3.11 AFFECTED SUB-REGIONS AND FISHING COMMUNITIES

Section 3.10 provides a description of each of the pelagic fisheries on a sector-by-sector basis. The present section explores the linkages between these fisheries/sectors and the geographic and sociocultural characteristics of five specific sub-regions within the Western Pacific Region – Hawai'i, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands and the U.S. Pacific remote island areas (PRIA). These linkages are described in two contexts: (1) the sub-regions and communities themselves, in order to place the fisheries in a regional and socioeconomic context; and (2) the sociocultural settings of the fishery, in order to place the fisheries in a cultural context. Both the regional/socioeconomic and cultural contexts vary from sub-region to sub-region and have the potential to influence the strength and direction of potential social impacts associated with fishery management measures.

This section's topics are organized as follows:

- a regulatory overview;
- the regional and socioeconomic context of the pelagic fisheries, including discussions of the economic importance of pelagic fisheries to communities; and
- a description of (1) the demographics and economy; and (2) fishing communities and sociocultural setting for each of the five sub-regions.

3.11.1 Regulatory Overview

The socioeconomic analysis provided in this section is driven by requirements of the National Environmental Policy Act, Executive Order 12898 and the Magnuson-Stevens Act. Under NEPA, 'economic' and 'social' effects are specific environmental consequences to be examined (40 CFR § 1508.8). This section contains an overview of the standard socioeconomic variables typically found in an EIS, including a summary of population, income and employment data for each sub-region.

Beyond NEPA requirements, this section takes into account Executive Order 12898 (59 FR 7629 [1994]), which requires federal agencies to address environmental justice concerns by identifying "disproportionately high and adverse human health and environmental effects...on minority and low-income populations." Consistent with these requirements, the socioeconomic analysis presented here includes demographic data on minority and low-income populations in each sub-region.

This section is also guided, in part, by National Standard 8 under the Magnuson-Stevens Act. National Standard 8 is part of a set of standards that apply to all FMP's and regulations promulgated to implement such plans. Specifically, National Standard 8 states that:

> Conservation and management measures shall, consistent with the conservation requirements of this [Magnuson-Stevens] Act (including the

> prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities and (B) to the extent practicable, minimize adverse economic impacts on such communities (Sec. 301(a)(8)).

The Magnuson-Stevens Act defines a 'fishing community' as "...a community that is substantially dependent upon or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities" (Sec. 3 (16)). NMFS further specifies in the National Standard guidelines that a fishing community is "...a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries dependent services and industries (for example, boatyards, ice suppliers, tackle shops)" (63 FR 24235, May 1, 1998). 'Sustained participation' is defined by NMFS as "...continued access to the fishery within the constraints of the condition of the resource" (63 FR 24235, May 1, 1998).

Consistent with National Standard 8, this section first identifies affected sub-regions and communities and then describes and assesses the nature and magnitude of their dependence on and engagement in the pelagic fisheries of the Western Pacific.

3.11.2 Regional and Socioeconomic Context

For the purposes of this socioeconomic analysis, the Western Pacific Region has been subdivided into five sub-regions that correspond to distinct geographic and political/social/cultural units. These sub-regions are:

- **State of Hawai'i**. This state lies 2,500 miles west of the continental United States. It spans approximately 1,500 miles, encompassing eight main islands and numerous smaller islands and atolls.

- **Territory of American Samoa**. This territory is composed of a group of islands south of the equator approximately 2,300 miles southwest of Hawai'i.

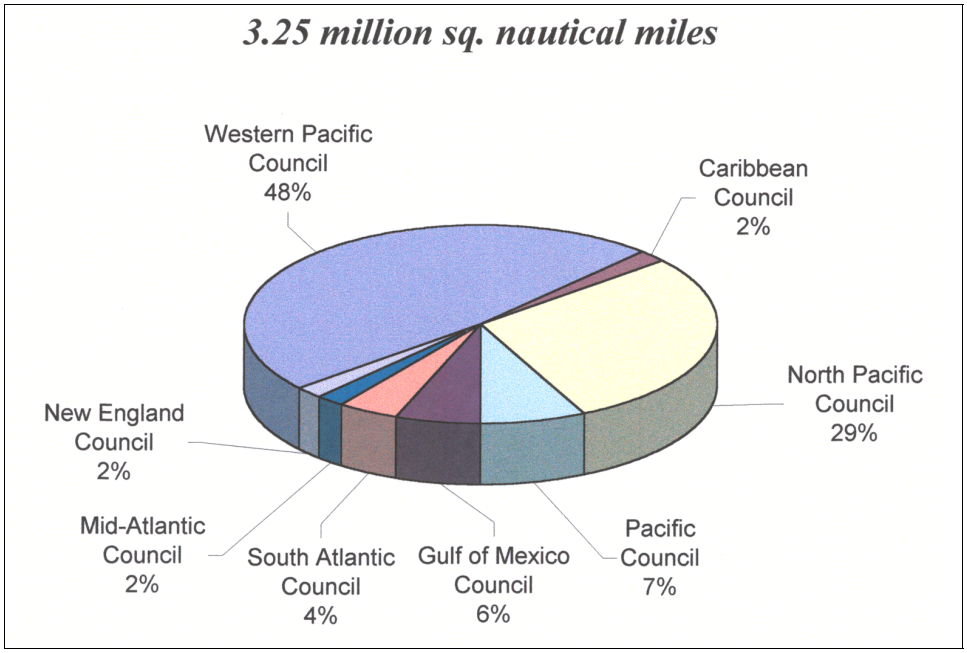
- **Territory of Guam**. This territory is comprised of a single island located on the southern end of the Mariana archipelago. It is 1,500 miles from Tokyo and 3,700 miles west sourthwest from Honolulu.

- **Commonwealth of the Northern Mariana Islands**. This commonwealth consists of 14 islands, and is the U.S.-affiliated island group closest to Asia. It is north of Guam with which it shares the Mariana archipelago.

- **U.S. Pacific Remote Island Areas of the Western Pacific Region**. This grouping consists of Wake, Howland, Baker and Jarvis Islands, Midway, Johnston and Palmyra Atolls, and Kingman Reef. These island areas are socioculturally distinct from the others described, as their human populations largely consist of transient military and/or other federal agency personnel.

These regions are geographically distinct, with vast distances separating some of the island groups (Figure 1-1). Most of the islands within these sub-regions are very small, but the EEZ waters surrounding them encompass almost 1.5 million square miles, an area nearly equal to all other U.S. EEZ waters combined (Figure 3.11-1). The pelagic fisheries occurring within this vast area have played an important role in shaping the social and economic fabric of each of the Pacific island societies included in the Western Pacific Region. Yet, in examining the pelagic fisheries in a sub-regional or community context, especially for the purposes of this specific analysis, it is critical to bear in mind that the degree to which the different island areas or sub-regions of the Western Pacific are affected by changes in the FMP varies significantly.

Figure 3.11-1: Area of the U.S. EEZ Under the Jurisdiction of Each Fishery Management Council. Source: WPRFMC, 1999.



Fishing industry sectors related to the harvest, processing and transshipment of tuna and other highly-migratory pelagic species have made U.S. ports in the Western Pacific Region among the nation's leaders in terms of value of catch landed. However, fisheries occurring inside the U.S. EEZs of the Western Pacific – that is, the area covered by the FMP – account for only a small fraction of the volume of pelagic species caught in the Pacific basin. This small percentage reflects the fact that Pacific pelagic stocks are capable of extensive movement

and are the targets of intense competition among a multitude of distant-water U.S. and foreign fishing fleets that operate on the high-seas and within the EEZs of many nations.

Hawai'i is unique in the Western Pacific Region in that a relatively high proportion of the pelagic fish landed in this sub-region are harvested within the U.S. EEZs. Even then, about half of the catch of the pelagic fishery of greatest economic importance to Hawai'i - the longline fishery - occurs outside the EEZ. The sub-region with the next highest landings of pelagic species harvested within the U.S. EEZ is American Samoa. Yet, the quantity of fish landed by boats operating in federal waters around the territory are far eclipsed by the landings of domestic and foreign distant-water fishing vessels that deliver tuna to American Samoa's fish canneries. Similarly, in Guam catches of pelagic species in the EEZ are much smaller than the landings by the international fleet of distant-water tuna vessels that utilize the territory as a reprovisioning and transshipment center. Even in the CNMI, which benefits the least from distant-water fishing fleets in the Pacific, the quantity of tuna that enters local air transshipment operations from island areas outside the commonwealth exceeds catches of pelagic species within the EEZ around the CNMI. In considering the baseline or existing conditions of the pelagic fisheries of the Western Pacific Region (and the subsequent analysis of alternatives) it is fundamentally important to understand the relative role of that portion of the fishery subject to direct management under the FMP.

3.11.3 Community and Sociocultural Setting of the Pelagic Fisheries

It is important to select an appropriate frame of reference or geographic/social unit of analysis because one of the primary purposes of this EIS is to adequately describe the differential distribution of potential social impacts that may arise from specific fishery management measures. The degree of specificity required to adequately perform this task varies from sub-region to sub-region, as described in the individual sub-regional discussions in the following subsections.

The community setting of the pelagic fisheries of the Western Pacific Region is a complex one. While the region shares some features with domestic fishing community settings elsewhere, it is unlike any other area of the United States or its territories and affiliates in terms of its geographic span, the relative role of U.S. EEZ versus foreign EEZ versus high seas area dependency, as well as its general social and cultural history. Further, the identification of specific, geographically identical and bounded communities in these small insular areas is often problematic, at least for the purpose of social impact analysis. Participants in some pelagic fisheries may reside in one area on an island, moor or launch their vessels in another area, fish offshore of a different area, and land their fish in yet another area. In these cases, an island or group of islands is the most logical unit of analysis for describing the community setting and assessing community-level impacts. On the other hand, in cases such as the Hawai'i-based longline fishery the influence of and dependency upon the fishery appears to be concentrated in certain areas of a particular island. Unfortunately, in most instances there is a paucity of socioeconomic data on fishery participants at a sub-island level with which to illustrate these points.

3.11.3.1 Economic Importance to Communities

The management of pelagic fisheries is of particular importance to the sub-regions and communities of the Western Pacific, as the harvest of pelagic species is the major component of fishing industry or activity in the region. The Pacific basin contains immense pelagic fisheries resources and provides more than 40 percent of the world tuna catch. The annual landings of various tuna species harvested from the entire Pacific islands region total over one million metric tons (mt), with a dockside value of $1.5 billion (Lawson, 1995).

When the WPRFMC was created in 1977, foreign fleets were fishing heavily for tuna as close as twelve miles to American-flag Pacific islands. The Council's initial priority was to restrict foreign fishing and allow domestic fishers more opportunities to catch fish. Hawai'i, being the most industrialized and populated island area, was in the best position to support an expansion of the domestic commercial fishery. At that time it was the policy of the United States that highly migratory fish could be effectively managed only through international arrangements. This policy led to a provision in the Magnuson Act of 1976 that effectively precluded the authority of coastal nations to establish exclusive fishing rights over tuna within their EEZs.[37] Despite the inability of the WPRFMC to manage tuna fishing by foreign vessels in the U.S. EEZ, the number of domestic longline vessels based in Hawai'i grew from 14 in 1979 to 141 in 1991. Landings by longline vessels increased from 1,900 mt to 11,500 mt between 1987 and 1993. The inflation-adjusted ex-vessel value of the catch more than tripled during this period to $56 million. Swordfish catches accounted for most of this revenue and represented about 60 percent of the total domestic landings for this species. More recently, the longline fleet has returned to targeted tuna species, and the harvest of albacore, bigeye and yellowfin reached a record high of 7,651 mt in 1997. In 1998, the port of Honolulu ranked 30th in the nation in terms of the quantity of fish landed, but it ranked 7th in terms of the value landings (Table 3.11-1).

[37] In 1992, the Magnuson Act was amended to include all tunas as management unit species so that the United States recognized coastal state jurisdiction over highly migratory species within EEZ boundaries.

Table 3.11-1: Ex-vessel value of fish landings by commercial domestic and foreign vessels at major U.S. ports, 1996-1998. Source: WPRFMC, 1999.

Port	Value of Landings ($ millions)		
	1996	1997	1998
Pago Pago, American Samoa	211.8	192.7	~232.0
Dutch Harbor-Unalaska, Alaska	118.7	122.6	110.0
New Bedford, Massachusetts	100.5	103.2	93.5
Agana, Guam	94.2	NA	NA
Kodiak, Alaska	82.3	88.6	78.7
Brownsville-Port Isabel, Texas	60.0	46.1	64.2
Honolulu, Hawai'i	50.1	53.7	49.0
Key West, Florida	62.8	54.9	NA
Reedville, Virginia	NA	29.5	42.6
Point Judith, Rhode Island	46.0	47.6	41.8

The expansion of the longline fishery in Hawai'i during the past two decades has been accompanied by a general trend away from bulk fisheries for pelagic species (e.g., fish cake and canned tuna) and development of quality, high-price products (e.g., *sashimi* tuna) that have enhanced the market value of Hawai'i's pelagic fisheries (Boehlert, 1993). Local and export markets for Hawai'i's seafood products have expanded enormously in recent years, and fresh fish from Hawai'i's waters now appears on restaurant menus throughout the United States, from Honolulu to Des Moines to Boston (Pooley, 1993).

Hawai'i's smaller-scale troll and handline fisheries have also benefitted in recent years from this expanding local and export markets for high-quality seafood products. Annual revenues within these fisheries total around $10 million.

Related to the troll fishery is the charter boat industry that targets billfish, tuna and other pelagic species mainly for a tourism-based clientele. With direct revenues of $17 million from patrons' fees and fish sales and indirect revenues of up to $30 million, and some 77,000 anglers participating annually, charter fishing is a notable component of tourism in Hawai'i (Glazier, 2000). Selling the catch is a priority for many charter vessel operators, with the revenues from fish sales generally being split evenly among the captain, crew and vessel owner (Hamilton, 1998). One component of recreational fishing that has gained in popularity is tournament fishing. Most notable is the Hawaiian International Billfish Tournament conducted annually on the Island of Hawai'i. Since its inception in 1958, this tournament has consistently attracted the most serious big game anglers in the world. In 1995, 72 boats with fishers from 15 countries participated. An indication of the economic significance of these tournaments is that the winner of a 1998 fishing tournament in Kona won $111,000 after landing a 500 lb blue marlin. Recreational fishing is also of economic importance in Hawai'i.

The U.S. FWS (1996) estimates that in 1996, 260,000 anglers in the state spent $130 million on fishing trip-related items.

The other areas within the Western Pacific Region have not experienced the same increase in domestic industrial-scale fisheries that occurred in Hawai'i, at least within the harvest sector. The local fishing fleets that operate in the EEZs around American Samoa, Guam, and the CNMI consist mainly of small boats operated by part-time commercial or recreational fishers. However, these islands have discovered alternative ways to take economic advantage of expanding Pacific pelagic fisheries. Tuna processing, transshipment and home port industries have developed in these islands because they possess a comparative economic advantage over other locations in the Pacific basin. These advantages include proximity to fishing grounds, shipping routes and markets; the availability and relatively low cost of fuel and other goods and services that support tuna fishing operations; tariff-free market access to the United States; and significant tax incentives.

American Samoa has seen a level of fish processing related activity unequaled elsewhere in the United States, with the capital of Pago Pago easily being the leading port in the United States in terms of the value of fish landings (Table 3.11-1). For many years Pago Pago has been the site of a major tuna canning industry, and the StarKist cannery in Pago Pago is the current world's largest tuna processing facility. In 1998, American Samoa received 208,300 short tons of fish worth approximately $232 million. Since the tuna processing industry began in American Samoa four decades ago, it has been the largest private sector employer in the territory and leading exporter.

The link between local waters and processors in American Samoa, however, is not a straightforward one. The principal suppliers of tuna to the canneries are island-based U.S. purse seiners that fish primarily between five and ten degrees north or south of the Equator for skipjack and yellowfin tuna. From 1990 to 1998, about 95 percent of the domestic purse seine harvest in the central and western Pacific occurred outside the U.S. EEZ, with most of the fishing taking place between Papua New Guinea, the Federated States of Micronesia and Kiribati. However, during some years, particularly during an *El Niño*-Southern Oscillation event, a substantial portion of the U.S. purse seine harvest comes from the U.S. EEZs around Palmyra Atoll, Jarvis Island, Howland Island and Baker Island. For example, 36,970 mt of skipjack and yellowfin tuna (26 percent of the total harvest) were caught around these islands in 1997. Other major suppliers of tuna to the canneries in American Samoa include U.S. albacore trollers operating in the North and South Pacific and foreign longline vessels that fish for large albacore, yellowfin and bigeye tuna. In addition, freezer vessels deliver tuna to American Samoa from various transshipment centers around the Pacific.

Guam has also benefitted from the development of an industrial scale pelagic fishery that is not focused exclusively either on a locally-based harvest fleet, or on fish from its portion of the U.S. EEZ. During the past decade Guam has been one of the largest tuna transshipment centers in the Pacific, and the value of the fish transshipped in Guam in 1996 was estimated to be more than $94 million. Frozen fish is delivered by domestic and foreign purse seiners

and fresh fish is landed by foreign longliners or air-freighted from the Marshall Islands, Federated States of Micronesia and other neighboring Pacific islands. The fish is then shipped from Guam to markets in Japan and elsewhere.

Some Western Pacific Region communities have also found ways to benefit from the regional pelagic fisheries beyond involvement in just the harvesting and processing sectors. A particularly lucrative activity related to the tuna canning and transshipment industry is the re-supplying of the fishing boats that deliver the fish. Pago Pago Harbor in American Samoa and Apra Harbor in Guam are home ports to several hundred foreign and domestic longline and purse seine vessels. Expenditures by these fleets on fuel, provisions and repairs make an important contribution to the economies of these islands. Fleet expenditures in American Samoa were estimated in 1994 to be between $45 million and $92 million (Hamnett and Pintz, 1996). Fleet expenditures in Guam were about $68 million in 1998 (Guam Department of Commerce, 1999). This home port industry in the islands has both created primary jobs and enhanced investment opportunities for local entrepreneurs.

It should be specifically noted that with the exception of the U.S. Pacific remote island areas, all of the sub-regions in the Western Pacific benefit from foreign as well as domestic fishing operations. While the importance of foreign longline vessels as suppliers of fish to the tuna canneries in American Samoa has steadily decreased in recent years, Pago Pago remains an important re-provisioning base for foreign distant-water '*sashimi*' vessels that transship their catch to carrier vessels in the harbor. Foreign longline and purse seine vessels are the principal customers in Guam's home port and transshipment industry. This type of support activity is not limited to surface transportation, as Guam is also the center of a large air transshipment operation that flies fresh fish caught by foreign vessels to overseas markets. A similar air transshipment operation is based in the CNMI. Finally, a substantial number of foreign fishing vessels find Hawai'i an attractive and convenient location for port calls. These vessels also transship a large volume of shark fins through the state.

3.11.3.2 Sociocultural Importance to Communities

The sociocultural setting of the Western Pacific Region pelagic fisheries reflects the particular cultural and social history of the area, with different aspects of the fisheries encompassing, by varying degrees, aspects of lifeways of a divergent mix of groups, from the traditions of the descendants of the earliest inhabitants of the islands to those of some of the most recently arrived groups. In general, the sociocultural setting or aspects of a fishery include the shared technology, customs, terminology, attitudes and values related to fishing of a wide variety of these groups. While it is the fishers that benefit directly from the fishing lifestyle, individuals who participate in the marketing or consumption of fish or in the provision of fishing supplies often share in the fishing culture. An integral part of this framework is the broad network of inter-personal social and economic relations through which the cultural attributes of a fishery are transmitted and perpetuated. The relations that originate from a shared dependence on fishing and fishing-related activities to meet economic and social needs can have far-reaching effects in the daily lives of those involved.

For example, they may constitute important forms of social capital, i.e., social resources that individuals and families can draw on to help them achieve desired goals.

The products of fishing supplied to the community may also have sociocultural significance. For instance, beyond their dietary importance fish may be important items of exchange and gift-giving that also help develop and maintain social relationships within the community. Alternatively, at certain celebratory meals various types of seafood may become imbued with specific symbolic meanings.

The sociocultural context of fishing may include the contribution fishing makes to the cultural identity and continuity of the broader community or region as well. As a result of this contribution, the activity of fishing may have existence value for some members of the general public. Individuals who do not fish themselves and are never likely to, may derive satisfaction and enjoyment from knowing that this activity continues to exist. They may value the knowledge that the traditions, customs and lifeways of fishing are being preserved.

It is also important to note that fishing is a traditional economic activity in the islands of the Western Pacific Region, and that fishing, in many cases, represents a continuity with the past that may or may not have parallels in other aspects of life and making a living in the modern context. The degree of 'traditional-ness' can and does vary by vessel and gear type, with some types of fishing more closely associated with particular social, cultural, and ethnic groups than others. This is important for the analysis of fishery management measures for pelagic species to the extent that specific measures may differentially impact specific regions and communities, and social, cultural, or ethnic groups.

Culturally distinct ideas and values of relevance to the management of the pelagic fisheries are not restricted to the domain of the target species and activities associated with the use of those species. For example, issues of primary concern to the contemporary management of the longline fishery relate to the incidental mortality of sea turtles and seabirds and the controversy associated with shark finning. In these cases there are concerns that could be categorized as 'existence' or 'ethically motivated' values. For example, value may emanate from the satisfaction of just knowing that a leatherback turtle or Laysan albatross exists in a natural state. Alternatively, the public, or some portions of the public, may place an intrinsic value on sea turtles and seabirds for religious or philosophical reasons. These animals may have symbolic value as a unique life form similar to the way some marine mammals have become 'charismatic megafauna.' However, perceptions of the value of sea turtles and appropriate protection strategies vary considerably from culture to culture and between social and ethnic groups in the Western Pacific Region. In the CNMI, for example, Saipan Carolinians have strongly argued that they should be allowed to capture green sea turtles for cultural purposes if it is determined that the stock could support a limited harvest (McCoy, 1998). Some Native Hawaiians have also requested a limited harvest of green sea turtles for traditional and customary uses (Charles Ka'ai'ai, pers. comm., 20 November 2000, WPRFMC).

With specific regard to sharks, the practice of finning is perceived as wasteful by some people, as less than five percent of the animal is utilized. Finning may also be viewed as unnecessarily inhumane, especially if it is thought that it results in a lingering death. Finally, others object to finning because of the religious significance of sharks in some Pacific island cultures. In traditional Hawaiian cosmology, for example, sharks could be an *'amakua*, or *'unihipili*. The first is a beneficent guardian spirit and the latter a spirit under the control of a sorcerer. McCoy and Ishihara (1999) briefly review the past and contemporary religious connection to sharks held by indigenous peoples in the U.S.-flag Pacific islands. They quote statements by Native Hawaiians that emphasize a contemporary recognition of sharks as *'aumakua*, even if the precise meaning of this relationship differs from that of the past. Although a spiritual relationship with sharks does not appear to be an aspect of contemporary culture in any of the other U.S.-flag Pacific islands, sharks landed in fisheries in American Samoa are still often distributed within Samoan villages according to age-old ceremonial traditions (McCoy and Ishihara, 1999; Severance and Franco, 1989).

3.11.4 Hawai'i

The state of Hawai'i lies 2,500 miles southwest of North America, the nearest continental land mass. The eight main islands are part of a 137-island archipelago stretching 1,523 miles from Kure Atoll in the northwest to the island of Hawai'i in the southeast (Figure 3.11-2). The total land area of the archipelago is 6,423 square miles. The main islands include O'ahu, Maui, Kaua'i, Ni'ihau, Hawai'i, Moloka'i, Kaho'olawe and Lana'i (Figure 3.11-3). Hawai'i was established as a territory of the United States in 1900 and became the 50th state in 1959.

Figure 3.11-2: Hawaiian Islands Archipelago.

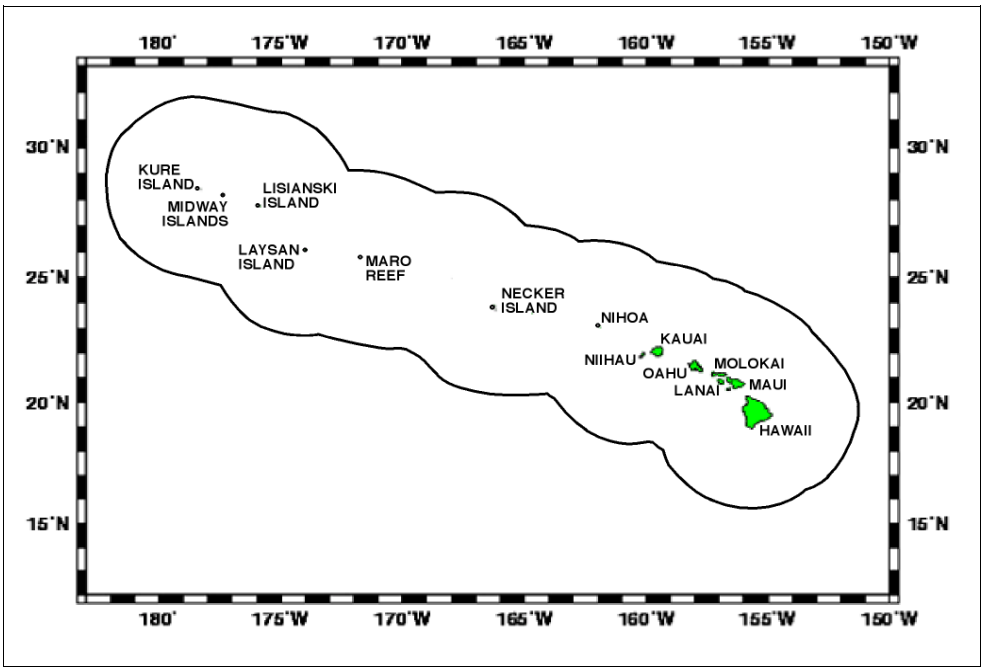
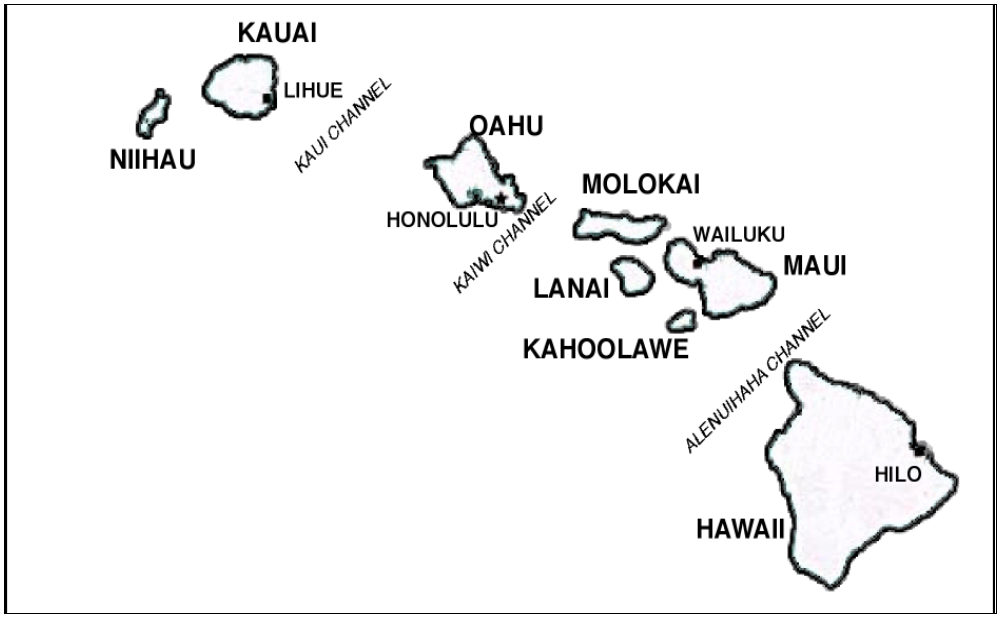


Figure 3.11-3: Main Hawaiian Islands.



In this and other sections of the EIS the description of existing conditions in the pelagic fisheries is somewhat more detailed for Hawai'i than for other sub-regions. The reason is that the focus of the FMP has generally been on the Hawai'i-based longline fishery as a consequence of (1) their high concentration in the area covered by the FMP (i.e., U.S. EEZ) in contrast to the pelagic fisheries important to the other U.S.-flag areas in the Western Pacific; (2) their complexity in terms of multiple gear types and user groups, which has necessitated more intensive management; and (3) their interaction with protected species such as seabirds and turtles..

The Hawai'i-based longline fishery has been the focus of more management or regulatory effort than any other pelagic fishery in the Western Pacific Region. Management measures in the FMP have largely been directed toward avoiding or mitigating adverse interactions between the longline fishery and small-scale fisheries and adverse interactions between the longline fishery and protected species such as the Hawaiian monk seal. There are no prohibitions that apply to any other specific pelagic fishery in the region, nor are there reporting and recordkeeping requirements, or even requirements for federal permits, for any other specific pelagic fishery.

3.11.4.1 Hawai'i Demographics and Economy

Population and Ethnicity

The 1990 census listed the population of Hawai'i as 1,108,229. This figure rose to 1,179,198 in 1995 and to 1,185,497 in 1999. The population increased by 6.9 percent between 1990 and 1999.

The state of Hawai'i is divided into five counties. The county of Maui includes the islands of Kaho'olawe, Lana'i, Maui and Moloka'i. The county of Honolulu encompasses the island of O'ahu and the Northwestern Hawaiian Islands excluding Midway Atoll. Kaua'i County consists of the islands of Kaua'i and Ni'ihau. The population of each county is provided in Table 3.11-2.

Table 3.11-2: Hawai'i Population by County. Source: U.S. Census Bureau.

	1990 Census	July 1999 (est.)
Hawai'i State	1,108,229	1,185,497
Honolulu County, HI	836,231	864,571
Hawai'i County, HI	120,317	142,390
Kaua'i County, HI	51,177	56,539
Maui County, HI	100,374	121, 939

The ethnicity of Hawai'i's population in 1998 was as follows: Caucasian (22 percent), Hawaiian/part Hawaiian (21 percent), Japanese (18 percent), Filipino (13 percent), Chinese (4 percent), and other (22 percent).

Economy

Income and Employment

Income generation in Hawai'i is characterized by tourism, federal defense spending and, to a lesser extent, agriculture (Table 3.11-3). Tourism is by far the leading industry in Hawai'i in terms of generating jobs and contributing to gross state product. The World Travel and Tourism Council (1999) estimates that tourism in Hawai'i directly generated 134,300 jobs in 1999. This figure represents 22.6 percent of the total workforce. Agricultural products include sugarcane, pineapples (which together brought in $269.2 million in 1997), nursery stock, livestock, and macadamia nuts.

Median household income in Hawai'i was calculated to be $40,827 in 1990 rising to $48,540 in 1998. Statewide per capita income in 1989 was calculated to be $15,770, rising to $25,684 in 1995 and $27,544 in 1999. The poverty rate in Hawai'i grew more over the 1990s than in the nation as a whole. Despite this growth, Hawai'i's poverty rate, which increased from 11.2 percent in 1988-1989 to 12.4 percent in 1997-1998, remained lower than the national average (13.0 percent in 1997-1998).

Hawai'i's employment growth was virtually nil for most of the 1990s, continuing through to the end of 1998. Statewide unemployment was 5.9 percent in 1990, 6.4 percent in 1996, and 5.6 percent in 1999.

Table 3.11-3: Statistical Summary of Hawai'i's Economy, 1994-1999. Source: State of Hawai'i Data Book http://www.hawaii.gov/dbedt/; BOH, 1999a.

		1994	1995	1996	1997	1998	1999
Civilian Labor Force	Number	580,150.0	576,400.0	590,200.0	592,000.0	595,000.0	594,800.0
Unemployment	Percent	6.1	5.9	6.4	6.4	6.2	5.6
Gross state product in 1996 dollars	$ Millions	38,328.0	37,963.0	37,517.0	37,996.0	38,015.0	NA
Manufacturing Sales	$ Millions	2,026.1	2,045.0	1,724.1	1,468.8	NA	NA
Agriculture (all crops and livestock)	$ Millions	503.8	492.7	494.6	486.5	492.6	NA
Construction completed	$ Millions	3,317.3	3,153.3	3,196.4	2,864.9	NA	NA
Retail sales	$ Millions	15,237.7	15,693.3	16,565.0	16,426.0	NA	NA
Defense expenditures	$ Millions	3,876.8	3,782.5	3,883.5	4,074.9	4,103.7	4,174.2

Non-Fishing Related Economic Activities

For several decades Hawai'i benefitted from the strength of regional economies around the Pacific that supported the state's dominant economic sector and principal source of external receipts – tourism (BOH, 1999a). In addition, industries of long-standing importance in Hawai'i, such as the federal military sector and plantation agriculture, also experienced significant growth. However, Hawai'i's economic situation changed dramatically in the 1990s. The state's main tourist market, Japan, entered a long period of economic malaise that caused the tourism industry in Hawai'i to stagnate. The post-Cold War era brought military downsizing. Tens of thousands of acres of plantation lands, along with downstream processing facilities, were idled by the end of the decade due to high production costs. Employment in Hawai'i sugar production fell by 20 percent between 1990 and 1993 and by an additional 50 percent from 1994 to 1995 (Yuen *et al.*, 1997).

As a consequence of the economic upheaval of the 1990s and the extensive bankruptcies, foreclosures and unemployment, Hawai'i never entered the period of economic prosperity that many U.S. mainland states experienced. Since 1998, Hawai'i's tourism industry has recovered substantially, mainly because the strength of the national economy promoted growth in visitor arrivals from the continental United States. However, efforts to diversify the economy and thereby make it less vulnerable to future economic downturns have met with little success. To date, economic development initiatives such as promoting Hawai'i as a center for high-tech industry have attracted few investors. It is unlikely that any new major industry will develop in Hawai'i in the near future to significantly increase employment opportunities and broaden the state's economy beyond tourism.

Fishing Related Economic Activities

Fishing has historically represented a small share of Hawai'i's economic activity. In 1992, Hawai'i's commercial, charter and recreational fishing sectors contributed $118.79 million of output (production) and $34.29 million of household income to the state economy, and employed 1,469 people (Sharma *et al.*, 1999). These contributions accounted for only 0.25 percent of total state output, 0.17 percent of household income and 0.19 percent of employment. However, in contrast to the sharp decline in some traditional mainstays of Hawai'i's economy such as large-scale agriculture, the fishing industry has shown appreciable growth. Revenues in Hawai'i's commercial fishing sector have fluctuated widely during the past decade, but there has been an overall upward trend (Table 3.11-4).

Table 3.11-4: Volume and Value of Commercial Fish Landings in Hawai'i, 1989-1999. Sources: WPRFMC, 1998a; WPRFMC, 1999a; NMFS, 2000; NMFS SWFSC-HL, pers. comm., October 15, 2000.

Year	Pounds Landed (1,000s)	Ex-Vessel Value (nominal $1,000s)	Ex-Vessel Value (inflation-adjusted $1,000s) [1]
1989	17,931	36,703	49,422
1990	19,744	42,604	53,463
1991	20,335	45,659	53,464
1992	28,822	58,798	65,698
1993	32,827	67,602	73,176
1994	25,746	57,534	60,621
1995	31,409	58,035	59,830
1996	30,134	58,705	59,599
1997	35,397	65,521	66,055
1998	34,786	58,108	58,718
1999	37,750	64,630	64,630

[1] Adjusted to 1999 dollars using Honolulu consumer price index.

Commercial, recreational and charter fishing has an economic impact on businesses whose goods and services are used as inputs in the fishery such as fuel suppliers, chandlers, gear manufacturers, boatyards, tackle shops, ice plants, bait shops and insurance brokers. In addition, the fishing industry has an impact on businesses that use fishery products as inputs for their own production of goods and services. Firms that buy, process or distribute fishery products include seafood wholesale and retail dealers, restaurants, hotels and retail markets. Both the restaurant and hotel trade and the charter fishing sector are closely linked to the tourism base that is fundamentally important to Hawai'i's economy. Finally, people earning incomes directly or indirectly from the fishery make expenditures within the economy as well, generating additional jobs and income.

Hawai'i's commercial fishing sector includes a wide array of fisheries. The Hawai'i-based longline fishery is by far the most important economically, accounting for 73 percent of the ex-vessel value of the total commercial fish landings in the state in 1999 (Table 3.11-5). Other fisheries targeting pelagic species, including the trolling, pelagic handline, and *aku* pole and line fisheries, accounted for an additional 16 percent of the value of the total landings.

Table 3.11-5: Volume and Value of Commercial Fish Landings in Hawai'i by Fishery, 1999. Source: NMFS SWFSC-HL, pers. comm., October 15, 2000.

Fishery	Pounds Landed (1,000s)	Percent of Total Pounds Landed	Ex-Vessel Value ($1,000s)	Percent of Total Ex-Vessel Value
Pelagics				
Longline	28,300	75%	47,400	73%
Troll	2,960	8%	4,550	7%
Handline	2,340	6%	3,950	6%
Pole and line	1,450	4%	1,850	3%
MHI bottomfish handline	420	1%	1,300	2%
NWHI bottomfish handline	370	1%	1,210	2%
NWHI lobster trap	260	1%	1,040	2%
All other fisheries	1,650	4%	3,330	5%
Total	**37,750**	**100%**	**64,630**	**100%**

3.11.4.2 Hawai'i Fishing Communities and Sociocultural Setting

Hawai'i Fishing Communities

Describing 'fishing communities' associated with the pelagic fisheries occurring around the Hawaiian Islands presents a particular analytic challenge. The fisheries vary in terms of the degree to which they are centered in identifiable 'ports' where fish are landed and processed and vessels are moored and re-provisioned. For example, as detailed below, the shore-side operational base of the longline fishery is heavily concentrated in the metropolitan area of Honolulu, while that of the troll and handline fisheries is dispersed across O'ahu and the rest of the islands. Similarly, the residences of participants in the pelagic fisheries are not concentrated in well-defined locales, and the area encompassed by residence location changes depending on the specific frame of reference (e.g., all fisheries, pelagic fisheries only, or specific pelagic fishery gear types that are likely to experience impacts under the range of management alternatives analyzed).

As a result of these various dispersal patterns there are several ways that the 'specific location' of fishing communities and the social or economic groups that share a common dependency on fishing could be described. This section examines a number of alternatives using the following available data sets:

- Points of departure for the fishing fleets;
- Fish landings by area;
- Residence information from relevant fishery license or permit holders; and
- Locations of fish processors or markets.

Points of Departure

One way to examine the linkage between communities and the fishing industry is to look at the points of departure for the fishing fleet and the harbors and facilities that serve as fishery infrastructure. Prior to World War II, the bulk of Hawai'i's commercial fishing fleet was found on O'ahu, moored at Kewalo Basin in Honolulu. After the war, fishers had to increasingly compete with the tourist industry for shoreline space and facilities. By the 1970s, Kewalo Basin still provided berthing for about 150 vessels, but that included many boats engaged in tourist-oriented water activities such as charter fishing, dinner cruises and whale-watching. As new longline boats arrived from the U.S. mainland during the fishing industry expansion of the 1980s, the majority of vessels were relegated to a portion of Honolulu Harbor, the largest and most important of the state's commercial harbors.

New piers were designed and constructed in the harbor to accommodate the growing fishing fleet. At present, however, the majority of longline vessels continue to offload their catch at Kewalo Basin because it is closer to the fish auction, United Fishing Agency, Ltd. Honolulu Harbor lies about a mile west of Kewalo Basin along the same stretch of waterfront abutting the city of Honolulu's central business district. While Kewalo Basin is designed to accommodate fishing and pleasure vessels, the main purpose of Honolulu Harbor is to service large container vessels transporting goods to and from Hawai'i. Nevertheless, NMFS treats Honolulu Harbor and Kewalo Basin as the same 'port' for the purpose of compiling fishery statistics for the annual publication, "Fisheries of the United States." Figure 3.11-4 illustrates the location of Honolulu Harbor and Kewalo Basin with respect to the greater Honolulu area. Figure 3.11-5 provides a close-up of an area in Honolulu Harbor where several longline vessels are moored and the moorage area and fish auction building in Kewalo Basin.

There exists little documentation on what harbors are considered by current participants in the Hawai'i' longline fishery to be their 'home ports." Until very recently, U.S. Coast Guard vessel records used by NMFS to derive home port data listed the place of vessel construction as the home port. Within the past few years, a 'hailing port' designation has been added for new vessels, but this information is not available for the rest of the fleet (Alvin Katekaru, pers. comm., 26 October 2000, NMFS PIAO, 96814). However, discussions with fishing industry representatives indicate that the shore-side base of the Hawai'i-based longline fishery continues to be primarily situated in Honolulu. During the past few years, twenty or so longline vessels that target swordfish have regularly shifted to California during the fall months, and occasionally a few longliners targeting tuna offload in Hilo. However, the bulk of the longline fleet is based in Honolulu year round.

Figure 3.11-4: Greater Honolulu Area.

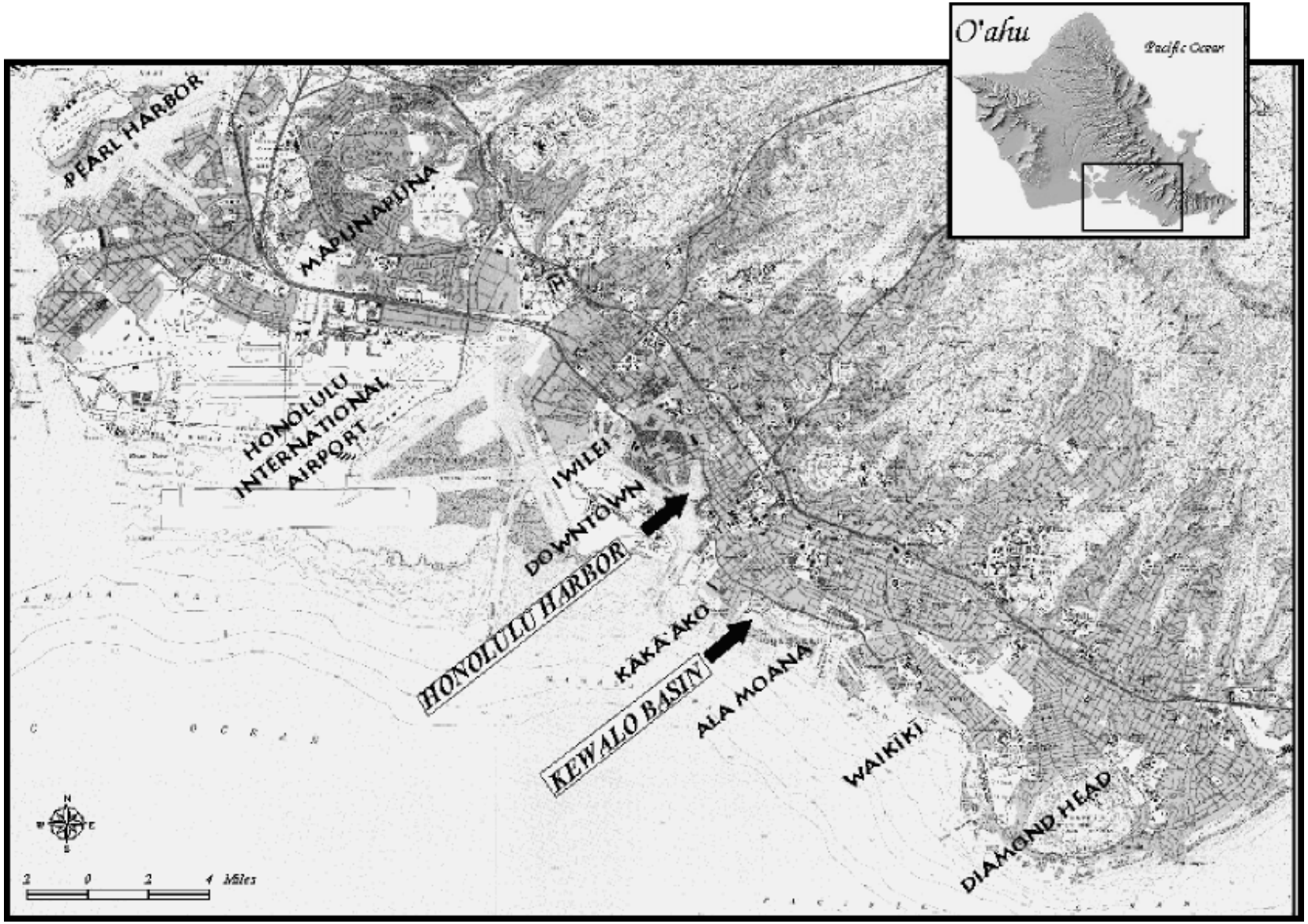
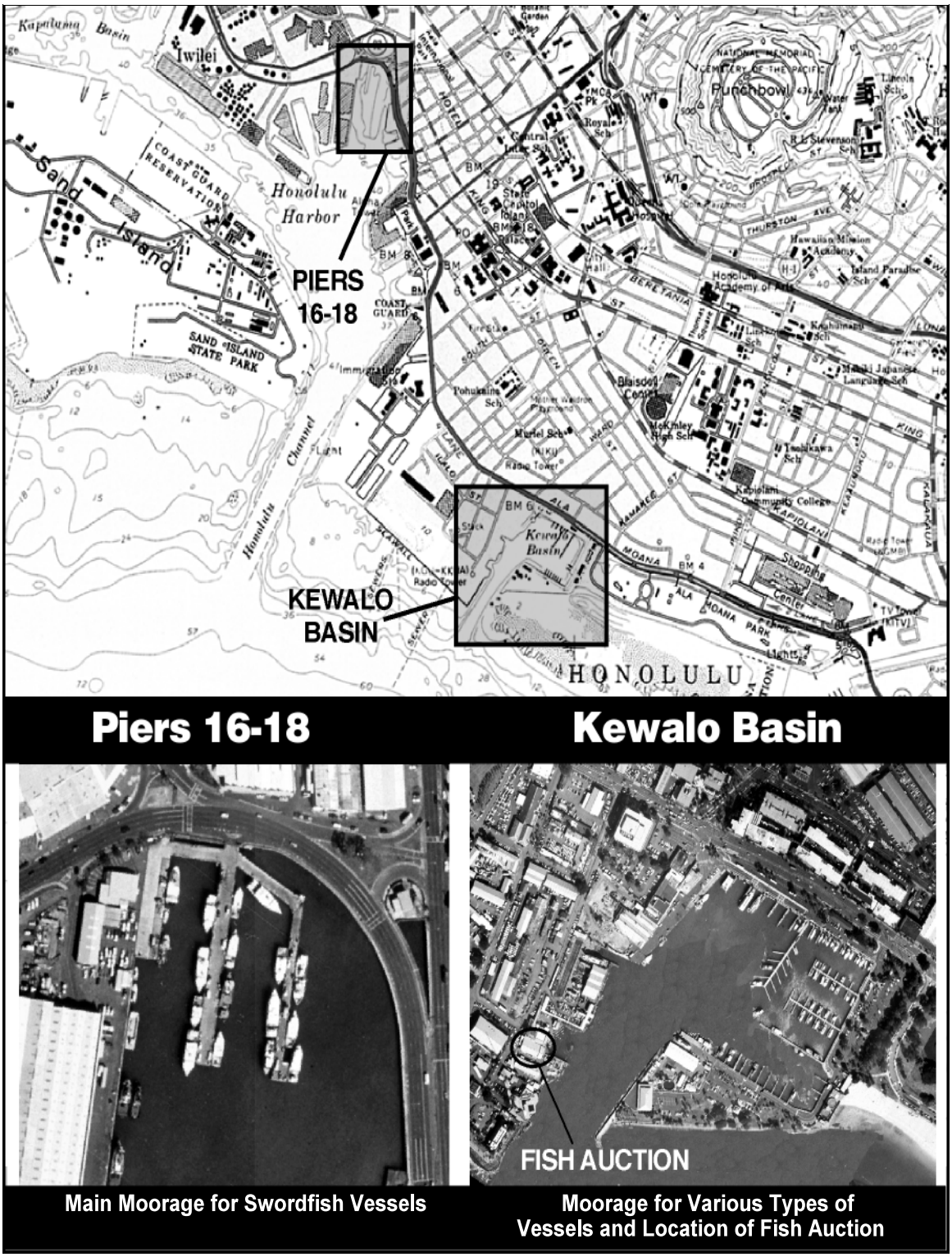


Figure 3.11-5: Honolulu Harbor and Kewalo Basin.



Honolulu is also a significant base for other types of pelagic fishing operations. Ten to 15 albacore trollers periodically use the facilities in Honolulu Harbor, and five of the seven vessels participating in Hawai'i's *aku* pole and line fishery are berthed in Kewalo Basin. In addition, a substantial number of foreign fishing vessels find Honolulu Harbor an attractive and convenient location for port calls. These vessels are prohibited under the Nicholson Act from off-loading fish in Honolulu, but they often purchase fuel, provisions and other goods and services. It is estimated that foreign fishing vessels made 316 port calls in Honolulu in 1998. These vessels also were involved in the transshipment through Honolulu each year of an estimated 120 mt of shark fins worth $2.6 million. The fins are transferred at sea from the fishing boats to foreign tankers which also re-supply the fishing boats with fuel and provisions purchased in Honolulu. U.S.-flag vessels, including some Hawai'i-based longline boats, are then contracted on a casual basis to transport the shark fins from the tankers to shore-side facilities. Typically, the contracted vessels meet the tankers as they are heading into Honolulu and receive the cargo of fins in international waters (McCoy and Ishihara, 1999).

As mentioned previously, the determination of a geographic base or 'fishing community' for other pelagic fisheries is more complex. For example, charter vessels participating in Hawai'i's troll fishery are intermixed with commercial and recreational fishing vessels in various boat harbors (Table 3.11-6).

Table 3.11-6: Distribution of Moored Charter Vessels in Hawai'i that Responded to a 1996-1997 Cost-Earnings Survey. Source: Hamilton, 1998.

Island	Boat harbor	Number of vessels
Hawai'i	Honokohau	28
O'ahu	Kewalo Basin	13
Maui	Lahaina	11
	Ma'alaea	4
Kaua'i	Nawiliwili	4
	Port Allen	1
Moloka'i	Kaunakakai	1

In addition, about 27 trailered vessels are used for charter fishing. In fact, the troll and handline fleet in the state consists mainly of trailered vessels that can easily move between launching ramps (Hamilton, 1997). Not only do harbor mooring facilities tend to be expensive, but small scale fishers prefer the mobility of a trailered boat, as they are able to significantly increase their fishing range (Glazier, 1999). For example, a 'run' of *ahi* on another side of the island is much more easily accessed by a trailered vessel. Although the shore-side facilities may be limited at many ramps and harbors, the extensive network of launching sites provides fishers living anywhere on a given island ready access to multiple fishing grounds.

Glazier (1999) identified 55 ramps and harbors used by fishing boats in Hawai'i (Table 3.11-7). This number does not include numerous other private boat mooring and launching

facilities. Many of these facilities consist of simple boat ramps in relatively isolated locations. Even some of the large, well-developed harbors, such as Honokohau, are remote from any central business district or residential area. However, fishers find these facilities to be attractive launching sites because of their proximity to fishing grounds. The relative attractiveness of the facilities typically changes throughout the year as weather and sea conditions and other factors change.

Table 3.11-7: State- and County-Owned Harbors and Boat Ramps by Island. Source: Glazier, 1999.

Facility	Location	Description
		O'ahu
Ala Wai	Honolulu (Waikiki)	The state-owned Ala Wai has 699 berths and 63 moorings mostly for sailboats, motor yachts and charter fishing-sized vessels. There is one launch ramp.
Kewalo Basin	Honolulu	Kewalo is home to O'ahu's primary charter fleet. The fleet shares the harbor with various longline vessels, O'ahu's *aku* pole and line fleet, other commercial fishing vessels, and tour and parasailing boats.
Ke'ehi Harbor and Lagoon	Honolulu (near airport)	State-owned Keehi Harbor and Lagoon has 355 berths and 360 moorings. Three launch ramps make the harbor a favored point of south shore ocean access for small trolling vessels.
Waianae	Waianae, Leeward Coast	The state-owned Waianae Boat Harbor is one of the island's primary small vessel harbor and ramp access points. The harbor has berthing spaces for 146 vessels.
Hale'iwa	North Shore	Haleiwa Boat Harbor is a state-owned harbor and anchorage in Waialua District on O'ahu's North Shore. The harbor has some 85 berthing and mooring spaces.
Kahana Bay	Windward (central)	Kahana Bay facility consists of a single launch ramp.
He'eia Kea	Windward O'ahu, just north of Kane'ohe	The harbor is home to some 40 small vessels. The three-lane ramp facility attracts fishers from many points on O'ahu's Windward coast.
Kailua	Windward O'ahu, between Kailua and Lanikai	Kailua Ramp is a county-owned, single lane launch ramp.
Maunalua Bay	Southeast coast at Hawai'i Kai	Maunalua has two launch ramps.
		Hawai'i
Mahukona	North Kohala	This county-owned facility consists of a one-lane launch ramp providing access to the nearshore waters of North Kohala and Alenuihaha Channel.
Kawaihae	Kohala Coast	Kawalhae is a state-owned harbor facility situated near the intersection of Queen Kaahumanu Highway and Kawaihae Road. There are 52 mooring spaces here, and one single-lane launch ramp.
Puako	Kohala Coast	The facility at Puako is a state-owned single-lane launch ramp. It is situated within Puako Bay along Queen Kaahumanu Highway.
Honokohau	Kailua-Kona	Honokohau is a large state-owned harbor facility in North Kona. Charter operations dominate the 155 mooring spaces here, though some small troll vessels are also moored. There is a high volume of small troll vessel usage at the four-lane launch ramp here.
Kailua-Kona	North Kona	This state-owned facility is located in the heart of Kailua-Kona. There is one single-lane launch ramp and nine berthing spaces.
Keauhou	Central Kona	Keahou Harbor facility is a two-lane state-owned launch ramp located about six miles south of Kailua-Kona. There is a two-lane launch ramp, four berthing spaces, and 24 mooring spaces.
Honaunau	South Kona	There is a single-lane county-owned launch ramp at Honaunau in South Kona.

Facility	Location	Description
Ho'okena	South Kona	This is a single-lane ramp.
Milol'ii	South Kona	This launch ramp is actually a natural feature of the shoreline.
Kaulana Bay (Ka Lae or South Point)	Kau	This is a state-owned launching area.
Punalu'u	Kau	This is a privately-owned ramp.
Poihiki	Puna	A high percentage of vessels participating in Hawai'i's ika-shibi fishery operate from the harbor at Isaac Hale State Park.
Radio Bay	South Hilo	This state-owned anchorage in South Hilo has 12 mooring spaces.
Reed's Bay	South Hilo	The state-owned anchorage here has 25 mooring spaces but no launch ramp.
Wailoa Sampan Basin	South Hilo	This state-owned facility has 12 berthing spaces.
Wailoa	South Hilo	Wailoa is a state-owned harbor facility that has a two-lane launch ramp and 42 mooring spaces.
Waiakea	South Hilo	This is a single-lane launch ramp.
Lapahoehoe	North Hilo	There is a county-owned ramp facility.
Kaua'i		
Hanalei Bay	Hanalei Valley, North Shore	Trailered boats may be put in at a one-lane county-maintained launch ramp along the river.
'Anini	North Shore	A one-lane county-maintained launch ramp allows ocean access to small vessels.
Waiakaea Channel	Windward (east)	This state-owned two-lane launch ramp is located in Kapaa.
Wailua Marina	Windward (east)	Boat tour companies lease land from the state to operate a small ramp and private marina at the eastern terminus of Wailua River in Wailua.
Kaumuali'i	Windward (east)	This state-owned area is located in Kawaihua Judicial District.
Wailua	Windward (east)	This one-lane state-owned launch ramp is located across the river from the Wailua Marina.
Hanamaulu	Windward (east)	This country-owned single-lane launch ramp affords access to the ocean near Hanamaulu Stream.
Niumalu	Windward (southeast)	Niumalu access launch ramp is county owned.
Nawiliwili	Windward (southeast)	The state-owned facility has a two-lane launch ramp, 20 berthing spaces and 15 mooring spaces. A small charter fleet, numerous sailing vessels, and a few small vessel commercial troll and bottomfish fishing operations moor here.
Koloa	South	Koloa Landing is a county-owned single-lane launch ramp facility situated at the terminus of Waikomo Stream.
Kukui'ula	South	Kukui'ula facility is state-owned, single-lane launch ramp and nine mooring spaces.
Port Allen	South (central)	This state-owned boat harbor is located in a commercial area in Koloa District. There is a two-lane launch ramp facility here, and 34 berthing spaces. Two charter vessels operate regularly from the harbor, as do some small commercial fishing operations.
Makaweli	South (westerly reach)	This small private launch ramp with anchorage is located at the terminus of Makaweli River at Waimea.
Kiki a Ola	South (westerly reach)	Kiki a oOa is a state-owned facility at Waimea. There is a single-lane launch ramp and eight mooring spaces.
Maui		
Mala Wharf	West Maui (central northern)	Mala is a small facility just north of Lahaina, regularly used by the small vessel troll fleet and increasingly by tour boat operations. The state-owned facility has 2 launch ramps and anchorage.
Lahaina Anchorage	West Maui (central northern)	Lahaina Harbor is a state-owned facility situated in the midst of the tourist district in Lahaina. Consequently, the many tour and charter boats based here benefit from considerable walk-up traffic. There is relatively little small troll vessel usage of the harbor. The facility has 21 berthing spaces and 78 moorings.

Facility	Location	Description
Ma'alaea	Wailuku (southwest)	The facility has 31 berthing spaces and 66 mooring spaces.
Kalama	Wailukua	This is a one-lane ramp facility located in Wailuku District.
Kihei	Wailuku (south shore)	The state-owned facility at Kihei is a two lane launch ramp that provides assess to areas around Molokini Island and 'Alalakeiki Channel.
Hana Bay	Hana (central)	Hana Bay is a natural harbor located just south of Nanu'alele Point, the easternmost tip of Maui. This state-owned facility is a one-lane launch ramp that allows access to waters along the rugged coastline.
Ke'anae	Hana (north shore)	Ke'anae is a county-owned one lane launch ramp located near Ke'anae Point.
Maliko	Makawao (north shore)	Maliko is a state-owned one-lane ramp facility at Maliko Bay in Makawao District.
Kahului	Wailuku (western, north shore)	Kahului is the primary commercial harbor serving Maui. One small troll vessel regularly uses dockage here to sell its catch to local restaurants. In-transit and emergency mooring is offered to small vessels.
Moloka'i		
Kaunakakai Harbor	South Shore (central)	This state-owned harbor has one launch ramp, 3 berthing spaces, and 29 moorings. A number of small pelagic troll vessels and one charter boat are moored here.
Hale o Lono	South Shore (western)	Small vessels launch here despite the absence of structural launching facilities.
Kalaupapa	North Shore (central)	Use of this harbor and anchorage facility is restricted to operations associated with Kalaupapa National Historic Park.
Lana'i		
Manele	South Shore (southeast)	This state-owned facility has one launch ramp and 28 berthing spaces.
Kaumalapau	West Coast (southwest)	This privately-owned facility has a small harbor and anchorage.

Fish Landings by Area

Another way to identify possible links between the pelagic fisheries and specific communities or locales is to examine fish landings data on a geographic basis. Table 3.11-8 presents the total volume and value of landings for six of the main Hawaiian islands. As shown, O'ahu accounts for slightly over 84 percent of the total value of landings.

Table 3.11-8: Volume and Value of Commercial Fish Landings in Hawai'i by Island, 1998. Source: Hawai'i Division of Aquatic Resources commercial landings data compiled by NMFS SWFSC-HL (Note: Differences between the figures reported here and the figures reported for 1998 in Table 3.11-4 are due to differences between state and federal fishery data bases).

Island	Pounds Landed	Ex-Vessel Value	Percent of Total Ex-Vessel Value
Hawai'i	3,362,372	$5,658,269	10.18%
Kaua'i	803,897	$1,539,492	2.77%
Lana'i	23,725	$36,115	0.07%
Maui	706,903	$1,379,553	2.48%
Moloka'i	42,685	$142,684	0.26%
O'ahu	22,274,538	$46,810,884	84.24%
Total	**27,214,120**	**$55,566,997**	**100.00%**

There are numerous areas on each of the main islands where catch is landed (Table 3.11-9). Some of these overlap with the points of departure noted in the previous discussion, but the match is not uniform. As previously noted, the majority of these places are not 'ports' or 'communities' in the usual sense of these terms.

Table 3.11-9: Volume and Value of Commercial Fish Landings in Hawai'i by Landing Area, 1998. Source: Hawai'i Division of Aquatic Resources commercial landings data compiled by NMFS SWFSC-HL.

Landing Area	Pounds Landed	Ex-Vessel Value	Percentage of Total Island Ex-Vessel Value
Hawai'i			
Hilo, Papa'ikou, Waiakea, Wailoa	727,802	$1,357,985	24.00%
Honaunau	116,601	$203,614	3.60%
Honoka'a	245	$421	0.01%
Honokohau, Kailua, Kailua-Kona	1,295,350	$1,755,028	31.02%
Ho'okena, Kohala	1,711	$2,707	0.05%
Kau Desert	3,407	$4,754	0.08%
Kawaihae, Puako	104,046	$206,174	3.64%
Keahou, Kahalu'u	228,730	$373,572	6.60%
Kealakekua, Ke'ei, Napo'opo'o	56,882	$75,778	1.34%
Kona	131,751	$156,965	2.77%
Mahukona	406	$1579	0.03%
Miloli'i	45,028	$78,397	1.39%
Na'alehu, Ka Lae, Kaulana, Ka'alu'alu	10,635	$26,861	0.47%
Other	131,712	$219,212	3.87%
Pahoa	250	$210	0.00%

Landing Area	Pounds Landed	Ex-Vessel Value	Percentage of Total Island Ex-Vessel Value
Pohoiki, Kalapana, Kapoho Point, Puna	400,342	$945,669	16.71%
Punalu‘u	69,804	$163,659	2.89%
South Point	37,300	$83,898	1.48%
‘Upolu	370	$1,777	0.03%
Total	3,362,372	$5,658,269	100.00%
Kaua‘i			
Anahola	148	$286	0.02%
‘Anini, Kalihiwai, Moloa‘a	27,625	$31,952	2.08%
Ha‘ena	26	$0	0.00%
Hanalei, Wainiha	9,825	$9,338	0.61%
Hanama‘ulu	11,026	$7,478	0.49%
Kapa‘a, Wailua	49,990	$97,290	6.32%
Kekaha, Kiki a Ola, Mana	130,011	$294,000	19.10%
Koloa	3,022	$4,302	0.28%
Kukui‘ula, Makahu‘ena Pt.	12,249	$20,852	1.35%
Lihu‘e, Ahukuni	26,067	$56,693	3.68%
Nawiliwili, Niumalu	206,872	$31,5751	20.51%
Other	37,002	$94,866	6.16%
Port Allen	289,965	$606,452	39.39%
Waimea	69	$226	0.01%
Total	803,897	$1,539,492	100.00%
Lana‘i			
Manele Beach	19,625	$33,068	91.56%
Other	4,100	$3,047	8.44%
Total	23,725	$36,115	100.00%
Maui			
Hana	9,535	$26,393	1.91%
Honokowai, Ka‘anapali	4,506	$7,004	0.51%
Honolua	31	$0	0.00%
Kahului, Naska	69,067	$207,947	15.07%
Kihei	55,186	$144,607	10.48%
Lahaina	154,764	$176,266	12.78%
Ma‘alaea	157,910	$358,662	26.00%
Makena, Keone‘oi‘o	1,556	$4,099	0.30%
Mala Wharf, Kahana	55,708	$125,555	9.10%
Maliko, Ha‘iku, Pa‘uwela	32,390	$85,868	6.22%
Nahiku, Ke‘anae, Peahi	269	$1,209	0.09%
Olowalu	6	$0	0.00%
Other	165,975	$241,938	17.54%
Total	706,903	$1,379,553	100.00%

Landing Area	Pounds Landed	Ex-Vessel Value	Percentage of Total Island Ex-Vessel Value
Moloka‘i			
Halawa	495	$2,144	1.50%
Kamalo Harbor	756	$1,327	0.93%
Kaunakakai	31,120	$115,492	80.94%
Other	10,255	$23,663	16.58%
Puko‘o Harbor	59	$57	0.04%
Total	42,685	$142,684	100.00%
O‘ahu			
Awa Wai, Diamond Head, Waikiki	2,814	$7,049	0.02%
Campbell Park, Pearl Harbor, Hickam, Other	173,402	$269,379	0.58%
Ewa	921	$2,575	0.01%
Hale‘iwa	326,579	$672,914	1.44%
Hau‘ula, La‘ie, Punalu‘u	1,577	$2,195	0.00%
He‘eia, He‘eia Kea	48,271	$104,684	0.22%
Honolulu, Ke‘ehi, Sand Island	9,746,154	$21,355,245	45.62%
Honouliuli, Hoaeae	613	$1,181	0.00%
Kahalu‘u	185	$268	0.00%
Kahana Bay	1,099	$394	0.00%
Kahuku	628	$2,452	0.01%
Kailua Bay	2,783	$5,609	0.01%
Kane‘ohe Bay	60,145	$88,126	0.19%
Kaneohe, Mikiola	103,515	$240,039	0.51%
Kewalo Basin	10,957,172	$22,340,779	47.73%
Koko Head, Hawai‘i Kai, Maunalua Bay, Portlock	93,746	$243,640	0.52%
Nanakuli	124,485	$510,163	1.09%
Pearl City, Waipio, Waipahu	1,649	$3,446	0.01%
Waiahole	457	$481	0.00%
Waianae, Pokai Bay	627,887	$959,554	2.05%
Waikane	179	$400	0.00%
Waimanalo	277	$300	0.00%
Total	22,274,538	$46,810,884	100.00%

Several points are evident in Table 3.11-8. For the island of Hawai‘i, commercial fish landings were reported at 19 locales. The Hilo-Papaikou-Waiakea-Wailoa area accounts for about a quarter of the total value of the landings for the island, the Honokohau-Kailua-Kailua-Kona area accounts for nearly a third, and the Pohoiki-Kalapana-Kapoho Point-Puna area accounts for about 17 percent. Several landing facilities may be located within each of these areas. For the island of Kaua‘i and its 14 reported landing sites, two areas (Kekaha-Kikiaiola-Mana and Nawiliwili-Niumalu) each account for about 20 percent of the total value of island landings, while Port Allen accounts for about 40 percent. The volume of fish landed on Lana‘i and

Moloka‘i is relatively small and concentrated in a few areas. Maui has a relatively even distribution of landings across 13 locales, with six of the 13 each accounting for between about one-tenth to one-quarter of the total value of landings.

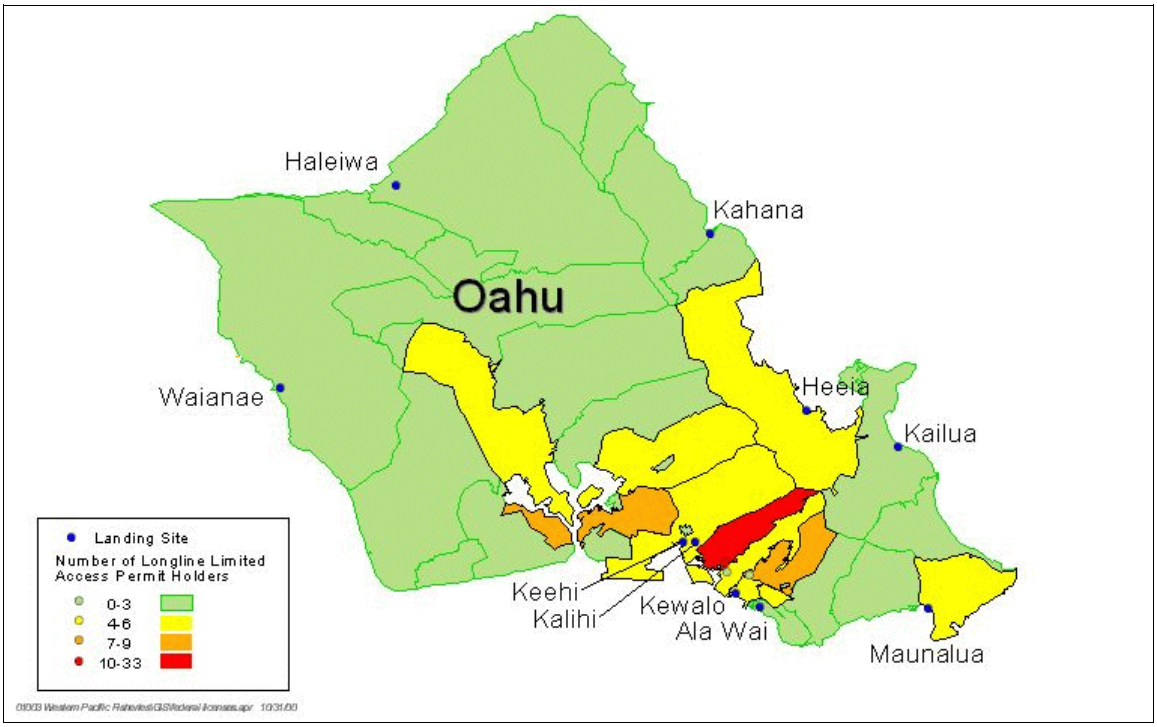
The pattern of landings for O‘ahu differs markedly from that of other islands in that there are many landing sites, but a few locales in the same general area account for nearly all the landings. Honolulu-Keehi-Sand Island and Kewalo Basin together account for slightly more than 93 percent of the total value of the landings for the island, due primarily to the concentration of the longline fishery in these areas. The next most prominent landing site on O‘ahu is Waianae-Pokai Bay, which only accounts for two percent of the island total. However, the value of the landings at this site exceeds that for any non-O‘ahu locale with the exception of the two highest volume areas on the island of Hawai‘i.

Residence Information

A third method of investigating potential connections between the pelagic fisheries and communities is by mapping residence information from fishery license or permit holders. Of particular relevance to the present analysis is spatial information on participants in the Hawai‘i-based longline fishery. The register of Hawai‘i-based longline limited access permit holders administered by NMFS PIAO provides information on the business or home mailing addresses of vessel owners. Federal regulations require that a U.S. fishing vessel must be registered for use under a Hawai‘i longline limited access permit if that vessel is used: (1) to fish for Pacific pelagic management unit species using longline gear in the EEZ around Hawai‘i; or (2) to land or transship, shoreward of the outer boundary of the EEZ around Hawai‘i, Pacific pelagic management unit species that were harvested with longline gear.

It is important to note that the ‘residence' addresses provided by longline limited access permit holders are actually mailing addresses. Some of these addresses are known to be in industrial waterfront areas. To the extent that businesses addresses rather than residential addresses are listed, and to the degree that business location varies from residential location, these data may be of limited usefulness to the present analysis. Nevertheless, these addresses represent the best available data, and they do show a pronounced pattern when mapped by zip code (Figure 3.11-6).

Figure 3.11-6: Distribution of Mailing Address Zip Codes of NMFS Hawai'i Longline Limited Access Permit Holders With an O'ahu Mailing Address, 2000 (n=116).



For confidentiality reasons locations with three or less permits were lumped into a single category. As shown, the greatest number of permits, by far, are clustered around Honolulu. No zip code elsewhere in Hawai'i or outside of the state has four or more longline permits, with the exception of one zip code in New Jersey. Of the 164 permit addresses recorded as of October, 2000, 15 addresses occur on O'ahu in zip code areas that have zero to three permit addresses each, and six permit addresses are on the island of Hawai'i, but all are in zip code areas with less than three permit addresses. There are a total of 38 permit addresses outside of Hawai'i. These occur in the following states: Washington (nine permit addresses), New Jersey (8), California (7), Florida (6), Oregon (4), and three other states (4).

Information is also available from the register of State of Hawai'i commercial marine license holders administered by the Hawai'i Division of Aquatic Resources (HDAR). This register provides information on the business or home mailing addresses of a population different than that represented by the register of Hawai'i longline limited access permits holders. State regulations require any person who "takes marine life for commercial purposes," whether within or outside of the state, to first obtain a commercial marine license from HDAR. For a particular vessel this regulation applies to each person aboard (captain or deckhand) who catches or attempts to catch a fish for commercial purposes.

The following maps show the distribution of the commercial marine license holders participating in different types of fisheries, with participants aggregated in the same general categories as found in Table 3.11-5. The geographic distribution of license holders is displayed by zip code rather than community, due to the very large number of place names that appear in the license database.

As shown in Figure 3.11-7, Hawai'i commercial marine license holders (crew members included) who indicate that their primary gear is pelagic longline are heavily concentrated on O'ahu. The pattern differs from that seen for vessel owners with Hawai'i longline limited access permits in that there are areas of concentration outside of Honolulu. Figure 3.11-8, which illustrates the distribution of license holders participating in the troll fishery, shows a very different pattern of distribution. Each of the five larger main islands have significant concentrations of participants. The distribution of participants in the pelagic handline fishery, illustrated in Figure 3.11-9, shows yet another pattern. These participants have a bimodal distribution of concentration, with clear nodes on the islands of Kaua'i and Hawai'i. The distribution of individuals engaged in the *aku* pole and line fishery cannot be presented as there are no zip codes with four or more participants.

Figure 3.11-7: Distribution of Mailing Address Zip Codes of HDAR Commercial Marine License Permit Holders Who Participated in the Hawai'i-based Longline Fishery, 1998 (n=110).

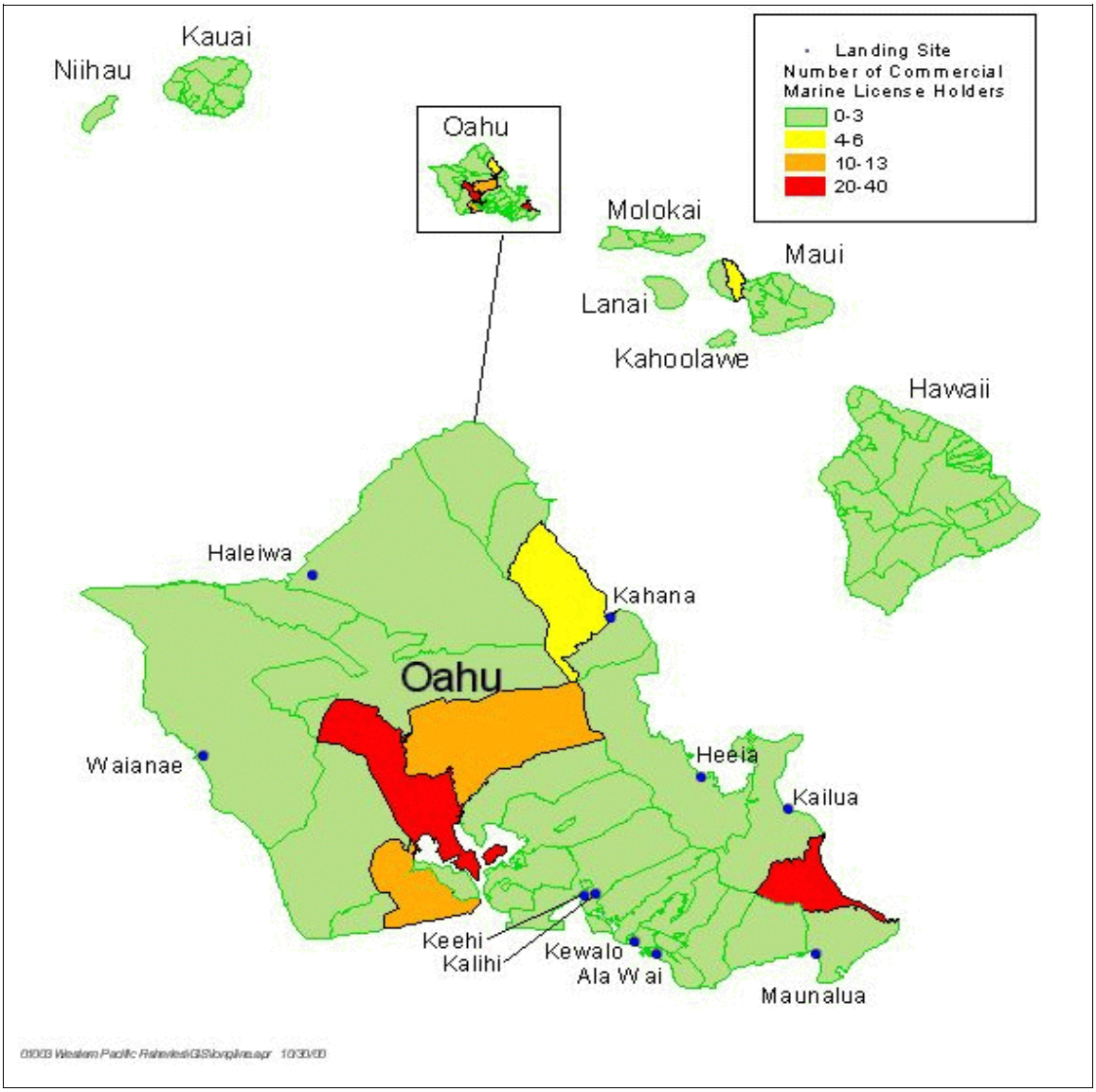
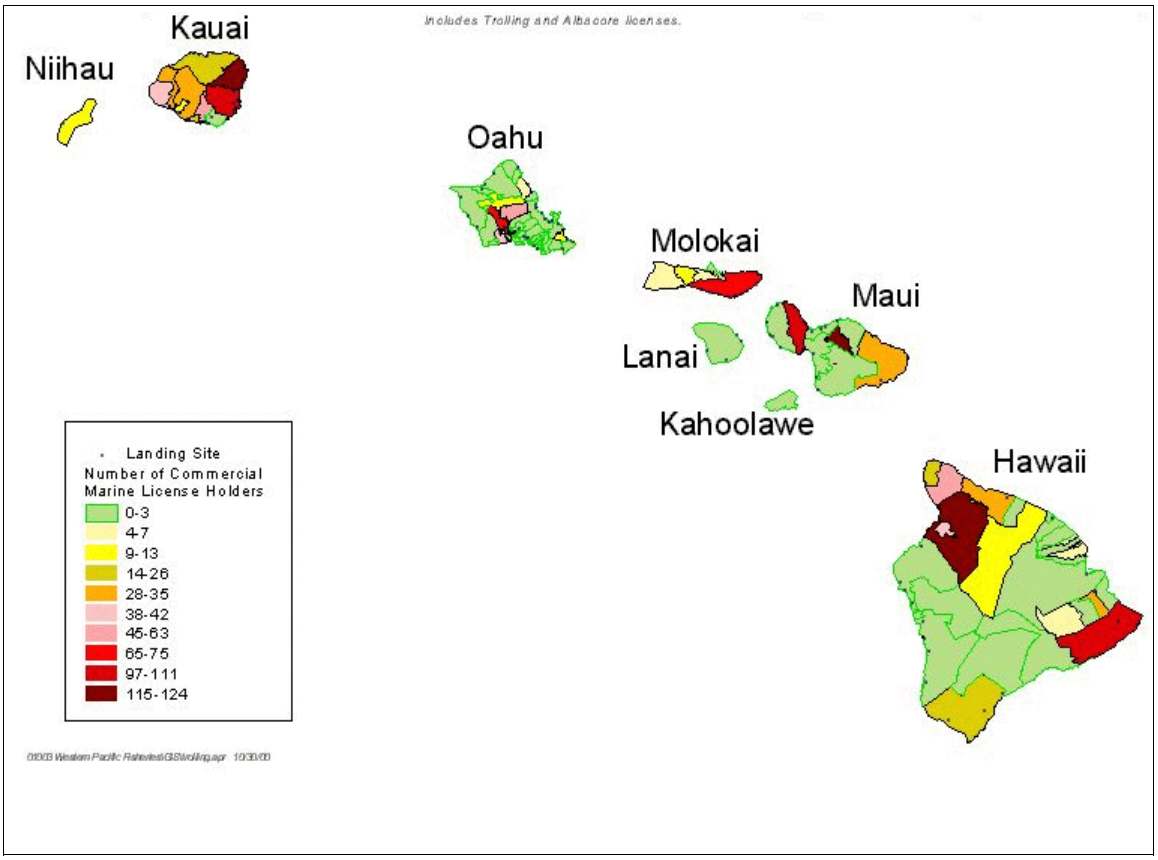
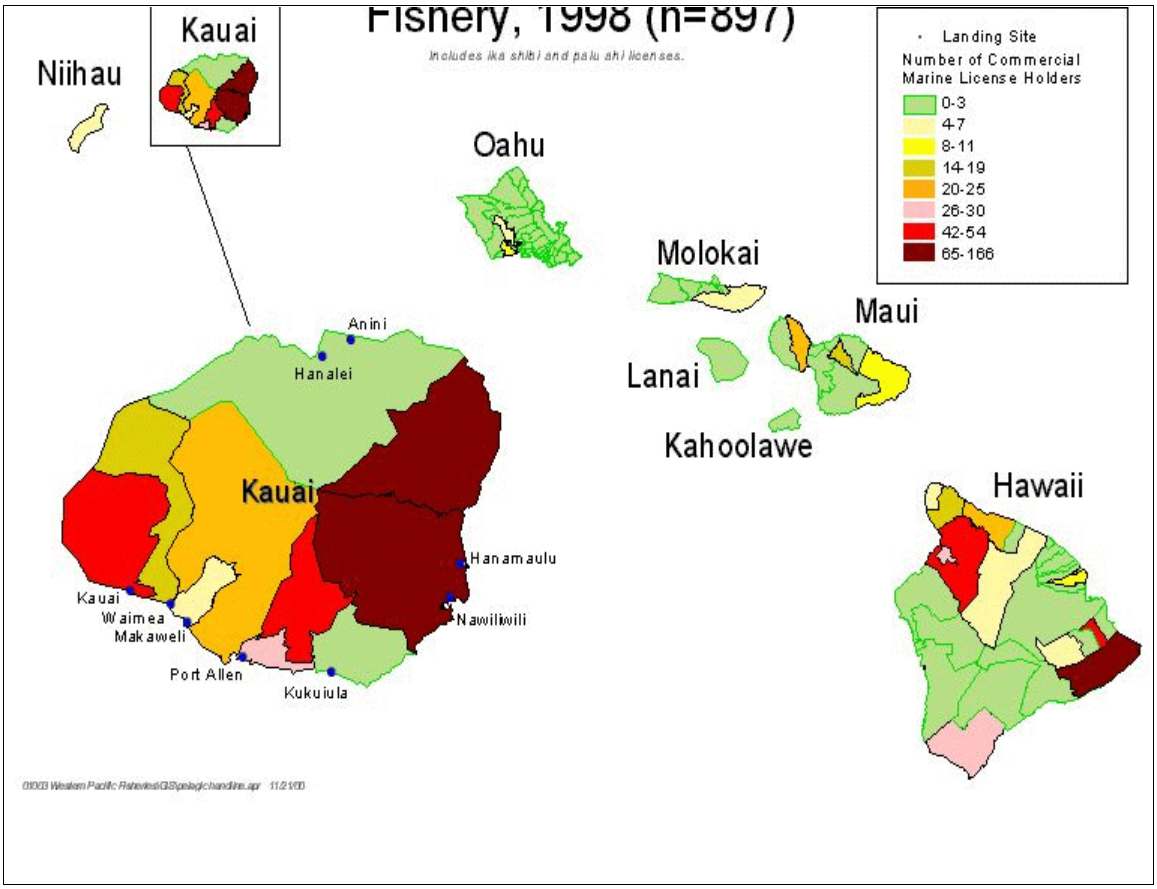


Figure 3.11-8: Distribution of Mailing Address Zip Codes of HDAR Commercial Marine License Permit Holders Who Participated



Figu AR
ed
in the e Fishery, 1998 (n=897).



Locations of Processors or Markets

Finally, one can examine linkages between the pelagic fisheries and specific locales or communities by tracing the landings of fish to processors or markets. However, as with many other aspects of Hawai'i's fisheries, processing and marketing operations tend to be diffuse. In general, the products of pelagic fishing do not flow into specific communities where landing, processing, and marketing activities take place in the same area where vessels are docked or where vessel owners and crew live. Firms that buy, process or distribute fishery products, including seafood wholesale and retail dealers, restaurants, hotels and retail markets, are dispersed across O'ahu and the other islands. The major fish auction and most of the large-volume, restaurant-oriented wholesalers are located in Honolulu, but there are many smaller wholesale/retail units outside of the greater Honolulu area. Businesses whose goods and services are used as inputs in the fisheries, such as ice plants, marine rail ways, marine suppliers, welders and repair operations, are similarly distributed.

The major firms servicing the domestic longline fleet are located in Honolulu, but there are many small fishing-supply stores scattered throughout the state. To consolidate businesses involved in fishing supplies and fish processing and marketing in one location, the state government initiated construction of a 'domestic fishing village' in an industrial waterfront area of Honolulu. At first, this effort to attract fishing-related shore-side businesses to a single site met with some success. However, uncertainty about the future of the Hawai'i-based longline fishery caused by the emergency rules implemented by NMFS in 1999 to reduce sea turtles interactions has since had a 'chilling' effect on further private investment in the project.

Summary

In summary, the linkages between Hawai'i's pelagic fisheries and specific locales or 'fishing communities' may be roughly separated by gear type. On the one hand is the intense concentration of the longline fleet in the Honolulu area, and on the other hand is the geographically dispersed nature of the small boat, troll and handline fleet. The longliners account for a large majority of the total catch, and they are the segment of the fisheries that is most likely to be directly affected by the proposed management alternatives. The relatively dispersed small boat fleet, and their associated activities, while important to the fabric of a number of locales and communities on the main islands, do not appear to have the central economic function in those communities that they possibly once had. There are a few small communities such as Milolii on the island of Hawai'i in which the majority of residents may remain heavily dependent upon or engaging in fishing to meet subsistence needs and supplement incomes, but empirical data on the level of dependence of these communities on fishing is absent. In summary, small boat fishing may be a critically important component of making a living to those engaged in it, but in terms of gross economic dependency at the community or island level, it is generally overshadowed by a number of other types of economic activity.

The nature and intensity of Honolulu's links to the commercial pelagic fisheries are unique within Hawai'i. The size and complexity of Honolulu's economic base renders its position as a 'fishing community' as somewhat of a paradox and complicates any social impact assessment related to pelagic fisheries. In many ways Honolulu is arguably more involved in pelagic fisheries than any other community in the state. It is the base of the longline and other industrial-scale fleets and the center of the state's fish marketing/distribution network. On the other hand, from a comparative and relativistic standpoint, it could be argued that the pelagic fisheries are less important to Honolulu than to nearly any other community considered. For example, the total number of pelagic fisheries-related jobs in the Honolulu metropolitan area compared to the overall number of jobs in the area is very small. O'ahu contains approximately three-quarters of the state's total population, and over one-half of O'ahu's residents live in the 'primary urban center,' which includes greater Honolulu. The sheer size of Honolulu makes the jobs and income derived from pelagic fisheries insignificant when viewed in the context of the community as a whole, or in terms of community 'dependence upon' or 'engagement in' the fisheries.

Given the complex nature of the linkage of pelagic fisheries to locales and communities in Hawai'i, this EIS will generally use the state as a whole as the unit of analysis for describing the socioeconomic impacts of alternative fishery management measures. However, in the case of impacts of changes in the longline fishery it will be possible to focus on a smaller geographic area (port/community), although the large scale and diversity of economic activities in the Honolulu area increases the complexity of the impact analysis.

Hawai'i Sociocultural Setting

Blue sampans ride in the harbor at Kewalo
under the copper brilliance of the sun;
blue sampans reel and tilt into the trade wind
on sea-paths traced by the Hawaiian moon;
blue sampans stagger and rise gallantly out of chasms of sea
in storms blowing out of the sultry south,
in hurricanes howling over the barren isles
far to the north, in a world of wind and foam.

Clifford Gessler, Tropic Landfall: The Port of Honolulu, 1942, p.267

Over the past 125 years, the sociocultural context of fishing in Hawai'i has been shaped by the multi-ethnicity of local fisheries. Although certain ethnic groups have predominated in Hawai'i's fisheries in the past and ethnic enclaves continue to exist within certain fisheries, the fishing tradition in Hawai'i is generally characterized by a partial amalgamation of multi-cultural attributes. An examination of the way in which the people of Hawai' harvest, distribute and consume seafood reveals remnants of the varied technology, customs and values of Native Hawaiians and immigrant groups from Japan, China, Europe, America, the Philippines and elsewhere.

Social Aspects of Fish Harvest

Commercial fishing first became important in the Hawaiian Islands with the arrival of the British and American whaling fleets during the early nineteenth century. The whalers made the islands their provisioning and trading headquarters because of their central location in the Pacific (Nakayama, 1987). This trade reached its zenith in the 1850s when more than 400 whaling vessels arrived in Honolulu annually (Shoemaker, 1948). European- and American-owned trading concerns, called 'factors,' were established to service the whalers and gradually became the dominant enterprises in Honolulu. The significance of whaling to Hawai'i's economy waned considerably during the late-nineteenth century, by which time plantation agriculture centered on sugar and pineapple production had grown in importance. A number of the trading companies that supported the whaling industry, however, adjusted to these economic changes and remained at the heart of Hawai'i's industrial and financial structure (Shoemaker, 1948).

The introduction of a cash economy into Hawai'i and the establishment of communities of foreigners on the islands also led to the development of a local commercial fishery. As early as 1832, it was the custom for fish and other commodities to be sold in a large square near the waterfront in Honolulu (Reynolds, 1835). In 1851, the first regular market house for the sale of fishery products was erected (Cobb, 1902). The territorial government replaced this market in 1890 with an elaborate structure that Cobb (1902:435) referred to as "one of the best [market houses] in the United States." Other fish markets were established on the islands of Maui and Hawai'i.

Initially, commercial fishing in Hawai'i was monopolized by Native Hawaiians, who supplied the local market with fish using canoes, nets, traps, spears and other traditional fishing devices (Jordan and Evermann, 1902; Cobb, 1902). However, the role that Native Hawaiians played in Hawai'i's fishing industry gradually diminished through the latter half of the nineteenth century. During this period successive waves of immigrants of various races and nationalities arrived in Hawai'i increasing the non-indigenous population from 5,366 in 1872 to 114,345 in 1900 (OHA, 1998). The new arrivals included Americans, Chinese, Portuguese and Filipinos, but particularly significant in terms of having a long-term impact on the fishing industry was the arrival of a large number of Japanese. The Japanese, like the majority of the early immigrants, were contracted to work on Hawai'i's sugar cane plantations. When contract terms expired on the plantations, many of the Japanese immigrants who had been skilled commercial fishers from the coastal areas of Wakayama, Shizuoka and Yamaguchi Prefectures in Japan remained in Hawai', turning to the sea for a living (Okahata, 1971). Later, experienced fishers came from Japan to Hawai' for the specific purpose of engaging in commercial fishing.

During much of the twentieth century Japanese immigrants to Hawai'i and their descendants were preeminent in Hawai'i's commercial fishing industry. The tightly knit communities that the first Japanese immigrants formed both helped ease the transition to American society and retarded the process of acculturation (Tamura, 1994). The Japanese were able to maintain their separate communities in Hawai'i more effectively than any other immigrant group. Among those Japanese communities of particular significance were the settlements of commercial fishers and their families in the Palama, River Street and Kaka'ako areas of Honolulu adjacent to the harbor (Lind, 1980).

The Japanese brought to Hawai'i their own fishing technology, the most significant being the sampan fishing vessel propelled by sails or oars. Gorokichi Nakasuji from Wakayama Prefecture imported the first wooden-hulled sampan to Hawai'i in 1899. Over time, Japanese boat-builders in Hawai'i adapted the original design to specific fishing conditions found in the islands, and a unique style of fishing boat evolved. The fishing range of the Honolulu-based sampan fleet increased substantially after 1905 when the first vessels became motor powered. Capable of traveling at an average speed of ten knots, the larger sampans equipped with diesel or gasoline engines were able to travel to distant, previously unexploited fishing grounds. As early as 1913, sampans were fishing in the Northwestern (Leeward) Hawaiian Islands several hundred miles from O'ahu. The Japanese immigrants

soon dominated the fishery for tuna, swordfish and other pelagic species. These open-ocean fish were mainly caught with either longline or pole-and-line gear. The longline method of harvesting fish, developed centuries earlier in Japan, was first employed in Hawai'i waters in 1917 off the coast of Waianae by a Japanese fishers named Imose. The Japanese technique of harvesting tuna with pole-and-line and live bait was also brought to Hawai'i by immigrants, but it closely resembled a fishing method traditionally used by Hawaiians.

The adherence of Japanese immigrants to traditional cultural practices included Japanese religious observances, and many of the religious activities of communities such as Kaka'ako were centered on fishing (Miyasaki, 1973). Various traditional Japanese taboos and rituals directed how a new fishing boat was to be launched, when a vessel could leave or return to port, what items could be brought on board a boat and many other aspects of fishing behavior. Over the years, succeeding generations of fishers of Japanese ancestry in Hawai'i became more 'Americanized,' but many Japanese fishing traditions persisted. For example, Japanese immigrant fishers brought from Japan the Shinto practice of building a *jinsha* (shrine) dedicated to a deity such as *Konpira-sama* or *Ebisu-sama* (Kubota, 1984; Miyasaki, 1973). Today, an *Ebisu jinsha* constructed at Ma'alaea on the island of Maui during the early 1900s still stands, and fishers of Japanese ancestry as well as others who share a common bond in fishing continue each year to ceremonially bless individual fishing vessels (Kubota, 1984).[38]

In addition to ethnic and community ties, the physical danger of fishing as an occupation also engendered a sense of commonality and camaraderie among fishers. Describing the captains and crews of the early sampan fleet in Hawai'i, Okahata (1971:208) wrote: "It is said that the fishers were in a clan by themselves and were imbued with a typical seaman's reckless daring spirit of 'death lies only a floor board away.'" The extreme isolation of the NWHI and the limited shelter they offered during rough weather made fishing trips to these islands particularly hazardous. The perils of fishing in the NWHI captured the attention of the public media (e.g., Lau, 1936), and inspired one individual to compose the poem included in the preface to this section.

As late as the 1970s, the full-time professional fishers in Hawai'i were predominately of Japanese descent (Garrod and Chong, 1978). However, by that period hundreds of local residents of various ethnicities were also participating in Hawai'i's offshore fisheries as part-time commercial and recreational fishers. In addition, a growing number of fishers from the continental United States began relocating to Hawai'i. Many of the new arrivals came to the islands because declining catch rates in some mainland fisheries had led to increasingly restrictive management regimes.

[38]In some communities in Japan *Ebisu* is regarded specifically as the god of fishing, farming and commerce (Tokihiko, 1983). He is depicted holding a fishing rod in his right hand and a sea bream under his left arm.

Perhaps the longline fishery is the best example of a fishery in Hawai'i that experienced rapid development as a result of the participation of new groups of fishers of various ethnic backgrounds. In 1979, only 14 vessels fished longline gear, most of these being the older wooden sampans (Pooley, 1990). By 1991, the fleet consisted of 141 vessels. This rapid expansion began during the early 1980s with the arrival of vessels from the Pacific Northwest. Some of these vessels initially came to Hawai'i to participate in the lobster and bottomfish fisheries, but when these fisheries began to experience lower catch rates and increased regulation, the vessels shifted to the longline fishery (Pooley, 1993). Later, a number of vessels that had long been engaged in the Atlantic swordfish fishery also migrated to Hawai'i when previously unexploited swordfish fishing grounds were discovered near the Hawaiian Islands (Travis, 1999). Most of these additions to the Hawai'i-based longline fleet from the West and East coasts were modern, well-equipped vessels owned and operated by Caucasians. The late 1980s also saw the relocation of 17 converted shrimp trawlers from the Gulf of Mexico (Pooley, 1990). These vessels were owned by Vietnamese-American fishers who had converted their boats from shrimping to pelagic longline fishing with the support of NMFS (Travis, 1999). Hawai'i was an attractive base for these fishers because of the proximity of productive and relatively uncongested fishing grounds and because of the state's multi-ethnic social environment. Finally, individuals of Korean ancestry also contributed significantly to the development of the Hawai'i-based longline fishery. During the late 1970's, about a dozen Korean nationals were hired as crew members aboard longline vessels in Hawai'i, as it was difficult to recruit local young men into the fisheries at that time. A number of these individuals permanently immigrated to the United States and began their own longline fishing operations. Later, other Korean-Americans also purchased longline vessels and began fishing in the waters around the state.

These developments resulted in a contemporary longline fishery that is ethnically complex, but the ethnic composition of the fishery participants continues to differ markedly from that of the state population as a whole. In a recent survey of 130 Hawai'i-based longline vessel owners and captains, 48 respondents identified themselves as Vietnamese, 45 Caucasian, 25 Korean, three Hawaiian, two Japanese, four mixed, two other, and one Samoan. The deckhands employed aboard these longline vessels are equally ethnically distinct (S. Martin, Pacific Ocean Producers, pers. comm., 25 October 2000, Honolulu, 96817). Boat owners of Vietnamese descent nearly exclusively hire other individuals of Vietnamese ancestry. In this case, according to industry sources, deckhands on these vessels may have limited English language skills. Boat owners of Korean descent hire predominately crews from the Federated States of Micronesia, mainly Chuukese and Pohnpeians. The crews of longline vessels owned by Caucasians are generally a mixture of Micronesians and established Hawai'i residents of various ethnicities. Some longline vessel owners also employ foreign nationals, mainly Filipinos, who obtain crewmen's visas through the U.S. consulates in their respective countries.

Differences in the ethnicity of participants in the longline fishery are linked to differences within the fleet in terms of a number of related factors, including target species, fishing grounds, vessel size and vessel operational characteristics. In 1999, the total number of

vessels participating in the fishery was119. Of these, 45 were not equipped with line shooters and therefore were restricted to targeting swordfish or a mixture of swordfish and tuna. The other 74 vessels were equipped with line shooters and targeted tuna. The swordfish/mixed vessels are typically larger than tuna vessels, as they generally operate in the rougher sea and weather conditions of more northerly waters. Between 1991 and 1998, the average distance traveled to first set by swordfish/mixed vessels was 570 miles, whereas the average distance traveled by tuna vessels was 275 miles. Virtually all of the swordfish/mixed vessels are owned and crewed by Vietnamese Americans. In contrast, this ethnic group operates only about four or five longline vessels targeting tuna. The ethnicity of the captains and crew members of the other 70 or so tuna vessels based in Hawai'i is highly diverse, and includes Caucasians, Koreans, Micronesians and others.

To some extent the ethnic dichotomy in the longline fleet extends to marine suppliers, with the two supply firms owned by Vietnamese-Americans largely catering to owners of swordfish/mixed vessels. However, most of the catch of both the swordfish/mixed and tuna longline vessels is sold at a single location, the Honolulu fish auction owned by United Fishing Agency, Ltd, although in the early 1990s at the peak of swordfish landings, catch was also sold to independent brokers and mainland buyers.

The majority of people involved in the charter fishing sector in Hawai'i are Caucasian. In a recent survey of charter boat owners/captains 67 percent of the respondents described their ethnicity as white/Caucasian or European. The next largest ethnic group was part-Hawaiian, indicated by ten percent of the respondents. The predominance of Caucasians in the charter fishing sector reflects the fact that most charter boat fishers 'migrated' to Hawai'i from the U.S. mainland, mainly California (Walker, 1996). In contrast, a recent survey of participants in Hawai'i's small-boat commercial and recreational fishing sectors (e.g., the trolling, pelagic handline and bottomfish handline fisheries) by Hamilton and Huffman (1997) found that the three largest ethnic groups represented in the sample were Japanese (33 percent), mixed with part-Hawaiian (16 percent) and Caucasian (12 percent). Hamilton and Huffman speculated that the high proportion of Japanese and part-Hawaiians in the sample reflects the traditional connections that these two ethnic groups have with the sea. These sociocultural connections are discussed further in the following section.

The motivations for fishing among contemporary Hawai'i fishers tend to be mixed even for a given individual (Glazier, 1999). In the small boat fishery around the MHI the distinction between 'recreational' and 'commercial' fishers is extremely tenuous (Pooley, 1993). Hawai'i's seafood market is not as centralized and industrialized as U.S. mainland fisheries, so that it has always been feasible for small-scale fishers to sell any or all of their catch for a respectable price. Money earned from part-time commercial fishing is an important supplement to the basic incomes of many Hawai'i families.

It is also important to note that many people in Hawai'i who might be considered 'commercial' fishers hold non-fishing jobs that contribute more to their household income than does fishing (Pooley, 1993). For some fishers non-fishing jobs are not a choice, but a

necessity due to the inability to earn an adequate return from fishing. Many participants in Hawai'i's offshore fisheries often catch insufficient fish to cover even fuel, bait and ice expenses, but they continue fishing simply for the pleasure of it. Some go so far as to pursue non-fishing occupations that allow them to maximize the time they can spend fishing regardless if it is profitable or not (Glazier, 1999).

Even those fishers who rely on fishing as their primary source of income have other reasons for their occupational choice besides financial gain. For example, fishers may enjoy the independent lifestyle. On the other hand, fulfillment of social obligations may also at times be an important reason for fishing. Fish are an important food item among many of the ethnic groups represented in Hawai'i, especially during various social events. Fishers are expected to provide fish during these occasions and may make a fishing trip especially for that purpose (Glazier, 1999). Sharing the catch is a common feature of the fishing lifestyle in Hawai'i and is not unique to any particular ethnic group or level of economic investment in fishing (Glazier, 1999).

Finally, some Hawai'i fishers feel a sense of continuity with previous generations of fishers and want to perpetuate the fishing life style. This sense of tradition is reflected in the importance placed on the process of learning about fishing from 'old timers' and transmitting that knowledge to the next generation. A recent sociocultural survey of small trolling vessel captains in Hawai'i found that many of those interviewed either descend from long-time fishing families or have worked in fishing or fishing-related work since they were in their teens (Glazier, 1999). The average captain had almost 18 years of offshore fishing experience. The survey found that 35 percent of boat captains were taught how to fish by their fathers, grandfathers or uncles, while 32 percent reported being taught by friends (Glazier, 1999). Only 14 percent indicated that they taught themselves. Most of Hawai'i's fishers consider knowledge and experience to be more important factors in determining fishing success than 'high-tech' gear. An example of the value placed on information passed down from previous generations of fishers is the monument that one town on O'ahu has recently proposed to commemorate the *kupuna* (elders) of that area who are recognized for their fishing skills and knowledge (Ramirez, 2000).

Whatever the motivations for fishing, the contributions of friends and family members to these efforts are often substantial. Small boat fishing in Hawai'i is almost always a cooperative venture involving friends or relatives as crew members (Glazier, 1999). In addition, wives, in particular, often play an essential role in shore-side activities such as the transport of fish to markets, purchase of ice, vessel maintenance, bookkeeping and so forth (Glazier, 1999).

In Hawai'i during the past several years there have been a number of highly publicized clashes between the owners of large and small fishing boats, as well as fishers who are newcomers and those who are established residents (Glazier, 1999). The reasons for these conflicts are complex, but the perception that the state's marine resources are being damaged and depleted by certain groups of fishers is a central factor. Fish landing statistics

support the notion that catch rates in some fisheries are on the decline. Many fishers have found that fishing is no longer a profitable enterprise and have dropped out of the industry (Glazier, 1999). The situation is aggravated by a depressed state economy that has made it more difficult for many fishers to find the financial resources to support marginal fishing operations.

In some cases, government regulations have helped alleviate competition among fishers. In 1991, for example, a longline vessel exclusion zone ranging from 50 to 75 nautical miles was established around the MHI to prevent gear conflicts between large longline vessels and small troll and handline boats. However, government regulations have also added to the level of tension and feelings of frustration among fishers. For instance, many fishers in Hawai'i have adjusted to natural variations in the availability of various types of fish by adopting a multi-species, multi-gear, highly flexible fishing strategy. However, this strategy is increasingly constrained by the implementation of limited access programs in Hawai'i's major commercial fisheries (Pooley, 1993).

Despite this highly competitive and divisive environment, fishers have been able to develop and maintain networks of social relations that foster collaboration and mutual support within the fishing community. However, fishers's attempts at organizing to promote their shared interests, whether in the market or lobbying government for changes in policy, have generally been fragmented. Nevertheless, some fishers in Hawai'i are represented by a *hui* or organization, and these voluntary associations often facilitate coordination and cooperation for the mutual benefit of their members. A case in point is the Hawai'i Longline Association, which was organized in 1999 to promote the interests of longline vessel owners, captains and deckhands. The association has 600 members, and all ethnic groups that participate in the longline fishery are represented (S. Martin, Pacific Ocean Producers, pers. comm., 23 October 2000, Honolulu, 96817).

Glazier (1999) observed that membership in a Hawai'i fishing *hui* can engender a strong sense of camaraderie and solidarity among fishers. The cohesion within these organizations constitutes available social capital for both their members and the broader community. For example, fishing clubs often organize fishing tournaments to encourage public involvement in the local fishing lifestyle and to raise funds for public projects that benefit the entire community (Glazier, 1999).

Examples of more ad hoc forms of cooperation among fishers are also common. For instance, fishers may take turns trucking each other's fish from distant landing sites to the central fish auction in Honolulu, thereby reducing transportation costs (Glazier, 1999).

Close social relationships also continue to be maintained between some fishers and fish buyers. For example, small boat fishers on Kaua'i and the Kona side of the island of Hawai'i tend to sell their catch directly to local buyers who, in turn, sell it to restaurants or retail markets (Glazier, 1999). By sending their fish directly to dealers fishers not only avoid the commission charged by the auction but also enjoy the price stability over the long-term that

comes with an established reciprocal relationship. As Peterson (1973:59) noted, "A fisherman feels that if he is 'good to the dealer' in supplying him with fish that he needs to fill his order, 'the dealer will be good to him' and give him a consistently fair price for his fish."

Social Aspects of Fish Distribution and Consumption

Archaeological evidence indicates that seafood was part of the customary diet of the earliest human inhabitants of the Hawaiian Islands (Goto, 1986). An early European visitor to Hawai'i observed that, "There is no animal food which a Sandwich Islander esteems so much as fish" (Bennett, 1840:214). Nineteenth century immigrants to Hawai'i from Asia also possessed a culture in which fish was an integral part of the diet. Despite the 'exorbitant' fish prices that Hawai'i residents have often encountered in the markets, the level of consumption of seafood in the islands has historically been very high. One early commentator noted:

> *In the Honolulu market 2,000,000 pounds of fresh salt water fish valued at $5,000,000 are sold annually. These figures represent a high price for a food that abounds in the waters all around the Islands, yet the people of this community, who are great lovers of the products of the sea, will gratify their tastes even at this expense* (Anon., 1907:17).

In recent times, per capita seafood consumption in Hawai'i is still at least twice as high as the national average (Shomura, 1987).

Because seafood was such a significant item in the diets of local residents, the fish markets themselves became important institutions in Hawai'i society. Dole (1920:20) noted that the fish market located in the busiest section of Honolulu was more than a commercial establishment, it was also "…Honolulu's political center where impromptu mass meetings were held …; it was, in a way, a social center also, especially on Saturdays for then business was at its height." Much of the retailing of fish now occurs through self-service supermarkets, but Honolulu's fish markets have endured and continue to be centers of social interaction for some island residents.

The fish markets are comprised of retail units, the majority of which are single proprietorship-family type operations. Close social connections have developed between retailers and consumers, as the success of the dealers is largely a function of their ability to maintain good relations with their customers and maintain a stable clientele (Garrod and Chong, 1978). One journalist wrote of the O'ahu Market, where fresh fish and produce have been sold for nearly a century: "In the hustle and bustle of daily life in downtown Honolulu, many people are drawn to O'ahu Market because of its informal charm and the feeling of family one gets while shopping there" (Chinen, 1984:9).

Early in the last century, Bryan (1915) developed a list of the various fish purchased in the Honolulu market by each of Hawai'i's principal 'nationalities.' The ethnic identification of

Hawai'i's *kama'aina* (long-time residents) with particular species has continued to the present day. The large variety of fish typically offered in Hawai'i's seafood markets reflects the diversity of ethnic groups in Hawai'i and their individual preferences, traditions, holidays and celebrations.

Many of the immigrant groups that came to Hawai'i brought with them cultures in which fish are not only an integral part of the diet but given symbolic and even transformative connotations. Certain fish communicate messages of solidarity, favor, opulence and the like, or are believed to impart specific desirable traits to the diners (Anderson, 1988; Baer-Stein, 1999). For example, the December peak in landings of *ahi* reflects the demand for this fish for *sashimi*, an important dish in feasts celebrating *Oshogatsu* (Japanese New Year's), considered the most important cultural celebration for people of Japanese ancestry in Hawai'i. For many of Hawai'i's residents, serving *sashimi* is associated with "affluence, free time, a pleasant experience" (Peterson, 1973:116). Hence, its importance also during non-seasonal events such as weddings, graduations and birthdays. For Hawai'i residents of Chinese descent fish or '*yu*' is an important item during feasts celebrating *Tin nien* (Chinese lunar New Year) and other ritual observances, as it is a homophone for abundance (Choy, 1989). In Chinese culture fish also symbolize regeneration and freedom because of their rapid ability to propagate as well as their speed and unconfined lifestyle (Baer-Stein, 1999).

An insistence on quality, as well as quantity and variety, has also long been a hallmark of Hawai'i's seafood markets. For example, the Japanese immigrants to Hawai'i came from a society in which fishers, fish dealers and even cooks typically handle prized fish with considerable care. Hawai'i seafood consumers continue to demand fresh fish. Both the discriminating tastes of local residents and the symbolic meaning with which some fish are imbued are linked to the importance of fish as gifts from one person or family to another. In Hawai'i various types of high-priced fish such as *ahi* are highly regarded as gifts (Peterson, 1973). Such sharing and gift giving may play an important role in maintaining social relations, as exemplified by the traditional Japanese obligation to engage in reciprocal exchanges of gifts according to an intricate pattern of established norms and procedures (Ogawa, 1973). Those who neglect the obligation to reciprocate risk losing the trust of others and eventually their support.

The sharing of fish among members of the extended family and community is also an early tradition of the indigenous people of Hawai'i. The social responsibility to distribute fish and other resources among relatives and friends remains a salient feature of the lives of many Native Hawaiians that is enacted on both a regular basis and during special occasions (Glazier, 1999). Among Native Hawaiians fish is considered a customary food item for social events such as a wedding, first communion, school graduation, funeral or child's first birthday (baby *luau*) (Glazier, 1999).

Social Significance of Fishing to the Broader Community

Commercial fishing has been part of Hawai'i's economy for nearly two centuries. Long-established fishing-related infrastructure in Honolulu such as the fish markets and Kewalo Basin mooring area has helped define the character of the city. Given the historical significance of commercial fishing in Hawai'i, it is likely that some local residents consider the fishing industry to be important in the cultural identity and heritage of the islands. Individuals who have never fished and do not intend to may nonetheless appreciate that others are fishing and that this activity is continuing to contribute to Hawai'i's social, cultural and economic diversity. This existence value may be expressed in various ways. For example, some individuals may engage in vicarious fishing through the consumption of books, magazines and television programs describing the fishing activities that others are pursuing in the waters around Hawai'i. It is also important to note that for some major ethnic groups in Hawai'i, such as the Japanese and Native Hawaiians, the role that their forebears played in the development of commercial fisheries in the islands remains an important part of their collective memory. In 1999, for example, the Japanese Cultural Center of Honolulu organized an exhibition commemorating the historical involvement of Japanese immigrants in Hawai'i's commercial fishing industry.

Just as Hawai'i's fishing tradition is an integral part of the islands' heritage and character, the image of Hawai'i has become linked with some types of locally caught seafood. Among the food fish that have become closely identified with Hawai'i are pelagic species such as *ahi* and *mahimahi*. The continued availability of these seafoods in Hawai'i has important implications for the mainstay of the state economy - tourism.[39] Japanese tourists visiting Hawai'i often want to enjoy the traditional foods and symbols of prosperity of Japan while they vacation in Hawai'i, including various types of high-quality fresh fish (Peterson, 1973). Hawai'i tourists from the U.S. mainland and other areas where fish is not an integral part of the customary diet typically want to eat seafood because it is perceived as part of the unique experience of a Hawai'i vacation. For both Japanese and U.S. mainland tourists, the opportunity to consume fish in Hawai'i may be enriched if the fish eaten is actually caught in the waters around Hawai'i. Suryanata (2000) observes that markets within the state for "grown in Hawai'i" products have expanded in the past decade through the proliferation of gourmet restaurants that feature 'Pacific Rim' and 'Hawai'i Regional Cuisine.' This marketing strategy eschews traditional symbols constructed by the tourism industry in favor of fostering an appreciation of the cultural setting, social relationships and physical environment that establish Hawai'i as a unique place.

[39] Suryanata (2000) notes that many attributes of Hawai'i have been constructed in the marketing of Hawai'i by the tourist industry, and unusual or exotic food complements the marketed image. In describing the current initiative to revive Hawai'i's agricultural sector by diversifying into high-value non-traditional export crops, such as tropical flowers, gourmet coffee and tropical speciality fruits, she writes "None of these products is unique to Hawai'i in a true sense to merit a higher price, but marketing strategies seek to define a strong place-association of these products with Hawai'i, to capitalize on Hawai'i's exotic image and to develop niche markets for speciality products from paradise." This statement is also true for locally-produced seafood sold in Hawai'i.

Suryanata (2000) also notes that place-based speciality food can retain its appeal to buyers beyond a vacation period or even attract buyers who have never been to the place in question. Just as the consumption of organic food may signify a commitment to a certain environmental and social value, a consumption of products from Hawai'i can symbolize a partial fulfillment of a desire to experience or relive a Hawai'i vacation. According to a national seafood marketing publication, the power of this constructed value to influence prospective buyers has not been lost on Hawai'i's seafood dealers:

> *When it comes to selling seafood the Hawaiians have a distinct advantage. Their product comes with built-in aloha mystique, and while they've emphasized the high quality of the fish taken from their waters, they've also taken full advantage of the aura of exotic Hawai'i itself in promotion on the mainland and, now, in Europe* (Marris, 1992:75).

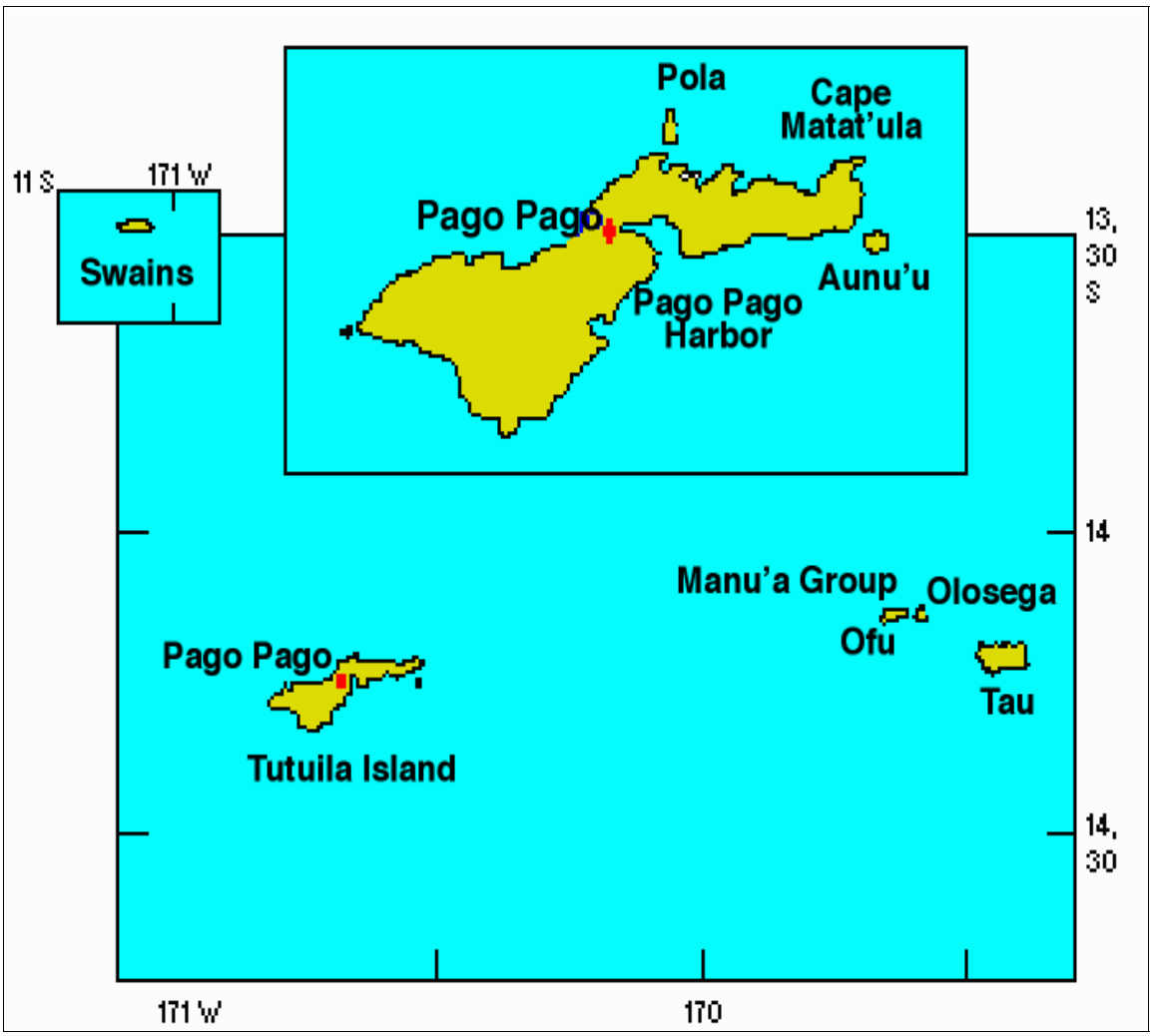
Local production of food as opposed to a reliance on imports also creates opportunities to foster social connections between consumers and their food producers. As noted above, much of the retailing of fish in Hawai'i now occurs through supermarkets, and a large quantity of the seafood sold is imported. However, there still exists in Hawai'i personal connections between consumers and the individuals who harvest and retail fish. Such connections may have broad public value. For example, a recent article by agricultural researchers identified proximity as one of the key attributes of a sustainable food system:

> *A sustainable food system is one in which "food is grown, harvested, processed, marketed, sold, [and] consumed as close to home as possible." An emphasis on locally grown food, regional trading associations, locally owned processing, local currency, and local control over politics and regulation is found within a proximate system. A proximate food system will have "grocery stores close to home which carry local items with little or no corporately owned products to compete," and would provide "specialty items that characterize the bioregion"* (Kloppenburg *et al.*, 2000:182).

3.11.5 American Samoa

The Territory of American Samoa is a group of islands with a total land area of 76 square miles lying approximately 2,300 miles southwest of Hawai'i. The islands of the territory include Tutuila, the three islands of Ofu, Olosega, and Ta'u of the Manu'a group, Aunu'u, Rose Atoll and Swain's Island. The main islands are shown in Figure 3.11-10. Formal annexation of Tutuila and Aunu'u by the United States occurred in 1900, Manu'a agreed to cede its authority to the United States in 1904, and Swain's Island was annexed in 1925. The islands remained under naval administration from 1900 to 1951, when the administration of American Samoa was transferred to the Secretary of the Interior.

Figure 3.11-10: Territory of American Samoa.



3.11.5.1 American Samoa Demographics and Economy

Population and Ethnicity

The American Samoa Government (ASG) estimated the total population in 1995 (the most recent year for which data are available) to be 56,350, up 20.5 percent from 1990, when the decennial census was conducted. Between 1990 and 1995, American Samoa's population grew at an annual rate of 3.8 percent, one of the highest growth rates in the Pacific Islands and the world. At this rate, total population would have reached 67,900 persons in 2000. Ethnically, American Samoa can be broken down into three groups: Samoan (89 percent), Tongan (four percent), and Caucasian (two percent).

Income and Employment

American Samoa has a small developing economy, dependent mainly on two primary income sources: the American Samoa Government (ASG), which receives income and capital subsidies from the federal government, and the two fish canneries on Tutuila (BOH, 1997). These two primary income sources have given rise to a third: a services sector that derives from and complements the first two. In 1993, the latest year for which the ASG has compiled detailed labor force and employment data, the ASG employed 4,355 persons (32.2 percent of total employment), followed by the two canneries with 3,977 persons (29.4 percent) and the rest of the services economy with 5,211 persons (38.4 percent). An estimated 2,718 people were unemployed, giving a total labor force of 16,261, and an unemployment rate of 16.7 percent. Though higher than unemployment rates in the rest of the United States, it is not unusual when compared with unemployment rates throughout the Pacific.

A large proportion of the territory's work force is from Western Samoa (now officially called Samoa) (BOH, 1997). While it would be true to say that Western Samoans working in the territory are legally alien workers, in fact they are the same people, by culture, history, and family ties.

Statistics on household income indicate that the majority of American Samoans live in poverty according to U.S. income standards. American Samoa has the lowest gross domestic product and highest donor aid per capita among the U.S.-flag Pacific islands (Adams *et al*, 1999). However, by some regional measures American Samoa is not a poor economy. Its estimated per capita income of $5,000 is almost twice the average for all Pacific island economies, although it is less than half of the per capita income in Guam, where proximity to Asia has led to development of a large tourism sector.

Fishing Related Economic Activities

The excellent harbor at Pago Pago and certain special provisions of U.S. law form the basis of American Samoa's largest private industry, fish processing, which is now more than forty years old (BOH, 1997). The territory is exempt from the Nicholson Act, which prohibits foreign ships from landing their catches in U.S. ports. American Samoan products with less than 50 percent market value from foreign sources enter the United States duty free (Headnote 3(a) of the U.S. Tariff Schedule). The parent companies of American Samoa's fish processing plants enjoy special tax benefits, and wages in the territory are set not by federal law but by recommendation of a special U.S. Department of Labor committee that reviews economic conditions every two years and establishes minimum wages by industry.

In 1998, Pago Pago received 208,300 tons of fish worth more than $200 million, making it the leading U.S. port in terms of the dollar value of fish landings. Furthermore, with a production increase of 50 percent over the past three years, StarKist Samoa, Inc. has become the largest tuna cannery in the world. Nearly all of the fish processed by the

canneries is harvested by domestic and foreign industrial fishing fleets operating in areas of the Pacific far from American Samoa.

The ASG estimates that the tuna processing industry directly and indirectly generates about 15 percent of current money wages, 10 to 12 percent of aggregate household income and seven percent of government receipts in the territory (BOH, 1997). On the other hand, both tuna canneries in American Samoa are tied to multinational corporations that supply virtually everything but unskilled labor, shipping services and infrastructure facilities (Schug and Galea'i, 1987). Even a substantial portion of the raw tuna processed by StarKist Samoa is landed by vessels owned by the parent company. The result is that few backward linkages have developed, and the fish-processing facilities exist essentially as industrial enclaves. Furthermore, most of the unskilled labor of the canneries is imported. Up to 90 percent of cannery jobs are filled by foreign nationals from Western Samoa and Tonga. The result is that much of the payroll of the canneries 'leaks' out of the territory in the form of overseas remittances.

Harsh working conditions, low wages and long fishing trips have discouraged American Samoans from working on foreign longline vessels delivering tuna to the canneries. American Samoans prefer employment on the U.S. purse seine vessels, but the capital-intensive nature of purse seine operations limits the number of job opportunities for locals in that sector as well. Only about 16 American Samoans are employed on U.S. purse seiners (Gillette and McCoy, 1997). However, the presence of the industrial tuna fishing fleet has had a positive economic effect on the local economy as a whole. Ancillary businesses involved in reprovisioning the fishing fleet generate a significant amount of jobs and income for local residents. Fleet expenditures for fuel, provisions and repairs in 1994 were estimated to be between $45 million and $92 million (Hamnett and Pintz, 1996).

Despite the recent substantial increases in cannery production, the future of the tuna processing industry in American Samoa is uncertain (BOH, 1997). The North American Free Trade Agreement (NAFTA) may result in competition from Mexican tuna processors. The General Agreement on Tariffs and Trade (GATT) may prevent preferential entry into the United States of processed tuna from American Samoa. Tax exemptions for the subsidiaries of American companies operating in U.S. territories are under pressure in Congress and are no longer assured for the cannery owners. Also, low labor costs in tuna canning operations in Thailand make for serious pressure from foreign competition.

The tuna processing industry has had a mixed effect on the commercial fishing activities undertaken by American Samoans. The canneries often buy fish from the small-scale domestic longline fleet based in American Samoa, although the quantity of this fish is insignificant compared to cannery deliveries by the U.S. purse seine, U.S. albacore and foreign longline fleets. The ready market provided by the canneries is attractive to the small boat fleet, and virtually all of the albacore caught by the *alia*-style vessels that fished with longline gear during the late 1990s was sold to the canneries. Nevertheless, local fishers have long complained that a portion of the frozen fish landed by foreign longline vessels enters

the American Samoa restaurant and home-consumption market, creating an oversupply and depressing the prices for fresh fish sold by local fishers.

Although the domestic longline fleet in Pago Pago consists mainly of small vessels, five locally-owned vessels larger than 50 ft are also engaged in the longline fishery. These latter vessels are outfitted with modern electronic equipment for navigation, communications and fish finding, and they are able to chill and freeze tuna catches. In addition, several other fishers in American Samoa are acquiring larger (38-50 ft) boats with a greater fishing range and capacity for chilling fish. At least in the short-term, most of the tuna landed by these vessels will likely be sold for canning. Local fishers have indicated an interest in participating in the far more lucrative overseas market for fresh fish. To date, however, inadequate shore-side ice and cold storage facilities in American Samoa and infrequent and expensive air transportation links have been restrictive factors.

Pago Pago Bay has the appearance of a 'working harbor' dedicated to the landing, processing and export of vast quantities of fish. The harbor supports mostly large fishing vessels, tankers and container vessels, but some small fishing and cruising boats moor there as well. However, the shore-side support facilities for small vessels are minimal. The fisheries occurring in the waters around American Samoa are typically small boat, one-day fisheries. In recent (1994-1998) years, the annual ex-vessel value of commercial landings of bottomfish and pelagic species by the small boat fleet has averaged about $633,700 (WPRFMC, 1998a; WPRFMC, 1999a). While the pelagic catch represented about 91 percent of the total value of these landings, it is apparent that the small boat pelagic fisheries account for a relatively insignificant amount of the economic activity in the territory.

In summary, in terms of social impacts, American Samoa is host to an industrial fleet that has relatively little direct participation of local residents. Further, the industrial scale processing (canning) operation employs relatively few long-term local residents. Clearly, the American Samoa economy benefits in a number of significant ways from the presence of these industrial activities. However, the industrial fishery is not strongly linked to either local fishing or fishing by locals. There are, in some respects, two separate pelagic fisheries-related spheres of activity in American Samoa; the one that American Samoans participate in as fishers, and the industrial fisheries that may benefit the local community in other ways.

For the purposes of this analysis, it is also worth noting that the industrial fleet based in American Samoa is to a significant degree not under the management auspices of the Council's pelagic fisheries management plan. Most of the fishing activity by U.S. purse seine vessels occurs in areas far outside the U.S. EEZ. In these areas the purse seine sector is covered by a separate international agreement (see Section 3.13). It is only during *El Niño* events that the purse seine vessels may shift their fishing activity to areas in the central Pacific, including the U.S. EEZ under the jurisdiction of the Council. During the northern hemisphere's winter, the U.S. albacore troll vessels that supply tuna to the American Samoa canneries participate in the South Pacific albacore troll fishery occurring along the sub-tropical convergence zone south of the U.S. EEZ around American Samoa. During the

northern hemisphere's summer these vessels participate in the North Pacific albacore troll fishery occurring north of the U.S. EEZ around the NWHI. With regard to the Asian longline fleet supplying the American Samoa canneries, these vessels fish exclusively in international waters or the EEZs of Pacific island nations (see Section 3.14). In other words, while pelagic fisheries are a cornerstone of the American Samoa economy, the pelagic fisheries of greatest significance generally occur far beyond the boundaries of the U.S. EEZ and are largely outside of the management purview of the FMP. The relative economic contribution of the pelagic fisheries occurring within the EEZ around American Samoa is very small.

3.11.5.2 American Samoa Fishing Communities and Sociocultural Setting

American Samoa Fishing Communities

American Samoa consists of seven islands covering a total of 76.1 square miles of land. Tutuila has 70 percent of the total land area and is home to 90 percent of the population. Pago Pago harbor on Tutuila is one of the Pacific's deepest and most sheltered harbors. The remaining 20 square miles include the three islands of Ofu, Olosega, and Ta'u of the Manu'a group located 60 miles east of Tutuila; Aunu'u, a small island 1/4 mile off the eastern shore of Tutuila; Rose Atoll, a national wildlife refuge 60 miles east of the Manu'a group; and Swain's Island, 200 miles north of Tutuila.

As noted above, there is a sharp differentiation between the local small boat fishing fleet and the locally based component of the industrial domestic and foreign distant-water tuna fleet. Local small-scale fisheries, common throughout the small communities of the main islands, are important as a source of food for local consumption, income and employment. The large majority of participants in these fisheries are of Samoan ancestry. A 1987 survey of 36 small vessel operators in American Samoa found that 72 percent were Samoan, 17 percent were Caucasian and 11 percent were some other ethnicity (Kasaoka, 1989). It is likely that the percentage of those involved in off-shore fishing who are of Samoan ancestry has increased in recent years with the expansion of the domestic longline fleet.

Small-scale fisheries also continue to be important for personal consumption and customary exchanges of food that support extended families and traditional leaders, and thereby help perpetuate the Samoan way of life and culture. Participation in commercial activities, wage labor and a cash economy has not weakened traditional principles of redistribution and reciprocity.

In terms of defining 'fishing communities' in this sub-region, the residential distribution of individuals who are substantially dependent on or substantially engaged in the harvest or processing of pelagic fishery resources approximates the total population distribution. These individuals are not set apart – physically, socially or economically – from island populations as a whole.

This dispersion is evident on the island of Tutuila, where tuna processing has been the largest industrial activity for more than three decades. The canneries themselves are located in the village of Anua; the shipyard servicing the vessels that supply fish to the canneries is in Satala; the wharf is in Fagatogo; the fuel facility is in Utulei; and the employees of these various fisheries-dependent private- and public-sector operations are bused in daily from villages all around the island.

American Samoans directly involved in the harvest of pelagic species are similarly dispersed. A recent fishing vessel census conducted by the American Samoa Department of Marine and Wildlife Resources indicates that American Samoans residing on each of the major islands participate in local pelagic fisheries, although 83 percent of all fishing vessels are on the island of Tutuila (Table 3.11-10). These data also show that larger vessels are exclusively concentrated on Tutuila.

Table 3.11-10: Profile of fishing fleet participating in pelagic fisheries in the U.S. EEZ around American Samoa. Source: WPRFMC, 2000f.

Vessel length	No. of vessels by island			No. of vessels by fishing method		Area of EEZ in which fishing occurs
	Tutuila	Aunu‘u	Manu‘a	Longline	Trolling	
< 30 ft	45	7	7	18	41	< 20 nm from shore
31-40 ft	22	1	0	13	10	< 50 nm from shore
41-50 ft	3	0	0	0	3	50-100 nm from shore
50-90 ft	4	0	0	4	0	Entire EEZ
> 90 ft	1	0	0	1	0	Entire EEZ and beyond
Total	75	8	7	36	54	--

Broad participation in the pelagic fisheries occur at the village as well as island level. A recent survey of fishers in American Samoa reported that individuals who fish for pelagic species are found in nearly every village in the territory (Severance *et al.*, 1999). This wide involvement in the pelagic fisheries is indicative of the cultural significance that the harvest of pelagic species holds for American Samoans.

The only currently maintained data set that possibly could provide information on the geographical distribution of fishers in American Samoa is the register of NMFS longline general permit holders. These permits entitle the holders to fish in the EEZ around the Pacific Insular Areas (American Samoa, Guam, the CNMI and the U.S. Pacific remote island areas) using longline gear. As with the register of Hawai‘i longline limited access permit holders, the mailing address of each permit holder is recorded. However, the register data for American Samoa permit holders proved unsuitable for the present analysis. The central problem is that virtually all the mailing addresses for American Samoa are post office boxes in Pago Pago, an artifact of the territory’s limited mail distribution system rather than an indicator of where fishers actually reside.

It is also the case that the number of longline general permit holders is not a good indicator of the number of commercial vessels that actually participate in the longline fishery in American Samoa. In anticipation of establishing a limited access system for the longline fishery at some future date, the Council and NMFS set a control date of July 15, 2000, after which any vessel would not be assured of being allowed to use longline gear to fish for pelagic management unit species in the EEZ around American Samoa (65 FR 62692 [2000]). There are currently no fees for acquisition of NMFS longline general permits, and many individuals apparently acquired permits prior to the control date, not because they intended to enter the longline fishery at this time, but because they wanted to be ensured access to the fishery in the future. Although a large number of permits have been issued (83 as of October 2000), only about 28 vessels participated in the longline fishery in 1999. Among those permit holders that have seldom, if ever, fished in the EEZ around American Samoa using longline gear are the dozen or so with non-American Samoa mailing addresses. These permit holders have addresses in Hawai'i or the U.S. mainland, with a total of four mainland states represented, and with no state having more than four permit holders. It is known that two of these permit holders use their fishing vessels mainly in the Alaska crab fishery and three are active primarily in the albacore troll fishery.

In conclusion, the long history and large scale of tuna processing operations in American Samoa have resulted in a level of economic dependency on pelagic fisheries unrivaled by any other community in the Western Pacific Region. In addition, ties to the 'non-industrial' component of the pelagic fisheries are, in general, not localized. For these reasons, the logical unit of analysis for examining the social impacts of management alternatives is the territory as a whole, although Tutuila may be the most appropriate unit for some specific issues related to the industrial fishing activities concentrated on that island.

Sociocultural Setting

The activity of fishing, including the preparatory rituals on shore, application of fishing skills at sea, and distribution of the catch according to strict protocols, has been an integral part of Samoan culture since time immemorial. It shaped the traditional Samoan religion, diet, material culture, oral traditions and calendar (Severance and Franco, 1989). Fishing and its products also played a fundamental role in the social structure. In traditional Samoan society, every adult participated as a member of an extended family or *aiga* that shared resources and responsibilities. Each *aiga* was headed by a titled 'chief' or *matai* who was the decision-maker and spokesperson for the family in many matters of village life. Untitled men and women had a myriad of obligations for service to the *aiga* and *matai* and were expected to contribute goods (including fish) and labor to important village ceremonies ranging from weddings to title investitures. Such service was expected of untitled individuals if they were to rise in status and perhaps achieve their own *matai* title and position. In addition, other, less formal exchanges of goods and services occurred among kinsmen and friends as expressions of a sustained relationship.

The introduction of a cash economy in American Samoa did not weaken this network of social obligations as much as provide new opportunities for customary exchange of goods and services within American Samoa's tightly held *aiga* system. Fishing has become increasingly commercialized, but fish, whether it be caught or purchased, remains a significant component of the customary exchange system. Fish supports the food needs of the extended family as well as the status of the family and the broader community.

Traditionally, *atu* (skipjack tuna) were by far the most important fish species in Samoan culture (Severance and Franco, 1989). Today, *atu* are still occasionally ceremonially cut up for formal presentation to the *matai*, village pastor, village council members and others of high social status within the community. Pelagic species, especially skipjack and yellowfin tuna, are the preferred offerings for village events. Even fish that is sold may be fulfilling obligations to friends and members of the extended family. Severance *et al.* (1999) recently conducted a survey of fishers in American Samoa who fish for pelagic species. The 60 fishers interviewed in 26 villages represent about 50 percent of the total number of fishers in the Territory who fish for pelagic species. Thirty-five percent of the fishers surveyed reported that they sell less than half of their catch. Forty percent of these fishers also reported that half or more of the catch that they sold was done so as *fa'ataulofa*, that is, sold at a reduced price to friends or kinsmen as an expression of a sustained social relationship. Furthermore, commercial fishers are expected to catch fish when village ceremonies are pending and to be generous in sharing their harvest. Some fishers keep fish in freezers with the expectation they will be called upon to provide food for cultural purposes by their *matai*.

Severance *et al.* (1999) examined the cultural importance of the distribution of the unsold portion of the catch. The average number of times during the past year that individual fishers contributed fish to Sunday village meetings was 22. Nineteen percent of the fishers surveyed reported that half or more of their catch was contributed to a *matai* as a form of *tautua*, that is, service to the kin group. Twenty-five percent of the fishers surveyed held *matai* titles themselves, but they may be obligated to contribute fish to the village pastor or to a higher-ranked individual. Another form of obligatory contribution takes the form of assistance to kinsmen in times of need known as *fa'alavelave*. Forty-two percent of the fishers surveyed reported contributing fish as *fa'alavelave* three or more times during the past year. A more individualized way of assisting kinsmen is referred to as *fesoasoani*. Thirty-two percent of the fishers stated that half or more of the unsold portion of their catch was offered as *fesoasoani*.

The development of the local commercial fish harvesting sector in American Samoa continues to be constrained by a shortage of private capital and, to some extent, by the economic preferences and cultural values of local fishers. The median household income in the territory is $16,114, and 56 percent of families have incomes below the federal poverty level. Most residents interested in commercial fishing do not have sufficient financial resources to invest in large, expensive vessels. For example, a 65-ft longline vessel would cost about $350,000. In contrast, a new 40-ft *alia* can be acquired for about $60,000, with earlier, locally-made versions of the *alia* available from $24,000 to $40,000.

The majority of the fishers in American Samoa do not rely on the sale of their catch as their only source of income. According to survey results in Severance *et al*. (1999), 65 percent of local fishers are employed at another job. Furthermore, as noted above all Samoans have cultural obligations to extended families, traditional leaders and village ministers that require the exchange of food and other resources. Undertaking fishing on a part-time basis, rather than as a full-time business, provides local residents with the flexibility to fulfill these obligations, which are an integral part of *fa'a Samoa* (the Samoan way of life).

The technologies and patterns of fishing that have evolved over the years in American Samoa are culturally acceptable as well as economically reasonable for small-scale fishers. While conservative in some respects, these individuals have demonstrated a willingness to adopt new types of fishing gear and methods, and the catching power and efficiency of their fishing operations have increased. The small to medium-size vessels favored by fishers are easily and inexpensively built and maintained, and they are capable of harvesting diverse fishery resources utilizing a variety of gear types.

The expansion of the small-boat fleet has led to new business opportunities for local entrepreneurs such as boat building, vessel support services, fish processing and export marketing. Recently, a non-profit private organization in American Samoa received a grant of $346,000 from the Administration for Native Americans (ANA) for startup of a small-scale fish processing business. When operational, the new enterprise is expected to process fresh fish landed by the small boat fleet and sell finished products in local and export markets. Another local non-profit organization received a grant from ANA to equip a 40 ft double-hull fishing vessel with hydraulically powered longline gear. The new boat is being built by a local firm and may serve as a prototype for other small boat construction projects.

In summary, the dependence of the early Samoans on fishing for food security shaped their social organization, values and religion. Of course, many aspects of Samoan society have changed over time, but fishing remains an important cultural practice. Despite increasing commercialization of the catch, the harvest of pelagic species continues to contribute to the perpetuation of Samoa culture and social cohesion of American Samoa communities. It offers individuals an occupation that is consistent with Samoan cultural values and the island lifestyle. Furthermore, to the extent that unemployment among the younger population can cause both economic and social ills, commercial fishing provides an additional opportunity for young people to be economically productive and socially responsible.

3.11.6 Guam

The Territory of Guam is an island of 212 square miles located at the southern end of the Mariana archipelago (Figure 3.11-11). It is 1,500 miles from Tokyo and 3,700 miles from Honolulu. The island was ceded to the United States following the Spanish American War of 1898 and has been an unincorporated territory since 1949.

Figure 3.11-11: Territory of Guam.

3.11.6.1 Guam Demographics and Economy

Population and Ethnicity

Guam's population was estimated to have reached 163,373 in 1999. The annual population growth rate averaged 2.3 percent from 1990 to 1998. A continuation of this growth rate will increase Guam's total population to167,130 in 2000, nearly double the 1970 total of 84,996.

Guam's indigenous Chamorros are the single largest ethnic group in the territory, representing 46.2 percent of the total resident population. Reflecting the large amount of immigration from the Philippines, Filipinos are Guam's second largest ethnic group, accounting for 30.6 percent of the population. Other groups include Micronesian (6.2 percent), Caucasian (4.7 percent), and Asian, including Japanese, Korean, Vietnamese, Thai, and Chinese (4.0 percent).

Income and Employment

The main income sources on Guam include tourism, national defense, and trade and services. Per capita income in Guam was calculated to be $12,028 in 1998, up from $10,152 in 1991, while median household income was calculated to be $39,484 in 1998, up from $31,118 in 1991.

The Guam Department of Labor estimated the number of employees on payroll to be 64,230 in 1998, a decrease of 3.8 percent from the 1997 figure. Of the 64,230 employees, 44,780 were in the private sector and 19,450 were in the public sector. The federal government employs 7.6 percent of the total work force, while the Government of Guam employs 22.7 percent. Guam had an unemployment rate of 15.2 percent in 1999.

Non-Fishing Related Economic Activities

In Guam, the major economic factor for most of the latter part of the twentieth century was the large-scale presence of the U.S. military (BOH, 1999b). In recent years, however, the military's contribution to Guam's economy has waned and been largely replaced by Asian tourism. Guam's macro-economic situation exhibited considerable growth between 1988 and 1993 as a result of rapid expansion of the tourist industry. In fact, Guam's economy has become so dependent on tourists from Asia, particularly Japan, that any significant economic, financial and foreign exchange development in the region has had an immediate impact on the territory (BOH, 1999b). During the mid- to late-1990s, as Japan experienced a period of economic stagnation and cautious consumer spending, the impact was felt just as much in Guam as in Japan. Visitor arrivals in Guam dropped 17.7 percent in 1998. Despite recent efforts to expand the tourist market, Guam's economy remains dependent on Japanese tourists.

The military presence on the island has diminished to the lowest level in decades and is still declining (BOH, 1999b). The military is likely to remain a small part of the economy unless unexpected tensions arise in the region and cause a redeployment of forces. Nevertheless, the military remains a vital stabilizing economic factor for Guam, particularly in times of regional economic crises.

The Government of Guam has been a major employer on Guam for many years. However, recent deficits have resulted from a steady rise in government spending at the same time that tax bases have not kept up with spending demands. Many senior government workers have been offered and have accepted early retirement to reduce the payroll burden.

Fishing Related Economic Activities

The importance of commercial fishing in Guam lies mainly in the territory's status as a major regional fish transshipment center and re-supply base for domestic and foreign tuna fishing fleets. Among Guam's advantages as a home port are well-developed and highly efficient

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

By the early 1990s, an air transshipment operation was also established on Guam. Fresh tuna is flown into Guam from the Federated States of Micronesia and elsewhere on air cargo planes and out of Guam to the Japanese market on wide-body passenger planes (Hamnett and Pintz, 1996). A second air transshipment operation that began in the mid-1990s is transporting fish that do not meet Japanese *sashimi* market standards to Europe.

Currently, Guam is the most important re-supply and transshipment center for the international tuna longline fleet in the Pacific. However, the future of home port and transshipment operations in Guam depends on the island's ability to compete with neighboring countries that are seeking to attract the highly mobile longline fleet to their own ports. Trends in the number of port calls made in Guam by various fishing fleets reflect the volatility of the industry. The number of vessels operating out of Guam decreased by almost half from 1996 to 1997, and further declined in 1998 (Hamnett and Anderson, 2000).

The Guam Department of Commerce reported that fleet expenditures in Guam in 1998 were about $68 million, and a 1994 study estimated that the home port and transshipment industry employed about 130 people (Hamnett and Pintz, 1996). This industry constitutes an insignificant percentage of the gross island product, which was about $3 billion in 1996, and is of minor economic importance in comparison to the tourist or defense industries (Hamnett and Anderson, 2000). Nevertheless, home port and transshipment operations make an important contribution to the diversification of Guam's economy (Hamnett and Pintz, 1996). As a result of fluctuations in the tourism industry and cuts in military expenditures in Guam, the importance of economic diversification has increased.

A number of fisheries occur in the U.S. EEZ surrounding Guam, but they generate relatively little income and employment. Similar to the case described for American Samoa, there is a sharp differentiation between the local small boat fleet and the locally based component of the industrial foreign and domestic distant-water fishing fleet. Offshore fishing in the waters around Guam typically involves small boats making 1 to 2-day fishing trips. In recent (1994-1998) years, the annual ex-vessel value of commercial landings of bottomfish and pelagic species has averaged about $616,500 (WPRFMC, 1998a, 1999a). The pelagic catch accounted for about 92 percent of the total value of these landings.

3.11.6.2 Guam Fishing Communities and Sociocultural Setting

Guam Fishing Communities

The Guam-based pelagic fisheries occurring within the U.S. EEZ consists primarily of small-scale fishing operations that are mainly recreational in nature (Vaughn *et al.*, 2000). Participants in the local pelagic fisheries are fairly evenly distributed across the island within several small villages and a few larger communities situated along the 78 mile coastline or slightly inland (Vaughn *et al.*, 2000). For example, approximately 20 percent of Guam's fishers reside within the municipality of Dededo, which in turn contains almost a quarter of the population of the island. A further 40 percent of the fishers reside in the municipalities of Mangilao, Merizo, Tamuning or Yigo.

Centrally located on the western leeward coast, the Hagatna Marina serves as the island's primary small boat launch site to fishing areas off the central and northern leeward coasts as well as the northern banks. Situated to the south, the Merizo pier, Umatac boat ramp and Agat Marina serve as access points to the southern shores and banks. Apra Harbor, on the western coast of Guam, is a large deepwater port characterized by multiple cargo handling and fuel piers. The tuna vessel home port and transshipment operations are concentrated in a portion of the harbor. There are few, if any, facilities for small fishing boats.

The Guam Fishermen's Cooperative Association lies adjacent to the Hagatna Marina. Organized in the late 1970s, the co-op established a small marketing facility so that fishers no longer had to make their own individual marketing arrangements. In 1980, the co-op acquired a chill box and ice machine and emphasis was placed on wholesaling fish. Today, the co-op has about 200 members, and it processes and markets an estimated 60 to 80 percent of the local commercial pelagic fisheries catch. The co-op's membership includes fishers from communities all around the island, and all ethnic groups that participate in the small boat fisheries are represented (Paul Bartram, pers. comm., 26 October 2000, Akala Products, Honolulu, 96816).

Small boat owners have long complained that they must compete with the industrial fishing fleet based in Guam both for fishery resources and in the market. While evidence of competition for resources between fleets is scant, it is well documented that a portion of the fresh fish landed in Guam by foreign longline vessels is sold to local fish dealers, restaurants and hotels. The longline-caught fish that enters the market consists of *mahimahi*, wahoo and other pelagic species considered 'incidental catch.' The competitive pricing and consistent availability of this fish has discouraged attempts to supplant foreign catches with locally caught fish. The Guam Fishermen's Cooperative Association has attempted to counter this price competition from imported fish by emphasizing the higher quality of fresh fish landed by co-op members.

In summary, the small size of Guam and dispersion of fishery participants across communities suggest that the island as a whole is the logical unit of analysis for the purpose

of measuring the social impacts of alternative fishery management measures. Furthermore, while fishing related economic activities may be important to some households they are not significant to the overall economy. The main port is a major home port and transshipment center for industrial distant-water fishing fleets operating in the Pacific, but the tuna transshipment industry is a minor segment of Guam's economy. The Guam-based pelagic fisheries occurring within the U.S. EEZ consists primarily of small-scale fishing operations of limited economic importance. On the other hand, it is important to note that fishing continues to play an important role in the cultural identity of many people on Guam, and fish are an integral item of the local diet, especially during celebratory feasts.

Sociocultural Setting

The sociocultural setting of fisheries in Guam is similar to that of fisheries in the Northern Mariana Islands. The combined discussion of the contemporary settings in the two areas appears below in the sociocultural setting subsection of the CNMI section.

The islands now known as Guam and the CNMI share many elements of pre-colonial and colonial history. Prior to the arrival of Europeans in Guam and the other Mariana Islands in the sixteenth century, the Chamorros, as the original inhabitants of these islands were called, possessed large sailing canoes that enabled them to fish on offshore banks and sea mounts (Amesbury and Hunter-Anderson, 1989). The manufacture of these canoes was monopolized by the *matua* (noble caste) who were also the deep-sea fishers and inter-island traders within Chamorro communities (Jennison-Nolan, 1979). In the early seventeenth century a Spanish priest described the Chamorros as "…the most skilled deep-water fishing people yet to have been discovered" (Driver, 1983:208). During the 1700s, however, the large, oceangoing canoes of the Chamorros were systematically destroyed by the Spanish colonizers of the Mariana Islands in order to concentrate the indigenous population in a few settlements, thereby facilitating colonial rule as well as religious conversion (Amesbury and Hunter-Anderson, 1989). Another far-reaching effect of European colonization of Guam and other areas of the Mariana Islands was a disastrous decline in the Chamorro population, from an estimated 40,000 in the late seventeenth century to approximately 1,500 a hundred years later (Amesbury and Hunter-Anderson, 1989). Most of the surviving Chamorros were forcibly moved to Guam. A few Chamorros on Rota managed to elude capture, but Saipan, Tinian and the other islands were depopulated.

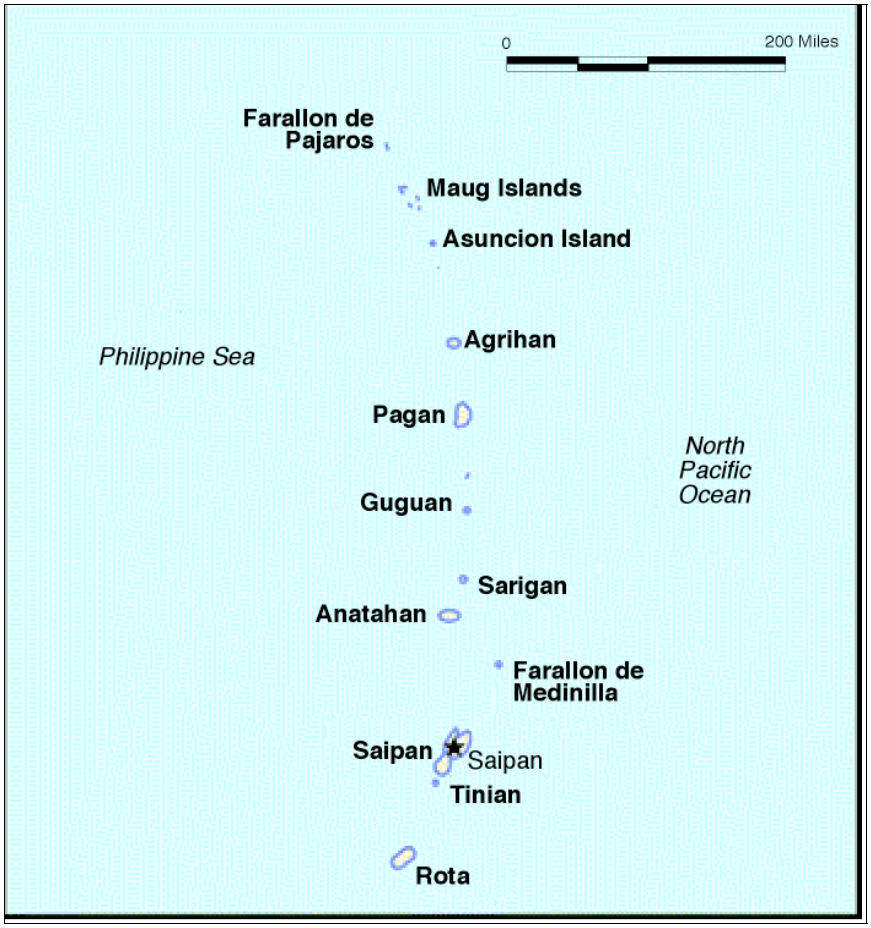
During the early 1800s, people from the Caroline Islands were encouraged by the Spanish government to establish permanent settlements in the Mariana Islands (Amesbury *et al.*, 1989). The Carolinians who settled there came with a well-developed sea-faring tradition. The post-World War II years saw a gradual involvement of the Chamorros and Carolinians of the Northern Mariana Islands in commercial fishing. According to Orbach (1980), the Carolinians were the leaders in forming crews for fishing enterprises involving larger craft and offshore fishing. Many of the Carolinians currently involved in commercial fishing live in villages on Saipan that historically have been Carolinian 'enclaves' such as Tanapag.

Today, the people of Guam and the CNMI continue to share many cultural traits despite the political separation of the islands. The U.S. citizen population in both areas is predominantly of Chamorro cultural extraction, but the Carolinian community has retained a separate cultural identity. Most U.S. citizens on Guam and the CNMI have a mode of life that is strongly influenced by Spanish Roman Catholic as well as by American culture. In recent years both Guam and the CNMI have evolved into multi-ethnic societies. Many immigrants from Asia and Micronesia have settled in the two island areas and substantially increased their cultural diversity.

3.11.7 Commonwealth of the Northern Mariana Islands

The Commonwealth of the Northern Mariana Islands is the U.S.-affiliated island group closest to Asia. It is 1,500 miles from Japan, 1,400 miles from Taiwan and 2,000 miles from South Korea. The CNMI consists of 14 islands, five of which are inhabited, with a total land area of 176.5 square miles spread over about 264,000 square miles of ocean (Figure 3.11-12). The Northern Mariana Islands became part of the Pacific Trust Territory administered by the United States under a mandate granted in 1947. The Covenant that created the Commonwealth of the Northern Mariana Islands and attached it to the United States was fully implemented in 1986, pursuant to a Presidential Proclamation that terminated the Trust Territory of the Pacific Islands as it applied to the CNMI.

Figure 3.11-12: Commonwealth of Northern Mariana Islands.



3.11.7.1 CNMI Demographics and Economy

Population and Ethnicity

The total population of the CNMI increased from 16,780 in 1990 to 79,429 in the first quarter of 1999, yielding an annual growth rate of 8.5 percent. The development of a garment industry based on imported foreign labor accounts for this phenomenal population growth (BOH, 1999c). Most of the population increase has been on Saipan, the commonwealth's commercial, governmental and civic center as well as its garment manufacturing capital.

The ethnic breakdown of the population in descending order in 1995 was as follows: Filipino - 33.7 percent; Chamorro - 29.1 percent; Chinese - 11.6 percent; Micronesian - 8.2 percent; Saipan Carolinian - 5.2 percent; Korean - 3.9 percent; Caucasian - 3.4 percent; Japanese - 1.8 percent; and all others - 3.0 percent. The only group that registered a population decline

between 1990 and 1995 was the Korean segment.

Income and Employment

Per capita income on Saipan in 1995 was $7,645, down from $7,721 in 1990 (figures for more recent periods are not available). The median household income on Saipan was $19,698 in the first quarter of 1999, as compared to $21,457 in 1990. The commonwealth had an unemployment rate in 1999 of 5.5 percent.

The main industries in the CNMI are garment manufacturing and tourism. Garment manufacturing arrived in Saipan in the 1980s and has grown to become the commonwealth's single largest source of income and employment. Government, however, is the employer of choice for U.S. citizens in the CNMI because of higher wages and other benefits.

Non-Fishing Related Economic Activities

The economy of the CNMI has historically benefitted substantially from financial assistance from the United States, but in recent years this assistance has declined as locally generated government revenues have grown. Between 1988 and 1996, tourism was the commonwealth's largest income source. During that period tourist traffic to the CNMI tripled from 245,505 to 736,117 (BOH, 1999c). Total tourist expenditures in the CNMI were estimated to be a record $587 million in 1996. In 1997 and 1998, however, the loss of air service between the CNMI and Korea, together with the impact of the Asian financial crisis on both Korean and Japanese travelers, caused tourist arrivals in the CNMI to drop by one-third (BOH, 1999c).

At present, garment production is the CNMI's fastest growing industry, with shipments of $1 billion to the United States under duty and quota exemptions (BOH, 1999c). The garment industry is credited with preventing an economic depression in the commonwealth following the decline of its tourist industry, but the future of the CNMI's garment manufacturers is uncertain. When the commonwealth was created it was granted an exemption from certain U.S. immigration, naturalization and labor laws. These economic advantages are now a matter of national political debate centered on what some regard as unfair labor practices in the CNMI's garment industry. The two main advantages for manufacturing garments in the CNMI are low-cost foreign labor and duty-free sale in the United States. The controversy over labor practices in the CNMI may cause the commonwealth to lose these unique advantages, forcing garment-makers to seek alternative low-cost production sites.

Fishing Related Economic Activities

In the early 1980s, U.S. purse seine vessels established a transshipment operation at Tinian Harbor. The CNMI is exempt from the Jones Act, which requires the use of U.S.-flag and U.S.- built vessels to carry cargo between U.S. ports. The U.S. purse seiners took advantage

of this exemption by offloading their catch at Tinian onto foreign reefer vessels for shipment to tuna canneries in American Samoa. In 1991, a second type of tuna transshipment operation was established on Saipan (Hamnett and Pintz, 1996). This operation transships fresh tuna caught in the Federated States of Micronesia from air freighters to wide-body jets bound for Japan. The volume of fish flown into and out of Saipan is substantial, but the contribution of this operation to the local economy is minimal (Hamnett and Pintz, 1996) .

With the exception of the purse seine support base on Tinian (now defunct), the CNMI has never had a large infrastructure dedicated to commercial fishing. The majority of boats in the local fishing fleet are small, outboard engine-powered vessels. In recent (1994-1998) years, the annual ex-vessel value of commercial landings of bottomfish and pelagic species has averaged about $473,900 (WPRFMC 1998a; WPRFMC, 1999a). The pelagic catch accounted for about 72 percent of the total value of these landings. Existing planning data for the CNMI are not suited to examining the direct and indirect contributions attributed to various inter-industry linkages in the economy. It is apparent, however, that fishing by the local small-boat fleet represents only a small fraction of the economic activity in the commonwealth.

3.11.7.2 CNMI Fishing Communities and Sociocultural Setting

CNMI Communities

There are three major inhabited islands in the CNMI – Saipan, Tinian and Rota. The largest of the three, Saipan, is home to almost 90 percent of the commonwealth's population. It is approximately 12.5 miles long, 5.5 miles wide and has a 54 mile coastline that is irregular except on the western side where there is a fringing reef. Of the eight main communities on Saipan, Garapan and Chalan Kanoa are considered the principal urbanized areas. Rota is approximately 10.5 miles long, three miles wide and has a 38.3 mile coastline. The principal community on the island is Songsong. Tinian is approximately 10.5 miles long, five miles wide and has a 38 mile coastline. The principal community is San Jose. A large portion of Tinian has been leased to the U.S. military.

Although there are a couple of fishing vessels on Saipan within the 55 to 60 foot range, the majority of the vessels used throughout the CNMI are less than 29 feet and powered by a single outboard engine. In relation to the overall CNMI economy, with a total workforce of over 35,000 and wages and salaries of over $420 million, commercial fishing is of little importance. From this perspective, the CNMI cannot be said to be economically dependent upon fishing. Nevertheless, commercial fishing is an important source of income for some individuals and families, and a supply of fresh fish is important to many local retail businesses and restaurants. In addition, many fishers use their boats for subsistence purposes and to contribute fish to community events such as fiestas.

The Port of Saipan is utilized primarily by cargo vessels and offers few facilities for fishing boats. A portion of the small-boat commercial, charter and recreational fishing fleet based

on Saipan is situated at Outer Cove Marina and the adjacent Smiling Cove Marina, but most of the smaller fishing vessels utilize jetty/ beach/ slipway-type facilities present at several locations on the island. The islands of Tinian and Rota both have small harbors that accommodate a limited number of small commercial and recreational fishing boats.

Because of the small scale of the harvesting sector in the CNMI, no marketing system for handling large quantities of fresh fish landings has developed. Although there have been some exports of fish to Guam and Hawai'i, nearly all of the domestic catch is consumed locally. The major commercial outlets for locally caught fish are small retail markets, resort hotels and restaurants on Saipan (Radtke and Davis, 1995). Restricted market outlets curtail harvesting activities during the peak fishing season. During other times of the year fishing activities are vulnerable to disruption by periods of even moderately rough seas because of the limited size of many of the boats.

In conclusion, given the small size of the islands, dispersal of fishing vessel facilities and extensive community networks for sharing locally caught fish, the entire commonwealth is the most suitable unit of analysis for describing the social impacts of alternative fishery management measures. While fishing is of limited importance to the island economy and the number of people who directly depend on fishing for their livelihood is small, fishing remains an important social and cultural activity in the CNMI.

Sociocultural Setting

Over the centuries of acculturation beginning with the Spanish conquest in the late seventeenth century, many elements of traditional Chamorro and Carolinian culture in Guam and the Northern Mariana Islands were lost. But certain traditional values and attitudes were retained and have been melded with elements of Western culture that are now a part of local life and custom. Amesbury *et al.* (1989:48) note that the practice of sharing one's fish catch with relatives and friends during Christian holidays is rooted in traditional Chamorro and Carolinian culture:

> A strongly enduring cultural dimension related to offshore fishing is the high value placed on sharing of the catch, and the importance of gifts of fish to relatives and friends. Such gifts are not limited to offshore fish; often they are made up of reef fish. Sometimes pelagic or bottomfish are sold in order to earn money to buy gifts for friends and relatives on important religious (Catholic) occasions such as novenas, births and christenings, and other holidays.

A recent survey of fishers in Guam found that nearly all the respondents regularly give fish to family and friends (Vaughn *et al.*, 2000). In addition, the people of Guam and the CNMI participate in many banquets throughout the year associated with neighborhood parties, wedding and baptismal parties and especially the village fiestas that follow the religious

celebrations of village patron saints. All of these occasions require large quantities of fish and other traditional foods (Orbach, 1980; Hamnett *et al.*, 1998; Vaughn *et al.*, 2000).

The social obligation to share one's fish catch extends to part-time and full-time commercial fishers. In Guam and the CNMI locally caught fish are often sold informally (Amesbury and Hunter-Anderson, 1989; Amesbury *et al.*, 1989). The buyers are mainly friends, neighbors, and relatives, especially in the CNMI. This non-anonymous, very personal 'market' tends to restrain the price asked and paid.

Orbach (1980) notes that the fisheries in the CNMI are inextricably involved with the lifestyles and plural-occupational patterns of the participants. Part-time fishing performed in conjunction with other activities has a prominent place in the socio-economic adaptations of local residents. People fish for bottomfish and pelagic species to supplement their family subsistence, which is gained by a combination of small-scale gardening and wage work (Amesbury *et al.*,1989). Orbach suggests that the availability of economic activities such as part-time fishing is among the major reasons that the CNMI has not experienced more of the problems of other island entities such as out-migration or high rates of crime and juvenile delinquency.

Fishing in Guam and the CNMI continues to be important not only in terms of contributing to the subsistence needs of the Chamorro and Carolinian people of the Mariana Islands but also in terms of preserving their history and identity. As noted above, many aspects of traditional Chamorro and Carolinian culture have been lost. Fishing has assisted Chamorros and Carolinians in keeping alive what remains of the maritime attributes of their traditional culture and helped them maintain their connection to the sea and its resources.

3.11.8 U.S. Pacific Remote Island Areas of the Western Pacific Region

Wake Island became a U.S. possession in 1898 and has been administered by the U.S. Air Force since 1962. Howland Island, Baker Island and Jarvis Island have been administered by the Department of the Interior since 1936 and have served as National Wildlife Refuges under the jurisdiction of the U.S. Fish and Wildlife Service since 1974. Johnston Atoll was annexed by the United States in 1856 and is administered by the Defense Nuclear Agency under a 1973 agreement with the U.S. Air Force. Palmyra Atoll became a U.S. possession in 1898 as part of Hawai'i and is privately owned. In late 2000, The Nature Conservancy purchased Palmyra Atoll with the intention of making part of the atoll a wildlife preserve. Kingman Reef was annexed to the United States in 1922 and has been under the jurisdiction of the U.S. Navy since 1934. In January 2001, the U.S. Fish and Wildlife Service declared Kingman Reef and the surrounding waters out to 12 nautical miles to be a national wildlife refuge. Midway Atoll was placed under the jurisdiction of the U.S. Navy in 1903. Ownership of the atoll was transferred from the Navy to the U.S. Fish and Wildlife Service in 1996, and the atoll is now managed as the Midway Atoll National Wildlife Refuge.

3.11.8.1 U.S. Pacific Remote Island Areas' Demographics and Economy

There is no indigenous population on any of the U.S. Pacific remote island areas. Baker Island, Jarvis Island, Howland Island, Kingman Reef, and Palmyra Atoll have been basically unoccupied in modern times. Midway Atoll, Wake Island and Johnston Atoll have had varying populations of military personnel during most of the 20th century. Howland Island, Baker Island and Jarvis Island are national wildlife refuges and not open for public visitation. Access to Johnston Atoll is restricted to military personnel supporting base operations. On average, about 1,000 persons reside on the atoll. Access to Wake Island is also strictly regulated. Currently, the island has approximately 302 inhabitants. Economic activity on Wake Island and Johnston Atoll is limited to providing services to U.S. military and contractors located on the islands. All food and manufactured goods are imported. The human population on Midway Atoll has decreased substantially in the last two decades, but year-round human habitation of the atoll has continued. Since 1996, there has been limited eco-tourism and public use within the Midway Atoll National Wildlife Refuge in the form of charter boat and shore 'catch-and-release' fishing, diving and wildlife observation. A privately-owned business was awarded a concession to develop and manage the tourist facilities in the refuge. The number of visitors allowed on the atoll at any one time is limited to reduce impacts to wildlife. In 2000, a private company received permission from the owners of Palmyra Atoll to establish a commercial fishing supply and transshipment operation on the island. This permission was received prior to the purchase of the atoll by The Nature Conservancy. The fishing operation based on Palmyra Atoll employs about six shore-side personnel.

3.11.8.2 U.S. Pacific Remote Island Areas' Fishing Communities and Sociocultural Setting

U.S. Pacific Remote Island Areas' Fishing Communities

Military personnel and other individuals residing on the U.S. Pacific remote island areas have long engaged in recreational fishing in the waters around the islands. Commercial fishing has generally been limited to vessels based in other areas, primarily Hawai'i. In 2000, however, four to five longline vessels began operating from a commercial fishing supply and transshipment base established on Palmyra Atoll. In addition, since 1996, a charter boat operation targeting PMUS has been based at Midway Atoll. Midway Sports Fishing, a private company, operates five vessels used for charter fishing. Another seven or so small vessels are used by Midway residents for recreational fishing.

The large majority of people that reside on the U.S. Pacific remote island areas are highly transient. The populations on Wake Island and Johnston Atoll are comprised of military personnel or civilian contractors for the military and experience a high turn-over rate. Similarly, the population on Midway Atoll consists of tourists, resort employees and U.S. Fish and Wildlife personnel, none of whom are long-term residents. Even the continuation of the current commercial fishing operation on Palmyra Atoll is limited by a five-year contract with the atoll's owners. Consequently, the populations on the U.S. Pacific remote island areas are

dissimilar to the residential communities found in the other sub-regions of the Western Pacific. For the purposes of this analysis, these island areas and their associated populations are not considered 'fishing communities.'

Sociocultural Setting

As noted above, there is no indigenous population on any of the U.S. Pacific remote island areas, and most of the people that do reside on the islands are highly transient. There have been few opportunities for individuals to invest a significant amount of time learning to fish in the area and developing a store of locale-specific fishing skills and knowledge that can be passed down from one generation to the next. While the opportunity for engaging in fishing and other ocean-related activities is a positive attribute of a military assignment or recreational visit to these locales, it cannot be considered a central part of the lifeways on these islands. With the exception of the small number of individuals on Palmyra Atoll and Midway Atoll who are employed in fishing enterprises, no one on the U.S. Pacific remote island areas is substantially dependent upon, or engaged in, fishing for income or sustenance.

3.12 ADMINISTRATION AND ENFORCEMENT

3.12.1 Enforcement

Enforcement costs are incurred by NMFS and the U.S. Coast Guard (USCG) in dockside and at-sea (e.g., boardings and aerial surveillance) inspections. The annual enforcement costs incurred by NMFS and USCG for the region's pelagic fisheries were estimated to be about $1.5 million.

The USCG conducts surveillance of the EEZ using C-130 aircraft and cutters. In 1998, the USCG conducted 753 hours of fisheries patrols with C-130 aircraft in the Western Pacific Region. Almost 300 days of surface patrols were also conducted. The Coast Guard patrol effort in the eight non-contiguous areas of the EEZ in the Western Pacific Region is shown in Table 3.12-1.

Table 3.12-1: USCG Patrol Effort in the Western Pacific Region, 1998. Source: WPRFMC, 1998a.

EEZ Area	Surface Patrol Days	Aircraft Patrol Hours
Main Hawaiian Islands	65	121
Northwestern Hawaiian Islands	9	42
Guam and Northern Mariana Islands	135	329
Johnston Atoll and Wake Island	10	17
American Samoa	6	30
Palmyra Atoll/Kingman Reef	10	40
Jarvis Island	10	51
Howland & Baker Islands	43	123

There were also 58 hours flown in direct support of international High Seas Driftnet (HSDN) enforcement. The USCG flew over 300 hours with HH-65 helicopters in support of fisheries operations; this effort was concentrated in the Main Hawaiian Islands and while deployed on high endurance cutters.

In 1998, there were 278 total fishing vessel boardings in the USCG 14th District Area of Responsibility (AOR). The breakdown of vessels boarded are as follows: 182 U.S., 40 Japanese, 28 Taiwanese, 9 South Korean and 19 of other nationalities.

Enforcement for the Hawai'i-based longline fishery is facilitated by use of a Honolulu-based vessel monitoring system (VMS) operated by NMFS and USCG. A VMS is an automated real-time, satellite-based tracking system that obtains accurate and near-continuous position reports from vessels at sea. The VMS in Hawai'i was established in 1994 to help enforce area closures around the Hawaiian Islands in which fishing with longline gear is prohibited. These area closures total about 414,000 km^2 (160,000 mi^2). NMFS certifies the VMS system hardware and software aboard each vessel and assigns each VMS unit a unique identification number.

The VMS, monitored in the 14th District Command Center by NMFS and USCG personnel, has proven to be an effective, cost-saving technology for the monitoring and enforcement of restricted areas over great distances. In 1998, there were nine significant enforcement cases cued by information obtained from VMS. Using "signature analysis," USCG and NMFS identify possible incursions into the main Hawaiian Island longline closure area and the Northwestern Hawaiian Island Protected Species Zone. This information is passed to patrolling cutters for investigation during at-sea enforcement boarding. In addition to enhancing government enforcement capability, VMS has yielded benefits for the fishers on equipped vessels, such as increased navigational capacity and secure, low-cost communications. The equipment also allows domestic fishers to transmit catch and effort data to NMFS and accurately report the position of illegal foreign fishing activity in the EEZ.

Special Agents of NMFS Office for Law Enforcement (OLE) conduct investigations of alleged violations of NOAA statutes and regulations, including the Magnuson-Stevens Act, the Lacey Act, the Marine Mammal Protection Act and the Endangered Species Act. During 1998, Special Agents were assigned to Honolulu, Hawai'i; Pago Pago, American Samoa; Hagatna, Guam; and Honiara, Solomon Islands. In 1998, the OLE documented 52 apparent violations of western Pelagic fisheries regulations.

3.12.2 Administration

3.12.2.1 Permitting

The NMFS Pacific Islands Area Office (PIAO) administers the permit system for U.S. fishing vessels operating in the Western Pacific Region. A U.S. fishing vessel must be registered for use under general longline permit if that vessel is used: (1) to fish for PMUS using longline gear in the EEZ around American Samoa, Guam, the Northern Mariana Islands, or other U.S. island possessions in the Pacific Ocean; or (2) to land or transship, shoreward of the outer boundary of the EEZ around American Samoa, Guam, the Northern Mariana Islands or other U.S. island possessions in the Pacific Ocean, PMUS that were harvested with longline gear. In addition, a U.S. fishing vessel of the United States must be registered for use under a Hawai'i longline limited access permit if that vessel is used: (1) to fish for PMUS using longline gear in the EEZ around Hawai'i; or (2) to land or transship, shoreward of the outer boundary of the EEZ around Hawai'i, PMUS that were harvested with longline gear. A receiving vessel must be registered for use with a receiving vessel permit if that vessel is used to land or transship, shoreward of the outer boundary of the fishery management area, PMUS that were harvested with longline gear.

There are no federal permit requirements for any specific pelagic fishery occurring in the Western Pacific Region other than the longline fishery.

3.12.2.2 Data Collection

Administrative costs are incurred in maintaining fisheries data collection systems in Hawai'i, American Samoa, Guam and the Northern Mariana Islands. Brief descriptions of the fisheries data collection systems for the pelagic fisheries in each island area are provided below.

3.12.2.2.1 Hawai'i

State of Hawai'i regulations require any person who takes marine life for commercial purposes, whether within or outside of the state, to first obtain a commercial marine license from the Hawai'i Division of Aquatic Resources (HDAR). Every holder of a commercial marine license must furnish to HDAR a monthly catch report commonly referred to as the "C3" form. Any commercial albacore troll vessel that lands its catch in Hawai'i is required to complete the HDAR Albacore Trolling Trip Report. Pole-and-line vessels in Hawai'i are required to record their catches on the HDAR Aku Catch Report. Longline vessels are

required to complete the NMFS Western Pacific Daily Longline Fishing Log and the HDAR Longline Trip Report. There are no federal reporting and recordkeeping requirements for any specific pelagic fishery occurring in the Western Pacific Region other than the longline fishery.

Every commercial marine dealer must furnish to HDAR a monthly report detailing the weight, number and value of each species of marine life purchased, transferred, exchanged or sold and the name and current license number of the commercial marine licensee from whom the marine life was obtained.

NMFS administers a fish market sampling program in Honolulu. In cooperation with the state, staff from both NMFS and HDAR visit the fish auction managed by the United Fishing Agency and obtain size frequency and economic data on pelagic fish and bottomfish sold.

The NMFS Western Pacific Region Daily Longline Fishing Log requires longline vessels to record the number of protected species released alive, injured or dead. Suspected under-reporting of interactions with protected species (sea turtles in particular) was the major factor that led to the establishment of a NMFS observer program for the Hawai'i-based longline fishery (DiNardo, 1993). From 1994-1999, the percentage of observer coverage was 4.7, 5.5, 4.9, 3.5 and 3.3, for an annual average of approximately 4.4 percent (Section 3.12.3). The selection of trips to observe is based on a sampling design to monitor sea turtle interactions.

3.12.2.2.2 American Samoa

Longline vessels are required to complete the NMFS Western Pacific Daily Longline Fishing Log. Catch data for other fishing methods are collected through creel surveys administered by the Department of Marine and Wildlife Resources (DMWR) of the American Samoa Government. Since 1985, the Offshore Creel Survey conducted on the island of Tutuila has examined both commercial and recreational boat trip catches at five designated sites. For two weekdays and one weekend day per week, DMWR data collectors sample offshore fishers between 0500 and 2100 hours. Two DMWR data collectors also collect fishing data on the islands of Tau and Ofu in the Manu'a Group.

Data on fish sold to outlets on non-sampling days or caught during trips missed by data collectors on sampling days are accounted for in a separate dealer invoice data collection system. A vessel inventory conducted twice a year provides data on vessel numbers and fishing effort.

3.12.2.2.3 Guam

An offshore creel survey program administered by the Division of Aquatic and Wildlife Resources (DAWR) of the Government of Guam provides estimates of island-wide catch and effort for all the major fishing methods used in commercial and recreational fishing. In 1982,

the Western Pacific Fisheries Information Network (WPacFIN) began working with the Guam Fishermen's Cooperative Association to improve their invoicing system and obtain data on all fish purchases on a voluntary basis. Another major fish wholesaler and several retailers who make purchases directly from fishers also voluntarily provide data to WPacFIN using invoices ("trip tickets") provided by DAWR.

3.12.2.2.4 Northern Mariana Islands

The Division of Fish and Wildlife (DFW) of the Commonwealth of the Northern Mariana Islands monitors the commercial fishery by summarizing sales ticket receipts from commercial establishments. DFW staff routinely distribute and collect invoice books from 80 participating local fish purchasers on the island of Saipan, including fish markets, stores, restaurants, government agencies and roadside vendors.

3.12.2.3 Permitting and Data Collection Under the High Seas Fishing Compliance Act

The High Seas Fishing Compliance Act of 1995 establishes a system of permitting, reporting and regulation for U.S. fishing vessels operating on the high seas. The NMFS Southwest Regional Office administers the Act as it pertains to non-purse seine vessels based in the Western Pacific Region. Data from longline vessels operating out of California are received by the SWR office and processed by SWFSC Honolulu Laboratory staff.

3.12.2.4 Permitting and Data Collection Under the Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America (SPTT)

The SPTT, entered into in1988, is an international agreement between the United States and sixteen members of the South Pacific Forum. The current agreement allows annual access for up to 50 U.S. purse seiners (with an option for 5 more if agreed to by all parties) to the EEZs of various Pacific island countries. U.S. operational, administrative, and enforcement commitments under the SPTT are carried out by NMFS on behalf of the Secretary of Commerce. These responsibilities are implemented by the NMFS Southwest Regional Administrator. The NMFS Southwest Regional Office maintains a field station in American Samoa to collect fishery data required by the SPTT, while the NMFS SWFSC is responsible for related data collation and summarization.

3.12.3 Observer Issues

The National Marine Fisheries Service, Southwest Region, Fisheries Observer Branch implements field aspects of the Marine Mammal Protection Act, Endangered Species Act, and the Magnuson-Stevens Fishery Conservation and Management Act. The Fisheries Observer Branch began fielding mandatory observers in 1976 aboard U.S. tuna purse seine vessels fishing in the eastern tropical Pacific Ocean. This continued until 1994 when NMFS

began to rely exclusively on observers placed by the Inter-American Tropical Tuna Commission in the purse seine fishery of the eastern tropical Pacific Ocean. This program was established under the Marine Mammal Protection Act out of public concern for the incidental take of small cetaceans used by fishers to locate tuna. Mortalities, especially spotted (*Stenella attenuata*), spinner (*S. Longirostris*), and common dolphins (*Delphinus delphis*) resulted from net entanglement.

Beginning in July 1990, the Fisheries Observer Branch began placing mandatory observers on the California set gillnet fishery targeting California halibut, angel shark, white seabass, soupfin shark, and yellowtail. Observed incidental take included California sea lions (*Zalophus californianus*), northern elephant seals *(Mirounga angustirostris*), harbor seals (Phoca vitulina), harbor porpoise (*Phocoena phocoena*), sea otters (*Enhydra lutris*), sea turtles, especially loggerhead turtles (*Caretta caretta*), cormorants (*Phalacrocorax* sp.), and common murres (*Uria aalge*). Also beginning July 1990, the Fisheries Observer Branch began placing mandatory observers aboard the Pacific drift gillnet fishery targeting swordfish and thresher shark.

In February 1994, the Hawai'i longline observer program was established to monitor the incidental sea turtle take for vessels targeting swordfish and tuna. In 1993, concerns over the expanding Hawai'i-based longline fleet's possible impact on sea turtles had led to the issuance of a biological opinion and incidental take statement (section 7 consultation of the Endangered Species Act) and the initiation of a voluntary observer program. A letter was sent to all owners of vessels covered by Hawai'i-based longline limited entry permits requesting their cooperation in carrying observers. The voluntary observer program ended when the mandatory program was established by interim final rule, published on December 22, 1993. This rule went into effect in February 1994. The first observers trained for the Hawai'i-based longline fishery were prepared for sea assignments on February 25, 1994. The first two observers departed on longline fishing trips on February 27, 1994. A final rule for the mandatory observer program was published on April 19, 1994, to ensure that NMFS had the authority to require observers during the lapse between the longline moratorium and the limited entry program which was to be implemented under Amendment No. 7 of the Pelagics FMP.

NMFS Southwest Region has established a Port Field Station in Honolulu, Hawai'i for monitoring vessel activity and deploying observers. Observer training is conducted in conjunction with Southwest Fisheries Science Center - Honolulu Laboratory, Bishop Museum, NMFS enforcement, U.S. Coast Guard, U.S. Fish and Wildlife Service, and the fishing industry.

The mission of the program is to observe and document all species caught, including sea turtles, seabirds, marine mammals, swordfish, tunas, sharks, and other non-target fishes and to collect selected biological specimens. The observer program, therefore, collects data on interactions between the pelagic longline fleet and protected sea turtles, marine mammals, and sea birds. In addition to protected species catch rates, the program has also gathered

data on sea turtle life history. The program provides DNA samples, turtle morphometrics, and a means for gathering satellite telemetry data. Secondarily, data and tissue samples from target species (swordfish, tuna) are also collected.

More specifically, among other tasks, observers:

identify protected species, target, and bycatch species by number and location;
record incidental mortality and injury of sea turtles, and tally all sea turtle observations during fishing activity;
dissect post-mortem marine species as instructed (gonads, stomachs, otoliths);
record sea turtle life history data, and tag all live sea turtles without existing tags;
record life history data on other selected marine species;
collect data on vessel activity and fishing operations;
review and enter all data into a computer data base when on-shore; and
collection of bird/fishing vessel interaction data including observations of deployed deterrents.

The NMFS Honolulu Laboratory analyzes the data in conjunction with logbook data (Pacific Islands Area Office) to estimate total sea turtle takes and mortalities. Data are used to prepare annual reviews of biological opinions, as required by the 1998 biological opinion, quarterly reports to the Western Pacific Fishery Management Council, and estimates of bird mortality to the U.S. Fish and Wildlife Service.

3.12.3.1 Coverage statistics

Observers are required to be on deck to monitor the entire length of the haul, which equates to 100 percent fishing effort coverage on those boats with observers. Since March 1994, branch personnel have conducted daily shoreside dock rounds in Honolulu to determine which fishing vessels are in port. These dock rounds are used to obtain an estimate of fishing effort on a real-time basis by assuming that a vessel is fishing when it is absent from the harbor.

Until the latter part of 2000, NMFS managed the observer program using only NMFS observers. The average coverage rate, based on proportion of total estimated trips departing with an observer on board was 4.25 percent between 1994 and 1999. Over this period the average number of trips per year departing with observers was 46 (minimum 38, maximum 55; see Table 3.12-2). Up to the end of 1999, a total of 275 observed trips had been completed. Historically, trips have typically lasted 14 to 42 days and vessels have undertaken in the region of ten trips per year. For example, in 1996 there were 164 Federal limited-entry longline permits. Of these permitted vessels only 103 vessels were active, completing a total of 1062 trips.

In 2000 the number of trips leaving with observers rose to 118 (10.4 percent coverage), due to the coverage requirements of an August 4, 2000, court order. More recent developments

in the Program, resulting from the August 4, 2000 Court Order are described in Section 4.10.

Table 3.12-2: Selected performance measures for the HLOP, from 1994 to 2000. Provided by HLOP, Fisheries Observer Branch Southwest Region, National Marine Fisheries Service.

Year	Number of longline trips by the Hawai'i-based longline fleet	Number of new observers hired by NMFS	Number of trips departing with observers	Number of sets observed[1]	% of trips covered by observers
1994 (3/94-2/95)	1031	12	55	570	5.3%
1995 (2/95-12/95)	937	0	42	488	4.5%
1996	1062	6	52	624	4.9%
1997	1123	0	40	507	3.6%
1998	1180	9	48	561	4.1%
1999	1136	10	38	463	3.3%
2000	1134	0	118	1401	10.4%

[1] The number of observed sea days can be inferred from the number of observed sets. The number of sets is approximately equal to the number of fishing days, although technically the number of sets underestimates the number of observed sea days, because trips commonly include occasional days when no sets are made for various reasons (e.g. steaming between fishing areas), and the last fishing day of a trip involves line hauling, but not a new set.

3.12.3.2 Stratification design and estimation of total turtle take based on observer data

Summary results, in terms of numbers of observed encounters and their outcomes between the start of the program and the end of 2000 are provided in Table 3.12-3.

There are no detailed records concerning the sampling design of the observer program. However, the following summary describes in general terms the ways in which observer coverage has been allocated across the longline fleet. In the early years of the observer program, placement of observers in the longline fleet was stratified according to the target species. Identification of target species was based on landings in four categories: tuna, swordfish, mixed and "switchers." In 1997 the stratification design was simplified to two strata: vessels greater than 70 ft length over all (LOA) and vessels shorter than 70 ft LOA. The target for observer placement in these strata was 50 trips overall; 43 trips on vessels greater than 70 ft and seven trips on vessels shorter than 70 ft. The justification for this target was that vessels longer than 70ft were more likely to be targeting swordfish, and therefore more likely to encounter sea turtles. The August 4 Court Order changed the coverage requirements across all vessel types and areas. The new requirements are described in section 4.10.

Sampling stratification would need to be taken into account in the analysis of data on sea turtle encounters (take) if that analysis used an estimator based on the sampling design (i.e. a sample-based estimator). A sample-based estimator would depend on the sampling probabilities to raise observed total takes to the fleet level, which would require a very clear idea how trips were drawn for observation; something that does not appear to be currently available. Instead, since 1996, NMFS has used a model-based estimator which assumes a statistical model of turtle takes. In essence, the model-based estimator depends on the assumptions of the model rather than the sampling probabilities. Hence, the difference in the sampling probabilities due to the stratification is not a factor. Details of the NMFS model-based estimator are provided in McCracken (2000).

The model-based estimator assumes that observed trips are independent observations. A list of explanatory variables considered for predicting total take is provided in Table 3.12-4. Vessel length was considered as one of the explanatory variables (i.e., to take into account any effect of vessel length on the probability of a vessel encountering a sea turtle), but it did not provide enough additional information to warrant it being included in the model. According to this analysis there was no evidence in the observer database that vessel length had a significant effect on the probability of a vessel encountering a turtle, even though this may have been one of the assumptions underlying the vessel length-based stratification design introduced in 1997. Explanatory variables included in the prediction models are provided in Table 3.12-5.

Another feature of the prediction model is that it is designed to minimize the need for extrapolation (i.e. the extent to which values outside the range of the predictor variables need to be predicted). Most of the predictions in the model are interpolations.

Most of the turtles encountered by the fishery are released alive (see table 3.12-3). Nevertheless there is still a possibility that these turtle will die due to the interaction with the fishing gear. NMFS uses a range of mortality probabilities, depending on the details of the interaction as recorded in the observer data (e.g. how the turtle was hooked, or entangled). Research is continuing in this area to refine estimates of post release mortality. The figures used in the analysis by McCracken (2000) are provided in Table 3.12-6.

The results of the NMFS analysis of the observer data, in terms of take and kill estimates, 95 percent prediction intervals and probabilities that real takes exceeded authorized levels are provided in Table 3.12-6.

Table 3.12-3: Data on observed encounters with turtles, marine mammals and seabirds between 1994 and 2000. NA = data not available. Extracted from HLOP annual reports, Fisheries Observer Branch Southwest Region, National Marine Fisheries Service.

	Period						
	Feb 24 1994 to Feb 20 1995	Feb 21 to Dec 31 1995	1996	1997	1998	1999	2000
Total Sets Observed	570	488	624	507	561	463	1401
Total Hooks Set	599,700	543,248	731,687	585,763	734,204	687,703	2,238,842
Observed Trips[2]	55	42	52	38	47	38	109
Trips without Turtles	36	31	30	20	21	24	81
Trips with Turtles	19	11	22	18	26	14	28
Turtle Encounters	38	18	50	40	60	30	54
Released Alive							
Loggerhead	20	10	26	24	45	17	27
Leatherback	8	3	7	11	5	1	11
Olive Ridley	4	2	8	3	2	6	8
Green/Black	2	0	3	0	2	2	3
Unid. Hardshell	3	2	2	0	0	1	0
Returned Dead							
Loggerhead	0	0	0	0	1	0	0
Leatherback	0	0	1	0	1	1	0
Olive Ridley	0	1	1	0	3	1	3
Green/Black	0	0	0	0	0	1	2
Released, Disposition Unknown							
Loggerhead	0	0	1	0	0	0	0
Leatherback	1	0	1	1	0	0	0
Unid. Hardshell	0	0	0	1	1	0	0
Turtles per 1,000 hooks	0.063	0.033	0.063	0.068	0.082	0.044	0.024

	Period						
	Feb 24 1994 to Feb 20 1995	Feb 21 to Dec 31 1995	1996	1997	1998	1999	2000
Marine Mammal Encounters	NA	3	3	5	3	5	8
Released Alive							
False Killer Whale	NA	0	0	1	1	0	0
Risso's Dolphin	NA	2	1	2	0	2	1
Spinner Dolphin	NA	0	0	1	0	0	1
Bottlenose Dolphin	NA	1	0	0	0	1	0
Common Dolphin	NA	0	0	0	0	0	1
Sperm Whale	NA	0	0	0	0	1	0
Short-Finned Pilot Whale	NA	0	0	0	0	0	1
Unid. Whale	NA	0	1	0	2	1	1
Unid. Cetacean	NA	0	0	0	0	0	2
Returned Dead							
Short-Finned Pilot Whale	NA	0	0	1	0	0	1
Released, Disposition Unknown							
Unid. Cetacean	NA	0	1	0	0	0	0
Seabird Encounters	205	208	90	172	104	71	248
Released Alive							
Black-footed Albatross	24	22	13	24	6	7	29
Laysan Albatross	32	28	6	19	26	7	30
Unid. Seabird	0	0	0	0	1	0	0
Returned Dead							
Black Footed Albatross	106	79	46	86	39	36	133
Laysan Albatross	42	78	25	43	30	21	55
Sooty Shearwater	0	0	0	0	0	0	1
Unid. Seabird	1	1	0	0	0	0	0
Released, Disposition Unknown							
Black Footed Albatross	0	0	0	0	1	0	0
Laysan Albatross	0	0	0	0	1	0	0

[2] The number of observed trips in this table refers to the number of completed trips (i.e. those with returning observers) within the relevant period. These numbers differ in some cases from those given in Table 3.12.1, which refer to the number of vessel *departures* on which observers were carried. The figures in Table 3.12.1 are the ones used by NMFS to calculate the coverage level for a given period.

Table 3.12-4: Explanatory variables considered for predicting total take. Source: McCracken, 2000.

Category	Variable	Notes
Location in time and space	latitude (lat) longitude (lon) distance to 17° C isotherm distance to 19° C isotherm year month day	degrees north degrees east calculated from lat, lon, and sst calculated from lat, lon, and sst 94-99, looked at pooling categories January-December, looked at pooling categories represented as a circular variable for a year using the cosine and sine functions
Condition of gear	hooks hooks/float	
Environment	temperature	sea surface temperature (sst)
Catch of other species	yellowfin skipjack albacore swordfish blue shark mahimahi striped marlin blue marlin wahoo spearfish opah albatross	total and proportion of total
Other	vessel length trip type	registered length 3 categories (swordfish, tuna, mixed)

Table 3.12-5: Explanatory variables included in the prediction models. Source: McCracken, 2000.

Species	Explanatory variables
Loggerhead	month in three categories: [1,2], [5,6] ,[3,4,7-12] latitude as a polynomial: lat + lat^2 sea surface temperature in two categories: [sst 23.77° C], [sst > 23.77° C]
Olive Ridley	sea surface temperature in two categories: [sst 24.22° C], [sst > 24.22° C]
Leatherback	latitude in four categories: [lat 14.95° N.], [14.95° N. < lat 24.84° N.], [24.84° N. < lat 33.82° N.], [lat > 33.82° N.]]
Green	none

Table 3.12-6: Estimated probabilities of mortality of turtles resulting from interaction with the longline fishery. Source: McCracken, 2000.

Condition	Loggerhead	Leatherback	Olive Ridley	Green
Hooked/Released				
Internal	.29	.29	.29	.29
External	0	0	0	0
Unknown	.17	.01	.18	.03
Dead	1	1	1	1
Entangled/Released				
Okay	0	0	0	0
Injured	0	0	0	0
Dead	1	1	1	1
No record/Released	.17	.01	.18	.03

Table 3.12-7: Take and kill estimates for sea turtles based on NMFS analysis of observer data (model-based estimator) with 95 percent prediction intervals (PI) and probabilities that the real takes or kills exceeded the authorized levels. Source: McCracken, 2000.

(i) Loggerhead

Authorized levels for take and kill of loggerhead turtles for 1994-1997 were 305 and 46, and for 1998-1999 were 489 and 103.

Year	Takes			Kills		
	Est.	95% PI	Prob.	Est.	95% PI	Prob.
1994	501	[315-669]	.98	88	[36-141]	.95
1995	412	[244-543]	.90	72	[31-115]	.89
1996	445	[290-594]	.96	78	[34-127]	.92
1997	371	[236-482]	.82	65	[28-102]	.84
1998	407	[259-527]	.09	71	[32-112]	.06
1999	369	[234-466]	.01	64	[28-102]	.03

(ii) Leatherback

Authorized levels for take and kill of leatherback turtles for 1994-1997 were 271 and 23, and for 1998-1999 were 244 and 19.

Year	Takes			Kills		
	Est.	95% PI	Prob.	Est.	95% PI	Prob.
1994	109	[68- 153]	.00	9	[0-22]	.03
1995	99	[62-141]	.00	8	[0-21]	.02
1996	106	[69-148]	.00	9	[1-21]	.02
1997	88	[55-124]	.00	7	[0-18]	.00
1998	139	[79-209]	.00	12	[1-28]	.23
1999	132	[76-193]	.00	11	[1-27]	.20

(iii) Olive ridley

Authorized levels for take and kill of olive ridley turtles for 1994-1997 were 152 and 41, and for 1998-1999 were 168 and 46.

Year	Takes			Kills		
	Est.	95% PI	Prob.	Est.	95% PI	Prob.
1994	107	[70-156]	.04	36	[8-64]	.36
1995	143	[90-205]	.39	47	[7-84]	.63
1996	153	[103-210]	.53	51	[11-90]	.70
1997	154	[103-216]	.54	51	[8-92]	.70
1998	157	[102-221]	.38	52	[11-92]	.62
1999	164	[111-231]	.46	55	[11-96]	.66

(iv) Green turtle

Authorized levels for take and kill green turtles for 1994-1997 were 119 and 18, and for 1998-1999 were 52 and 15.

Year	Takes			Kills		
	Est.	95% PI	Prob.	Est.	95% PI	Prob.
1994	37	[15-65]	.00	5	[0-16]	.01
1995	38	[15-70]	.00	5	[0-17]	.02
1996	40	[19-70]	.00	5	[1-17]	.02
1997	38	[14-73]	.00	5	[0-17]	.00
1998	42	[18-76]	.28	5	[1-19]	.06
1999	45	[18-82]	.34	6	[1-19]	.06

3.13 THE U.S. WESTERN AND CENTRAL PACIFIC PURSE SEINE FISHERY

Prior to 1976 the U.S. purse seine fleet operated in the eastern Pacific Ocean (EPO) (Figure 3.13-1). During the early 1980s most of the fleet relocated to the western and central Pacific Ocean (WCPO) due to a strong ENSO event and reduced catch rates in the EPO. Additionally, several U.S. vessels also moved to the WCPO in the early 1990s with the advent in the EPO of dolphin-safe requirements and restrictions on fishing tuna associated with dolphins. The U.S. purse seine activity occurs within 10° of the equator in the WCPO, typically within the EEZs of Papua New Guinea (PNG), the Federated States of Micronesia (FSM), the Marshall Islands, the Republic of Kiribati, and Tuvalu (Figure 3.13-2). In the WCPO, the U.S. fleet has multilateral fishing access under the *Treaty on Fisheries Between the Governments of Certain Pacific Island States and the Government of the United States of America* or U.S. Multilateral Tuna Treaty (SPTT), which was signed in 1987 between the U.S. and 16 member countries of the Forum Fisheries Agency (FFA). The SPTT allows long-term access of tuna resources within various Pacific Islands EEZs for up to 50 U.S. purse seine vessels. The numbers of U.S. purse seiners has fluctuated from 35 to 39 since 1996. Thirty-six vessels were licensed under the 12th licensing period (up to December 31, 1999). Vessels range from 60 to 75 meters (197-246 ft) in length and had an average carrying capacity of 1,184 tonnes in 1999.

Figure 3.13-1: Map of Western and Central Pacific Ocean (WCPO) and Eastern Pacific Ocean (EPO).

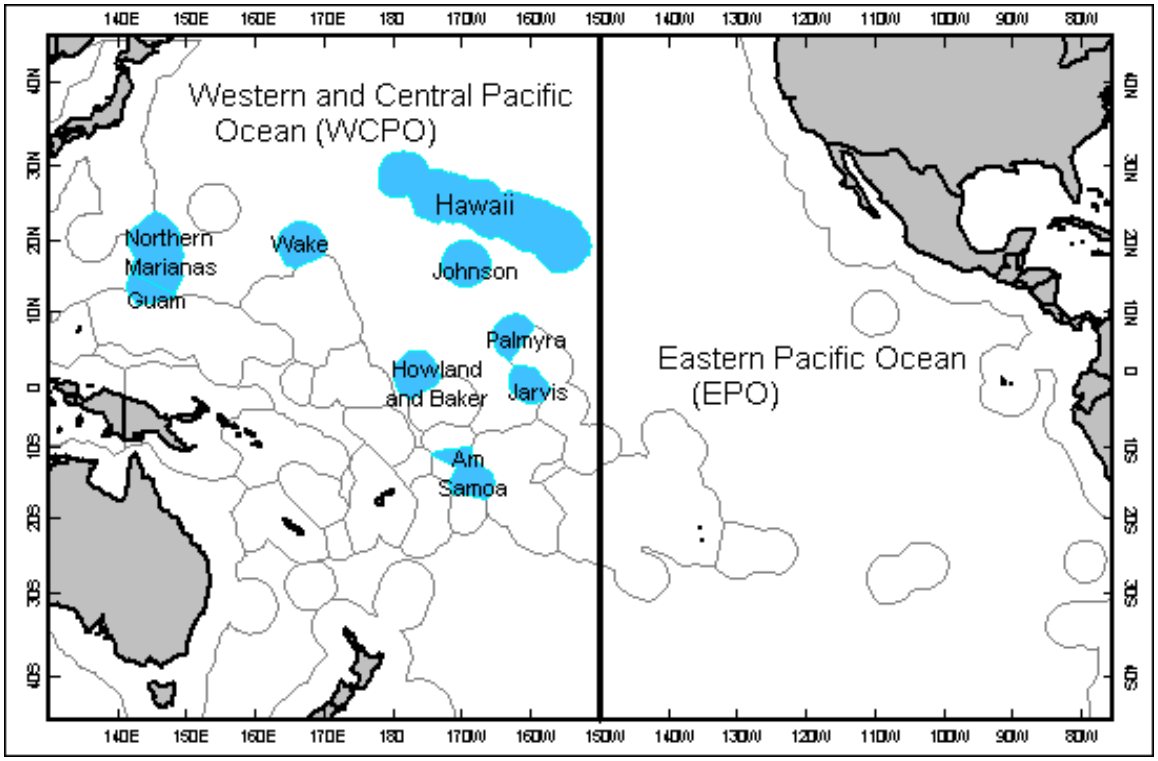
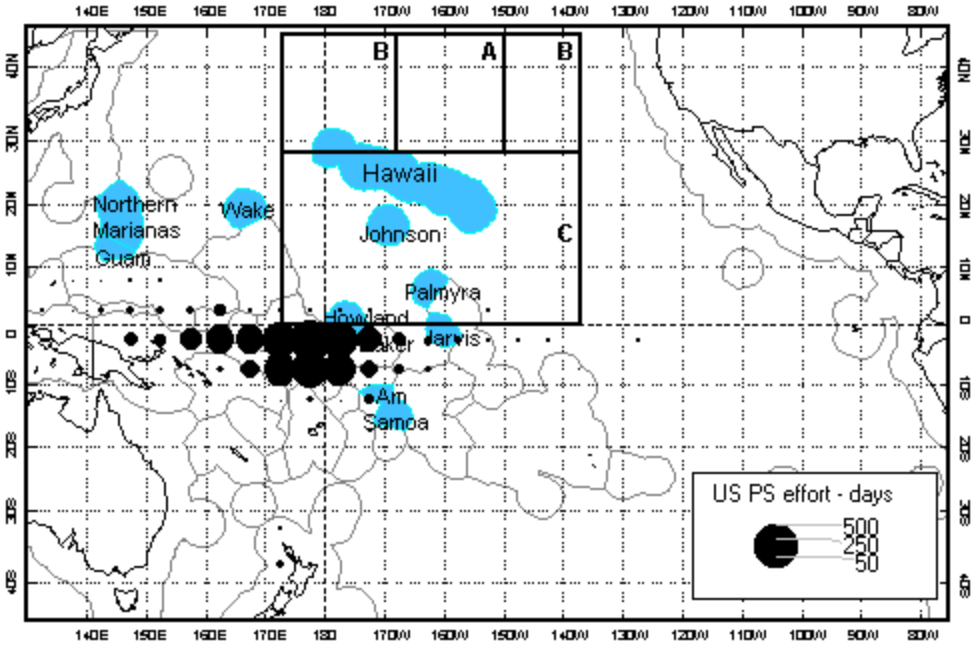


Figure 3.13-2: Distribution of Fishing Effort by the U.S. Purse Seine Fleet During 1999. Areas A, B and C refer to area restrictions for Hawai'i-based longliners based on the 4 August, 2000, Court injunction. Source: SPC Oceanic Fisheries Program.



Purse seiners set on a variety of school types or "associations." Associated sets are when schools are associated with floating objects, such as logs and other naturally occurring debris, man-made fish aggregating devices (FADs), dead whales or schools swimming with live animals such as whales and whale sharks. Unassociated sets are made on tuna schools not associated with floating objects or other animals; these may be free-swimming schools that are usually feeding on baitfish. The type of association usually determines the quantity and kinds of by-catch and discards in the fishery. A significant change in setting technique has occurred in the U.S. WCPO fishery. From 1980 to 1995 about 80 percent of the sets were unassociated and 20 percent occurred on logs; however, the percentage of sets on drifting FADs has increased from 30 percent in 1996 to over 90 percent in 1999.

The U.S. purse seine catch totaled 182,000 mt in 1999 (Coan *et al.*, 2000). The catch was composed of 131,000 mt of skipjack, 34,384 mt of yellowfin and 16,673 mt of bigeye. The catch was four percent higher than the 1998 catch and would have been greater but fishing effort declined in the 4th quarter due to some voluntary reduction related to historically low cannery prices (~US$400 per mt). The 1999 catch of bigeye was a record level for the U.S. fleet, largely as a result of the rapid expansion in using drifting FADs. FAD fishing had several advantages for the U.S. fleet – highest catch rate on record (38 mt/day) and the shortest fishing trips on record (41.5 days/trip). Historically, the U.S. purse seine catch is landed to

the canneries in American Samoa, but there is a trend to unload in other ports in the region. In 1999, 78 percent of the catch was landed in American Samoa, with the remainder landed in the Philippines (eleven percent), Fiji (five percent), Solomon Islands (three percent) and other locations (three percent).

In recent years there has been a shift in purse seine activity relative to the "warm pool," an ocean area where sea surface temperature is > 28° C. During *El Niño*, or warm events, the warm pool and the skipjack stock are displaced eastward towards the Marshall Islands, Nauru and Kiribati EEZs (Lehodey, 1998). In strong *El Niño* events the stock may be displaced eastward to the dateline (180°). Conversely, during *La Niña*, or cool events, the warm pool compresses and skipjack are concentrated towards PNG and the FSM in the western equatorial Pacific. The U.S. fleet has unrestricted access to the EEZs of most Pacific Island countries; consequently the fleet can readily follow the dispersion of the skipjack stock. The U.S. fleet and other fleets fished east of the dateline during *El Niño* conditions in 1998. The western Pacific experienced a *La Niña* phenomenon throughout 1999. Most of the fleets moved westward in 1999 compared to 1998; however the U.S. fleet remained east of the other fleets and fished almost exclusively on drifting FADs.

The FFA has managed the data collection for the SPTT. Vessels are required to complete the South Pacific Regional Purse Seine Logsheet for each purse seine set. NMFS port samplers in American Samoa and FFA observers onboard purse seiners estimate the species and size composition of the catch. The U.S. purse seine fleet has the highest level of at-sea observer coverage, due to the extensive fishery monitoring policies under the SPTT. Approximately 20 percent of U.S. purse seine trips are monitored annually. Tuna and bycatch species may be discarded for several reasons such as an undesirable species with no commercial value, no space available, damaged fish, or difficulty in landing. For sets made on floating objects, observers in 1999 reported a discard rate of 1.52 mt/set for undersize tuna and 0.34 mt/set for unwanted bycatch (Coan *et al.*, 2000).

3.14 FOREIGN FISHERIES

This section examines patterns and trends in the geographical distribution of foreign tuna and swordfish fisheries currently operating in the Pacific. Information on fishery development and recent activities were incorporated from reports and data from national or regional fisheries agencies (e.g., National Research Institute of Far Seas Fisheries (Japan), National Fisheries Research and Development Institute (Korea) and the Overseas Fisheries Development Council (Taiwan), Inter-American Tropical Tuna Commission (IATTC), the Commonwealth Scientific and Industrial Research Organization (CSIRO) and the Secretariat of the Pacific Community (SPC)). The industrial fisheries covered in this section include three gear types: longline, pole-and-line and purse seine.

3.14.1 Pelagic Longline Fisheries

3.14.1.1 Pelagic Longline Fisheries of the Pacific

The global expansion of the Japanese tuna longline fishery was essentially a post-war development. The distant-water Japanese longline fleet expanded rapidly when constraints were lifted in 1951. Longlining quickly spread eastwards to the Gilbert Islands (170° E.) and southwards to the Tasman Sea (45° S.). By 1960, the Japanese longline fleet had conducted exploratory fishing and developed commercial operations over most of the tropical and subtropical Pacific where longline fisheries currently exist.

In support of the geographic expansion, Japan established supply bases and stationed longliners in several Pacific Island countries (e.g., Vanuatu, Fiji). Frozen tuna from these bases were freighted to America Samoa, Hawai'i and the U.S. West coast for canning. Japanese operations reached their height during the 1970s. By 1980, they had extended their operations throughout most of the Pacific and Indian Oceans and as far south as latitude 50° S. However, these activities were restricted in 1980 when many Pacific nations declared 200 nm EEZs and fishing zones.

Longline fisheries usually target tuna or swordfish. Tuna longlining is characterized by day fishing at moderate depths (100-250 m) to target albacore and yellowfin, or deeper depths (250-400 m) to effectively target bigeye tuna (Hanamoto, 1976; Boggs, 1992). The Japanese longline fleet had mainly targeted albacore for canning until the early 1970s. These longliners deployed "conventional" longline gear of four to six hooks between floats (HBF) fishing a depth of approximately 90-150 meters. In the early 1970s longliners changed to 'deep' sets by placing more hooks between longline floats. The depth distribution of the gear was deeper in the water column at approximately 100-250 m (Suzuki *et al.*, 1977). The deeper longline gear was more effective in catching bigeye tuna and the fleet shifted activities in waters near the equator where the thermocline is shallower. The development of distant-water longliners with ultra-low temperature freezers led to the closing of Japan's island bases and mothership operations.

Korean and Taiwanese vessels also targeted albacore in the 1960s. Both of these distant-water fleets peaked in the late 1970s. Similar to the Japanese fleet, the Korean fleet changed operations and currently targets the tropical tunas - yellowfin and bigeye. Taiwanese vessels are the only distant-water fleet that has consistently targeted albacore tuna.

The contemporary tuna longline fisheries in the Pacific mainly involve two types of operations: (1) large (typically > 250 GRT) freezer vessels which undertake long voyages (months) and operate over large areas of the region; and (2) smaller (typically < 100 GRT) vessels which are usually based domestically, with ice or chill capacity, and serving fresh or air-freight *sashimi* markets. The larger vessels constitute the distant-water fleet and target either yellowfin or bigeye in the tropics or albacore in the subtropics. These vessels have utilized similar fishing grounds as the Hawai'i-based longline fleet. The smaller vessels

operate mostly in tropical areas and some fleets operate in areas adjacent to EEZs under the Council's jurisdiction, such as the Samoan *alia* fleet and Taiwanese and mainland Chinese "offshore" vessels in Micronesia.

Developments in the 1990s include a gradual increase in the number of Pacific Islands domestic vessels, and entrance and subsequent decline of the smaller "offshore" *sashimi* longliners of Taiwan and mainland China into the fishery. There has also been a trend towards flexibility in species targeting in some fleets, notably those with ultra-low temperature freezing capacity, and the capability of some fleets to shift operations between oceans.

The diverse longline fleet in the WCPO was composed of roughly 4,700 vessels in 1999. These vessels can be divided into four components largely based on the area of fishing operations: (1) over 400 vessels are domestically based in the Pacific Islands with the Samoa *alia* fleet representing half of these vessels; (2) approximately 3,000 vessels are domestically based in non-Pacific Island countries, largely in Japan and Taiwan; (3) about 750 large distant-water freezer vessels from Japan, Korea and Taiwan that operate over large areas in the region; and (4) about 450 offshore vessels based in Pacific Island countries and composed of roughly equal numbers of vessels from mainland China, Japan and Taiwan. A noteworthy development in 1999 was the voluntary reduction by Japan for large vessels (> 200 GRT) based on agreement to the FAO's international plan on fishing capacity. The Japanese distant-water longline fleet was reduced 25 percent from 1998 to 1999 (623 to 471 vessels).

Pacific-wide longline effort increased from 300 to 500 million hooks from 1962 to 1980. Since 1980, annual pelagic longline effort has been roughly 560 million hooks. Effort in the longline fishery is the most widespread of any industrial fishery in the Pacific (Figure 3.14-1). Vessels target bigeye and yellowfin in tropical waters for the frozen *sashimi* market, and albacore in the subtropical waters for canning. The greatest effort is expended to the north and east of the French Polynesia EEZ in the Pacific equatorial divergence, a traditional area for the Japanese tuna longline fleet. Other areas of high longline effort include the domestic fishery near Taiwan and longline fisheries in Micronesia (FSM, Marshall Islands, Kiribati). The tuna catch reflects the distribution of fishing effort which is primarily within 10° of the equator. It should be noted that there is some interannual variability in longline effort and catch distribution especially in the WCPO, where fishing access for the offshore and distant-water fleets is dependent upon securing bilateral agreements.

Figure 3.14-1: Distribution of Foreign Longline Effort Reported from 1995 to 1997. Areas A, B and C refer to area restrictions for Hawai'i-based longliners based on the 4 August, 2000, Court injunction. Source: SPC Oceanic Fisheries Program.

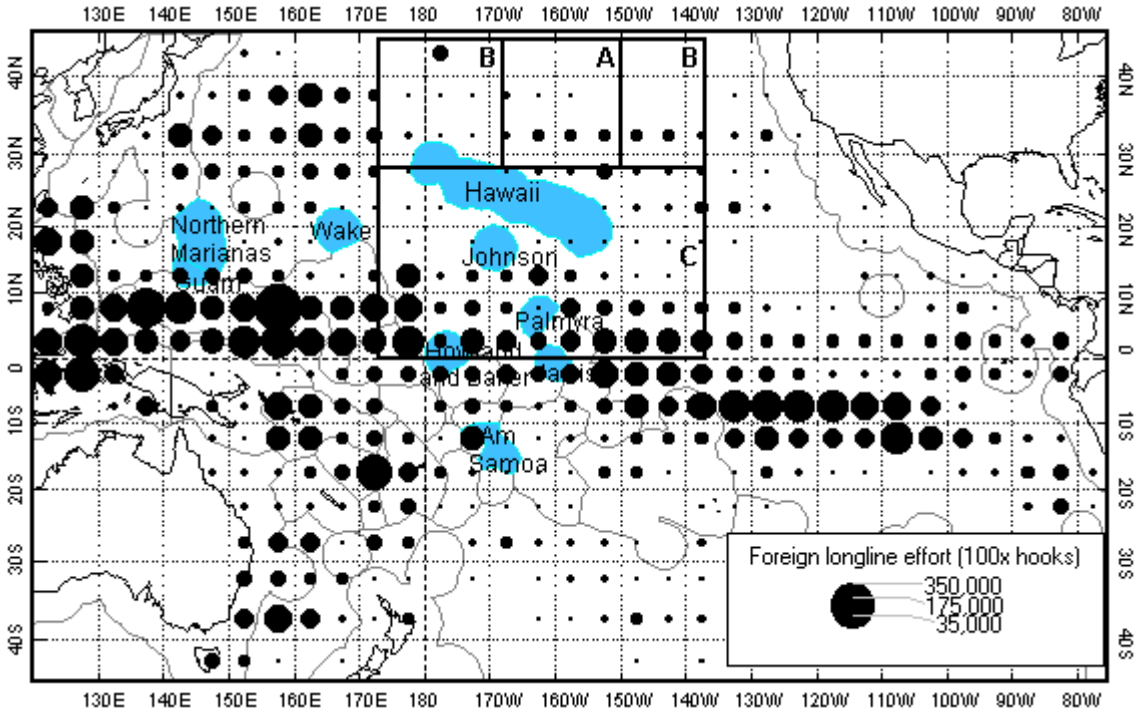
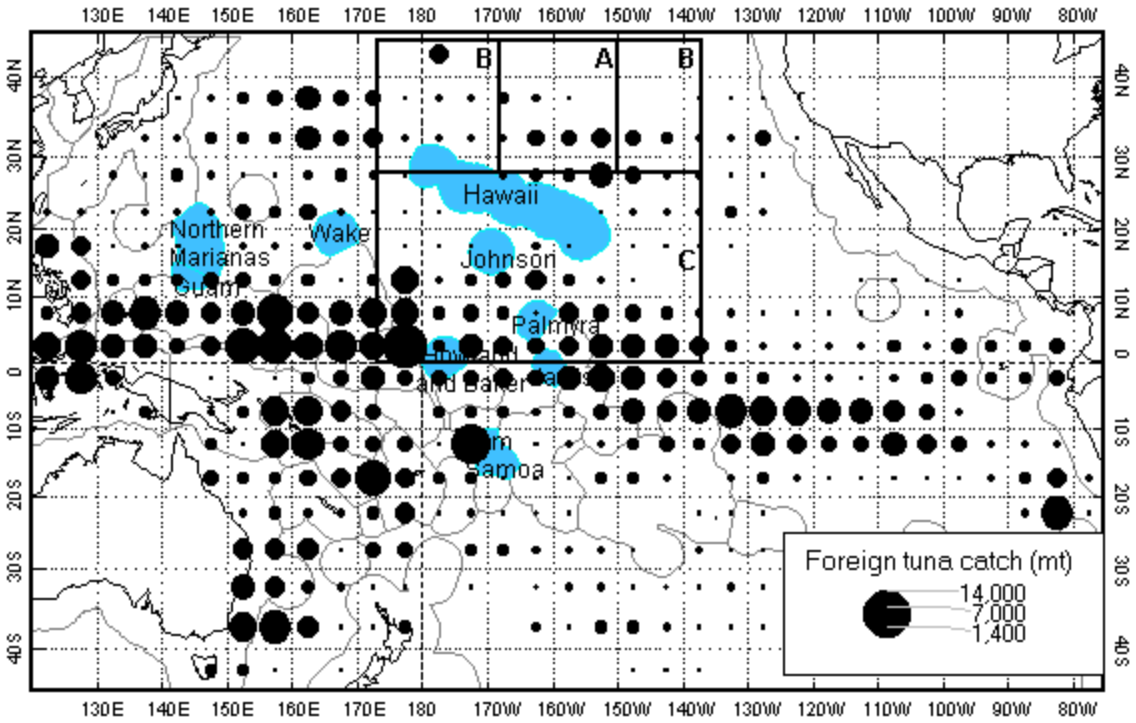


Figure 3.14-2: Distribution of Foreign Longline Tuna Catch Reported from 1995 to 1997. Areas A, B and C refer to area restrictions for Hawai'i-based longliners based on the 4 August, 2000, Court injunction. Source: SPC Oceanic Fisheries Program.



The Pacific-wide catch has averaged 250,000 mt over the period 1970-1997 (range 171,000-300,000 mt). Recent catches are similar to the long-term average. While catch composition differs by area, the regional tuna species composition was approximately 21 percent albacore, 44 percent bigeye and 35 percent yellowfin. In the 1990s, the composition of albacore has increased in the catch while bigeye has decreased.

A provisional estimate of longline catch in the Pacific Ocean in 1999 was 242,000 mt, a decline of three percent from the 1998 catch. The 1999 longline catch was about 10 percent of the total Pacific catch; however, it has a similar economic value to the purse seine fisheries. The yellowfin catch of ~67,000 mt was the lowest in 30 years and appears attributable in part to a 25 percent reduction in the number of Japanese distant-water vessels. As in previous years, most of the 1999 catch (>200,000 mt) was taken by the distant-water fleets of Japan, Korea and Taiwan.

Of the three large-scale commercial fishing methods, longline fishing is the least selective and therefore catches the most non-target or bycatch species. Within the international longline fishery, catch monitoring is through submission tofishery agencies of the flag country and

coastal states of the South Pacific Regional Longline Logsheet. Statistical coverage of the longline fishery in South Pacific EEZs is estimated by comparing catches on logsheets with catches in regional ports. Coverage rates in the 1990s range from 30 to 60 percent due to logsheets not being obtained for vessels fishing on the high seas (SPC unpublished data). Catch and effort data for the high seas are provided by the fleets of distant-water nations as aggregated data at 1° or 5° resolution. While catch estimates for the target species and some bycatch species (e.g., Istiophorids) appear valid, logsheets do not provide a breakdown for shark species and have no documentation of marine mammals, turtles, or seabirds. Data on the incidence of sharks and protected species may be available through research cruises on Japan, Korean and Taiwanese vessels; however, to-date these data have been unobtainable.

SPC Observers have recorded over 60 species in the WCPO longline tuna fishery between 10° N. and 35° S. The longline catch is typically composed of target tunas, tuna-like fish, billfish, sharks, other fishes, marine turtles and marine mammals. Approximately half of the bycatch species may be retained, while other species are discarded for several reasons. Bycatch levels vary due to several factors, but observer data (SPC unpublished data) indicate that bycatch was 53 percent of the total catch in number from 10° N. to 10° S. compared to 26 percent at higher latitudes (10°-35° S.).

3.14.1.2 Directed Swordfish Fisheries of the Pacific

In addition to the sector of the Hawai'i-based longline fishery which targets swordfish, there are several foreign fleets (e.g., longline, gillnet and harpoon) that target swordfish in the Pacific. While most of the longline effort targets tuna species, it may be instructive to provide information on the shallower swordfish longlining which has a higher incidence of encountering a protected or endangered species. Information on swordfish fisheries largely comes from reviews by Takahashi and Yokawa (1999), and Ward and Elscot (2000).

Foreign longline fisheries specifically targeting swordfish occur in Japan, Chile and Australia. The geographical distribution of longline swordfish catches is illustrated in Figure 3.14-3 (note: no data are available for the Chilean fishery). Moderate catches of swordfish occur as bycatch in the tropical tuna fisheries, domestic Taiwan fishery and the Japanese tuna fishery in the eastern Australian fishing zone (Figure 3.14-2). Japanese longline fisheries are classified into three categories based on vessel size: coastal (10-20 gt), offshore (20-120 gt) and distant-water vessels (120-500 gt). Japanese offshore and distant-water vessels produce annual catches of about 11,000 mt. In the north Pacific, the longline catch was over 9,000 mt in 1985 and 1987, declined to 4,800 mt during 1991 and fluctuated between 6,000 and 8,000 mt since 1992. The offshore and distant-water Japanese catch in the north Pacific represents about 55 percent of the Pacific-wide catch. Catches in the coastal Japanese longline fleet were less than 1,000 mt in the 1980s, but increased to about 1,300 since 1993. The coastal and offshore fleets participate in a directed swordfish fishery in the Higashioki fishing grounds where the largest longline catches and catch rates occur. The Higashioki grounds are between 140°-180° E. and 20°-45° N., geographically to the west of where the

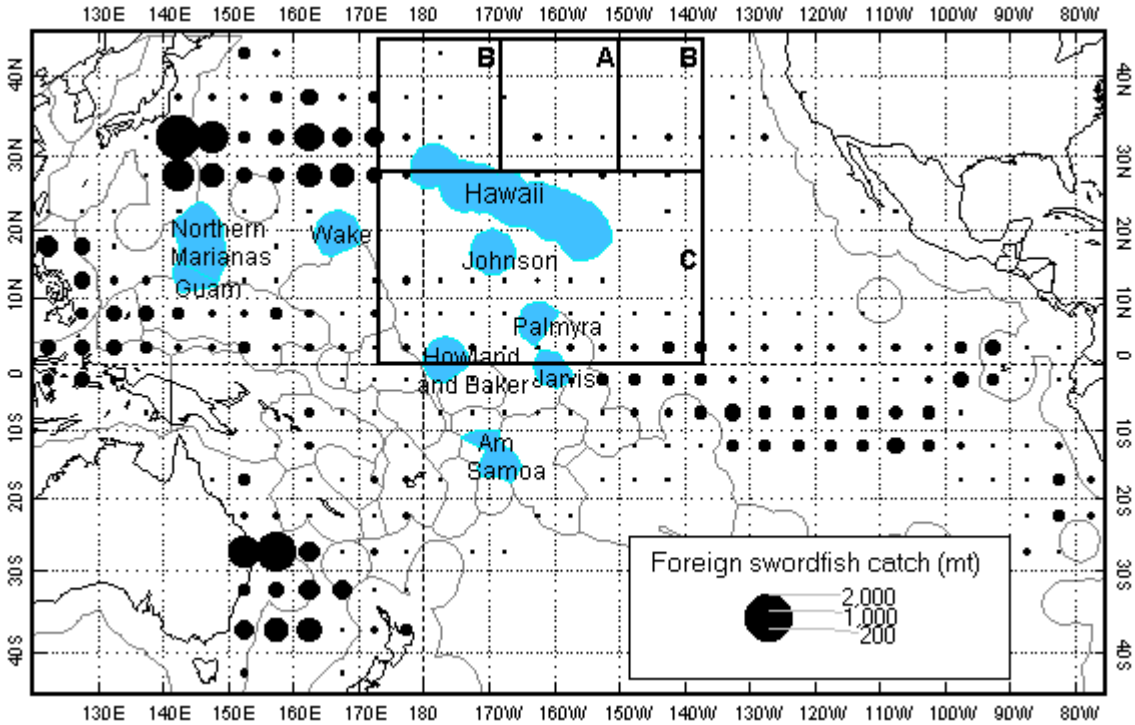
Hawai'i-based longline fishery operates. Fishing methods by the Japanese swordfish fleets are similar to the Hawai'i fleet: night fishing with three or four branchlines between each float which results in a shallow gear configuration.

Activity by domestic Australia longliners increased substantially during the late 1990s, with many larger vessels entering the fishery, thereby extending the range of longline activities further offshore. Fishing effort doubled from four million hooks in 1996 to 9 million in 1998. Over the same period, swordfish catches increased from 613 mt to 2,373 mt. Bycatch is monitored on CSIRO research cruises and on Japanese fishing vessels. The swordfish fishery is relatively new and there is potential for longliners to interact with turtles (Ward and Elscot, 2000). In particular, the Brisbane grounds are adjacent to major nesting sites of loggerhead turtle at Mon Repos and Capricorn-Bunkers. While Australian observers have monitored over 2,000 longline sets in the Japanese tuna fishery in the Australian EEZ, the Australian Fisheries Management Authority is developing a domestic observer program.

Chile has a substantial longline fleet, but most vessels are involved in other fisheries (e.g., Patagonian toothfish). Swordfish fishing is highly seasonal and distributed over a wide latitudinal range (15°-40° S.) near Chile. Up to 143 vessels have fished for swordfish since 1985 and annual longline catches have increased to over 2,000 mt in 1998.

Gillnet fisheries that target swordfish and marlin occur in Japan, Mexico and Chile. Large-mesh gillnet operations occur within the 200 nm EEZ of Japan near the Tohuku and Hokkaido regions. Fishing effort has declined substantially since 1990 and the 1996 swordfish catch was 400 mt. A small gillnet fishery in Mexico targets swordfish and marlin beyond 50 nm off the coast. Catches were 800 mt of swordfish in 1991, declined to 100 mt in 1994 and increased to 250 mt in 1998. Similarly, artisanal gillnet fishers in Chile have fished since the early 1980s and average about 3,000 mt. Both Taiwan and Japan have harpoon fisheries that target a complex of marlins and swordfish, but encounters with protected species would be rare.

Figure 3.14-3: Distribution of Foreign Longline Swordfish Catch Reported from 1995 to 1997. Areas A, B and C refer to area restrictions for Hawai'i-based longliners based on the August 4, 2000, Court injunction. Source: SPC Oceanic Fisheries Program.



3.14.2 Pole-and-Line Fishing

Pole-and-line was originally the dominant pelagic gear type in the Pacific. Japanese pole-and-line vessels commenced venturing away from their traditional coastal fishing grounds near Japan in 1930 due to an increasing demand for skipjack tuna. Fishing operations spread south through Micronesia and as far east as the Marshall Islands. While Japanese longline vessels were operating over vast areas of the tropical Pacific by the mid-1950s, pole-and-line vessels had a more limited range because of the survival of baitfish. However, in the early 1970s, refrigerated baitfish tanks and conditioning techniques had been developed which allowed pole-and-line fishing to spread southwards to 20° S. and eastwards to 170° W. During the 1980s and 1990s, the Japanese distant-water fleet steadily declined due to: (1) economic factors of increasing fuel, labor and vessel construction costs; (2) technological advances in the purse seine fishery; and (3) EEZ access restrictions.

Pole-and-line fleets, primarily Japanese, initially dominated the fishery, with the catch peaking at 424,000 mt in 1984, but the relative importance of this distant-water fleet has declined steadily. There has also been a gradual reduction in other pole-and-line fleets over the past

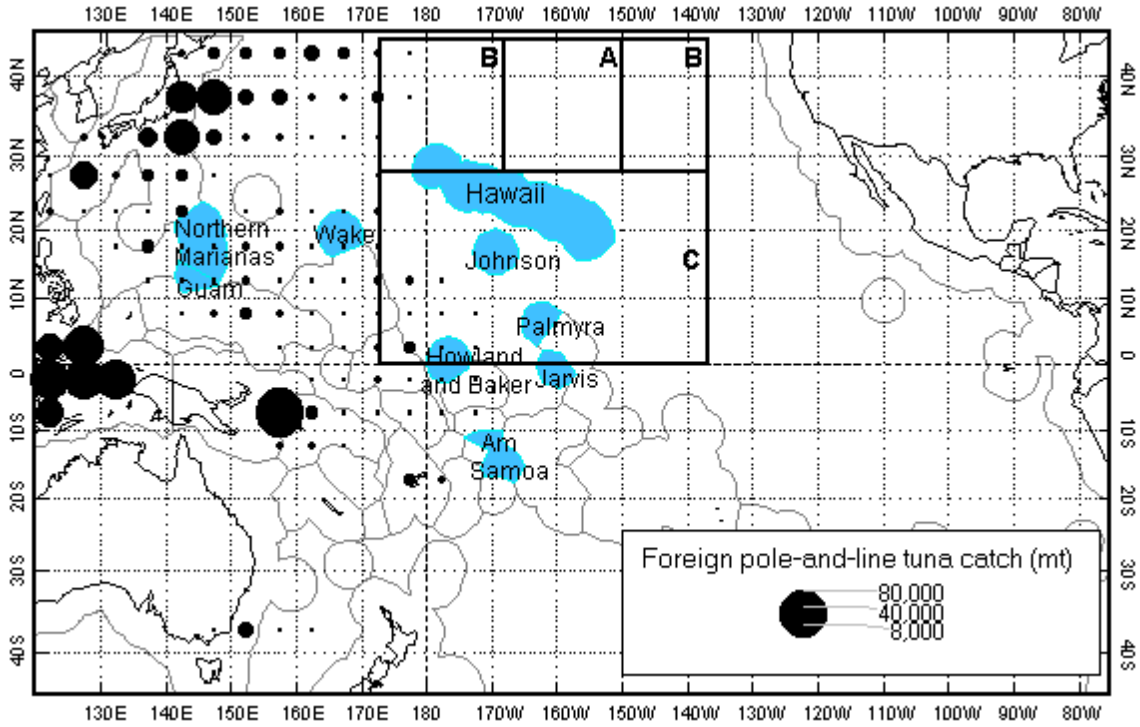
decade; Pacific Island domestic fleets have declined in recent years – fisheries formerly operating in Palau, Papua New Guinea and Kiribati are no longer active, and only a few vessels are now operating in Fiji (similar to the Hawai'i-based fishery). Domestic fleets remain active in the Solomon Islands, Indonesia and French Polynesia. There is also a baitboat fishery in the EPO with vessels from Ecuador, Mexico and the United States. However, with the advent of purse seining in the EPO, the baitboat fishery declined from 95 vessels in 1961 to approximately 20 vessels in 1996 (IATTC, 1998).

The pole-and-line fleet was composed of approximately 1,400 vessels in the 1999 WCPO fishery. Most of the vessels are small to medium size and operated in the domestic fisheries in Indonesia and Japan. Over 100 vessels operate in Pacific Island countries and there are 159 relatively large (< 499 GRT) vessels in the Japanese distant-water fleet. The WCPO pole-and-line fishery has three components: (1) a year-round tropical skipjack fishery that provides most of the catch and includes the domestic fleets of Indonesia, Solomon Islands, French Polynesia, and the distant water fleet of Japan; (2) seasonal sub-tropical skipjack fisheries in home waters of Japan (March-July) and Australia (March-May); and (3) a seasonal albacore/skipjack fishery northeast of Japan (June-November) occurs as an extension of the Japanese homewater fishery (Figure 3.14-4).

In the 1990s, the Japanese distant-water fleet fished and searched for about 21,000 to 25,000 days per year (Lawson, 2000). During this time, the WCPO catch has averaged 281,000 mt (252,000 - 313,000 mt). The distribution of catch is related to the three components of the fleet. The 1999 catch of 285,000 mt was composed of: skipjack – 241,000 (84 percent of the total), albacore – 29,000 (ten percent) taken by the Japanese coastal and offshore fleet in temperate waters of the north Pacific, yellowfin – 14,000 (five percent), and small amounts of bigeye (3,000 mt, one percent). Catch estimates for 1999 were slightly higher than in 1998. By fleet, the Japanese offshore and distant-water fleet (120,000) and Indonesian fleet (86,000) accounted for most of the fishery catch. The catch by the Solomon Islands fleet was over 30,000 mt in 1999, the highest catch for this fleet since 1995.

There are few environmental issues concerning pole-and-line fishing because the technique is very selective in catching tuna species. Despite the problems in under-reporting in the fishery, levels of bycatch and discards are thought to be relatively low given the nature of the fishery (Bailey *et al.*, 1996). Pole-and-line fishing is perhaps the most controllable industrial tuna fishery in the Pacific as each school is assessed according to the species composition and fish size. If a chummed school contains a high proportion of undesirable bycatch then the fishing operation can be halted. There are no records of seabirds, marine reptiles or marine mammals being caught in WCPO pole-and-line fisheries (Bailey *et al.*, 1996).

Figure 3.14-4: Distribution of Foreign Pole-and-line Tuna Catch Reported from 1995 to 1997. Areas A, B and C refer to area restrictions for Hawai'i-based longliners based on the August 4, 2000, Court injunction. Source: SPC Oceanic Fisheries Program.



3.14.3 Purse Seine Fishing

Purse seining occurs in both the EPO and WCPO by vessels fishing under a number of flags. Although purse seining occurs across a wide longitudinal area (Figure 3.14-5), the EPO and WCPO fisheries are different in fishing operations and species composition.

Purse seining initially developed in the EPO in the late 1950s and early 1960s with the conversion of larger baitboats to purse seiners (IATTC, 1998). From 1961 to 1991, the number of purse seiners increased from 125 to 152 and a capacity of 27,000 to 106,000 mt. The fleet reached its largest size of 282 vessels during the late 1970s and early 1980s. A prominent *El Niño* event occurred in 1982-1983 and fish were less vulnerable to capture especially in the EPO. During this *El Niño* event, the fleet declined due to vessel deactivation or moving to the WCPO. In early 1990, the U.S. canning industry adopted a policy of not purchasing tuna from sets where tuna were associated with dolphins. As a result of this policy, many of the remaining U.S. vessels moved into the WCPO. After 1991, the EPO fleet increased with the participation of non-U.S. flag vessels. In 1996, 175 vessels with a capacity of about 116,000 mt were reported to be fishing in the EPO. Currently, Mexican and Venezuelan flagged vessels comprise the majority of the total capacity.

Purse seine fishing operations in the EPO consists of catching tuna in three types of schools: (1) tuna associated with dolphins; (2) tuna associated with floating objects; and (3) unassociated schools where tuna occur only with other fish. Traditionally, yellowfin has dominated the surface catch in the EPO, but in recent years catches of skipjack and bigeye have increased. Research, monitoring and management of the EPO fisheries is conducted by the Inter-American Tuna Tropical Commission (IATTC) and annual catch estimates from 1990 to 1996 have averaged 386,000 mt (range 298,000 - 587,000 mt) of which yellowfin typically composed 65 percent of the catch. The provisional catch estimate for 1999 (587,000 mt) is a record for the EPO purse seine fishery. The EPO purse seine fishery occurs to the east of the Hawaiian archipelago over a wider latitudinal range (15° S.-20° N.) than the WCPO fishery (Figure 3.14-5).

As noted in Section 3.13, fishing on drifting FADs is common in the EPO where the method was initially adopted. Purse seine catches of juvenile bigeye increased from typical levels of less than 10,000 mt per year to 29,000 mt in 1994; 36,000 mt in 1995; and over 50,000 mt in both 1996 and 1997. Two resolutions were adopted by the IATTC in 1998 to regulate the EPO tuna catch. A resolution was adopted for a quota of 225,000 mt for yellowfin in a sub-area known as the CYRA, while another resolution prohibited purse seine sets on floating objects after 45,000 mt of bigeye had been caught.

Vessels from Japan and the U.S. fisheries have fished in the WCPO since the mid-1970s and new vessels from Korea and Taiwan entered the fishery in the early 1980s. The WCPO purse seine fishery has accounted for around 70 percent of the Pacific Ocean purse seine catch by volume since the early 1990s, with annual catches in the range 900,000 – 1,000,000 mt. The majority of the WCPO purse seine catch is taken by the four main distant-water fishing nation (DWFN) fleets – Japan, Korea, Taiwan and United States, but with an increasing contribution from the growing number of Pacific Island domestical vessels. Skipjack tuna regularly account for 70-75 percent of the purse seine catch, and the WCPO purse seine fishery is essentially a skipjack tuna fishery, unlike those of other ocean areas.

The purse seine fleet comprised 223 vessels in the 1999 WCPO fishery. The fleet structure was 159 distant-water vessels, 31 domestic Pacific Island vessels, and 33 domestic non-Pacific Island vessels (e.g., Australia, Indonesia, Japan and New Zealand). The 1999 catch of 1,033,000 mt was comprised of: skipjack – 781,000 mt (76 percent of the total), yellowfin – 218,000 mt (21 percent) and bigeye – 35,000 mt (three percent). The catch in 1999 was a decline of ~10 percent from the record catch in 1998, though catch rates (CPUE) remained high. The decline is primarily due to some voluntary reduction in fishing effort related to the historically low cannery prices (~US$400 per mt). Catches for the Pacific Islands domestic purse seine fleets continue to increase. Catch estimates in 1999 were 125,000 mt, a significant proportion (12 percent) of the WCPO purse seine catch.

A fundamental difference between the EPO and WCPO purse seine fisheries is tuna association with dolphins. In the EPO, large yellowfin form associations with dolphin species, primarily the spotted dolphin (*Stenella attenuata*). Purse seiners make dolphin associated

sets in the EPO and dolphin bycatch was a major problem especially in the 1970s and 1980s. Similar dolphin species occur in the WCPO but appear to be rare in the area of purse seine activity and do not form large aggregations similar to those in the EPO. Therefore, dolphin captures by purse seine are extremely rare in the WCPO.

Purse seine activity occurs within 10° of the equator in the WCPO (Figure 3.14-5). As noted in Section 3.13, there are longitudinal shifts in fleet distribution depending on ENSO cycle; whereby fleets are distributed in the western Pacific during *La Niña* events and farther to the east during warm *El Niño* events.

Currently there is no management authority for the WCPO purse seine fishery, though there are several regional arrangements in place. The SPTT was described in Section 3.13 and the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery came into effect in 1995. The Palau Arrangement is a sub-regional tool that coordinates management of the eight parties with regard to the western Pacific purse seine fishery. Specifically, the Palau Arrangement provides an input control by placing a cap on vessel numbers at 205. As of March 2000, 193 licenses were reported.

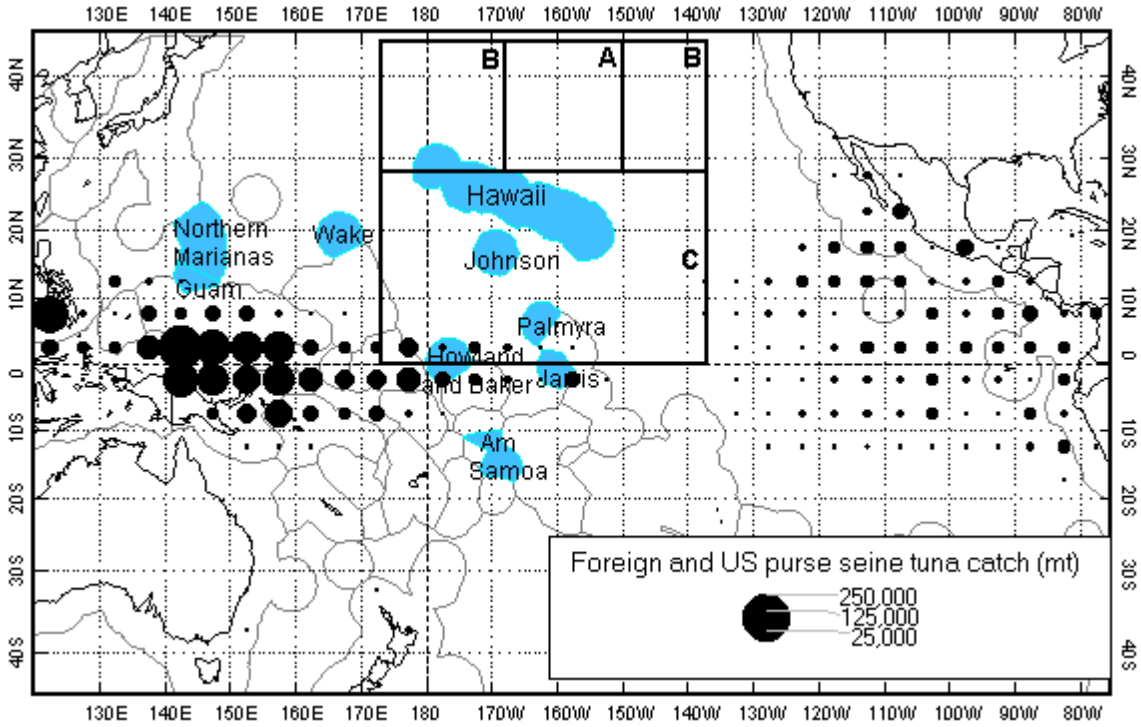



Figure 3.14-5: Distribution of Total (Foreign and U.S.) Purse Seine Tuna Catch Reported from 1995 to 1997. Areas A, B and C refer to area restrictions for Hawai'i-based longliners based on the August 4, 2000, Court injunction. Source: IATTC and SPC Oceanic Fisheries Program.