Coast Guard and NMFS are charged with the responsibility of enforcing these plans. The Western Pacific Regional Fishery Management Council is currently in the process of preparing FMP's for billfish, spiny lobster, and bottomfish.

Under Public Law 95-354, the Secretary of Commerce may issue permits allowing U. S. fishermen to transfer catches at sea to foreign fishing or processing vessels. These transfer arrangements are referred to as "joint ventures." "Joint venture" permits can be issued only in the event that harvest capabilities of U. S. fishermen exceed the processing capabilities of U. S. processors for a particular species. A "joint venture" can be

negotiated only with a foreign nation. It cannot be negotiated between the U. S. Territories and a foreign nation nor between the U.S. and its territories or possessions (Singh, 1979).

Under the FCMA, only vessels which are documented under the laws of the United States, or registered under the laws of any state of the U. S., are allowed to fish in the FCZ. Foreign-built vessels cannot receive the necessary documentation or registration for use in the fishery. The only exception occurs under a Treasury Department ruling (T.D. 56382-6) which allows vessels under five net tons to be used by U. S. citizens and resident aliens to fish in U. S. waters.

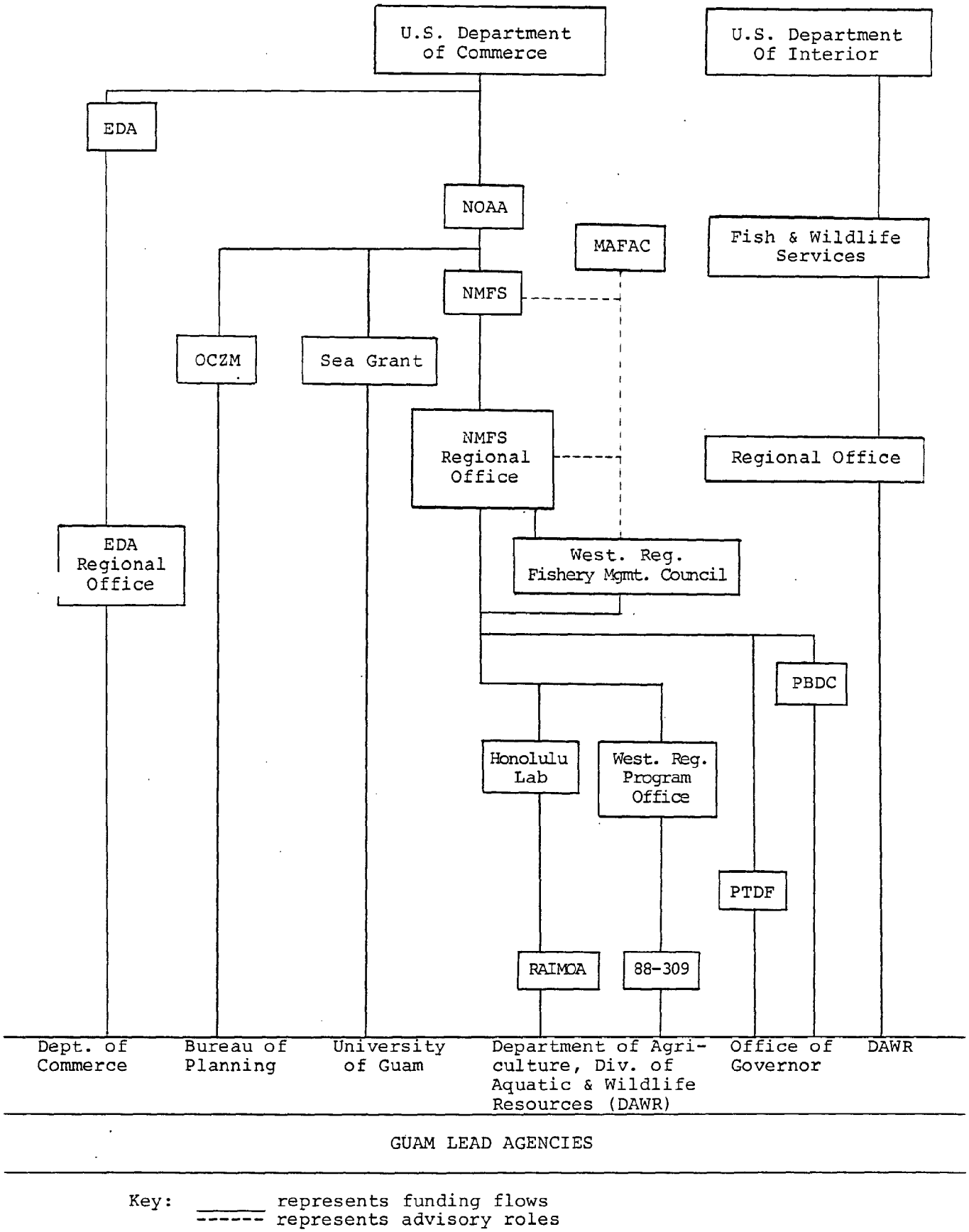
Section 11 of the Merchant Marine Act of 1920 (the Jones Act) states that "...vessels built within the United States and belonging wholly to citizens thereof; ...may be used for coastwise trade," i.e. commerce directly between two U. S. ports. In addition, Section 21 (a) of the Jones Act prohibits foreign flag vessels, except by special treaty, from landing "...in a port of the United States its catch of fish taken on board such vessels on the high seas or fish products processed therefrom, or any fish or fish products taken on board such vessels on the high seas from a vessel engaged in fishing operations or in processing of fish or fish products." Under U. S. Customs regulation (Marine Circular No. 124-1953) foreign-flag fishing vessels are allowed to land fish in Guam; however, Jones Act restrictions with respect to use of foreign built vessels still apply to citizens of Guam both for fisheries and coastwise trade.

In summary, the Federal government does not prohibit the landing of fish in Guam by foreign-built or-owned vessels, so long as the fish are harvested outside the 200 mile FCZ. The only exception is tuna, which can be harvested anywhere outside 3 miles and landed in Guam by foreign-built or-owned vessels. Citizens and residents of Guam may not use foreign-built fishing vessels over five net tons, and, as far as coastwise trade in fisheries is concerned, all vessels must be constructed and registered in the United States.

In addition to the above-mentioned laws, various departments and agencies of the Federal Government exert both enforcement and regulatory powers which directly or indirectly impact upon fisheries development in Guam. For example, the Department of Defense through the Coast Guard and Navy can, in the interest of national defense, limit access to Apra Harbor and control fishing practices which may interfere with military operations. The Department of Justice through the Immigration and Naturalization Service administers regulations which limit access to shore leave for foreign crews. The Department of Labor administers regulations regarding local employment of foreign fishermen for training programs. The Coast Guard enforces a complex of environmental and safety regulations, while the Army Corps of Engineers and the Department of Interior regulate the construction of port and docking facilities in coastal waters.

An in-depth analysis of Federal laws and regulations affecting fishery development and management in Guam is warranted. Where possible, this study should recommend procedures for seeking relief from laws and regulations detrimental to fisheries development and management in Guam.

The major sources of Federal funds for fisheries development and management, along with lead recipient agencies at the local level are presented in Figure 3-2. This diagram emphasizes the complexity of funding channels involved and points out the difficulty of coordination and planning at the Federal as well as local levels (see Harville, 1980). Every effort should be made to coordinate and consolidate Guam's fishery development efforts. The Guam Marine Fisheries Advisory Council established under Executive Order 79-6 provides a potential vehicle for local coordination provided that its activities are fully supported by the line agencies involved.



Key: _____ represents funding flows
------ represents advisory roles

Figure 3-2. Major Federal Funding Sources Relative to Fisheries Development and Management on Guam.

CHAPTER IV

GOALS AND OBJECTIVES FOR FISHERY DEVELOPMENT AND MANAGEMENT ON GUAM

A. Overall Territorial Development Goals and Objectives

Fishery management and development must be viewed within the context of overall island development strategies and priorities. These overall strategies and priorities for the Territory of Guam are spelled out in the Overall Economic Development Plan for Guam (Guam Department of Commerce, 1979a) which contains the following intermediate and long term development goals:

1. Increased employment in the private sector - reducing the importance of government employment while continuing to absorb the growing labor force

2. Strengthened Government of Guam revenue base - allowing reduced dependence on federal government capital improvement programs and improved stability of local government revenue flows

3. Increased per capita income - bringing Guam's standard of living more in line with that of the whole nation

4. Desensitization of the economy from military fluctuations - broadening the economic base in order to reduce the local impact of fluctuations in military spending

The Overall Plan also identifies priorities and strategies aimed at accomplishing the above-mentioned goals. Major priorities are:

1. Increased tourism - both in numbers and length of stay

2. Establishment of new industry in light manufacturing, transshipment, regional service and supply, and research and development

3. Development of commercial agricultural and fisheries

4. Implementation of a comprehensive manpower development strategy to train local professionals and skilled labor needed on the island

Fishery development and management activities as outlined in this Plan are designed to complement, enhance, and contribute to the above-mentioned overall territorial goals, priorities, and strategies.

B. Territorial Objectives and Priorities for Fisheries

It must be realized that the total fishery resources available to the Territory are limited. Whenever resources are limited, criteria for conservation and allocation among potential user groups must be addressed. Although there is some overlap, user groups in Guam can be classified as

household-subsistence-recreational, sports-charterboat, artisanal (small- and medium-scale commercial), and large-scale commercial. Due to the common property nature of fishery resources, the natural market system cannot be relied upon for conservation and efficient allocation. Therefore it is suggested that the following set of priorities provide the philosophical criteria for fishery resource allocation and management in Guam:

First, we eat them (household-subsistence-recreational)
Second, we market them locally (artisanal, small scale commercial)
Third, we play with them (sport-charterboat-tourism)
Fourth, we export them (large-scale commercial)

On the basis of these priorities for Territorial resource use, the following development and management objectives were presented at the Pacific Basin Development Conference in Honolulu, Hawaii, February 17-20, 1980:

1. Optimize the social and economic benefits accruing to Guam from harvest of aquatic resources in the area

2. Insure the conservation and management of aquatic resources for the benefit of succeeding generations

3. Reduce dependence on imported fishery products by increasing the availability of locally produced fishery products

4. Increase employment opportunities outside the government sector

5. Foster the development of fishery product exports

6. Create balanced fishery development in the sense that large-scale harvesting, transshipment, and processing interface and complement traditional subsistence, artisanal, recreational, charterboat, and small- to medium-scale commercial activities.

The general priorities and objectives listed above, along with the authors' perceptions of resource abundance and development potentials, form the framework within which specific objectives, constraints, and program recommendations are developed in succeeding chapters.

C. General Constraints to Development and Management

Although more specific constraints will be discussed subsequently in conjunction with immediate programs and priorities, the following represents a list of general constraints which hamper attainment of the Territorial fishery development objectives:

1. Lack of scientific and technical information on the resource base

2. Lack of socio-economic data on patterns of resource distribution and use

3. Insufficient infrastructure, land, and shoreside facilities

4. Inappropriate federal and local regulations hindering development

5. Poorly developed market and distribution systems for locally caught fish

6. Insufficient sources of local private risk capital

7. Relatively high opportunity costs for local labor

8. Communication and transportation problems associated with Guam's geographic and cultural distance from the U. S. mainland

9. Fragmented responsibility, lack of coordination, and the absence of a firm commitment toward fisheries development and management on the part of the Government of Guam

10. Insufficient coordination of a technical level with the Commonwealth of the Northern Mariana Islands

11. Inadequate control over harmful fishing practices

CHAPTER V

REEF FISHERIES

A. Fisheries Development and Management Objectives

Reef fisheries include all harvesting activities on Guam's fringing reefs, reef fronts, and reef slopes, and within the shallow lagoon areas of Cocos Lagoon and Apra Harbor. Principal fishing methods are the use of nets, weirs, and traps, spear fishing, hand harvesting, and rod and reel fishing. The principal harvestable resources are reef fishes of many species, mollusks (including oysters, clams, topshells, octopus, etc.), crustaceans (crabs and spiny lobsters), echinoderms (sea cucumbers and sea urchins), hard corals, and seaweeds.

Reef harvesting on Guam is a traditional form of resource exploitation which has been practiced as long as people have lived on the island. Although little information is available on pre-Spanish fishery practices, it is probably safe to say that the types of resources harvested and the methods used today differ only in minor ways from those of thousands of years ago. Perhaps the main differences are in the present-day use of more durable and more easily acquired materials for nets and fishing lines and the use of modern spear guns and diving gear. Where people's food supply depends on their efficiency of harvesting, fishermen, even in very traditional cultures, are not slow to adopt more effective methods.

As in the past, the present-day harvest of edible products is primarily for home consumption, although some of the catch is marketed locally. It may be possible to develop export markets for some reef products if local resource supply is adequate and favorable marketing arrangements can be developed. However, the primary emphasis in the development and management of reef fisheries on Guam is the maximization of reef harvesting opportunities, on a sustainable basis, for home consumption and for domestic marketing. Lesser emphasis is placed on developing reef resources which have a commercial export potential.

Supporting these general program emphases are other specific development and management objectives. Among these are the preservation of reef habitats from the damaging effects of pollution and from destructive modifications. This is essential for the maintenance of the variety of habitats necessary for reef resource species to carry out their life cycles and to maintain their productivity.

Another specific objective is the protection of reef stocks against overharvesting (that is, harvesting at an intensity which will result in a long-term decline in stock productivity and, if extreme, may result in localized stock extinction) and against destructive harvesting practices (such as the use of poisons and explosives) which damage valuable habitat areas and kill undersized juveniles, non-target species, and target species which are not subsequently retrieved for use.

A further objective is the development of a continuing program for monitoring the ecological condition of reef habitats and reef resource stocks so that appropriate action can be taken should valuable habitats or stocks be found to be in need of protection.

Reef harvesting is an important part of Guam's cultural heritage and the preservation of traditional fishing methods is an objective of fishery development and management on Guam.

Summary of Development and Management Objectives

1. Maximization of Reef Resource Harvesting for Home Consumption and Domestic Marketing

   A. Preservation of reef habitats

   B. Protection of reef stocks against overharvesting and destructive harvesting methods

   C. Monitoring the ecological health of reef habitats and reef stocks

   D. Preservation of traditional fishing methods

2. Development of Commercial Export Harvesting of Appropriate Reef Resources

B. Constraints

The achievement of the development and management objectives specified above is hampered by a number of constraints. Among these is the existence of a variety of pollution sources and environment-modifying activities which are potentially destructive to the habitats of reef resource species. Sewage treatment plant effluents, hot water discharge from power plants, oil spills, terrestrial runoff carrying pesticides, hydrocarbons, agricultural fertilizers, and topsoil, and construction activities, involving dredging and filling in reef and shoreside areas, all contribute to habitat destruction and to the degradation of water quality upon which reef organisms depend.

Various destructive methods of harvesting reef organisms are frequently used on Guam's reefs. Among these are the use of explosives and toxic substances (including clorox and Derris root extract) to stun or kill fishes. These harvesting methods are nonselective and result in the wasteful death of many reef organisms in addition to those collected for sale or home consumption. Perhaps even more important is the damage that poisons and explosives wreak on food chains and reef habitats, lessening their capacity to support valuable marine life.

Overharvesting may take two forms: 1) size overharvesting, which is most likely to occur with slow-growing organisms, wherein the harvesting intensity is so great that most individuals are harvested before they have had an opportunity to attain their optimal size, and the harvest, as a result, consists of progressively smaller individuals over time; and 2) recruitment overharvesting, which is most likely to occur in species that reproduce late in their lives or which produce only a small number of offspring, wherein the harvest of adult organisms is intense enough to cause a decline

in the number of recruits to subsequent generations. This may, over a long period of time, result in significant declines in population size or even population extinctions. Recruitment overharvesting can also occur if young individuals are harvested before they have reached reproductive maturity. The lack of baseline data on the stock abundance of various resource species makes it almost impossible to unequivocally demonstrate whether overharvesting is occurring on Guam's reefs. There are some indications that species of giant clams (Tridacna) and the topshell (Trochus) may be overharvested, at least in some locations. The absence of strong rabbitfish (manahac) runs in recent years has caused some fears that overharvesting may have reduced stocks of these species, but other environmental factors may in fact be responsible.

A major constraint to effective management of reef species is the absence of baseline data on the abundance and distribution of reef stocks. Without this basic information, overharvesting cannot be clearly recognized nor can deleterious effects of pollution be unequivocally demonstrated. The lack of distribution and abundance data and the lack of data on the population dynamics of important reef species hampers the development of appropriate regulations on harvesting and on pollution discharge. Such regulations as are presently in effect are based principally on intuition and hearsay and may not be the most effective measures for stock conservation and management.

It hardly needs saying that regulations are only as effective as the capacity to enforce them. But what should be emphasized is that enforcement is not solely the job of game wardens and government agencies. Most effective resource protection can be provided by the user groups themselves if they are sufficiently aware of the damage to their food supply and livelihood posed by dynamiters and polluters. The lack of understanding of the value of reef resources and the declining participation in reef harvesting by younger people on Guam remove much of the social control over destructive activities; social controls have, historically, been a dominant form of resource management in all Pacific Islands (see Johannes, 1977; 1978).

A variety of reef resource species may have export potential, such as topshells (Trochus), sea cucumbers (beche-de-mer), economic seaweeds, black coral, stony coral, and aquarium fish. However, insufficient information is available on market demand, resource productivity, and the economics of commercial harvesting to indicate whether commercial harvesting would be feasible and the scale of such harvesting that could be supported by existing resources.

Summary of Constraints

1. Lack of Necessary Information on the Status of Harvestable Reef Stocks:

   A. Need for baseline data on distribution, habitat requirements, and stock abundance of important reef species

   B. Need for data on stock dynamics of important reef species

   C. Need for on-going program of reef stock assessments coordinated with data on harvesting pressure

2. Deleterious Impacts on Reef Stocks:

   A. Pollution and habitat modification

   B. Destructive harvesting practices

   C. Potential overharvesting

3. Lack of Control Over Deleterious Impacts:

   A. Need for effective regulations and enforcement capacity to control reef harvesting

   B. Need for effective regulations to control pollution and habitat modification

   C. Need for greater appreciation of the value of reef resources by the society as a whole

4. Lack of Information on Potential for Commercial Export Harvesting:

   A. Market demand

   B. Resource availability

   C. Economics of commercial harvesting

C. Recommendations

The management and development of Guam's reef fisheries are dependent upon the acquisition of various kinds of information upon which appropriate decisions can be made. The first area in which information is needed is the present and continuing status of stocks of harvestable reef species. An initial baseline survey of harvestable reef resources should be performed island-wide, with specific attention given to determining the types of habitats within which specific resource species are found. Economically important fishes, mollusks, crustaceans, stony corals, black corals, seaweeds, and echinoderms should be censused and their densities and distributions mapped. Analysis of these survey results will permit an initial determination of stocks which are in need of management, stocks which are ecologically sound, and stocks which have a potential for fishery development. Furthermore, these surveys will provide information on the types of habitats which support species of economic and social importance and will make it possible to designate critical habitats which must be protected to ensure long-term productivity of reef resources.

Certain resource species, primarily those determined to be in need of management and those with potential for expanded harvesting, should be subject to further investigations of stock dynamics (growth rates, reproductive rates, recruitment rates, etc.) so that appropriate management and development strategies can be designed. In some cases, useful information may already exist in the scientific literature; in other cases, specific field and laboratory studies should be undertaken.

Reliable information on the local catch of reef species is essential for stock management. Because most of the reef harvest is used for home consumption and there is no central landing point, harvest estimates must be based primarily on creel censuses of fishermen on the reef. Gathering these data is made difficult by the variety of harvesting methods used and the large extent of fringing reef around Guam. The present creel censusing program, being carried out by the Guam Division of Aquatic and Wildlife Resources (DAWR), needs to be expanded and improved so that more reef areas are censused on a regular basis and a more detailed breakdown of species caught is recorded. Furthermore, the creel census data need careful and timely analysis so that trends in catch and effort in various reef fisheries can be detected.

The data collection efforts described above should lead to the establishment of a continuing program of stock monitoring involving periodic resurveys of various habitats and various resource stocks. This program, combined with the expanded creel census program, will provide a sound basis for reef stock management and development.

The establishment of reef sanctuaries at various locations around the island, wherein all harvesting of marine species shall be prohibited, offers several potential benefits to Guam:

1) Populations of resource species living unmolested within the sanctuaries will be able to reproduce and contribute to the recruitment of new individuals to populations all around the island.

2) The sanctuaries will serve as yardsticks for the measurement of the effects of harvesting pressure on other reef areas.

3) The sanctuaries will offer recreational opportunities to skin divers and underwater photographers; they could well develop into popular tourist attractions.

Marine sanctuaries have been established in many areas in the world. The sanctuary at Hanauma Bay on Oahu has proved very successful.

Several problems must be dealt with if marine sanctuaries are to be established on Guam:

1) Location--To be most beneficial, sanctuaries must be in areas capable of supporting significant amounts of marine life and in areas accessible to the public; these are the areas also favored by reef fishermen for harvesting.

2) Size--To be effective, sanctuaries have to be large enough to include a variety of habitat-types and to provide enough range for the day-to-day wanderings of reef species in search of food; however, the larger they are, the more impact the sanctuaries will have on reef fishing activities.

3) Enforcement--Poaching from sanctuaries may be difficult to control, particularly at night. Unless there is strong public acceptance of the marine sanctuary concept, it will not be possible to establish such a program on Guam.

A feasibility study is needed to determine the most appropriate size and locations for reef sanctuaries and to solicit public input on the desirability of establishing marine sanctuaries on Guam.

Although ciguatera fish poisoning has not been a major health problem on Guam, a few cases are recorded each year. A program of ciguatera monitoring, involving periodic ciguatoxin assessment of selected food fish species from various reef areas is desirable. Such a program would serve to pinpoint species and areas where the occurrence of ciguatera is high, and might prevent or reduce the incidence of fish poisoning.

A second area of program emphasis is the development of management measures to protect critical habitats against harmful impacts and to prevent overharvesting and stock declines. A thorough review of present and anticipated future activities which may cause reef pollution and environmental damage is a necessary first step. This review should also evaluate measures for controlling these activities or ameliorating their effects on the reef. The results of this review should be analyzed in light of data on critical habitat requirements of reef resource species in order that appropriate regulations for protecting critical habitats against environmental degradation can be developed and implemented.

The stock assessment and harvesting data should be analyzed as they become available so that needs for harvesting controls can be detected in time to be effective against overharvesting. Harvesting regulations must be developed and implemented as their need becomes apparent. In addition, appropriate regulations prohibiting the use of explosives, poisons, and other wasteful and destructive harvesting methods must be implemented.

The sine qua non of all management efforts, whether designed to ameliorate pollution, to prevent overharvesting, or to prohibit destructive harvesting methods is the development of an effective enforcement capacity to guarantee that regulations are adhered to. A major emphasis in this area should be educational efforts to foster a greater understanding of the value of reef resources of Guam. Such an educational program should emphasize the biological functioning of the reef environment and the potential damage posed by pollution, destructive fishing methods, and overharvesting. In addition, workshops and training in reef fishing methods should encourage more participation in reef harvesting by Guam's younger generations and help to preserve traditional fishing methods.

The third area of program emphasis is the development of commercial export harvesting of reef resources. Efforts in this area should be in the gathering of appropriate information on the economic potential of export harvesting and the dissemination of this information to interested entrepreneurs.

Information on the price and market demand of such resources as Trochus shells, marine aquarium fish, economic seaweeds and their derivatives, beche-de-mer, black coral, and other products should be sought. Markets in Japan, Taiwan, Hawaii, and the continental United States should be investigated first.

Those species for which favorable marketing conditions exist should then be investigated to determine the magnitude of the resource potential

on Guam. In some cases, natural resource potential may be supplemented by culturing or other manipulations of the stocks.

An economic analysis of the potential for commercial development should be carried out for those resources which are marketable and which are abundant enough to support commercial harvesting. Costs of harvesting, processing, and shipping, as well as various marketing opportunities, should be addressed in this analysis.

At the same time, harvesting regulations should be developed to ensure that natural stocks will be able to provide maximum yields over a long period of commercial harvesting.

The actual commercial development of export reef fisheries is the task of private industry, and, to promote this development where appropriate, relevant biological and economic information should be made available to interested commercial harvesters.

Summary of Recommendations

1. Acquisition of Necessary Information on the Status of Harvestable Reef Stocks:

   A. Island-wide stock assessment of harvestable reef resources

   B. Analysis of critical habitat requirements of important reef species

   C. Studies of stock dynamics of selected species of reef organisms of socio-economic value

   D. Enhancement of present efforts to collect and analyze data on reef harvesting pressure

   E. Establishment of continuing program of reef stock assessments coordinated with data on harvesting pressure

   F. Study of the feasibility of the establishment of reef sanctuaries

   G. Establishment of a program for ciguatera monitoring

2. Development of Program for Ameliorating Deleterious Impacts on Reef Stocks:

   A. Review of reef pollution sources and evaluation of measures for effective control of pollution and habitat destruction

   B. Development and implementation of regulations for protecting critical habitats against environmental damage

   C. Evaluation of need for control of harvesting of important resource species

   D. Development and implementation of appropriate regulations to prevent overharvesting of those species in need of stock management

E. Development and implementation of regulations prohibiting wasteful and destructive harvesting methods

F. Development of effective enforcement capacity

G. Establishment of educational programs to foster appreciation of the value of reef resources, to encourage increased participation in reef fisheries, and to preserve traditional fishing methods

3. Acquisition of Information on Potential for Commercial Export Harvesting:

   A. Acquisition of export market information for selected species

   B. Assessment of resource potential of species with favorable market potential

   C. Analysis of economic potential for development of commercial export harvesting of selected reef species

   D. Development of appropriate commercial harvesting regulations to ensure long-term stock productivity

   E. Publication of relevant economic and biological information to enable commercial business interests to develop economic potential of export harvesting

D. Program Implementation

Responsible Agencies

Several Guam agencies and institutions are presently involved in activities related to the management and development of reef resources. The Bureau of Planning's Guam Coastal Management Program (GCMP) has a broad mandate to develop programs for the management of resources in Guam's coastal zone, which includes resources of the fringing reefs. In this capacity GCMP would be the logical lead agency to coordinate the implementation of the development and management program for reef fisheries. In its coordinating efforts, GCMP should work closely with the Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR) which is concerned with the conservation and management of reef resources and is responsible for promulgating and enforcing reef harvesting regulations. DAWR is also responsible for collecting catch data from reef harvesters. The Guam Environmental Protection Agency (GEPA) is responsible for monitoring and regulating activities which affect the reef environment and for enforcing applicable environmental quality regulations. The Department of Parks and Recreation (DPR) is involved with recreational fishing activities and should participate in the reef sanctuary studies. The Department of Public Health and Social Services (DPHSS) will be involved in the study of ciguatera fish poisoning as part of its continuing efforts to improve public health on Guam. The Department of Commerce (DOC), with its responsibility for the Territory's economic development, should be involved in appropriate efforts to promote commercial development of reef resources with export potential.

The University of Guam Marine Laboratory (UGML) has carried out numerous studies on Guam's reef environment and resources and should be utilized for biological and environmental research necessary for reef resource management and development. The University of Guam Sea Grant Advisory Program (UGSGAP) is involved in a variety of marine-oriented public education programs and would be the appropriate organization to carry out the recommended reef resource education effort. The University of Guam College of Business and Public Administration (UGCBPA) has the capability of carrying out economic analyses necessary for the development of export harvesting of appropriate reef resources.

Development Scenario

A timetable for the implementation of the various recommendations listed above is presented in Table 5-1.

It is anticipated that most of the research and data gathering can be completed within 3 to 4 years, and by the fifth year reef fishery management efforts will consist mainly of monitoring and enforcement programs by the Division of Aquatic and Wildlife Resources (DAWR), the Department of Public Health and Social Services (DPH&SS), and the Guam Environmental Protection Agency (GEPA), and on-going educational programs by the University of Guam Sea Grant Advisory Program (UGSGAP). Further research may be required on species with particular development or management needs.

The reef sanctuary feasibility study should be completed within 3 years, and, if the sanctuary program is accepted and appropriate legislation is enacted, the sanctuaries could be established within 5 years.

Commercial export harvesting of species with economic potential should be underway within 4 to 5 years, if appropriate resource stocks are available. DAWR will be monitoring and regulating these fisheries to maximize sustainable yields.

Thus, it is anticipated that within 5 years of the implementation of the reef fishery development and management program, Guam's reef resources will be adequately protected against misuse and will be providing benefits to the people of Guam as sources of food, recreation, and commercial industry.

Table 5-1
Program Implementation Timetable for Reef Fisheries Development and Management

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
1A	Island-wide stock assessment of harvestable reef resources	UGML DAWR	begin	continue	completion		
1B	Analysis of critical habitat requirements of important reef species	UGML DAWR GEPA	begin	continue	completion		
1C	Studies of stock dynamics of selected reef organisms of socio-economic value	UGML DAWR		begin	continue	evaluate need for further studies	
1D	Enhancement of present efforts to collect and analyze data on reef harvesting pressure	DAWR	this project is a continuing effort →				
1E	Establishment of continuing program of reef stock assessments	DAWR			this project will be a continuing effort based on results of project 1A →		
1F	Study of feasibility of the establishment of reef sanctuaries	UGML DAWR GCMP DPR GEPA	begin	continue	completion (followed by legislation if appropriate)		
1G	Establishment of a program for ciguatera monitoring	GCMP UGML DPHSS DAWR	begin	continue as an on-going program by DAWR and DPHSS →			

Table 5-1
Continued

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
2A	Review of reef pollution sources and evaluation of measures for effective control of pollution and habitat destruction	GEPA	begin	evaluate need for further studies			
2B	Development and implementation of regulations for protecting critical habitats against environmental damage	GEPA		begin project based on results of projects 1B and 2A	continue as an on-going program	→	
2C	Evaluation of need for control of harvesting of important resource species	DAWR		begin project based on results of project 1A	continue	evaluate need for further study	
2D	Development and implementation of appropriate regulations to prevent overharvesting of those species in need of stock management	DAWR			begin project based on results of project 2C	continue as an on-going effort	→
2E	Development and implementation of regulations prohibiting wasteful and destructive harvesting methods	DAWR	begin	continue as an on-going effort			
2F	Development of effective enforcement capacity	DAWR GEPA	this project is a continuing effort	→	→	→	→
2G	Establishment of educational programs to foster appreciation of the value of reef resources, to encourage increased participation in reef fisheries, and to preserve traditional fishing methods	UGSGAP	this project is a continuing effort	→	→	→	→

Table 5-1
Continued

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
3A	Acquisition of export market information for selected species	DOC UGCBPA	this project can be completed in one year				
3B	Assessment of resource potential of species with favorable market potential	UGML DAWR		begin	continue	evaluate need for further study	
3C	Analysis of economic potential for development of commercial export harvesting of selected reef species	DOC UGCBPA			begin	evaluate need for further efforts	
3D	Development of appropriate commercial harvesting regulations to ensure long-term stock productivity	DAWR			this project is a continuing effort	→	
3E	Publication of relevant economic and biological information to enable commercial business interests to develop economic potential of export harvesting	DOC UGCBPA UGSGAP				begin	evaluate need for further efforts

CHAPTER VI

SMALL-BOAT FISHERIES

A. Fisheries Development and Management Objectives

Small-boat fishing is the most productive form of commercial fishing at present on Guam. It is additionally an important form of recreation and source of food for home consumption. The fledgeling charterboat fishing industry on Guam has potential for expansion and may, in time, prove to be an important part of Guam's tourism industry.

The small-boat fleet on Guam consists of boats in the 15-40 foot range, operated by one to three fishermen. Surface trolling for tunas, billfish, mahimahi, and other pelagic species is the principal type of small-boat fishing, although bottomfishing for snappers and other demersal species is becoming increasingly important. Night handlining for atulai (big eye scad) is also a productive type of small boat fishing. Trapping for deep-water shrimps (Heterocarpus) has been successful and may have potential for expansion, along with trapping for other resource species.

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.

Appropriate development of the various categories of small-boat fishing (commercial fishing, harvesting for home consumption, recreational fishing, and charterboat fishing) involves the attainment of various specific development and management objectives as discussed below.

The development of the commercial potential of domestic small-boat fishing is dependent upon the establishment of stable markets for the catch. This is the most important first priority for commercial small-boat fishery development as it provides the economic stability necessary to make commercial fishing a viable full-time career option.

Next in importance is the development of the necessary infrastructure for small-boat fishing, such as harboring facilities (including a provision for harbors-of-refuge for times of extreme weather), dockside fuel and ice facilities, boat repair yards, launch ramps, and cold storage facilities.

Small-boat fishing is, of course, dependent upon the availability of boats and the financial ability of fishermen to purchase them. An important objective, then, is to provide financial assistance to small-boat fishermen for the purchase and fitting out of fishing boats. A related objective is the provision of vessel insurance for small-boat fishermen.

The objectives listed above will enhance the productivity of small-boat commercial fishing by encouraging more fishermen to enter this industry. Further increases in the harvest can be achieved by increasing the productivity of individual fishermen through the development of new fishing techniques and through the exploitation of under-utilized resources.

Increased productivity will lead to the need for the development of export markets for locally-caught fishery products. Guam's proximity to Japan and Taiwan and other Pacific basin nations with heavy dependence on seafood makes this a highly feasible development objective.

It is important that the stock productivity of commercial and recreational fishery resources be protected against over-harvesting. Demersal resources such as bottomfish and shrimps are potentially in greatest danger of over-harvesting, particularly if large-scale foreign fisheries exploit these species. Pelagic resources, such as tuna and billfish, will be little affected by domestic fishing activities, but, because of their wide-ranging migratory habits, may be impacted by the large-scale, distant-water fisheries of Japan, Taiwan, Korea, and the United States.

The development of small-boat fishing on Guam may well prove to be an important economic sector in its own right, and additionally should provide economic benefits to related support industries such as local boat building and repair, fish markets and restaurants catering to consumers who prefer fresh, local products, fishing gear supply stores, etc. The development of a healthy charterboat fleet should attract additional tourists to the island, benefitting other sectors of the tourism industry.

Summary of Development and Management Objectives

1. Overall Objectives of Development:

   A. Increase supply and quality of food fish for island consumers.

   B. Decrease Guam's dependence on imported products

   C. Increase employment and investment opportunities in domestic fisheries

   D. Supplement family real income in the form of fish for home consumption

   E. Enhance recreational opportunities for sport fishermen

   F. Enhance Guam's visitor industry through the development of charterboat fishing opportunities

   G. Improve safety for small-boat fishermen

2. Small-boat Fishery Sectors for Development:

   A. Develop economic potential of commercial small-boat fisheries

B. Enhance harvesting opportunities for home-consumption small-boat fisheries

C. Enhance recreational opportunities for local sport fishermen

D. Expand tourist-oriented charterboat fleet

3. Specific Development Objectives:

A. Enhance local market development and stability

B. Provide necessary infrastructure

C. Provide financial assistance for development of small-boat fisheries

D. Increase productivity of domestic small-boat fishermen

E. Develop export markets for domestic fishery products

F. Preserve productivity of fishery resources harvested by small-boat fishermen

G. Enhance economic benefits to support industries and other related sectors of Guam's economy

B. Constraints

A major constraint to the development of a viable commercial fishing industry on Guam has been the lack of a centralized dockside market where fishermen can offload their catch, be paid, and set out again to fish. This lack has forced fishermen to seek out their own markets after returning from a fishing trip, and fishermen have often spent as much time driving around town trying to sell their catch as they spent fishing. Competition between individual fishermen, and the need to sell the catch before it deteriorates, forces prices down and creates an unpredictable marketing situation. The Guam Fishermen's Cooperative Association is attempting to alleviate this problem and has established a small marketing facility at the Public Market in Agana, The continued operation and eventual expansion of this facility at a dockside location is an essential prerequisite of commercial small-boat fishing on Guam.

An additional constraint to marketing of the local catch is competition from fish imported from the Philippines, Palau, and elsewhere in the Pacific. Low wages in these areas enable importers to acquire this fish very cheaply and to sell it on Guam at prices below those which domestic fishermen must charge to make commercial fishing economically feasible.

Foreign tuna boats docking at the Commercial Port to transship their tuna catch often offload fish which are not suitable for transshipment (billfish and other non-tuna species and tuna which are of insufficient quality for transshipment). Much of this "scrap fish" finds its way into the local market at low prices, and local fishermen have had difficulties

in selling their catch of billfish and other large fishes because markets have been glutted with this transshipment by-catch.

In light of the problems of price competition with foreign fish, domestic fishermen have capitalized on their ability to produce fresh, high-quality fish for the local market. However, the relatively low family income on Guam (compared to other U. S. areas) and the lack of consumer awareness of fish quality criteria tend to encourage the purchase of lower-priced, lower quality foreign fish over higher-priced, higher quality local fish in the market place.

Other areas in the Pacific, notably Hawaii, Japan, and Taiwan, are major consumers of fishery products and are willing to pay high prices for top quality seafood. Guam fishermen may be able to take advantage of Guam's proximity to these areas for export marketing of fishery products, but information is needed on demand, prices, trade barriers, and strategies for entering these markets.

Lack of appropriate infrastructure is another major constraint to small-boat fishery development on Guam. Launch ramps are needed in many areas around Guam to make fishing areas more immediately accessible to commerical, recreational and home-consumption fishermen. The Agana Marina has a limited capacity for mooring fishing boats and lacks dockside facilities for obtaining fuel and ice. Fuel is available at the Merizo pier, but docking facilities are in need of repair and expansion. Additional boat mooring facilities are also needed in other parts of the island.

Because of the frequency of major tropical storms and typhoons around Guam, there is a critical need for harbors-of-refuge to protect fishing boats against storm damage. Any substantial growth in the local fishing fleet will be greatly jeopardized if facilities are not available to protect the boats.

A number of financial and economic constraints face the individual fisherman who wishes to enter or expand his participation in commercial small-boat fishing. The first of these is the high cost of fishing boats. Existing U. S. laws prohibit the use of foreign-built vessels greater than 5 net tons for commerical purposes, including commerical fishing and charter-boat operations. In the absence of a local boat-building industry, the United States is the only source of boats for commercial use on Guam, and bringing a vessel from the mainland United States to Guam imposes a burden of additional thousands of dollars in transportation costs, over and above the original purchase price of the boat.

This financial burden is exacerbated by the difficulty local fishermen have in securing loans for the purchase of fishing vessels. Because fishing is a high-risk business venture wherever it is carried out, private lending institutions are reluctant to lend money for fishing vessel purchase or re-building. This fact is recognized by the National Marine Fishery Service (NMFS) which has a program for commercial fishing vessel loan guarantees. Unfortunately, this program has such strict guidelines, which cannot be met by Guam fishermen, that only one vessel loan guarantee has ever been made available to fishermen on Guam by NMFS.

Fishing vessel insurance has also been virtually impossible to obtain on Guam, jeopardizing investment in domestic fisheries in the Territory.

The rising price of boat fuel is another economic concern for small-boat fishermen. The principal small-boat fishing technique used on Guam is surface trolling, a method which entails substantial fuel consumption. Increasing fuel costs, and the possibility of fuel rationing, threaten the economic viability of small boat fishing.

Many capable fishermen are handicapped in their efforts to gain their livelihood through fishing by their lack of basic business and accounting skills. This hampers their ability to improve their operating efficiency, to apply for financial assistance, and to minimize their tax burden.

The productivity of domestic small-boat fisheries depends upon the availability of harvestable resource species and the fishermen's effectiveness in harvesting them. Lack of information in both of these areas presently acts as a constraint to increased domestic fishery yield. Presently under-utilized stocks, such as deep-water tunas, deep-water shrimps, precious corals, and seamount groundfish, need additional study to demonstrate their potential productivity. There may well also be other harvestable resources whose productive potential is not yet suspected. Species for which fisheries already exist, such as bottomfish and pelagic trolling fishes, could provide greater yields if more information were available to domestic fishermen on their distribution, abundance, and seasonal patterns.

A rather small repertoire of small-boat fishing techniques are commonly utilized on Guam, principally surface trolling, mackeral handlining, and bottomfishing. There is a need to experiment with various other small-boat fishing methods, both for the harvesting of under-utilized resource species as well as for more efficient harvesting of existing target species. This type of experimental fishing requires a significant commitment of time and resources which are not available to the working fishermen.

An important factor in the continuing development of domestic harvesting is the proper protection and management of resource stocks. Demersal stocks, such as bottomfish, and pelagic species which aggregate around submerged banks and reefs are particularly vulnerable to overfishing. There are at present no management measures for the protection of offshore resources and little data upon which to base such management measures. Foreign fishing, which is increasing at a rapid rate in the waters around Guam, is essentially unregulated.

Ocean-wide pollution and the threat of nuclear waste dumping in nearby waters is a further concern of Guam's fishermen. Despite the alleged safety of nuclear dumping, consumer fears of contaminated fish could destroy Guam's chances to develop a significant fishery industry.

From time to time small-boat fishermen are lost at sea because of bad weather, engine failure, or navigational errors. Inadequate channel markers and nonfunctioning channel lights endanger fishermen returning to port. Fishermen safety is a major concern to fishery development on Guam.

Summary of Constraints

1. Marketing Constraints:

A. Lack of centralized, dockside market

B. Competition with imported and foreign-caught fish

C. Low family income in Guam

D. Lack of consumer-awareness of fish quality criteria

E. Lack of information on export potential for domestic fishery products

2. Infrastructure Constraints:

A. Insufficient boat launching ramps

B. Limited mooring space

C. Lack of dockside facilities for fuel and ice

D. Lack of typhoon protection

3. Economic and Financial Constraints:

A. High cost of fishing vessels

1) Prohibition on the use of foreign-built boats

2) Lack of local boat building industry

3) High cost of transporting boats from U. S. mainland

4) Difficulty in securing loans for vessel purchase

5) Difficulty in obtaining vessel insurance

B. Rising cost of fuel and possible limited fuel availability

C. Lack of business skills by domestic fishermen

4. Resource and Harvesting Constraints:

A. Lack of information on the potential of under-utilized fishery resources

B. Lack of information on the distribution and abundance of existing target species

C. Limited variety of fishing methods in common use

D. Ineffective management of resource species and limited information upon which to base stock management

E. Threat of pollution and nuclear dumping

5. Need for Improved Boating Safety

C. Recommendations

Improvement of Seafood Marketing

The creation of a smoothly-running, efficient, and stable marketing mechanism is the single most important factor in developing commerical small-boat fishing on Guam. Once this exists, domestic fishing will have a strong base from which to expand. The most feasible means of accomplishing this goal is through the implementation of the Guam Fishermen's Cooperative Association's proposed marketing facility at the Agana Marina. The Coop's present fish outlet at the Public Market is functioning, in the absence of a better facility, but lacks adequate space for storage, preparation, and display. The Coop's proposed marketing facility, combined with dockside ice and fuel supply, will streamline the process of catch discharge and boat resupply, allowing fishermen to spend more of their productive hours fishing. The Coop should be fully and effectively supported in their efforts to develop this facility.

The problem of "dumping" foreign-caught fish by tuna transshipment vessels is being addressed by the Port Authority of Guam. More stringent guidelines have been drawn up to institute better control over fish leaving the port. The results of these controls should be monitored to determine how effective they are in opening up local markets for fish caught by domestic fishermen.

Appropriate regulations are needed to require seafood products to be labeled as to their condition and place of origin. Such labeling would enable local consumers to make an informed choice among the various seafood products on the market, allowing those who prefer to purchase fresh, locally-caught fish to do so.

The Sea Grant Advisory Program is holding workshops for local fishermen, instructing them in the proper care of their catch to ensure highest quality. These efforts should continue and should include programs for consumer-awareness of the criteria for determining good quality fish in the market.

In addition to these steps, a comprehensive study of the domestic market for seafood is needed. Such a study should investigate the kinds and quantities of seafood purchased by various markets (retail markets, the military, government institutions, restaurants, and hotels) and the prices paid. This study can be used to identify potential markets and to develop strategies for expanding the marketing of domestic seafoods.

Potential export markets also need investigation. Seasonal over-abundances of certain resource species occasionally flood the local market, and it is hoped that future development of domestic fisheries on Guam will produce a consistent exportable surplus. Markets in Hawaii, Japan, and Taiwan should be investigated first, but inquiries to other Pacific nations may disclose additional potential markets. The export marketing study should include information on the demand for various species, desired condition, prices, trade barriers (if any), shipping costs and schedules, and a list of seafood brokers in the various countries who would handle relatively small volumes of export products.

Development of Appropriate Infrastructure

A variety of infrastructure developments are needed to promote further small-boat fishery development on Guam. A comprehensive plan for small-boat facilities should be prepared which addresses all of the infrastructure recommendations proposed below.

Boat launching ramps must be constructed to provide fishermen who trailer their boats easy access to fishing areas around the island. The windward (east) side of Guam is particularly in need of launching ramps.

Additional mooring facilities are needed, particularly for charter-boats and commercial fishing boats which are used on a daily basis. It must be recognized in the planning and construction of these additional facilities that many of the boats to be accommodated will be used for part-time or full-time commercial purposes. Furthermore, marina expansion must take into account future increases in vessel size as well as vessel number. The major areas of concentration for marina development are the Agana Marina, which still needs considerable work to implement the existing Agana Marina Development Plan; the facilities at Merizo, which are badly in need of maintenance and improvement; small-boat facilities at Apra Harbor; and the proposed marina in Agat Bay, the development of which has been delayed by a variety of land-use conflicts.

Of particular importance with regard to the development of Agana Marina is the need for a dockside fuel and ice facility. The present practice of trucking in ice and fuel by individual fishermen is time-wasting and dangerous. A fuel pier and ice facility should be a high-priority development for Agana Marina, and, ideally, should be situated at the dockside marketing facility. The ice facility should be combined with a cold storage locker of sufficient capacity to accommodate anticipated growth in the domestic harvest.

Another important development need at Agana Marina is a blast freezing unit. A blast freezing capacity will serve the domestic market by opening up opportunities for sale of local fishery products to military bases and by enabling fishermen to preserve catches of seasonally abundant fish in top condition for later sale when these species are less abundant. It will further open up export marketing opportunities for locally-caught tunas, which can be blast frozen and then shipped to Japan for sale in the highly lucrative sashimi market. If properly done, blast freezing can preserve high quality fishes in peak condition for long periods of time.

The other small-boat facilities at Merizo, Agat, and Apra Harbor will also need infrastructure development to support commercial fishing. As Apra Harbor is the most likely area for the development of facilities for larger vessels, commercial fishing facility development here should be considered early in the planning stages so that domestic fisheries will have an area to grow into.

Growth in the domestic fleet will require the development of facilities for periodic maintenance and repair of fishing vessels. A study needs to be performed to determine what sort of haul-out, maintenance, and repair facilities will be needed and where they can be located. Subsequent to this study, steps should be taken to develop these facilities.

The periodic tropical storms and typhoons which Guam encounters are a continuing threat to the domestic fishing fleet. Expansion of this fleet will be endangered unless harbors-of-refuge are developed to protect fishing boats against storm damage. Planning should begin immediately to locate and design harbors-of-refuge. Once this is completed, funds must be sought for construction of these facilities.

Reduction of Economic Barriers to Commercial Fishermen

The marketing and infrastructure needs discussed above must be met if commercial fishing is to develop as an important industry. The recommended development steps will make commercial fishing a viable career option for Guam's citizens. However, individual fishermen are faced with a number of economic barriers which must be overcome if they are to participate in this industry. The most important of these is the high cost of fishing vessels on Guam, resulting from Federal restrictions on the use of foreign-built boats for commercial fishing. As this financial burden is largely due to inappropriate Federal regulations, efforts to overcome the problem will, in the main, involve negotiations with the Federal government for relief of these constraints. Crucial to these negotiations is the gathering of accurate information upon which to base the Territory's lobbying efforts.

A study should be made of the purchase price of fishing vessels of various sizes and designs, both foreign-built and U.S.-built. This study should also investigate the costs of transporting vessels of various sizes to Guam from the mainland U. S. and Hawaii and from foreign boat-building ports.

Based on the information gathered in this study, efforts should be mounted to seek federal relief from the burden of high fishing vessel cost. Two avenues should be pursued:

1) Exemption of Guam's commercial fishermen and charterboat operators from Federal restrictions on the use of foreign-built fishing boats;

2) Establishment of a Federal subsidy to defray the costs of transporting U. S.-built boats to Guam.

The second alternative has several potential advantages:

1) It should gain the support of the U. S. boat building industry which may try to block efforts to obtain exemptions from laws requiring the use of U. S.-built boats;

2) U. S.-built boats are built to Coast Guard safety standards and may be more easily insured;

3) U. S.-built boats are built to American standards of comfort and may be preferred by Guam's fishermen;

4) Federal loans for the purchase of fishing vessels may be more easily obtained if the boat to be purchased is U. S.-built.

Ideally, both measures together would provide Guam's fishermen with a variety of options for obtaining fishing vessels.

A further source of fishing vessels would be through the development of a local boat-building industry. For such an industry to be successful, the boats built must be well-designed to meet the needs of Guam's fishermen. A feasibility study for a local boat-building industry should be carried out to identify appropriate vessel designs and materials and to assess the demand for locally-built boats. It may be advantageous to initiate inquiries with mainland firms, encouraging them to set up local boat-building franchises on Guam.

Although the availability of Federal vessel-purchase loans was cited above as a reason for preferring U. S.-built boats over foreign-built boats, the fact remains that Guam fishermen have been unable to qualify for these loans (available under programs administered by the National Marine Fisheries Service) because of strict lending guidelines. Efforts need to be made to persuade NMFS to relax their qualification requirements when considering loan applications from Guam's domestic fishermen. Commercial fisheries are in their developmental stages on Guam, and local fishermen are not able to meet requirements which are appropriate in U. S. areas with long-established fishing industries.

In order to encourage and protect investments in commercial fishing vessels and charterboats, reliable vessel insurance at reasonable rates must be made available. A survey of local insurance agencies should be made to compile information on the types of coverage presently available to local boat operators. The Fishermen's Coop or other groups should seek group policies which may help to lower rates and to encourage issuing of policies with appropriate coverage.

Another economic consideration for domestic small-boat fishermen, one that is taking on increasing importance, is the rising cost of boat fuel. The most effective means of countering this problem is by encouraging fishermen to become more fuel-efficient in their operations, and, to do this, information is needed on several aspects of fuel use in small-boat fishing:

1) relative fuel-efficiency of diesel- and gasoline-operated engines, inboards and outboards;

2) ratio of boat size and engine power output to optimize fuel consumption;

3) fuel-efficiency of various boat designs, including feasibility of motor-sailers or strictly wind-powered fishing vessels;

4) relative fuel-efficiency of various types of small-boat fishing methods.

Provided with the above information, fishermen will be able to make intelligent choices when purchasing vessels and engines and when planning their fishing strategies.

A present inequity in fuel pricing exists whereby foreign fishing vessels bunkering at Commercial Port are able to purchase fuel at considerably lower prices than domestic fishermen who must buy their fuel at automobile gas stations. Although economics of scale are involved in this price differential, provision should be made for legitimate domestic commercial fishermen to obtain boat fuel at comparable prices to those paid by foreign fishermen.

Should future developments in the international petroleum market dictate, fuel rationing may be necessary on Guam. If this occurs, domestic fishermen should be given high priority in the allocation of fuel. As a producer of food for local consumption and as an economic sector of growing importance, the continued viability of small-boat fisheries is of significant value to the Territory.

Charterboat fishing may have considerable potential for growth as a tourism-oriented industry. World-record gamefish have been taken in Guam's waters and the Marianas Fishing Derby has proved to be a popular annual event. Promotion of charterboat fishing on Guam could lead to the development of an important industry in itself as well as benefitting other sectors of Guam's visitor industry. This promotional effort should begin with a survey of potential Japanese visitors, members of Japanese sportfishing associations and others, to determine how many tourists would be attracted to Guam by charterboat fishing opportunities, what they would be willing to pay for this activity, and what their expectations would be (in terms of facilities, catch, trophies, etc.). This information should then be used to assess Guam's present capacity to satisfy visiting sportfishermen's needs. If the present capacity exceeds the present demand for charterboat-fishing, promotional efforts should be undertaken to encourage more Japanese tourists to visit Guam to take advantage of sportfishing opportunities. If the demand exceeds Guam's current charterboat capacity, local entrepreneurs will be encouraged to enter this industry.

Commercial fishermen and charterboat operators would both benefit through the development of business and accounting skills. Extension programs should be developed to provide instruction in recordkeeping and tax computation. Aid should also be provided to fishermen in filling out loan applications, insurance claims, etc.

Improvement of Harvesting Effectiveness of Small-Boat Fishermen

Fishing yields depend upon the fishermen's ability to locate resource stocks and to utilize effective methods for harvesting those stocks. Enhancing fishermen's knowledge in both these areas will lead to increased small-boat fishery harvests.

Although surface trolling for pelagic fish is the predominant type of small-boat fishing on Guam, bottomfishing is taking on increased importance. The advantages of bottomfishing over trolling include the following factors:

1) bottomfishing requires less fuel;

2) bottomfish species command a higher market price;

3) bottomfish are available year-round

Further information is needed on the distribution and abundance of bottomfish stocks in waters accessible to domestic small-boat fishermen, particularly around Rota Banks, Galvez Banks, Santa Rosa Reef, and other offshore shoals. More accurate and more complete charting of the seabottom topography around Guam would be a valuable aid to fishermen seeking bottomfish and other demersal resources around the island. Bottomfish fishermen, particularly new entrants into this fishery, would benefit by the availability of this information.

A species which is seasonally very abundant is the atulai or big-eye scad. In some years seasonal runs of this fish are weak and few are caught. In other years the species is harvested in enormous abundance, markets are flooded, and prices drop. The reasons for these year-to-year fluctuations are not understood, and good and poor years can not be predicted in advance. An ability to predict the strength of atulai runs from year to year would be valuable for developing marketing strategies (export, cold storage, etc.) prior to heavy runs. A study of the reproductive biology, growth, and environmental relationships of this species would provide information necessary for the development of a predictive model of atulai stock dynamics.

Several fishery resources of potential commercial value are known to or are suspected to occur in waters near Guam, but are currently not harvested by domestic fishermen:

1) Seamount groundfish are currently being investigated by the Division of Aquatic and Wildlife Resources through a project funded by the Pacific Tuna Development Foundation. The results of this study should demonstrate whether further efforts to develop this fishery resource are warranted.

2) Deep-dwelling spiny lobsters are being trapped in economic quantitities in the Northwest Hawaiian Islands. Although preliminary trapping for spiny lobsters around Guam and the Marianas has not proved fruitful, further trapping studies, for lobsters and for other trappable crustaceans and fish, should be carried out around Guam.

3) Deep-water shrimps (Heterocarpus) have been shown to exist in potentially economic quantities in the waters off Guam. Although several attempts to harvest these shrimps by deep-water trapping have failed for various reasons, there still exists a potential for at least a small-scale shrimp harvesting industry. Further work is needed on a pilot scale to work out the problems of operating multiple-trap lines so that sufficient quantities of shrimp can be harvested daily. Further experimental studies on various trap designs, bait, and trap set duration may lead to improved catch rates. Additional studies are needed to explore preservation, processing, and marketing of these shrimps to make them competitive with imported shrimp.

4) Preliminary explorations for precious corals indicate that commercial quantities do not exist around Guam. It remains possible that beds do exist and have so far not been discovered, but further efforts to develop this fishery, particularly in light of the demise of the precious coral fishery in Hawaii, do not presently appear worthwhile.

5) Sharks of various species occur in the waters around Guam, but are considered more of a nuisance than a resource. If export markets for shark products could be identified, efforts to develop a shark fishery may be productive. Commercial shark fisheries have developed off Mexico and Central America and the fins are sold to Taiwan and perhaps Mainland China (Ernest Kosaka, pers. comm.)

6) Deep-living tuna species (big-eye, yellowfin, and albacore) are known to occur in the waters around Guam. Japanese longline fisheries harvested almost 2000 metric tons of these species within the U. S. Fishery Conservation Zone around Guam in 1977; 314 metric tons of that catch was taken within 50 miles of Guam. These deep-living tunas are harvested in Hawaii using deep handlining techniques (palu ahi and ika-shibi) and by longlining. Ika shibi trials were carried out in Guam in 1978-1979 by the Division of Aquatic and Wildlife Resources, with financial support from the Pacific Tuna Development Foundation. Although these trials were not successful in catching any deep-water tunas, further investigations of tuna handlining methods are recommended. In Hawaii, where these methods are used very successfully, catches appear to be concentrated in certain areas and at certain times of year; it is necessary to carry out further studies on ika-shibi and palu ahi methods to locate productive areas around Guam. It is an indisputable fact that these deep-water tuna species occur in the waters near Guam, and their potential value to the domestic fishery is very great. If the 1977 Japanese catch of these species within 50 miles of Guam were harvested by domestic fishermen, the ex-vessel value of these fish at current local prices would be in excess of $1,000,000; flash frozen and shipped to Japan, the value would be even greater. These tuna species can also be taken with longlines; the potential of developing a domestic longline fishery on Guam is discussed in the section on Large-Scale Harvesting.

In addition to the harvesting methods discussed above, there may be other methods of small-boat fishing which would be productive on Guam. Techniques which have proved successful in other tropical areas, as well as other innovative techniques which seem promising, should be investigated to determine their value on Guam. New techniques may prove to be more effective or more fuel-efficient than existing methods, and may be useful for harvesting presently under-utilized resources.

One such new development is the deployment of fish aggregating devices. These moored devices have proved effective in Hawaii and Samoa for concentrating pelagic fishes and enhancing catches of these species by trolling fishermen (including charterboats) and by ika-shibi fishermen. The aggregating devices placed near Guam have not yet proven their value, but the program of deployment of fish aggregating devices on Guam has been faced with several problems. The first of these problems is the placement of the devices. Most of the sites originally selected for placement of the devices were not approved by the U. S. Navy because of possible problems with submarine activities. Efforts should be made to negotiate a reasonable compromise with the U. S. Navy in the selection of sites. A second problem has been vandalism, including apparently deliberate cutting of the mooring lines. Perhaps redesign of the devices to increase sea worthiness and to reduce vandalism, would solve this problem. A further problem results from the fact that many fishermen may not understand the best methods of fishing in association with aggregation devices. Fishermen may be expecting much greater yields around the devices than actually occur; controlled tests

would demonstrate the effectiveness of these devices. Once the aggregating devices have been shown to be effective, more of these devices should be deployed around Guam.

As new developments in fishing methodology evolve, and as new participants enter the fishery, programs for fishery information dissemination and fishermen-training will become increasingly valuable. The Sea Grant advisory program and the Guam Fishermen's Cooperative Association are already involved in programs of this nature and should be supported. Other programs involving bringing knowledgeable individuals to Guam for workshops and training sessions, and sending qualified trainees to other areas for training, should be developed as well.

Improvement of Resource Management

The goal of resource management is the optimal long-term utilization of fishery resources and their environments. A variety of activities are involved in achieving this goal including:

a) collecting and analyzing data on fishing catch and fishing effort of both foreign and domestic fisheries,

b) developing more efficient strategies for resource harvesting,

c) monitoring the status of resource stocks,

d) monitoring the condition of habitats utilized by resource species, and

e) designing appropriate regulations for the wise use of resource stocks and their habitats.

The National Marine Fisheries Service Honolulu Laboratory has recently initiated a 5-year program of fishery resource assessments throughout the Marianas chain. This program, called RAIOMA (Resource Assessment Investigations of the Marianas Archipelago), should provide baseline data on many of the harvestable resource stocks in the Marianas and help to achieve the goals listed above. However, it is essential that resource stocks be monitored on a continuous basis beyond RAIOMA to take advantage of the initial data base provided by this program. This continuing need for fishery research and monitoring will require the strengthening and expansion of Guam's local fishery research capability through the University of Guam Marine Laboratory and the Division of Aquatic and Wildlife Resources. Among the major needs for expanding local research capability is the availability of a research vessel provided with the necessary research equipment and of sufficient size to carry out extended studies in the waters throughout the 200-mile zone around Guam.

Related to this need for enhanced local field research capability is the need to establish a local fishery data bank for the collection and analysis of fishery data obtained from NMFS, from the South Pacific Commission (SPC), from the Fishery Resources Division of the United Nations Food and Agriculture Organization (FAO), and from foreign nations fishing in the waters around Guam.

Collection and analysis of local fishery data are being ably performed by the Division of Aquatic and Wildlife Resources. Support should be given to their efforts to expand their data collection program by more complete censusing of small-boat effort and catch and by more thorough analysis of the data collected.

Several efforts at the Federal and Regional level are being made to collect, analyze, and make available data on fisheries for Guam and the central and western Pacific. NMFS is funding a nation-wide recreational fisheries survey, which includes Guam. Results of this survey have been slow in becoming available and the validity of the data is in some doubt. However, it is hoped that improvements in this survey program will soon result in timely and reliable fishery data for Guam. Another NMFS program, FIN (Fishery Information Network), which is designed to link all parts of the United States into a nation-wide fishery data bank, is being developed. It is likely to be several years before Guam becomes tied into this network, but it should prove extremely valuable to the Territory once it becomes included. The Western Pacific Regional Fishery Management Council has initiated a program to collect, consolidate, and analyze existing fishery data from the member states (Guam, American Samoa, and Hawaii, as well as the Commonwealth of the Northern Marianas). This program should also prove to be extremely beneficial to Guam and will provide a basis for better collection of local fishery data in the future.

A few of the fishery resources available to small-boat fishermen on Guam occur principally within three miles of the island, and their management is under Territorial jurisdiction. However, most of the resources, and by far the most valuable ones, have ranges which extended well-beyond the three-mile zone around Guam, and management of these resources will involve the activities of the Western Pacific Regional Fishery Management Council. In the case of tunas, which are not covered by the Fishery Conservation and Management Act (FCMA), management will involve international negotiations. Although Guam has recently passed a law extending Territorial claim over all marine resources within 200 miles of the island, exercising this jurisdication is dependent upon development of a Territorial research, surveillance, and enforcement capacity and upon legal negotiations with the Federal government and with foreign nations. For the present, Guam's efforts to manage offshore fishery resources within 200 miles of the island will require working through the Western Pacific Regional Fishery Management Council in the preparation of Fishery Management Plans (FMP's).

The current (August 1980) status of Fishery Management Plans being addressed by the Western Pacific Regional Fishery Management Council, and Guam's principal management needs with regard to the various resources, are as follows:

1) Precious Coral FMP---Completed and awaiting approval from the U. S. Secretary of Commerce. In the absence of any demonstrated stands of precious corals around Guam, management of the resource in this area is unnecessary. The FMP permits exploratory harvesting under permit; should stands of precious corals be discovered around Guam, their extent and productivity must be investigated in order to develop a rational management regime.

2) Spiny Lobster FMP---In preparation. In the absence of demonstrated stocks of spiny lobsters in areas beyond three miles from Guam, management of the resource in this area is unnecessary. Should exploratory trapping reveal the presence of economically important concentrations of spiny lobsters around Guam, appropriate management measures should be instituted, based on studies of the biology and fishery potential of the resource.

3) Billfish FMP---In preparation. In view of the rather small domestic harvest of billfish, all of which is taken within 50 miles of Guam, and the large and increasing harvest of billfish by foreign nations in the FCZ around Guam, appropriate management measures for this resource in the FCZ around Guam would include the following:

a) Prohibition of foreign longline harvesting in areas frequented by domestic fishermen, and

b) Limitations on the increase of foreign longlining and billfish catch in the FCZ around Guam to prevent diminishing availability of this resource to domestic fishermen.

Because of the wide-ranging distribution of billfish species, international management agreements must ultimately be achieved to prevent overharvesting of this resource.

4) Bottomfish FMP--To be initiated. Much more information must be gathered on the distribution of bottomfish stocks around Guam and the population dynamics of the species. Available studies indicate that bottomfish stocks can be depleted from an area very quickly and are slow to recover (Ikehara, et al. 1970). Management measures should prohibit all foreign bottomfishing in the FCZ around Guam due to the fragility of the stocks. Domestic bottomfishing should be monitored to prevent localized overfishing.

5) Seamount Groundfish FMP--To be initiated. Studies presently under way will demonstrate the extent of seamount groundfish stocks around Guam. Very little is known about the stock dynamics of these species, but it seems likely that localized overharvesting, particularly on pinnacles and seamounts of small size, is a real danger; unless information to the contrary is obtained, foreign seamount groundfish fishing in the FCZ around Guam should be strictly limited. No domestic capacity for harvesting this resource has yet developed.

The management of tuna species is a more complex problem, as the FCMA specifically excludes the management of tunas. The wide-ranging nature of pelagic tuna species necessitates international management efforts. Should international tuna management programs be initiated, it is essential that Guam, perhaps in a coalition with other Pacific entities, be able to represent its interests independently of the United States. U. S. tuna interests in the Pacific, headquartered in southern California, are very influential in shaping U. S. policies toward Pacific tuna development. The southern California tuna industry is currently much more interested in retaining its fishing rights in the eastern and southern tropical Pacific than it is in developing tuna fisheries in the western Pacific. If the U. S. bargaining position on Pacific tuna management reflects the views of the southern California tuna industry, western Pacific tuna resources may well be ceded to foreign fisheries in exchange for U. S. fishing allocations in other parts of the world.

Not only must resources species be properly managed, but the environments within which they spend their lives must be protected as well. Because of the highly migratory nature of many marine resources species, oceanic pollution, even at considerable distance from Guam, can affect the condition of resource stocks harvested by Guam's fishermen. Although many types of pollutants can harm marine habitats and fishery species, two deserve particular attention: petroleum and radioactive wastes.

Petroleum released into the ocean from an oil tanker accident, or other causes, will, for the most part, float at the ocean surface. Some dense petroleum fractions may sink to the sea floor, but the most significant harm occurs when the floating oil washes onto reef areas. Adult, juveniles, larvae, and eggs of resource species may be killed by the petroleum pollutants and habitats may be disturbed for lengthy periods of time. In addition, the agents used to clean up oil spills are themselves very harmful to marine life. Because of these potential problems, plans to develop oil tanker superports in areas near Guam must be examined carefully. At least three proposals to establish super tanker ports in the CNMI have been made during recent years (Ernest Kosaka, pers. comm.).

Ocean dumping of nuclear wastes is potentially a much more serious problem. Because of the extraordinarily long lives of some radioactive substances, accidental release of nuclear material into the ocean could affect many generations in the future. Little is yet known about methods of long-term containment of nuclear wastes, and about the complex mixing and circulating characteristics of the ocean. It appears highly inadvisable at this time to use the oceans for nuclear waste disposal, and the Government of Guam should do all it can to discourage such activities, particularly in oceanic areas within the migratory range of fishery species harvested on Guam. Even if nuclear wastes are disposed of in such a way that there is no leakage, a single report of a fish caught near Guam with an usually high level of radioactivity (from whatever cause) could generate consumer fears and lead to the collapse of fishery development on Guam.

Improvement of Boating Safety

The U. S. Coast Guard and the Sea Grant Advisory Program are presently involved in programs of boat safety education. These programs should be supported and expanded as necessary.

Small-boat fishermen are particularly vulnerable to adverse weather conditions. At times of high waves and strong swells it is often impossible for small boats to return to the Agana Marina. It is important that small boat fishermen have accurate, up-to-date information on predicted weather and sea conditions. Such information should be available at established boat launching areas and announced on the radio early enough so that fishermen leaving port early in the morning will be informed.

Visible channel markers and operating channel lights are essential for the safety of Guam's boaters, particularly in times of bad weather and at night. The agency responsible for the maintenance of these markers must be capable of immediate repairs in the event of malfunctions. Markers should be constructed in areas frequented by boaters in which channel markers are not presently established.

The Harbor Patrol's capabilities for aiding boaters in distress should be reviewed. They should be provided with such personnel, facilities, and equipment as are necessary for rapid, effective response to requests for assistance.

Summary of Recommendations

1. Improvement of Seafood Marketing:

   A. Government support for development of Guam Fishermen's Coop marketing facility

   B. Implementation and enforcement of regulations prohibiting dumping of foreign-caught fish

   C. Enactment and enforcement of seafood labeling legislation

   D. Dissemination of information on seafood quality to consumers

   E. Comprehensive study of domestic marketing potential for locally-caught seafood

   F. Study of export marketing opportunities for locally-caught seafood

2. Development of Appropriate Infrastructure:

   A. Planning and construction of boat launching ramps

   B. Expansion and improvement of small-boat mooring facilities at Agana, Merizo, Apra Harbor, and Agat

   C. Enhancement of commercial fishing facilities at Agana Marina, Merizo, Apra Harbor, and Agat

      1. Dockside fuel and ice facility

      2. Blast freezer

   D. Study of need and feasibility of development of vessel haul-out and repair facilities

   E. Planning and construction of harbors-of-refuge

3. Reduction of Economic Barriers to Commercial Fishermen:

   A. Study of purchase prices of U. S.-built and foreign-built fishing vessels

   B. Study of costs of transporting U. S.-built fishing vessels to Guam

   C. Lobbying efforts to obtain exemption from U. S. laws requiring use of U. S.-built boats in commercial fishery

D. Lobbying efforts to obtain Federal transportation subsidies for U. S.-built boats

E. Study of feasibility of development of local boat-building industry

F. Efforts to obtain special consideration for Guam applicants for NMFS fishing vessel purchase loans

G. Survey of available fishing vessel insurance policies

H. Study of fuel use in domestic fisheries

I. Parity of fuel price for domestic commercial fishermen and foreign commercial fishermen

J. Priority fuel allocation for domestic fishermen in fuel rationing plans

K. Study of potential tourist participation in charterboat fishing on Guam

L. Promotional efforts to encourage tourists to take advantage of charterboat fishing opportunities on Guam

M. Training programs for fishery business and accounting skills

4. Improvement of Harvesting Effectiveness of Small-boat Fishermen:

A. Stock assessment of bottomfish in areas accessible to domestic fishermen

B. Study of year-to-year fluctuations in atulai stocks

C. Development of under-utilized resources:

1. Seamount groundfish

2. Spiny lobsters

3. Deep-water shrimps

4. Precious corals

5. Sharks

6. Deep-living tunas

D. Research on innovative small-boat fishing methods

E. Testing and increased deployment of fish aggregating devices

F. Expansion of programs for fishery information dissemination and fishermen training

5. Improvement of Resource Management:

   A. Expansion of fishery research capacity of local research organizations

   B. Establishment of fishery data bank for collection and analysis of relevant fishery information

   C. Enhancement of local catch and effort monitoring efforts

   D. Development of effective management measures for resource species in Guam's waters:

      1. Precious corals

      2. Spiny lobsters

      3. Billfish

      4. Bottomfish

      5. Seamount groundfish

      6. Tunas

   E. Protection of oceanic environment from pollutants and hazardous materials which may affect Guam's fishery resources

6. Improvement of Boating Safety:

   A. Expansion of programs for boat safety education

   B. Availability of timely information on weather and sea conditions

   C. Construction and maintenance of channel markers and lights

   D. Enhancement of Harbor Patrol's capabilities for aiding boaters in distress

D. Program Implementation

Responsible Agencies

The development of small-boat fisheries on Guam has been hampered by the lack of a governmental lead agency to aggressively promote this development. Several agencies [Division of Aquatic and Wildlife Resources (DAWR), Bureau of Planning (BOP), Department of Commerce (DOC), Department of Parks and Recreation (DPR), etc.] have responsibilities that coincide with the various needs for small-boat fishery development, but their efforts have not been coordinated in a productive way. The Guam Marine Fisheries Advisory Council (GMFAC) has been established to aid in coordination and information exchange, but lacks a full-time staff to implement its recommendations.

Various proposals have been made to solve this problem, such as the establishment of an Office of Fishery Development or the reorganization of GovGuam departments and the formation of a Department of Marine Resources or a Department of Natural Resources.

If the recommendations of this fishery development and management plan are to be carried out, it is necessary that some GovGuam agency be charged with the responsibility of implementing the plan. This will require either governmental reorganization or expanded responsibilities of one of the existing agencies. Without a lead agency with the necessary expertise and enthusiasm, fisheries development on Guam will languish, and the people of Guam will lose many of the potential benefits of the fishery resources around their island.

The needs of small-boat fishery development on Guam are numerous, and many organizations at the local, regional, and national level must be involved. A list of those organizations, with the abbreviations used in this document, follows:

Local Organizations

Governmental

Governor's Office

Guam Legislature

Guam Economic Development Authority (GEDA)

Department of Commerce (DOC)

Port Authority of Guam (PAG)

Department of Public Health and Social Services (DPH&SS)

Bureau of Planning (BOP)

Department of Parks and Recreation (DPR)

Attorney General (AG)

Division of Aquatic and Wildlife Resources (DAWR)

Guam Environmental Protection Agency (GEPA)

Guam Energy Office (GEO)

Department of Public Safety (DPS)

University

University of Guam Sea Grant Advisory Program (UGSGAP)

University of Guam College of Business and Public Administration (UGCBPA)

University of Guam Marine Laboratory (UGML)

Non-Government

Guam Fishermen's Cooperative Association (GFCA)

Guam Visitors Bureau (GVB)

Regional Organizations

Western Pacific Regional Fishery Management Council (WPRFMC)

Pacific Tuna Development Foundation (PTDF)

Pacific Basin Development Council (PBDC)

National Organizations

Congressional Representative

National Marine Fisheries Service (NMFS)

U. S. Army Corps of Engineers (USACOE)

U. S. Coast Guard (USCG)

Office of Coastal Zone Management (OCZM)

National Weather Service

Economic Development Authority (EDA)

Development Scenario

Program implementation for the development of small-boat fisheries involves many organizations and a variety of activities (Table 6-1). If the recommendations are implemented, it is anticipated that within 5 years the following results will be obtained:

1. The Coop marketing facility will be constructed in combination with other fishing facilities at the Agana Marina and local fish marketing will be on a firm footing.

2. More fishermen will become involved in small-boat fishing on a full-time basis and the total local catch will increase.

3. More launching ramps and mooring facilities will be constructed around the island, improving access to all fishing grounds.

4. Haul-out and repair facilities and harbors-of-refuge for fishing boats will be constructed.

5. Local fishermen will be purchasing new, larger boats from the U. S., foreign countries, and/or local boat builders.

6. More tourists will be engaging in charterboat fishing during their stays on Guam, and many tourists will come to Guam primarily to take advantage of sportfishing opportunities.

7. Bottomfishing and other economically realistic fishing techniques will be more widely used and various resources that are presently under-utilized will be harvested commercially.

8. More fish aggregating devices will be in place and these will be utilized by local commercial and recreational fishermen to increase their catch.

9. Local fishery research organizations will be collecting, analyzing, and publishing information which will help fishermen to increase their efficiency and which will contribute to effective management of local fishery resources so that they will maintain continued productivity.

10. The increased fishing activity around Guam will be accompanied by improved safe-boating practices.

11. New markets will be developed for the export sale of locally produced fishery products, demand will exceed supply, and fishermen will choose to increase their investment in the local fishery, purchase larger vessels, and expand into large-scale harvesting enterprises.

Table 6-1

Program Implementation Timetable for Small Boat Fishery Development and Management.

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
1A	Government support for development of Guam Fishermen's Coop marketing facility	Governor's Office Guam Legislature GEDA DOC	obtain construction funding	begin construction	complete facility		
1B	Implementation and enforcement of regulations prohibiting dumping of foreign-caught fish	PAG	implement and enforce regulations	→	→	→	→
1C	Enactment and enforcement of seafood labeling legislation	Guam Legislature DPHSS	enact and enforce	→	→	→	→
1D	Dissemination of information on seafood quality to consumers	GFCA UGSGAP	on-going	→	→	→	→
1E	Comprehensive study of domestic marketing potential for locally-caught seafood	DOC UGSGAP	complete				
1F	Study of export marketing opportunities for locally-caught seafood	DOC UGCBPA NMFS	complete	update as necessary	→	→	→
2A	Planning and construction of boat launching ramps	BOP DPR USACOE GEPA	planning	construction	→		
2B	Expansion and improvement of small-boat mooring facilities at Agana, Merizo, Apra Harbor, and Agat	BOP DPR USACOE PAG GEPA	planning	further planning and construction	additional construction		
2C	Enhancement of commercial fishing facilities at Agana Marina, Merizo, Apra, and Agat.	DOC DPR GFCA GEDA GEPA	planning	construction and installation	continue as necessary		

Table 6-1
Continued

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
2D	Study of need and feasibility of development of vessel haul-out and repair facilities	BOP DPR USACOE PAG GEPA	complete study	begin appropri-ate plann-ing			
2E	Planning and construction of harbors-of-refuge	BOP DPR USACOE GEPA	preliminary study and planning	additional planning	begin construction		
3A	Study of purchase pricesof US-built and foreign-built fishing vessels	DOC UGSGAP	complete				
3B	Study of costs of transporting US-built fishing vessels to Guam	DOC UGSGAP	complete				
3C	Lobbying efforts to obtain exemp-tion from US laws requiring use of US-built boats in commercial fishery	Governor's Office Congressional Rep. DOC AG	continue present efforts until successful				
3D	Lobbying efforts to obtain federal transportation subsidies for US-built boats	Governor's Office Congressional Rep.	continue efforts until successful				
3E	Study of feasibility of development of local boat-building industry	DOC		begin study	begin appropriate planning		
3F	Efforts to obtain special consider-ation for Guam applicants for NMFS fishing vessel purchase loans	Governor's Office Congressional Rep. DAWR DOC	continue efforts until successful				
3G	Study of available fishing vessel insurance policies	DOC	complete study				

Table 6-1
Continued

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
3H	Study of fuel use in domestic fisheries	GEO UGSGAP DOC	complete study				
3I	Parity of fuel price for domestic commercial fishermen and foreign commercial fishermen	DOC PAG GEO	complete				
3J	Priority fuel allocation for domestic fishermen in fuel rationing plans	Governor's Office GEO	complete				
3K	Study of potential tourist participation in charterboat fishing on Guam	GVB DOC	complete study				
3L	Promotional efforts to encourage tourists to take advantage of charterboat fishing opportunities on Guam	GVB		begin	continue →		
3M	Training programs for fishery business and accounting skills.	UGSGAP UGCBPA	begin	continue →			
4A	Stock assessment of bottomfish in areas accessible to domestic fishermen	UGML DAWR NMFS	begin	complete			
4B	Study of year-to-year fluctuations in atulai stocks	UGML DAWR	begin	continue →			
4C	Development of underutilized resources:						
	1. Seamount groundfish	DAWR	complete				
	2. Spiny lobsters	NMFS UGML	as opportunities are available				
	3. Deep-water shrimps	UGML UGSGAP NMFS	begin	complete			
	4. Precious corals	UGML	as opportunities are available				

Table 6-1
Continued

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
	5. Sharks	DOC UGML DAWR UGSGAP	begin	continue	complete		
	6. Deep-living tunas	DAWR NMFS	begin	continue	complete		
4D	Research on innovative small-boat fishing methods	UGML	begin	continue →			
4E	Testing and increased deployment of fish aggregating devices	DAWR	on-going →				
4F	Expansion of programs for fishery information dissemination and fishermen training.	UGSGAP UGML DAWR GFCA	on-going →				
5A	Expansion of fishery research capacity of local research organizations	UGML DAWR	on-going →				
5B	Establishment of fishery data bank for collection and analysis of relevant fishery information	DAWR UGSGAP UGML	begin	continue →			
5C	Enhancement of local catch and effort monitoring efforts	DAWR	on-going →				
5D	Development of effective management measures for resource species in Guam's waters						
	1. Precious corals	WPRFMC	complete				
	2. Spiny lobsters	WPRFMC	complete				
	3. Billfish	WPRFMC	complete				
	4. Bottomfish	WPRFMC	continue efforts →		complete		

Table 6-1
Continued

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
	5. Seamount groundfish	WPRFMC	continue efforts	→	complete		
	6. Tunas	Governor's Office AG DAWR	begin	continue	→	→	→
5E	Protection of oceanic environment from pollutants and hazardous materials which may affect Guam's fishery resources	Governor's Office GEPA DPH WPRFMC AG	on-going	→	→	→	→
6A	Expansion of programs for boat safety education	UGSGAP USCG	on-going	→	→	→	→
6B	Availability of timely information on weather and sea conditions	UGSGAP National Weather Service	on-going	→	→	→	→
6C	Construction and maintenance of channel markers and lights	DPR USCG	on-going	→	→	→	→
6D	Enhancement of Harbor Patrol's capabilities for aiding boaters in distress	DPS	on-going	→	→	→	→

CHAPTER VII

LARGE-SCALE HARVESTING

A. Fisheries Development and Management Objectives

Fisheries involving vessels larger than 40 feet in length, with an effective fishing range beyond 50 miles from the island, and with the capability of making trips lasting several days are considered to be large-scale fisheries. There are essentially no large-scale domestic fishery operations on Guam at present, but there appears to be a good potential for such development in the future.

Target species for the development of large-scale domestic fisheries include offshore pelagic species, principally tunas and billfish, seamount groundfish, bottomfish in areas beyond the range of small-boat fishermen, and perhaps other species.

The development of large-scale fisheries on Guam would provide an important contribution to the Territory's economic growth. The goals of development of large scale domestic harvesting are to increase the supply and quality of food fish for island consumers and to reduce Guam's dependence on imported fish products; to harvest under-utilized resources currently beyond the range and capability of small-boat fishermen; to develop a significant export market for domestic fishery products; to increase employment opportunities in the domestic fishing industry; to provide local investment opportunities; to generate significant tax revenues for the Government of Guam; and to provide development opportunities for other economic sectors related to the fishery industry. An overall goal of large-scale fishery development is the establishment of the Territory of Guam as a major center for fishery activity in the western Pacific.

In order to attain these goals, various specific objectives must be achieved. The first of these is the development of an economically healthy domestic small-boat fishery to provide a strong base out of which large-scale harvesting can develop. Without the effective marketing system, the pool of experienced fishermen, the infrastructure development, and the solution of other problems associated with the development of a small-boat fishery, the establishment and growth of a large-scale domestic fishing industry on Guam will be very difficult. With an economically sound small-boat industry, the development of large-scale harvesting can occur as a natural process of industry growth.

This growth will be encouraged through expanded infrastructure development for the operational support of larger fishing vessels, through the encouragement of increased investment in Guam's fishing industry, through further development of resource potential in areas accessible to larger vessels, and through further efforts to manage and preserve the productivity of those resources.

Although the development of a large-scale harvesting industry on Guam may create significantly expanded business opportunities in fisheries continued economic stability and long-term benefits of fisheries to

Guam require that all sectors of the fishery industry--subsistence, recreational, small-scale commercial, and large-scale commercial--be able to co-exist and prosper. Resource allocation and marketing strategies must be responsive to the needs of all sectors of the domestic fishing industry.

Summary of Development and Management Objectives

1. Overall Objectives of Development:

   A. Increase supply and quality of seafood products for domestic consumers

   B. Reduce Guam's dependence on imported seafood

   C. Harvest resources beyond the present range and capability of small-boat fishermen

   D. Develop significant export production of seafood

   E. Increase employment opportunities in domestic fishery industry

   F. Provide local investment opportunities

   G. Generate significant tax revenues

   H. Promote development of other economic sectors

   I. Develop Guam's potential as a major fishery center in the Western Pacific

2. Specific Development Objectives:

   A. Establishment of economically sound domestic small-boat fishery out of which large-scale harvesting can develop

   B. Expansion of infrastructure to meet needs of large-scale fishery

   C. Encouragement of increased investment in large-scale fishery development

   D. Development of resource potential in areas accessible to large-scale harvesters

   E. Preservation of the productive potential of resources harvested by large-scale fisheries

   F. Balanced development of all sectors of domestic fishery industry

B. Constraints

Many of the constraints to the development of large-scale harvesting on Guam are the same as those faced by small-boat fishery development, but on a larger scale. Until the constraints facing small-boat fishery development are overcome, there is little likelihood that large-scale harvesting can develop. Assuming that an economically sound small-scale fishery is established on Guam, the following constraints must be overcome if large-scale fishing is be realized:

A fleet of large (over 40 feet) fishing boats will require expanded docking facilities. A few boats up to approximately 50 ft in length could be accommodated in the Agana Marina, but vessels larger than that will require docking facilities in Apra Harbor near the Commercial Port. Along with these docking facilities, facilities for fuel and ice and for the unloading and storage of the catch will be necessary. An expanded capability for vessel maintenance and repair must be developed, as must provision for protecting the fleet during typhoons.

The capital investment required for purchasing, fitting out, and operating large vessels will be significant. Rising fuel costs and the possibility of fuel rationing may create major economic problems for the development of a large-scale domestic fishery.

The local market may prove too limited to absorb the catch of both large-and small-scale fisheries, and export markets must be developed. Japan appears to be a particularly attractive market for high quality tuna and seamount groundfish, but reliable information on the Japanese (or other) export market potential is lacking. Although Guam is involved in the tuna cannery transshipment network, the relatively low prices currently paid for cannery-grade fish probably rules out complete reliance on this export strategy for domestic harvesters.

The most promising resource species for large-scale domestic harvesting are tunas, and the principal methods of harvesting these species on a large scale are longlining, live-bait pole-and-line, purse-seining, and commercial trolling. Each of these methods has constraints which must be overcome if domestic harvesting is to be realized:

1. Longlining--This method has the fewest developmental constraints of the four methods listed above. Foreign longlining around Guam has already demonstrated that this method will catch significant amounts of tuna and billfish. Boats as small as 40 ft can be used for longlining, and immediate expansion of docking facilities would not be necessary (although growth of this industry would require subsequent infrastructure development). The major need is for a pilot-scale investigation of longline feasibility using a vessel around 40 ft in length, which, if successful, would be followed up by training in longlining methods. Once demonstrated to be a viable form of domestic fishing, tuna longlining could be developed as a natural outgrowth of domestic small-boat fishing.

2. Live-bait pole-and-line fishing--This method targets on surface dwelling schools of skipjack and yellowfin tuna. The most immediate constraint is the lack of local supplies of suitable baitfish and the lack of reliable methods for culturing baitfish on Guam. An additional constraint is the larger vessel size typical of pole-and-line fisheries--60 to 90 ft. A significant fleet of domestic pole-and-line boats would require major financial investment and major development of docking and supply facilities. Despite these constraints, tuna bait capture, holding, aging, and culture activities should be investigated. Although Guam has no proven source of live bait for pole-and-line tuna fishing, there may be some potential for importation of live bait for storage and sale to both foreign and domestic pole-and-line vessels. Small amounts of local bait in Guam and the Northern Marianas might also be accumulated in holding pens for sale to foreign or domestically-owned vessels. Aquaculture experiments may result in production

of bait fish for sale to pole-and-line vessels. Baitfish culture trials currently under way in Samoa, Hawaii, and other Pacific islands should be monitored for applicability to Guam. Further exploration of all these possibilities is warranted.

3. Tuna purse-seining--Purse-seining vessels are typically very large (350-1200 net tons). The capital investment required for vessels and gear ($4-7 million per vessel) precludes the likelihood of a domestically owned purse-seine tuna fishery. In addition, harboring and servicing facilities would require extensive development. Exploratory purse-seining carried out in waters near Guam by the Pacific Tuna Development Foundation has not been overwhelmingly successful, and the potential for the development of this fishery using local capital seems unlikely. Furthermore, tunas taken by purse-seiners are generally of lower quality, suitable only for the cannery market. Although Guam is part of the Pacific tuna transshipment network, the price of cannery-grade tuna is much lower than tuna for the fresh fish market, either domestic or export. U. S. west coast purse-seiners are beginning to show interest in fishing in the western Pacific as their access to tunas in the eastern Pacific is limited by the 200-mile jurisdictions of Mexico and the nations of Central and South America. Japanese purse-seiners are also increasing their operations in this area. U. S. and Japanese purse-seine fisheries may develop in the western Pacific, in which case Guam should be prepared to serve as a base for vessel servicing and supply. This subject is discussed further in the chapter on Transshipment and Processing.

4. Commercial trolling--Hawaii has an albacore tuna fishery operating in the high seas near Midway Islands, using 55-75 ft trolling vessels and a larger mothership. Most of the boats participating in this fishery are based in the U.S. west coast or Hawaii, and are contracted to work the Hawaii fishery during the albacore season (April-September). This fishery is in the early stages of development in Hawaii, but seems to show considerable promise. There seems little likelihood that such a fishery could develop on Guam in the foreseeable future: near-surface-dwelling albacore appear to be limited to more northerly waters; Guam is located so far from Hawaii or Alaska, the major U. S. markets for albacore, that it is doubtful that trolling boats would choose to travel this far without significant guarantees of success; the enormous logistics problems of operating a large fleet out of Guam would require a major development of Guam's capacity to service such a fleet. Despite these difficulties, there is some evidence that annual migrations of albacore move from west to east in the northern Pacific. If this is the case, it may be possible for trolling boats leaving Guam to intercept albacore stocks at the western extention of their migratory range and to follow the migration into the Hawaii fishery. This may offer the opportunity for a seasonal albacore fishery operating between Guam and Hawaii.

Seamount groundfish may also offer opportunities for large-scale fishery development, although exploratory surveys to date have not indicated the existence of fishable stocks of these species near Guam. The techniques of fishing for seamount groundfish are apparently not easily acquired. Should stocks be found in waters near Guam, training programs would be necessary before a domestic harvesting capacity could be developed.

Bottomfish occuring in waters beyond the range of the domestic small-boat fishery may have considerable potential for development. Essentially untapped stocks of bottomfish exist along the Northern Marianas Chain and along the parallel West Mariana Ridge. Precautions must be taken in the development of bottomfish resources as it is apparently easy to overfish localized areas. The major constraints to the development of a large-scale domestic bottomfish fishery are the acquisition of vessels capable of operating over long distances, the care necessary to maintain the catch in good condition for the duration of the fishing trip, and the development of sufficient market capacity (domestic and export) to handle the harvest. It will also be necessary to develop regulations to protect the small-boat harvest of bottomfish from being depleted by large-scale harvesters.

Development of domestic large-scale harvesting will be dependent upon the accumulation and analysis of much more data on the distribution, abundance, and seasonal patterns of resource species as well as research on gear development, economics, and other aspects of fisheries science. The lack of an effective local research capacity for the investigation of high-seas and distant-water resources will impede rapid development of large-scale domestic fisheries.

Summary of Contraints

1. Need for economically sound small-boat fishery from which large-scale harvesting can develop

2. Lack of adequate infrastructure for large-scale domestic fishery operations:

   A. Docking facilities

   B. Facilities for vessel supplying and catch handling

   C. Facilities for vessel maintenance and repair

   D. Facilities for fleet protection during typhoons

3. Large capital investment costs

4. Fuel costs and possible fuel rationing

5. Local market limitations

6. Lack of information on export market potential

7. Harvesting constraints:

   A. Need for pilot-scale demonstration of domestic longlining effectiveness

   B. Lack of fishermen experienced in methods of large-scale fishing

   C. Lack of natural or cultured baitfish

   D. Lack of major success in purse-seining trials around Guam

E. Dependence of purse-seining on the cannery market for the sale of harvest

F. Lack of demonstrated abundance of near-surface albacore near Guam

G. Logistics difficulties and infrastructure needs for the support of commercial tuna trolling and purse-seining fleets

H. Lack of demonstrated stocks of seamount groundfish near Guam

I. Potential user conflicts among small- and large-scale bottomfish fishermen

8. Lack of effective local fishery research capacity to supply data needs for large-scale fishery development.

C. Recommendations

Although the benefits provided by the development of a large-scale seafood harvesting industry on Guam would accrue to a large segment of the island community--through the increased availability of locally produced seafood, through increased employment, through the generation of tax revenues, etc.--it is the profit motive that encourages private sector investment and participation in this development. The role of the government, as it should be in any type of economic development, is to acquire and disseminate information on the potential for development, to provide appropriate public facilities to support development, and to manage public resources to achieve long-term public benefits. If the government promotes an economic climate within which large scale fisheries are able to develop, the private sector can be relied upon to take the lead in making this development a reality.

The most important foundation for the development of a large-scale domestic harvesting capacity on Guam is the successful development of a domestic small-boat fishery. A well-developed small-boat fishery will provide a pool of trained fishermen, experienced in the fundamentals of commercial fishing and knowledgeable in the fishery resources of the area; it will provide the initial infrastructure which can be developed to accommodate the needs of larger fishing vessels; and, perhaps most importantly, it will provide the confidence that Guam can develop its fishery resources in a way which will provide the greatest benefits to its people.

Large-scale fishery developments, based in the continental United States, Japan, Taiwan, or elswhere, may use the port facilities in Guam to support their activities in this area, and thereby provide economic benefits to Guam. However, distant-water fisheries based outside of Guam cannot be expected to be as responsive to the social and economic needs of the Territory as a locally based fishery would be. Whether or not off-island fishery development involves Guam as a base, Guam should proceed with the development of a local large-scale harvesting capacity which will maximize benefits to all the people of Guam.

The recommended priorities for development of large-scale local harvesting are the following:

1) Longlining for subsurface tunas and billfish

2) Distant-water bottomfishing

3) Seamount groundfish fishing

4) Live-bait pole-and-line fishing for surface tunas

Other potential large-scale harvesting methods--tuna purse-seining, albacore trolling, precious coral harvesting, and spiny lobster trapping--do not appear feasible for local fishery development in the foreseeable future, although new discoveries could change this assessment.

As the development of any of these large-scale fisheries will require an extensive commitment of island resources, both public and private, it is necessary that thorough analyses of the economic potential of these fisheries be performed. Such analyses should consider resource availability, capital opportunity costs, social costs, production costs, and the value of the harvested resources under various marketing strategies.

General Development Needs for Large-Scale Domestic Harvesting

All large-scale harvesting methods require appropriate fishing vessels, large enough to fish over considerable distances and for relatively long periods of time, and equipped to carry out the desired type of harvesting. To make these vessels available to Guam's fishermen, the same steps as outlined above for improving the availability of small boats must be taken:

1) study of purchase prices of U.S.-built and foreign-built fishing vessels;

2) study of transportation costs for U.S.-built vessels;

3) lobbying for exemption from U.S. laws prohibiting use of foreign-built vessels in domestic commercial fisheries;

4) lobbying to obtain Federal transportation subsidies for U.S.-built vessels;

5) efforts to obtain NMFS vessel-purchase loans;

6) efforts to obtain reasonably-priced, reliable marine insurance.

Fuel will continue to be a problem. Domestic fishing vessels should be able to obtain fuel at prices equal to or lower than those charged foreign vessels. In the event of fuel rationing, domestic fishing vessels should receive high priority, certainly higher than foreign fishing vessels.

Facilities for mooring, supplying, servicing, repairing, and protecting the domestic fleet should be planned and implemented to meet the needs of a growing number of large fishing vessels. In developing these facilities, as well as facilities for handling and storing the catch, land will be required near Commercial Port. Territorial-Federal negotiations regarding the use of this land must be resolved. Furthermore, the U.S. Navy's use of Apra Harbor must be consistent with the growing use of this harbor by domestic fishing vessels.

Each of the resources recommended for large-scale domestic harvesting

has its own unique marketing opportunities and constraints, but the need for expanded markets is common to all. A comprehensive study of the market potential of the various species of tunas, bottomfish, and seamount groundfish must be carried out. This study should address the following issues:

1) the capacity of the local market to handle greater volumes of fish;

2) export marketing opportunities in Japan, Hawaii, the U.S. mainland, and elsewhere;

3) shipping costs and schedules for export marketing;

4) form of product desired by various markets (fresh, flash-frozen, filleted, etc.);

5) seasonal fluctuations in price and market demand.

Specific Development Needs

1. Longlining for Subsurface Tuna and Billfish--

This fishery seems to be quite promising for rapid domestic development:

a) Subsurface tuna and billfish resources (mainly yellowfin, bigeye, albacore, and blue marlin) are known to occur in the waters around Guam and are currently being harvested in considerable quantities by Japan, Taiwan, and Korea;

b) Vessels no larger than some of the boats currently in use on Guam can be used effectively in this fishery, with subsequent expansion into the use of larger boats;

c) Longline bait is more easily acquired than the bait fish used in skipjack pole-and-line fisheries.

The major needs for the development of this fishery are to demonstrate its effectiveness and to develop export marketing arrangements. A pilot-scale demonstration of longline fishing should be carried out in Guam waters using a relatively modest-sized vessel (40-60 ft). This should be a year-long study to determine the seasonal availability of various longline resource species around Guam. Combined with this study should be a program for fishermen training, providing domestic fishermen with experience in using longlining methods.

At the same time, marketing opportunitites for these species in Japan should be explored. The Japanese market appears to be the most promising and should be investigated first, but other export markets should be addressed subsequently.

Management of the tuna and billfish resources harvested by the domestic longline fleet will require efforts on a regional level (through the Western Pacific Regional Fishery Management Council) and on an international level. Specific approaches to management of these resources have been addressed in the

previous section on Small-Boat Fisheries. Development of a domestic longline fleet will create an even greater need for Guam to have an influential voice in the management of these resources.

2. Distant-Water Bottomfishing--

The target species of this fishery are the stocks of bottomfish beyond the range of domestic small-boat fishermen, in the Northern Mariana chain and on the West Mariana Ridge. Development of this fishery will depend upon the acquisition of large vessels capable of making extended fishing trips to productive grounds and with the capacity to flash-freeze and store the catch until the vessel returns to Guam. The management of this fishery presents some potentially controversial problems. It has been demonstrated that unrestricted bottomfishing in a small area can deplete localized bottomfish stocks which are slow to recover. As bottomfishing is becoming increasingly important in the domestic small-boat fishery harvest on Guam, it is essential that the resources within the range of the small-boat fleet be protected against over harvesting by large-scale fisheries. Resources within the range of the domestic fishermen of the Commonwealth of the Northern Mariana Islands must also be protected against overharvesting. Furthermore, foreign bottomfishing within the FCZ around Guam and CNMI must be carefully regulated to prevent depletion of this valuable resource. The Bottomfish Fishery Management Plan, the development of which is being initiated by the Western Pacific Regional Fishery Management Council (WPRFMC), may provide an appropriate means of balancing the management needs of bottomfish fisheries in the Guam-Marianas area; however, the relationship of the CNMI to the WPRFMC is rather unclear at the present time, and this may create difficulties for optimal management of these resources. It may be in the best interests of Guam and the CNMI to develop a joint management regime for bottomfish, supplementary to the work of the WPRFMC.

Bottomfish resource management, however accomplished, must be based on reliable scientific information on stock size and distribution, growth rates, recruitment rates, harvesting pressure, etc. There is a major need for bottomfish stock assessment throughout the whole Marianas chain and along the West Mariana Ridge. Recruitment rates can be studied by monitoring stock recovery at experimentally depleted sites. Bottomfish growth rates, based on the analysis of growth rings in bones and scales, are being studied in Hawaii; these studies should be supplemented by the analysis of growth rings from bottomfish specimens from the Guam-Marianas area.

Export markets for an expanded domestic catch of bottomfish must be explored.

3. Seamount Groundfish Fishery

On-going exploratory fishing by the PTDF-funded Typhoon will presumably determine whether this fishery has development potential as a domestic industry. Results thus far have not been promising, but subsequent fishing may reveal a resource potential in seamount groundfish around Guam. Japanese reports indicate that the techniques of seamount groundfishing are difficult to acquire, and the failure of the Typhoon to capture these fishes may be a result of the crew's lack of experience in this fishery.

Should the existence of fishable stocks of seamount groundfish be demonstrated around Guam, programs to train local fishermen in the techniques of locating and harvesting these species should be initiated. Further development will depend upon the acquisition of appropriate vessels with a capability for freezing and storage of the catch. Local and export market potential must also be addressed.

The three methods of fishing discussed above as separate industries would probably be best developed through the use of multi-purpose vessels, equipped to carry out longlining, bottomfishing, and seamount groundfishing as resource availability and market demand varies.

4. Live-Bait Pole-and-Line Fishing

The species harvested by this method, surface schools of skipjack and yellowfin tuna, are known to occur in abundance around Guam and are harvested extensively by the Japanese. In 1977, Japanese baitboats harvested more than 2000 metric tons of skipjack tuna in the Fishery Conservation Zone around Guam and almost 3000 metric tons in the Fishery Conservation Zone around the Northern Marianas.

The fundamental requirement for development of a domestic live-bait skipjack fishery is the availability of baitfish. Natural baitfish stocks in the waters around Guam appear to be small, but further exploratory work may be able to identify sufficient stocks of baitfish to support a small number of vessels. More promising in the long run, however, is the development of a local capacity to raise baitfish in captivity. Several experimental programs in Hawaii, Samoa, and Palau are investigating the feasibility of culturing skipjack baitfish. The results of these investigations should be studied closely. Once baitfish culturing methods have been developed and the cultured baitfish have been demonstrated to be successful in the fishery, efforts should be made to develop a local baitfish culturing program. Experimental trials with the locally-cultured baitfish should then be carried out around Guam in conjunction with programs for training local fishermen in skipjack pole-and-line fishing techniques. If these steps are successful, subsequent development will depend upon the capacity for increased baitfish production, the acquisition of appropriate fishing vessels, and development of marketing strategies.

There may be some potential for accumulation of small amounts of natural or cultured bait for sale to domestic or foreign pole-and-line vessels. The transport and storage of live bait from Japan may also prove feasible. Studies of the feasibility of both these alternatives should be undertaken.

Efforts to develop a large-scale fish harvesting capacity on Guam will depend on the acquisition and analysis of much data on the economic, technological, and biological aspects of fisheries. The efforts of the National Marine Fisheries Service to obtain and analyze these data must be supplemented by an increased local capacity for fishery research.

Continuing efforts to protect offshore resource stocks against pollutants, particularly radioactive contaminants, must be maintained. It would be a tragedy to lose the enormous resource potential of the marine

environment of the western Pacific through lack of wisdom in waste disposal.

Summary of Recommendations

1. Proceed with development of domestic small-boat fisheries to provide basis for development of domestic large-scale fisheries.

2. Perform economic analysis of developmental potential of domestic large-scale fisheries

3. Improve local access to large fishing vessels

4. Provide adequate supplies of boat fuel

5. Provide appropriate infrastructure for large-scale fisheries development

6. Negotiate Federal-Territorial use of Apra Harbor and adjacent land

7. Carry out comprehensive marketing study for disposition of large-scale harvest

8. Initiate pilot-scale demonstration and training program for tuna longlining

9. Promote regional and international management of billfish and tuna

10. Promote sub-regional and regional management of bottomfish resources

11. Carry out bottomfish stock assessment in area of Guam-Northern Marianas

12. Develop training programs for seamount groundfish harvesting if this resource has a demonstrated potential

13. Carry out survey of natural stocks of skipjack baitfish around Guam, and study the potential for tuna bait storage and transfer

14. Monitor research on baitfish culturing and initiate local baitfish culturing programs when appropriate

15. Carry out cultured baitfish field trials and pole-and-line training programs

16. Develop local fishery research capacity to support large-scale domestic fishery development

17. Maintain efforts to protect fishery stocks and their environments from radioactive contamination and other types of pollution.

D. Program Implementation

Responsible Agencies

The need for a lead agency to coordinate and direct Guam's fishery development has been addressed in the previous section on Small-Boat Fishery Development. Large-scale local harvesting is envisioned as an outgrowth of domestic

small-boat harvesting, and the same lead agency should be responsible for both sectors of fishery development on Guam.

The various existing organizations which would be involved in carrying out the recommended projects (see Table 7-1) are as follows:

Local Organizations

Governmental

Governor's Office

Department of Commerce (DOC)

Attorney General (AG)

Guam Energy Office (GEO)

Port Authority of Guam (PAG)

Division of Aquatic and Wildlife Resources (DAWR)

Guam Environmental Protection Agency (GEPA)

Department of Public Health and Social Services (DPH&SS)

Bureau of Planning (BOP)

University

University of Guam College of Business and Public Administration (UGCBPA)

University of Guam Marine Laboratory (UGML)

Regional Organizations

Western Pacific Regional Fishery Management Council (WPRFMC)

National Organizations

Congressional Representative

National Marine Fisheries Service (NMFS)

Development Scenario

It is anticipated that domestic harvesting on a large-scale can develop from small-scale fisheries by a process of natural industry growth, helped, where appropriate, by governmental action.

Although large-scale local fisheries are not expected for some years, early action on a number of fronts is necessary to make the transition to large-scale harvesting feasible (see Table 7-1).

Studies must be initiated on the marketing and economic potential of large-

scale domestic harvesting and on the resource potential of appropriate target species. Training fishermen in large-scale methods will be necessary.

Efforts must be continued to obtain the use of land adjacent to Apra Harbor for facilities development, and the planning of these facilities should be initiated. Continued efforts are also needed to obtain easier access to fishing vessels for local fishermen.

An appropriate local research capacity must be developed to meet the needs of a growing domestic fishery for enhancing the yield of large-scale fisheries and for proper management of stocks.

It is anticipated that within 5 years there will be a modest number of local longline vessels harvesting tunas primarily for export sale. Vessels capable of extended fishing trips for the harvest of bottomfish (and perhaps seamount groundfish) at greater distances from Guam should also be operating. It is hoped that skipjack bait culturing methods will have been developed within 5 years and that trials using this bait will have been performed around Guam.

Full development of Guam's local fishery capacity will take longer than 5 years, but significant steps in this direction should be apparent by this time. Success within the first 5 years will encourage investment and participation in this industry and pave the way for future expansion.

Table 7-1

Program Implementation Timetable for Large-Scale Fishery Development and Management

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
1.	Proceed with development of domestic small-boat fisheries to provide basis for development of domestic large-scale fisheries	(See previous section)					
2.	Perform economic analysis of developmental potential of domestic large-scale fisheries	DOC UGCBPA	begin	continue	complete	update as necessary →	
3.	Improve local access to large fishing vessels	Governor's Office Congressional Rep. AG DOC	continue efforts until successful				
4.	Provide adequate supplies of boat fuel	Governor's Office GEO DOC PAG	on-going effort →				
5.	Provide appropriate infrastructure for large-scale fisheries development	DOC PAG			preliminary planning	continued planning	construction as appropriate
6.	Negotiate Federal-Territorial use of Apra Harbor and adjacent land	Governor's Office Congressional Rep. AG	continue efforts until successful				
7.	Carry out comprehensive marketing study for disposition of large-scale harvest	DOC UGCBPA	begin study	complete		update as necessary →	
8.	Initiate pilot-scale demonstration and training program for tuna longlining			begin	complete		

Table 7-1 Continued

	PROJECT	RESPONSIBLE ORGANIZATIONS	YEAR 1	2	3	4	5
9.	Promote regional and international management of billfish and tuna	Governor's Office Congressional Rep. WPRFMC	initiate efforts	continue			
10.	Promote sub-regional and regional management of bottomfish resources	Governor's Office WPRFMC DAWR	initiate efforts	continue			
11.	Carry out bottomfish stock assessment in area of Guam-Northern Marianas	NMFS WPRFMC		initiate studies	complete		
12.	Develop training programs for seamount groundfish harvesting if this resource has a demonstrated potential	DAWR		initiate if appropriate			
13.	Carry out survey of natural stocks of skipjack baitfish around Guam and study the potential for tuna bait storage and transfer	UGML DAWR			begin	complete	
14.	Monitor research on baitfish culturing and initiate local baitfish culturing program when appropriate	UGML DAWR	on-going research monitoring		initiate local culturing when appropriate		
15.	Carry out cultured baitfish field trials and pole-and-line training programs						when appropriate
16.	Develop local fishery research capacity to support large-scale domestic fishery development	UGML DAWR	on-going				
17.	Maintain efforts to protect fishery stocks and their environments from radioactive contamination and other types of pollution	Governor's Office GEPA DPH&SS WPRFMC	on-going efforts				

CHAPTER VIII

TRANSSHIPMENT AND PROCESSING

A. Fisheries Development and Management Objectives

The current status of tuna transshipment activities in Guam is discussed in an earlier section of this document (see Chapter III, Section E). Although transshipment provides a positive contribution to the economy, its growth is limited and depends largely upon factors outside the control of Guam. Such factors include tuna resource abundance, the growth of competitive Pacific islands, tuna price and exchange rate fluctuations, technological innovations in harvesting methods, fuel availability, shipping route changes, container availability, etc. The major buyers and sellers of tuna are large multi-national corporations. Having little or no capital invested in Guam, they can easily shift transshipment through other ports should economic or political conditions change.

At the present time it appears that most American tuna canneries are operating at less than full capacity. Demand for canned tuna softened during 1979, the U. S. cannery pack was off by 12 percent from a year earlier, and imports of foreign caught tuna were down (U. S. Department of Commerce, 1980). Tuna harvests in the Pacific have tended to level off in the last four years, and Bumble Bee Sea Food, the U. S. firm most interested in expansion, has recently decided to build a cannery in the Philippines. All these factors make it highly unlikely that an American firm will desire to construct tuna canning operations in Guam for the foreseeable future.

Other potentials for processing remain to be investigated. These include tuna "loining", foreign tuna cannery operations, and other methods of small scale regionally-oriented processing of specialty fish products. These small scale processing activities may ultimately prove well-suited to the land, labor, capital, resource, and market constraints common to island economies in the western Pacific.

<u>Summary of Development Objectives</u>

1. Create local investment and employment opportunities

2. Decrease Guam's dependence on imported fish products

3. Increase the supply, quality, and desirability of locally produced fish products

4. Create more adequate local participation in and benefit from resources harvested within Guam's waters

5. Ensure that processing and transshipment activities interface with and complement traditional subsistence, artisanal, recreational, and charterboat fishing activities.

6. Encourage locally produced fishery exports

The following specific objectives are based upon the above general objectives for development of transshipment and processing:

1. Increase foreign and domestic tuna transshipment activity, both by sea and air

2. Increase use of Guam's Commercial Port as a base for both U. S. and foreign tuna fishing vessels

3. Expansion of industrial land and infrastructure proximal to Guam's Commercial Port

4. Investigation of potential for partial tuna processing, i.e. loining with associated fish meal and oil by-product production

5. Evaluation of potential for small scale fish processing for local consumption and regional export, i.e. Kamaboko, fish kelaguin, guaneles (lomi-lomi), packaged fillets, small scale canning, and dried and smoked products

B. Constraints

Following are the major constraints to development of transshipment and processing in Guam:

1. Inefficiencies with present transshipment processes

2. Periodic lack of sufficient refrigerated containers

3. Lack of container storage capacity

4. Lack of sufficient industrially oriented land and utility infrastructure proximal to Guam Commercial Port

5. Lack of abundant natural live bait for tuna pole-and-line fishing

6. Difficulties with immigration and customs regulations and procedures

7. Lack of adequate and low cost ship repair facilities

8. Poor access to recreational facilities for vessel crews on shore leave

9. High fuel prices and inconsistent availability of fuel

10. Lack of a coordinated Government program to attract both foreign and domestic tuna industry

11. Lack of coordinated programs and local expertise aimed at developing small scale processing of specialty fishery products for local and regional consumption.

C. Recommendations

Pursuit of the following recommendations is considered essential to further growth of transshipment and processing in Guam:

1. Implement cost saving and improved efficiency of existing transshipment activities at the Commercial Port (Callaghan and Simmons, 1980). Guam should have a reputation for unloading vessels quickly and efficiently so that minimal time is lost on the fishing grounds. Dockside costs of operation for many purse-seiners may run as high as $2,500 per day.

2. Begin active coordination (including development of necessary legislation and regulations, and fixing authority and responsibility) to insure that vessels offloading fish are given priority over non-transshipping vessels for fuel, provisioning, anchorage, dock space, crew shore leave, and recreation.

3. Implement immediate procedures for data collection and develop a questionaire to be administered to each fishing vessel entering the Port of Guam. Data from each vessel on a wide range of biological and economic variables is essential to both development and management of fisheries in Guam's waters.

4. Associated with #3, maintain regular contact with vessel captains and industry representatives to ensure that problems with transshipment activities are quickly and adequately remedied.

5. Proceed with container yard expansion plans as soon as possible.

6. Make every effort to secure from the Navy suitable industrial land adjacent to Guam Commercial Port and begin immediately to ensure sufficient water, power and other industrial infrastructure.

7. Develop a coordinated program to actively seek and encourage foreign and domestic processing as well as both sea and air transshipment. This should be done in conjunction with item #2 in order to sell U. S. and Asian processors on Guam's industrial and transshipment potential.

8. Develop a coordinated and planned effort by both public and private sectors to encourage use of Apra Harbor as a base of operations for fishing vessels of both the United States and foreign nations. Such a program should involve port improvements to facilitate all types of vessel and shipping services. There is every expectation that tuna purse-seining will become the dominant method of tuna fishing in the western Pacific over the next several years. Guam is in an excellent geographic position to serve as a western base for American seiners. Recent developments in the northwest albacore troll fishery also hold promise of attracting more U. S. tuna vessels to this part of the world at least on a seasonal basis. It is essential that Guam begin now to attract this potential business.

9. Explore the possibility of tuna "loin" processing on Guam. The loining process involves heading, gutting, sectioning, precooking and freezing of tuna in preparation for eventual canning. Prices paid by canneries for the loined product are from 2 to 3 times more than for whole frozen tuna of the same species. Shipping costs and the need for containers are reduced since more usable meat can be shipped in a single container. Byproducts of fish meal and fish oil result from the loining process. Further research on the feasibility of loining in Guam is warranted.

10. Explore the potential for Kamaboko (fish cake) production on Guam. Foreign longline vessels frequently call at the Commercial Port for fuel, provisions, and ice, but do not transship tuna (Callaghan 1980). From 20 to 50 percent of all longline catches represent species other than tuna. Many of these incidental species, including sharks, are suitable for use in Kamaboko. Foreign vessels may welcome the opportunity to offload incidental catch, receiving some revenue, and at the same time freeing hold space for the more valuable target species - tuna and billfish. Kamaboko production could also provide a low priced market for locally caught fish during seasonal periods of oversupply. Further research on the feasibility of kamaboko production in Guam is warranted.

11. Explore the feasibility for a wide range of small scale processing activities for specialty items such as poki, fish kelaguin, guaneles (lomi-lomi), packaged fillets, small scale canning, and dried and smoked products. Guam's ethnic diversity and tourism industry provides an excellent opportunity for small scale entrepreneurial production of seafood specialty products appealing to local cultural tastes. Some of these items may have export potential to nearby islands and Asian Countries.

D. Program Implementation

Local agencies responsible for the implementation of the foregoing recommendations are:

Bureau of Planning (BOP)

Department of Commerce (DOC)

Port Authority of Guam (PAG)

Attorney General (AG)

Public Utility Agency of Guam (PUAG)

Guam Power Authority (GPA)

Division of Aquatic and Wildlife Resources (DAWR)

Guam Energy Office (GEO)

Each of these local agencies may have access to federal funds through the following federal and regional agencies and programs:

Pacific Basin Development Council (PBDC)

Pacific Tuna Development Foundation (PTDF)

National Marine Fisheries Service (NMFS)

Economic Development Authority (EDA)

Office of Coastal Zone Management (OCZM)

Department of Navy (DN)

A recommended program implementation timetable is presented in Table 8-1.

Table 8-1

Program Implementation Timetable for Transshipment and Processing

	PROJECT	RESPONSIBLE ORGANIZATION	YEAR 1	2	3	4	5
1.	Introduce efficiency and cost-saving efforts at Guam Commercial Port	PAG	this project is a continuing effort				
2.	Development of legislation and policies aimed at giving fuel priority and other advantages to vessels transshipping fish through Guam	AG DOC GEO	begin	evaluate need for further work			
3.	Increased data collection from vessels entering the Commercial Port of Guam	PAG DOC DAWR	this project is a continuing effort				
4.	Container yard expansion, and land acquisition on Cabras Island	PAG DOC DN	begin	continue as needed			
5.	Planning and development for land, water, power, and other infrastructure needs at Guam Commercial Port	PAG PUAG DN GPA DOC BOP	begin	continue as needed			
6.	Develop coordinated effort to sell the use of Apra Harbor to both foreign and U.S. industry	PAG DOC	begin	evaluate need for effort			
7.	Study feasibility of tuna "loining"	DOC	begin	completion			
8.	Study feasibility of "Kamaboko" and other small scale processing activities	DOC	begin	completion			

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APPENDIX

RECOMMENDATIONS BY CATEGORIES

INFRASTRUCTURE DEVELOPMENT

Small-Boat Fisheries

Development of Guam Fishermen's Coop Marketing Facility

Planning and Construction of Boat Launching Ramps

Expansion and Improvement of Small-Boat Mooring Facilities at Agana, Merizo, Apra Harbor, and Agat

Enhancement of Commercial Fishing Facilities at Agana Marina, Merizo, Apra Harbor, and Agat:

1. Dockside Fuel and Ice Facility
2. Blast Freezer

Planning and Construction of Harbors-of-Refuge

Construction and Maintenance of Channel Markers and Lights

Large-Scale Fisheries

Provide Appropriate Infrastructure for Large-Scale Fisheries Development

Transshipment and Processing

Proceed with Container Yard Expansion Plans

RESEARCH AND DATA-GATHERING -- BIOLOGICAL

Reef Fisheries

Island-wide Stock Assessment of Harvestable Reef Resources

Analysis of Critical Habitat Requirements of Important Reef Species

Studies of Stock Dynamics of Selected Species of Reef Organisms of Socio-Economic Value

Enhancement of Present Efforts to Collect and Analyze Data on Reef Harvesting Pressure

Establishment of Continuing Program of Reef Stock Assessments Coordinated with Data on Harvesting Pressure

Study of Feasibility of the Establishment of Reef Sanctuaries

Establishment of a Program for Ciguatera Monitoring

Assessment of Resource Potential of Reef Species with Favorable Market Potential

Small-Boat Fisheries

Stock Assessment of Bottomfish in Areas Accessible to Domestic Fishermen

Study of Year-to-Year Fluctuations of Atulai Stocks

Studies on Under-Utilized Resources:

1. Seamount Groundfish
2. Spiny Lobsters
3. Deep-Water Shrimps
4. Precious Corals
5. Sharks
6. Deep-Living Tunas

Expansion of Fishery Research Capacity of Local Research Organizations

Establishment of Fishery Data Bank for Collection and Analysis of Relevant Fishery Information

Enhancement of Local Catch and Effort Monitoring Efforts

Large-Scale Fisheries

Carry Out Bottomfish Stock Assessment in Area of Guam-Northern Marianas

Carry Out Survey of Natural Stocks of Skipjack Baitfish around Guam

Monitor Research on Baitfish Culturing and Initiate Local Baitfish Culturing Program when Appropriate

Develop Local Fishery Research Capacity to Support Large-Scale Domestic Fishery Development

Transshipment and Processing

Implement Procedures for Collecting Fishery Data from Fishing Vessels Entering the Port of Guam

RESEARCH AND DATA-GATHERING--ECONOMIC

Reef Fisheries

Acquisition of Export Market Information for Selected Reef Species

Analysis of Economic Potential for Development of Commercial Export Harvesting of Selected Reef Species

Small-Boat Fisheries

Comprehensive Study of Domestic Marketing Potential for Locally-Caught Seafood

Study of Export Marketing Opportunities for Locally-Caught Seafood

Study of Purchase Price of U.S.-Built and Foreign-Built Fishing Vessels

Study of Costs of Transporting U.S.-Built Fishing Vessels to Guam

Study of Feasibility of Development of Local Boat-Building Industry

Survey of Available Fishing Vessel Insurance Policies

Study of Fuel Use in Domestic Fisheries

Study of Potential Tourist Participation in Charterboat Fishing on Guam

Large-Scale Fisheries

Perform Economic Analysis of Development Potential of Domestic Large-Scale Fisheries

Carry Out Comprehensive Marketing Study for Disposition of Large-Scale Harvest

Study the Potential for Tuna Bait Storage and Transfer

Transshipment and Processing

Explore the Feasibility of Tuna Loin Processing on Guam

Explore the Potential for Kamaboko (Fish Cake) Production on Guam

Explore the Feasibility for Other Small-Scale Fish Processing Activities on Guam

RESEARCH AND DATA-GATHERING--TECHNOLOGY

Small-Boat Fisheries

Research on Innovative Small-Boat Fishing Methods

Testing and Increased Deployment of Fish Aggregating Devices

Large-Scale Fisheries

Initiate Pilot-Scale Demonstration and Training Program for Tuna Longlining

Monitor Research of Baitfish Culturing and Initiate Local Baitfish Culturing Programs When Appropriate

Carry Out Cultured Baitfish Field Trials and Pole-and Line Training Programs

Develop Local Fishery Research Capacity to Support Large-Scale Domestic Fishery Development

DEVELOPMENT OF LEGAL AND POLICY FRAMEWORK FOR FISHERY DEVELOPMENT AND MANAGEMENT

Reef Fisheries

Review of Reef Pollution Sources and Evaluation of Measures for Effective Control of Pollution and Habitat Destruction

Development and Implementation of Regulations for Protecting Critical Habitats Against Environmental Damage

Evaluation of Need for Control of Harvesting of Important Resource Species

Development and Implementation of Appropriate Regulations to Prevent Over-Harvesting of those Species in Need of Stock Management

Development and Implementation of Regulations Prohibiting Wasteful and Destructive Harvesting Methods

Development of Effective Enforcement Capacity

Development of Appropriate Commercial Harvesting Regulations to Ensure Long-Term Stock Productivity

Small-Boat Fisheries

Implementation and Enforcement of Regulations Prohibiting Dumping of Foreign-Caught Fish

Enactment and Enforcement of Seafood Labeling Legislation

Lobby Efforts to Obtain Exemption from U.S. Laws Requiring Use of U.S.-Built Boats in Commercial Fishery

Lobbying Efforts to Obtain Federal Transportation Subsidies for U.S.-Built Boats

Efforts to Obtain Special Consideration for Guam Applicants for NMFS Fishing Vessel Purchase Loans

Parity of Fuel Price for Domestic Commercial Fishermen and Foreign Commercial Fishermen

Priority Fuel Allocation for Domestic Fishermen in Fuel Rationing Plans

Development of Effective Management Measures for Resource Species in Guam's Waters:

1. Precious Corals
2. Spiny Lobsters
3. Billfish
4. Bottomfish
5. Seamount Groundfish
6. Tunas

Protection of Oceanic Environment from Pollutants and Hazardous Materials which May Affect Guam's Fishery Resources

Large-Scale Fisheries

Improve Local Access to Large Fishing Vessels

Provide Adequate Supplies of Boat Fuel

Negotiate Federal-Territorial Use of Apra Harbor and Adjacent Land

Promote Regional and International Management of Billfish and Tuna

Promote Sub-Regional and Regional Management of Bottomfish Resources

Maintain Efforts to Protect Fishery Stocks and Their Environments from Radioactive Contamination and other Types of Pollution

Transshipment and Processing

Begin Efforts to Ensure that Vessels Transshipping Fish are Given Priority over Non-Transshipping Vessels for Fuel, Provisioning, Anchorage, Dock Space, Crew Shore Leave, and Recreation

Secure from the Navy Suitable Industrial Land Adjacent to Guam Commercial Port and Begin Immediately to Ensure Sufficient Water, Power, and Other Industrial Infrastructure

EDUCATION, TRAINING, AND INFORMATION DISSEMINATION

Reef Fisheries

Establishment of Educational Programs to Foster Appreciation of the Value of Reef Resources, to Encourage Increased Participation in Reef Fisheries, and to Preserve Traditional Fishing Methods

Publication of Relevant Economic and Biological Information to Enable Commercial Business Interests to Develop Economic Potential of Export Harvesting

Small-Boat Fisheries

Dissemination of Information on Seafood Quality to Consumers

Promotional Efforts to Encourage Tourists to Take Advantage of Charterboat Fishing Opportunities on Guam

Training Programs for Fishery Business and Accounting Skills

Expansion of Programs for Fishery Information Dissemination and Fishermen Training

Expansion of Programs for Boat Safety Information

Availability of Timely Information on Weather and Sea Conditions

Large-Scale Fisheries

Initiate Pilot-Scale Demonstration and Training Program for Tuna Longlining

Develop Training Programs for Seamount Groundfish Harvesting if this Resource Has a Demonstrated Potential

Carry Out Cultured Baitfish Field Trials and Pole-and-Line Training Programs

Transshipment and Processing

Develop a Coordinated Program to Actively Seek and Encourage Foreign and Domestic Processing as well as Both Sea and Air Transshipment

Develop a Coordinated and Planned Effort to Encourage Use of Apra Harbor as a Base of Operations for Fishing Vessels of Both the United States and Foreign Nations

IMPROVEMENT OF ON-GOING ACTIVITIES

Small-Boat Fisheries

Enhancement of Harbor Patrol's Capabilities for Aiding Boaters in Distress

Transshipment and Processing

Implement Cost Saving and Improved Efficiency of Existing Activities at the Commercial Port

Maintain Regular Contact with Vessel Captains and Industry Representatives to Ensure that Problems with Transshipment Activities are Quickly and Adequately Remedied

COMMENTS ON THE DRAFT

TERRITORY OF GUAM FISHERIES DEVELOPMENT AND MANAGEMENT PLAN

A draft of the Territory of Guam Fisheries Development and Management Plan was provided to all members of the Guam Marine Fisheries Advisory Council (GMFAC) in October 1980 for their review. Comments received from the agencies and organizations represented on the Council were evaluated and the draft was revised to incorporate many of the suggestions made. On December 16, 1980, the revised draft was sent out for formal review to the following organizations:

Government of Guam

Department of Commerce
Guam Port Authority
Guam Economic Development Authority
Bureau of Planning
Department of Agriculture
Territorial Planning Commission
Department of Land Management
University of Guam Marine Laboratory
Department of Parks and Recreation
Guam Environmental Protection Agency

Regional Organizations

Pacific Basin Development Council
Western Pacific Regional Fishery Management Council
Pacific Tuna Development Foundation
University of Hawaii Sea Grant Program

Federal Agencies

National Marine Fisheries Service, Western Pacific Program Office
U.S. Army Corps of Engineers, Guam Project Office
U.S. Coast Guard, Marianas Section
National Park Service, Guam
U.S. Fish and Wildlife Service, Hawaii
Office of Coastal Zone Management

Others

Guam Fishermen's Cooperative Association
Guam Boating and Fishing Association
Guam Growth Council

Comments were received from the following organizations:

Date	Organization
11/19/80	Director, Department of Parks and Recreation
12/29/80	Director, Bureau of Planning
1/5/81	Sam Pooley, Western Pacific Regional Fishery Management Council
1/5/81	Chief, Guam Operations Office, U.S. Army Corps of Engineers
1/7/81	Executive Director, Pacific Basin Development Council
1/7/81	Director, Department of Commerce
1/9/81	Acting Director, University of Guam Marine Laboratory
1/9/81	Director, Department of Agriculture
1/13/81	Administrator, Guam Environmental Protection Agency
1/16/81	General Manager, Port Authority of Guam
1/21/81	Pacific Islands Administrator, U.S. Fish and Wildlife Service
1/23/81	Executive Director, Western Pacific Regional Fishery Management Council
1/27/81	Office of Coastal Zone Management
1/30/81	Executive Secretary, Territorial Planning Commission

Following are summaries of the comments received and the responses made:

1. Director, Department of Parks and Recreation

Suggests that reference be made to insufficient laws and enforcement thereof regarding illegal fishing practices as constraints for development and management of reef fisheries and that the preservation of traditional fishing methods be a management objective. Also notes that the Merizo fuel pier is private and does not serve the general public.

Response:

These suggestions have been addressed in the appropriate areas of the text.

2. Director, Bureau of Planning:

Suggests inclusion of more information on fisheries-related weather conditions around Guam; listing of Office of Coastal Zone Management as a source of Federal funding; statement acknowledging OCZM for preparation of plan.

Response:

More fisheries-related weather information is provided in Chapter I and in Table 1-1; OCZM is listed as a source of Federal funding Chapter VIII; acknowledgement of OCZM for Plan preparation is included inside the front cover.

3. Sam Pooley, Western Pacific Regional Fishery Management Council:

Need for description of interrelationships between Territory of Guam and Western Pacific Regional Fishery Management Council, RAIOMA (Research Assessment Investigations of the Marianas Archipelago), the Pacific Basin Development Council, and the National Marine Fisheries Service; need for underlining the importance of a Territorial lead agency for fisheries development and management; need for summary of data needs and reference to proposed data collection efforts by National Marine Fisheries Service and Western Pacific Regional Fishery Management Council.

Response:

Figure 3-2 has been added to Chapter III in an attempt to indicate the various and complex interrelationships among Federal, Regional, and Territorial organizations concerned with fishery development and management. However, this diagram may soon become an anachronism under the major reprioritization and budget management programs of the new Federal Administration. Until the dust settles, it may be premature to attempt a more detailed description of Federal Regional, and Territorial interactions in the area of fisheries.

The RAIOMA project is described briefly in Chapter VI.

The importance of a Territorial lead agency for fisheries development has been emphasized by several reviewers of the draft plan (see comments #8, 9, and 12). Whereas the Plan suggests lead agencies for carrying our specific recommendations and for coordinating interagency activities, the major recommendation regarding an overall Territorial lead agency for fisheries is that the creation or designation of some lead agency is essential, leaving the specific choice to the discretion of the Government of Guam.

Recommendations regarding fishery data needs are brought together by categories (Biological, Economic, and Technology) in the Appendix; a discussion of Federal and Regional fishery data collection efforts relative to Guam has been added to Chapter VI.

4. Chief, Guam Operations Office, U.S. Army Corps of Engineers:

Indicates that Department of Army permits may be required for some areas of the Plan.

5. Executive Director, Pacific Basin Development Council:

Expresses the desire of PBDC to assist Guam in fishery development and indicates that the PBDC Regional Fishery Development Plan will clarify PBDC's role in regional fishery development.

6. Director, Department of Commerce:

Suggests changes in Figure 3-1 dealing with distribution of seafood products; provides updated information on 1979 seafood imports to Guam.

Response:

Figure 3-1 has been modified as suggested. The values in Table 3-4 have been changed to reflect updated import information.

7. Acting Director, University of Guam Marine Laboratory:

Indicates Marine Laboratory support for Plan and desire to continue its involvement in research on Guam's marine resources.

8. Director, Department of Agriculture:

Expresses support of Department of Agriculture for the Plan.

9. Administrator, Guam Environmental Protection Agency:

Questions whether the Guam Coastal Management Program should be the lead agency for reef fishery management and development; indicates that the Division of Aquatic and Wildlife Resources (Department of Agriculture) would be more appropriate.

Response:

Clearly, close cooperation between these two agencies (GCMP and DAWR) is necessary for management and development of reef resources; the Plan recognizes this (Chapter V) and, in fact, close cooperation between these two agencies has been established. Budgetary realities may soon determine which agency has the manpower and funding to serve as lead agency for reef resource management.

10. General Manager, Port Authority of Guam:

Need for elaboration of discussion on coordination of government agencies involved in fisheries development on Guam; clarification of discussion on "dumping" of scrap fish by fishing vessels transshipping fish through Guam.

Response:

The Guam Marine Fisheries Advisory Council has made recommendations regarding governmental reorganization to improve government efforts to develop fisheries. Other than the appointment of a Fishery Officer, little has been done. The Department of Commerce, in its efforts to develop an Overall Economic Development Plan, has emerged as the most active Territorial agency in the area of fisheries development. The "dumping" of scrap fish presents marketing problems for local fishermen, as discussed in Chapter VI, Section B. The General Manager of the Port Authority has indicated in his comments that the Port is working with the Department of Revenue and Taxation (Business License Unit) and the Department of Commerce (Division of Customs and Quarantine) to ensure that all applicable regulations and statues are complied with when large quantities of scrap fish are involved.

11. Pacific Islands Administrator, U.S. Fish and Wildlife Service:

Suggests prioritization of recommendations and project cost analyses; suggests expansion of fishing facilities at Apra Harbor rather than Agana Marina; clarification of Jones Act restrictions; clarification of size over-harvesting; suggests appropriate literature citations; suggests need to implement reef sanctuaries for some species immediately; suggests "rotating" sanctuaries; indicates market potential of limited shark fishery; requests documentation of bottomfish stock depletion and recovery; proposes Territorial leasing of seamount groundfish fishing rights to foreign harvesters such as is done in Papua New Guinea; indicates that at least three supertanker ports have been considered for the Commonwealth of the Northern Mariana Islands; indicates lack of knowledge of larval fish distributions relative to toxic effects of oil; indicates potential harm to fish stocks caused by clean-up efforts.

Response:

Project prioritization is being performed by GMFAC which is serving as the Marine Resource submcommittee for OEDP. Project cost analyses are being developed by OEDP and by the contractor for the PBDC Regional Fishery Development Plan.

Whereas Agana Marina may ultimately be outgrown by domestic fishermen, the development of at least minimal fishery infrastructure (facilities for dockside receipt of catch and facilities for providing fuel and ice) at the Agana Marina appears to be much more immediately possible than would the development of appropriate small boat facilities at Apra Harbor. The Plan does recognize, however, the need to develop Apra Harbor for eventual expansion of the domestic fishing fleet.

Commercial operators on Guam are permitted to use foreign-built vessels if the vessels are less than five net tons; the CNMI is permitted by Executive Order of the President of the U.S., to use foreign-built vessels of any size for commercial purposes for the duration of the Trust Territory trusteeship agreement.

The discussion of size overharvesting has been modified by substitution of the term"optimal size" for "full size".

Bob Johannes' work on tradition methods of fishery management has been cited.

The need for immediate establishment of reef sanctuaries has not been clearly demonstrated yet, and the establishment of sanctuaries without adequate public input and education would be counterproductive. Subsistence reef harvesting is practiced widely on Guam, and most reef harvesters operate on reef areas near their village of residence. There would be considerable resentment among reef fishermen if sanctuaries were imposed on them without opportunities for review and discussion and, under such conditions, poaching would be difficult to eliminate. Studies on the feasibility of establishment of reef sanctuaries should evaluate the possibility of having moving, rather than, or in addition to, fixed sanctuaries.

The Mexican and Central American shark fishery has been noted in Chapter VI.

The bottomfish stock depletion study has been cited in Chapter VI; local bottomfish fishermen report that catches continue to be poor at this location more than a decade after the overfishing occurred.

It would appear that leasing fishing rights to foreign fishermen is not a legal option for Guam under its present relationship with the United States. This could well be an item for discussion in Guam's future status negotiations with the United States.

The comments on supertanker ports and oil pollution have been included in Chapter VI.

12. Executive Director, Western Pacific Regional Fishery Management Council:

Indicates need to show Plan's relationships with WPRFMC's Guam - NMI Integrated Plan, RAIOMA, and the PBDC Regional Fishery Development Plan; need to identify Federal lead agencies for fishery development; need to show interrelationships between recommendations which refer to different fishery sectors but which are similar in content.

Response:

The three projects mentioned (WPRFMC's Guam-NMI Integrated Plan, RAIOMA, and PBDC's Regional Fishery Development Plan) were in an early stage of development at the time the draft Plan was prepared and the scopes of these projects were all rather vaguely defined. RAIOMA has been firmed up somewhat, but there is still a good deal of uncertainty about the effects of Federal funding cuts on the breadth and duration of this program. A brief summary of RAIOMA has been included in Chapter VI. The PBDC Regional Fishery Development Plan will apparently confine itself solely with fishery development issues which are of Regional importance. It is expected that the PBDC Plan will be consistent with the local fishery plans of Guam, the CNMI, American Samoa, and Hawaii. Although a preliminary list of objectives for the WPRFMC's Guam-NMI integrated Plan has been drawn up, the actual scope and content of this Plan are still rather unclear.

Federal interrelationships have been indicated diagrammatically in Table 3-2. The impact of policy shifts by the new Federal Administration may cause major changes in Federal responsibilities for fishery development and management in the Western Pacific.

The Appendix categorizes the various recommendations and brings together those which are similar in content. Whenever possible, projects which satisfy more than one recommendation should be encouraged.

13. Office of Coastal Zone Management:

Need for more specificity on pollution and habitat modification in reef areas; specification of data collection needs; need for input from all Territorial agencies involved in fisheries in the development of the Plan; need for agreement among Territorial agencies on the goals and implementation recommendations for fisheries management and development; resolution of interagency conflicts regarding fisheries management and development; emphasis on necessity for "...the Government of Guam to spell out specific territorial positions in the form of objectives and policy statements in the areas of territorial influence over living marine resources and their habitat."

Response:

Chapter V Section B lists the various types of pollution and habitat-modifying activities that can have harmful effects on Guam's reef habitats. The Plan itself does not identify particular pollution sources but does recommend that a thorough review of present and anticipated future activities which may cause reef pollution and environmental damage be carried out by the Guam Environmental Protection Agency.

Data collection needs are included in the recommendations in Chapters V through VIII. In the Appendix, all the data-gathering needs are categorized.

The Plan review process has allowed all Territorial agencies involved with fisheries to provide input and criticism. Whereas there have been some interagency differences in the direction of fisheries development

on Guam, and whereas there is a lack of clarity regarding potentially overlapping agency responsibilities in the area of marine resource development and management, many of these problems have arisen because no plan for Territorial fisheries development and management has existed; the adoption of this Plan should go far toward minimizing interagency conflicts by establishing Territorial objectives and implementation stategies for fisheries development. The Plan itself, once adopted, will become the Territorial policy on marine resource development and management.

14. Executive Secretary, Territorial Planning Commission:

No comments.

The authors of the Territory of Guam Fisheries Development and Management Plan appreciate the contributions of all the reviewers. The efforts of the reviewers have resulted in an improved Plan for Guam.

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