U.S. FRESH TUNA MARKET STUDY

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SUMMARY OF FINDINGS

Fresh tuna marketing in the U.S.A. is becoming more complex because of diversification in food preferences, products and market niches. Widespread use of lightly cooked and barely cooked fresh tuna in restaurant cuisine has raised tuna purchasing standards in Hawaii and U.S. west coast markets to the same high quality level as for *sashimi.*

Recent trends in supplies and prices of longline-caught fresh tuna and incidental pelagic species were investigated. Recommendations are made for strategies and procedures to enter Hawaii and west coast fresh tuna markets. A decision matrix is provided to clarify marketing choices for Pacific island suppliers based on the grade of tuna exported, the expected selling price, the cost of marketing and the likely net return.

By becoming regular suppliers of good quality tuna and by closely tracking market trends, Pacific island tuna exporters can exploit market windows in the U.S.A. that offer the potential for higher net returns than the Japan fresh tuna market, especially for no. 2 grade yellowfin tuna. The expected U.S. market prices can only be realized if there is tight grading of tuna to satisfy buyers' requirements for high quality. Fresh tuna exports need extended shelf life to allow time for transportation and marketing overseas. Temperature control from the time of fish capture, through processing, packing and air shipment is required to prolong product shelf life.

Lower quality tuna should generally not be exported as a fresh product because of the low market value in the U.S.A. Processing of frozen loins is often a better use of no. 3 grade longline tuna than freezing whole fish for canning.

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INTRODUCTION AND PURPOSE

Background

A significant locally-based longline fishery has developed in the central and western Pacific. The fishery targets mainly bigeye and yellowfin tuna but also makes substantial catches of albacore tuna and other marketable pelagic species.

The major markets for the longline catch are Japan, Hawaii and the west coast of the continental U.S.A. The U.S. markets provide an alternative to Japan's *sashimi* tuna market, particularly for grade B (no. 2) fish. The U.S.A. also provides a market for cooking-grade tuna and for other pelagic species that are processed into dinner portions and steaks by restaurants and retailers.

The present study investigates recent trends in U.S. supplies and prices of longline-caught fresh tuna and incidental pelagic species. Marketing strategies are recommended for Pacific island suppliers. A decision matrix is provided to clarify marketing choices based on the grade of tuna exported, the expected selling price, the cost of marketing and the likely net return.

The present study is timely. As tuna production increases worldwide, marketing alternatives will be crucial to maintain the economic viability of the Pacific island fresh tuna industry. Global consumption of fresh and frozen tuna is increasing, although consumption of traditional tuna products in the U.S.A. (canned tuna) and in Japan (*sashimi* tuna) is not. Depreciation of the yen against many currencies since mid-1995 has caused a decline in the value of tuna exports to Japan. This trend may encourage diversion of some exports to markets where sales are in US dollars instead of yen.

Study Tasks

1. Identify the main species (tuna and other pelagics) taken by tuna longliners and supplied to the Hawaii and U.S. west coast markets.

2. Identify the key markets located in Hawaii and the west coast of the U.S. for fresh, frozen and processed fish (bigeye, yellowfin, albacore, swordfish, marlin, moonfish, etc.) caught by tuna longliners, differentiating by species and product form where necessary.

3. Identify the current source of imports and domestic catches and the volume from suppliers into these markets for the last five years and analyze possible linkages between changes in supply from the U.S. domestic fleet and changes in the level of imports from Pacific island countries.

4. Analyze demand and price trends in these markets over the past five years.

5. Identify and explain any seasonal trends that characterize each market.

6. Analyze projected demand, supply and prices in the short and medium term for the key species, differentiating by product form where appropriate.

7. Develop market entry strategies for the key species for each of the identified markets.

8. Describe the logistical procedures in each market that exporters from the region should be made aware of. Such procedures may include, but are not limited to, transport requirements, customs and other import procedures, the use of agents, sales commissions and market charges.

9. Assess likely returns to suppliers net of marketing costs, by market, by species and by season.

10. Identify any niche markets for specialized tuna products (tuna jerky, tuna sausages, etc.) that may provide additional market opportunities for suppliers and provide consumption and price data over the last two years for such products.

1. LONGLINE FISHERIES PRODUCTS

Longline fisheries harvest targeted species (bigeye tuna, yellowfin tuna and, in a few areas, albacore tuna and swordfish) but also catch incidental, non-targeted species. The relative availability, marketability and export potential of major species are evaluated in Table 1-1.

Table 1-1

Export Potential of Pacific Island Longline Products

Common Name	Scientific Name	Relative Abundance in Longline Catch	Relative Marketability		Relative Export Potential to U.S.A.	
			Fresh	Frozen	Fresh	Frozen
Albacore Tuna	*Thunnus alalunga*	High	Moderate	Very good	Fair to good	Good if cannery nearby
Bigeye Tuna	*Thunnus obesus*	High	Good	Poor	Very good in HI; good in CA	Poor
Yellowfin Tuna	*Thunnus albacares*	High	Good	Good	Very good in CA; good in HI	Good
Skipjack Tuna	*Katsuwonus pelamis*	Low	Poor unless day-boat catch	Fair	Very poor	Poor
Bluefin Tuna	*Thunnus maccoyii*	Low	Very good	Fair-Good	Very good	Poor unless ultra-low frozen
Black marlin	*Makaira indica*	Low	Good	Good	Fair to good in HI; illegal to sell in CA	Poor in HI; illegal to sell in CA
Blue Marlin	*Makaira mazara*	Moderate	Moderate	Good	Fair in HI; illegal to sell in CA	Poor in HI; illegal to sell in CA
Striped Marlin	*Tetrapterus audax*	Moderate	Good	Good	Fair to good in HI; illegal to sell in CA	Poor in HI; illegal to sell in CA
Black Marlin	*Makaira indica*	Low	Good	Good	Fair to good in HI; illegal to sell in CA	Poor in HI; illegal to sell in CA
Broadbill swordfish	*Xiphias gladius*	Low unless targeted	Good	Good	Fair in HI; good in CA	Poor in HI; good in CA
Mahimahi	*Coryphaena hippurus*	Low to moderate	Good	Good	Fair in HI; poor in CA	Fair to poor
Ono (Wahoo)	*Acanthocybium solandri*	Low to moderate	Good	Good	Fair in HI; poor in CA	Fair to poor
Moonfish	*Lampris regius*	Low to moderate	Good	Fair	Good	Poor
Monchong (large-scale black pomfret)	Family Bramidae	Low	Good	Fair	Fair	Poor
Spearfish	*Tetrapterus angustirostris*	Low to moderate	Fair	Poor	Poor	Poor
Escolar	*Lepidocybium flavobrunneum*	Low	Fair	Poor	Good in CA	Poor
Sailfish	*Istiophorus platypterus*	Low	Poor	Poor	Poor	Poor
Sharks	Mako (*Isurus oxyrinchus*), thresher (*Alopias vulpinus*), blacktip (*Carcharhinus limbatus*)	Low to moderate	Good	Poor	Fair in CA	Poor

2. DESCRIPTION OF MARKETS

This section describes the markets for tuna and other longline-caught fish products in Hawaii and the west coast of the continental U.S.A.

2.1 FRESH TUNA

Fresh tuna marketing in the U.S.A. is becoming more complex because of diversification in food preferences, products and market niches. Chefs continually invent new dishes featuring fresh tuna. Tuna marketers attempt to satisfy highly differentiated purchasing specifications, with the *sashimi* (raw fish) market being the most demanding.

Through individual grading, each tuna entering the fresh market acquires an identity that links its physical properties to the quality requirements of possible end uses. The range of quality acceptable for each potential market niche and product type defines the grade and, ultimately the price, of fresh tuna. Fresh tuna which are identical in species and size and nearly identical in time and area of capture may sell for a wide variation of prices because some fish have the desired characteristics but others do not (Bartram, et al., 1996).

Grading, although a subjective process, is relatively standardized in the fresh tuna industry. Criteria include tuna muscle coloration, transparency, texture and fat content. A common understanding of tuna grade specifications simplifies transactions between fresh tuna sellers and buyers. Grading is a form of shorthand communication facilitating product assessment and sorting as individual tuna move through the chain of distribution to a particular market niche and end use.

Numbered quality levels (no. 1, no. 2, etc.) are used throughout this report. These refer to grades of fresh tuna that are generally recognized in the U.S.A. There are some differences in grading terminology used by the Hawaii tuna market and the U.S. west coast tuna market. The fresh tuna characteristics corresponding to each grade are summarized in Table 2-1.

Tuna grading attempts to standardize what is a highly subjective process. Except for tuna species, weights and core temperatures, there are no completely objective measurements used; hence, grading remains more an art than a science. A combination of physical characteristics places each tuna in a quality grade. This grade is not a fixed point but a flexible range of qualities that are acceptable for particular market niches and end uses. Grading criteria are not always applied uniformly but a common understanding of quality standards evolves over time between tuna sellers and buyers in each market.

Non-tuna fish species caught incidentally in longline fishing are also graded for marketing as fresh fish. Muscle transparency is an important indicator of freshness in these fish, as in tuna. Buyers also closely examine the color and condition of the blood line, or dark muscle. A bright red and narrow blood line indicates a fresher fish than a dark and wide blood line.

Table 2-1

Characteristics of Fresh Tuna Grades Generally Recognized In Hawaii and the U.S. West Coast

Grade Hawaii (W.Coast)	Tuna Characteristics*										
	Visible Fat			*Muscle Clarity*				*Muscle Color*			
	Layered	**Present**	**Not Apparent**	**Bright**	**Clear**	**Clear to Cloudy**	**Dull**	**True Red**	**Reddish**	**Pale**	**Brown**
No. 1 ++	■			■				■			
No. 1 +		■		■				■			
No. 1			■	■				■			
No. 2+ No. 1-)			■		■			■			
No. 2 (No. 2+)			■			■			■		
No. 2- No. 2)			■				■		■		
No. 3			■				■			■	
No. 4			■				■				■

Note: * one to two-grade reduction for soft muscle texture

2.1.1 Hawaii Markets

Hawaii is a primary producer, exporter, importer and significant consumer of fresh tuna. The average weekly consumption of tuna is 50 – 80 metric tonnes (MT). Hawaii is directly supplied by domestic longline, handline and troll fisheries but fresh tuna imports arrive regularly from throughout the Indo-Pacific.

The majority of the domestic and imported tuna is consumed fresh by a resident and visitor population whose per capita seafood consumption is twice the U.S. average. According to marketers and consumer surveys, at least 40% of Hawaii's tuna supply is consumed raw (Bartram, et al., 1996). The *sashimi* market places a premium on large (> 23 kg dressed, h&g weight), high quality tuna but the well-developed market niche for *poke* (raw fish cubes mixed with relishes) is able to absorb all species, sizes and all but the lowest grades of fresh tuna at varying prices. Brown or discolored tuna muscle is unacceptable in the *sashimi* market and most other market niches. Tuna with pale muscle is only marginally acceptable.

Skipjack tuna (*aku*) dominated the Hawaii tuna market until the late1980s. This situation changed because of attrition in the pole-and-line fleet (targeting skipjack) and expansion of the longline and small-boat handline fleets which target yellowfin and bigeye tuna (*ahi*). The latter have become the predominant tuna species in the contemporary market, although *aku* is still favored for certain products, especially *poke* and dried jerky.

As in Japan, the Hawaii sashimi market values bigeye tuna more than yellowfin because of the brighter muscle color, higher fat content and longer shelf life of the former species. Most restaurants use the two species interchangeably for grilling. When the former are in short supply and high priced, albacore tuna is sometimes substituted. The latter is often marketed as *ahi tombo* in an attempt to associate it with the more popular bigeye and yellowfin. The general relationship between fresh tuna quality grades and product end use is illustrated in Table 2-2.

Imported tuna is sold in various ways: (a) consignment to the Honolulu fish auction for sale by competitive bidding; (b) consignment to Hawaii importer for distribution to wholesalers; or (c) consignment to major Hawaii wholesalers who process fresh tuna and other products for re-sale restaurants and retailers.

Wholesalers supplying restaurants have a different purchasing strategy from those supplying retailers. Restaurant purchasing builds an inventory of fresh seafoods for which wholesalers are reasonably sure there is demand. This knowledge develops from learning the purchasing habits of particular restaurant clients. In contrast, the strategy of retail purchasing is to minimize inventory and to heavily purchase seafoods which retailers have advertised as "specials." The importers' strategy is develop a broad base of alternative sources of fresh fish to avoid discontinuities in supply and to be reliable in supplying steady customers.

Most of the fresh tuna imported by Hawaii is received as dressed (headed and gutted) fish. Fresh yellowfin tuna loins were imported from the Philippines (grade no. 2) and Micronesia (grade no. 2-) at various times in the past five years but fish quality was inconsistent. Chilled tuna loins can be stored for only a short time without a loss of quality, so the importers were often forced to discount price to sell the product rapidly. Hawaii distributors are reluctant to import higher-grade (no. 1) tuna that is already loined because of the short shelf life of chilled loins. Although vacuum packaging can extend the shelf life of fresh tuna loins, blood purged from the loins in vacuum bags renders the product unacceptable for *sashimi*.

Table 2-2

Differentiation of Product Quality by Market Niche In Hawaii's Fresh Tuna Market

	Quality Grade							
Market Niche	**1+**	**1**	**2+**	**2**	**2-**	**3**	**3-**	**4**

Source: adapted from Bartram, et al., 1996

2.1.2 U.S. West Coast Markets

There are substantial markets for fresh tuna on both coasts of the continental U.S.A. Annual consumption of fresh tuna may be over 10,000 MT (Bartram, et al., 1996). The attractions of fresh tuna seem to be that it is a healthier food than meat, yet is similar to beef in ease of handling and cooking.

Although some Pacific island tuna exports are sold on the east coast, the present study focuses on the west coast, which is the usual entry point for Pacific island seafood exports to the continental U.S.A. There are some major distinctions between the two coasts: (a) the high end of the market for top-quality tuna is well-developed on the west coast but virtually absent on the east coast; (b) the price structure for fresh tuna has a lower range on the east coast; (c) tuna of lower quality (no. 2-, no. 3 grades) that are often unmarketable in the fresh market on the west coast can be sold on the east coast; (d) the east coast has no appreciation or price premium for tuna with visible fat as available on the west coast; and (e) the retail segment of the fresh tuna market is much better developed on the east coast than on the west coast, which has a restaurant focus.

Steady growth in restaurant use of fresh tuna has driven demand and product preferences for the past 10 years or longer. With increasing exposure to fresh tuna, restaurant buyers and chefs have learned about better quality and purchasing standards have risen in the last five years. Japanese specialty food buyers and *sushi* bars are no longer the only customers for high-grade tuna. The Asian influence on cuisine is evident in the numerous lightly cooked and barely cooked restaurant preparations of tuna. Fresh tuna is imported directly and indirectly from suppliers in the Gulf of Mexico, Central and South America and the Indo-Pacific.

Northern California

Most of the fresh tuna exported directly to northern California is purchased by two major distributors for re-sale to wholesalers, retailers and restaurants. A few wholesalers in San Francisco and Sacramento import tuna from island-based suppliers or through brokers. Wholesalers whose focus is processing rather than primary to secondary wholesale distribution do not usually import directly. Los Angeles distributors also sell fresh tuna in northern California.

Pacific island tuna is shipped on consignment for sale at spot market prices or is sold at pre-negotiated prices for delivery of a specific grade of fish. The latter method of sale often results in discounts taken for the percentage of tuna that fail to meet the grade specified by the buyers.

The major seafood distributors based in northern California purchase from 10 MT to 15 MT of fresh yellowfin and bigeye tuna per week. Yellowfin tuna is preferred to bigeye tuna for restaurant use but fresh albacore accounts for a growing share of the retail tuna market.

Most of the product is processed into loins for distribution to restaurants and retailers. Loins are processed from dressed tuna as needed. Because loins are highly perishable and tuna muscle rapidly discolors when exposed to air, there is little interest in direct importation of fresh tuna loins. In contrast, dressed tuna can be stored for several days before processing.

The market niche for *sashimi* tuna is not as well developed as in southern California but upscale restaurants demand good quality tuna (no. 2+) for specialty cooking. The popularity of lightly cooked and seared raw tuna has created a broader market base for high-quality tuna in northern California restaurants. Although large tuna (> 27 kg dressed weight) are preferred, one major restaurant distributor has developed a niche market for smaller tuna (14-27 kg, dressed weight) and for longline by-products, including exotic species like moonfish.

The retail sector is developing but most of the demand is for affordable tuna and longline by-products, rather than higher-grade, more expensive fish. A major seafood distributor in San Francisco is targeting this market.

Southern California

Los Angeles International airport is the primary entry point for fresh tuna imported from the Indo-Pacific. At least 6 major importer/distributors receive Pacific island tuna. Much of this product is distributed outside of southern California, however. Wholesalers specializing in supplying *sushi* bars and Japanese specialty foods import high quality fresh tuna directly and also purchase from the major distributors.

Imported tuna is sold in the same manner as in northern California: (a) shipped on consignment for sale at spot market prices; or (b) purchased at pre-negotiated prices for delivery of a specific grade of fish, with discounts taken for fish that do not meet the promised grades. A fresh tuna auction was recently attempted in Ventura, California, but is was a short-lived venture because it did not attract enough buyers to be truly competitive.

The retail market for fresh tuna and associated products is poorly developed in southern California, except for some high-end retailing of *sashimi*-grade tuna in the Japanese specialty food sector. Tuna suppliers have seen steady growth in sales to restaurants in the past decade. Weekly fresh tuna consumption in the Los Angeles – San Diego region is estimated by major distributors to average 50 to 60 MT. Upscale restaurants account for about half of the demand, whereas the Japanese specialty food sector, including *sushi* bars, accounts for the other half.

Unlike northern California, most tuna is distributed to southern California wholesalers in dressed (h&g) form, rather than as loins. As in northern California, large tuna (> 27 kg dressed weight) are strongly preferred. When supply is short, tuna from 22 kg to 27 kg (dressed weight) are acceptable. Large fish yield more edible product than small tuna. They produce a higher yield of premium cuts for *sashimi*, as well as more uniform dinner portions for grilling.

Medium-sized tuna from 18 kg to 27 kg (dressed weight) must be sold at a discount. There is no use in the southern California market for tuna smaller than 18 kg (dressed, h&g weight). Small tuna cannot be portioned into dinner plate-sized servings and are difficult to sell at any price. There is no *poke* market, as in Hawaii, able to utilize undersized tuna and trimmings from tuna processing.

High quality bigeye with visible fat is the tuna of choice for the Los Angeles *sashimi* market. To satisfy this market niche, bigeye must be Japan grade A quality. For grade no. 2 tuna, yellowfin is greatly preferred to bigeye tuna. Much of the bigeye tuna distributed on the west coast is imported from a handline fishery in Ecuador. The muscle in handline-caught tuna, although fresh, is considered too grainy or sandy to make good *sashimi*. The muscle in longline-caught tuna is better cured and has the buttery texture desired for *sashimi*. Buyers are especially wary of Central and South American bigeye tuna because of its soft texture and because of a defect known as *sashi* (small pus pockets formed in the muscle by protozoan infections), a problem much more common in bigeye than in yellowfin. According to a major buyer: "Bigeye makes a good number one but a poor number two; yellowfin makes a fair number one but a good number two."

The general relationship between fresh tuna quality grades and product end uses is shown in Table 2-3. Fresh tuna is graded about one-half grade higher on the west coast than in Hawaii. (Fresh tuna is graded about one-half grade higher on the east coast than on the west coast). California buyers frequently request no. 2+ tuna (firm, bright red muscle) to use for no. 1 products, especially *sashimi*. They request good no. 2 tuna (firm, red muscle with some clarity) to use for no. 2+ products, such as lightly cooked or barely cooked tuna preparations.

Marketing options for no. 2-/3+ grade tuna are limited on the west coast because there is no market for *poke*, as in Hawaii. When the tuna supply is low, however, no. 2-/3+ grade fish can work in the fresh market. No. 3 grade tuna are hardly utilized at all in the west coast fresh market. Fresh seafood buyers associate low-grade tuna with a potential histamine hazard.

Table 2-3

Differentiation of Product Quality by Market Niche
In U.S. West Coast Fresh Tuna Market

Market Niche	Quality Grade							
	1+	1	2+	2	2-	3	3-	4
	Sushi Bars							
		Restaurant Sashimi						
		High-End Cooking						
			Lower-End Sashimi					
				Standard Cooking				
					Canning Quality			

Source: adapted from Bartram, et al., 1996

2.2 FROZEN TUNA

2.2.1 Hawaii Market

Hawaii is primarily a fresh tuna market. The two most common frozen tuna products are: (a) frozen skipjack tuna loins imported from Japan; and (b) frozen yellowfin tuna loins and steaks imported from Seattle and Los Angeles-based processors. The skipjack loins are used almost exclusively by one company which manufactures dried *aku* (skipjack) products. Frozen yellowfin loins are imported in small amounts to make a dried tuna product. The yellowfin steaks are distributed to caterers and institutional food service establishments which require large volumes of uniformly portioned products. Although the cost of these products is much lower than for fresh tuna, so is the quality.

2.2.2 U.S. West Coast Market

There is a well established market for frozen steaking-grade tuna loins on the west coast. Large quantities of frozen yellowfin tuna loins (and smaller quantities of frozen albacore and bigeye loins) are imported by Seattle and Los Angeles-based processors for steaking into meal-sized portions. The loins are produced in Indo-Pacific ports where there are large landings of fresh tuna by Asian longline fleets. Lower-quality tuna rejected for transshipment to the Japanese *sashimi* tuna market is cut into quarter loins, with skin and blood line removed. The finished product is quick frozen.

When ocean container quantities (15+ MT) are accumulated, shipments are made to the U.S. west coast. The minimum size loin that can be utilized for steaking is 2.25 kg (from fish > 15 kg). U.S. buyers strongly encourage their suppliers to vacuum package frozen tuna loins so that oxidation is reduced and quality preserved during freezer storage. Some suppliers glaze the product instead of vacuum packing.

One specialized frozen tuna product has achieved notable success in penetrating the U.S. (and Japan) market. Sold under names such as "lightly smoked" tuna or "saku" tuna, the product is processed in the Philippines, Indonesia and Taiwan. Fresh tuna, usually in the form of blocks or steaks, is exposed to carbon monoxide (CO) gas, which binds with metaglobin in the tuna flesh to turn it a bright red color. The product is then quick frozen. Initially, processors used laboratory-grade CO for treatment but some producers have refined the process by generating wood smoke and filtering out emissions except for CO residue.

Unlike raw tuna, the CO-treated product can be shipped and distributed at conventional freezer temperatures without oxidizing and turning brown. For U.S. seafood buyers, CO-treated frozen tuna offers a lower-priced alternative to fresh tuna without complex and expensive ultra-low freezing technology, such as used in Japan's frozen *sashimi* industry to maintain red muscle color in tuna from harvest to final distribution. CO-treated tuna is entering U.S. tuna markets in significant quantities, mostly on the east coast, where it sells for about US$1.50/kg less than for fresh loins.

Red tuna muscle is associated with higher quality and freshness in the minds of marketers and consumers. CO-treated products appear to be of higher quality than they really are. CO treatment transforms even the lowest-grade tuna muscle into an unnaturally red color, which may tempt consumers to eat it in preparations (e.g., *sashimi*, *sushi*) which require the high quality raw tuna. Naturally red-pigmented muscle is a safeguard against consuming poor quality tuna. CO treatment removes that safeguard and increases the risk that unacceptable tuna might accidentally be kept in restaurant kitchens or in retail counters because the unnaturally red pigmentation prevented detection of decomposed product. In Japan, some cases of seafood-borne illness have been traced to CO-treated tuna.

Because CO has a sterilizing effect, the thawed product has a shelf life of several weeks before decomposing. According to Hawaii and Los Angeles tuna buyers, the thawed product never loses its red color even after many weeks of cold storage. The U.S. Food and Drug Administration concedes that CO concentrations in treated tuna are not high enough to be injurious to health but the agency is concerned that the treated product misleads consumers as to the freshness of the tuna and that it could disguise decomposed tuna.

The U.S. Food and Drug Administration (FDA) advised an inquirer that CO gas treatment of tuna to enhance its color "...is a clear violation of the Food, Drug and Cosmetic Act," because CO has not been shown to be safe as a food or color ingredient or additive. Tuna exposed to CO as a residue of wood smoke may be acceptable to the FDA, although there has been no final decision (NFI, 1997).

Some processors have submitted proposals to the FDA to allow importation of lightly smoked tuna into the U.S.A. They hope that FDA might support their arguments with the Japanese government, which has banned all imports of CO-treated fish and which does not distinguish between wood smoke CO residue and CO gas treatment. Japan has set a limit of 200 micrograms/kg in imported fish products but laboratory studies have shown that most non-treated raw fish with high oil content exceed this limit. The Japanese government has specified a standard test method that may estimate a wide range of CO levels in replicate tests of identical tuna samples.

2.3 INCIDENTAL NON-TUNA SPECIES

Depending on where and how longline fishing is conducted, incidental species, such as marlin, swordfish, ono (wahoo), mahimahi, moonfish and others, may comprise a significant percentage of the total catch. Catch levels are difficult to predict for incidental species, so landings and product availability are subject to considerable fluctuation.

2.3.1 Hawaii Market

Hawaii offers marketing opportunities for the full array of pelagic fish species. Except for some species of sharks and oilfish, most fish harvested in Hawaii's longline fishery can be marketed and there is little discard. Restaurants have been able to diversify their menus using incidental species from the longline fishery. Much of the creative "Pacific regional cuisine" developed by Hawaii's elite chefs utilizes non-tuna pelagic species.

Marlin enters the same fresh fish markets as fresh tuna. Although paler than tuna muscle, marlin is served as *sashimi* and *poke* in Hawaii, especially in large group catering, because the muscle discolors more slowly than tuna muscle. Blue marlin and striped marlin are among the most affordable seafoods in Hawaii, although striped marlin with fatty muscle (orange-red color) can sell for high prices because of its value for *sashimi*. Because of the higher oil content, striped marlin is more highly regarded than blue marlin. In blue marlin over about 70 kg, the muscle often has connective tissue that makes it tough and chewy to eat. Large marlin were once used as a raw material in the processing of fish cakes and they continue to be used for smoking. Blue marlin is especially popular among low-income and fixed-income consumer groups.

Fresh mahimahi (dolphin fish) and ono (wahoo) have regularly appeared on Hawaii restaurant menus since the late1970s and these fish are especially appreciated in the tourist industry. The image and commercial value of other species, particularly moonfish and large-scale black pomfret (*monchong*), have been upgraded to fine dining cuisine as a result of aggressive promotion by Hawaii seafood marketers and chefs.

Like tuna, longline by-products must be sold fresh to receive the best prices. Except for mahimahi and ono (wahoo) fillets (mass produced and imported from Asia and South America), there is little demand for frozen pelagic fish. Large blue marlin landed by Hawaii fishermen is often loined and frozen for later use by smokers.

2.3.2 U.S. West Coast Market

Swordfish is the only non-tuna species targeted in Pacific longline fisheries. The fresh product is imported primarily by one southern California buyer for national distribution.

Non-tuna pelagic species caught incidentally by longline fishing fill some of the need for affordable fish on the west coast. A smooth-skinned oilfish known as *escolar* (*Lepidocybium flavobrunneum*) is more prized in southern California restaurant cuisine than other incidental species. A few shark species (mako, thresher, blacktip), fresh mahimahi and ono (wahoo) are popular but lower-value species for restaurant use. Moonfish and large-scale black pomfret have become exotic additions to some restaurant menus in northern California. Not all incidental longline species can be sold, however. Because of their status as protected gamefish, no species of marlin can be marketed in California.

Longline by-products are imported almost exclusively as fresh, dressed (h&g) fish. The exception is moonfish, which is exported as a "rack," from which most of the head (but not the collar) and the entire lower body are removed. The value of frozen pelagic fish is very low on the west coast. The major source is Taiwan, which can produce frozen longline fish products inexpensively.

3. RECENT TRENDS IN TUNA SUPPLY

This section reviews the sources of tuna supply to Hawaii and the U.S. West Coast. The major providers to each market are identified and the relative importance of imports and domestic catches is evaluated for the period 1992-1996. Trends are analyzed with particular attention to tuna and incidental pelagic species imported from Pacific island countries.

3.1 HAWAII FISH SUPPLY

3.1.1 Fresh Tuna

Fresh tuna imports received in Hawaii have declined over the past two to three years. One of the contributing factors is high domestic landings of bigeye, yellowfin and albacore by Hawaii's longline, handline and troll fishermen since 1994. It should not be assumed, however, that fresh tuna imports which clear U.S. Customs in Honolulu are necessarily for local sale. In fact, major seafood distributors estimate that up to 40% of domestic catches and imports are re-exported.

Indo-Pacific island fish exporters are shipping more of their products directly to the U.S. West Coast, thereby avoiding transshipment through Honolulu. Some major air carriers offer cargo routings directly from Australia, Fiji, New Zealand and Singapore to Los Angeles at the same cost as to Honolulu. Attractive freight rates have encouraged Pacific island exporters to divert a significant portion of the tuna which previously was distributed through Hawaii and for which Honolulu was recorded as the port of entry to the U.S.A.

Bigeye Tuna

Table 3-1 compares the relative contributions of domestic catches and imports of bigeye tuna to the total Hawaii supply in the period 1992-1996. Annual imports of this species have declined from a high of 180-190 MT in 1993-1994 to a low of 40 MT in 1996. Reliance on imported bigeye decreased to 2-3% of the total supply in 1995-1996 from a peak of 8-9% in 1993-1994. One factor in the decline has been recent high landings of bigeye by Hawaii's longline fishery.

Table 3-1

Contributions of Domestic Catch and Imports To Hawaii's Fresh Bigeye Tuna Supply
1992-1996

YEAR	Domestic Catch*		Imports**		TOTAL
	MT	% Total	MT	% Total	MT
1992	1,590	0.94	100	0.059	1,690
1993	2,180	0.92	190	0.080	2,370
1994	1,950	0.92	180	0.085	2,130
1995	2,130	0.97	70	0.032	2,200
1996	2,360	0.98	40	0.017	2,400

Sources: * WPRFMC, 1997

** Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA.

Exporting countries are ranked in Table 3-2, according to quantities of fresh bigeye tuna imp by Hawaii during the 1992-1996 period.

Table 3-2

Fresh Bigeye Tuna Imports, Honolulu
Top 8 Exporting Countries
1992-1996

Exporting Country	1992	1993	1994	1995	1996
			(kg)		
Marshall Is.	37,888	102,396	131,501	46,070	6,951
Indonesia	58,164	71,831	20,823	4,833	7,609
Fiji	4,360	0	11,362	6,076	12,658
Australia	0	1,204	6,916	4,501	559
Malaysia	0	0	0	0	8,403
Tonga	0	3,176	982	654	2,520
FSM	1,413	2,401	657	0	0
Cook Is.	0	0	0	3,036	349
TOTAL	101,825	181,008	172,241	65,170	39,049
Pacific Islands	43,661	107,973	144,502	55,836	22,478
% of Total	0.43	0.60	0.84	0.86	0.58

Source: Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

All of Hawaii's bigeye tuna imports originate from the Indo-Pacific, with the majority exported from Pacific islands. Hawaii is presently importing far less bigeye tuna than in 1993-1994, when this was one of the major exports from the Marshall Islands. During that period, Hawaii was the principal market for most of the fresh tuna produced by a small domestic longline fishery. The domestic fishery subsequently failed and attempts to revive it failed. The locally-owned fleet was replaced by a Chinese longline fleet which is shipping most of its catch to Japan using a leased 727 jet. Air Marshall Islands, which had transported the domestic fresh tuna catch to Hawaii, stopped operating its DC-8 cargo plane.

In 1992-1993, a freight forwarding company in Pohnpei, FSM, exported small amounts of fresh bigeye tuna to Hawaii in conjunction with large scale tuna transshipments to Japan by a Taiwanese longline company. The Taiwanese fleet subsequently relocated to Indonesia.

Fiji has become the leading supplier of Hawaii fresh bigeye tuna imports, with Tonga a smaller contributor.

Yellowfin Tuna

Table 3-3 compares the relative contributions of domestic catches and imports of yellowfin tuna to the total Hawaii supply for the 1992-1996 period. Imports have declined from a peak of 580 MT in 1993 to only 130 MT in 1996 and reliance has dropped from a high of 24-25% of total supply in 1992-1993 to a low of 7% in 1996. Hawaii's commercial fishermen made record high landings of yellowfin tuna in recent years and the domestic market has been better supplied compared to the early 1990s. Catchability of yellowfin tuna around the Hawaiian Islands fluctuates considerably from year to year depending on oceanographic factors which concentrate forage but there is no evidence that recent high levels of catch are not sustainable or that fishing pressure is adversely affecting the yellowfin stock (WPRFMC, 1997).

Pacific island countries presently account for approximately three-fourths of the fresh yellowfin tuna imported by Hawaii. In the 1992-1996 period, their contribution to the yellowfin supply was relatively consistent, peaking in 1995 at 84%. Fiji was the top producer in 1995-1996. Customs data are not complete for 1997 but Fiji tuna exports are expected to decline somewhat and Samoa is expected to be among the top ten producers.

In the early 1990s, the Marshall Islands was also a significant exporter. During that period, Hawaii was the principal market for most of the fresh tuna produced by a small domestic longline fishery. The domestic fishery subsequently failed and attempts to revive it were unsuccessful. The locally-owned fleet was replaced by a Chinese longline fleet which shipped most of its catch to Japan using a leased 727 jet. Air Marshall Islands, which had transported the domestic catch of fresh tuna to Hawaii, stopped operating its DC-8 cargo plane.
In 1992-1993, a freight forwarding company in Pohnpei, FSM, exported moderate quantities of fresh bigeye tuna to Hawaii in conjunction with large scale tuna transshipments to Japan by a Taiwanese longline company. The Taiwanese fleet subsequently relocated to Indonesia.

Table 3-3

Contributions of Domestic Catch and Imports To Hawaii's Fresh Yellowfin Tuna Supply
1992-1996

YEAR	Domestic Catch *		Imports **		TOTAL
	MT	% of Total	MT	% of Total	MT
1992	1,360	0.76	440	0.24	1,800
1993	1,770	0.75	580	0.25	2,350
1994	1,860	0.80	460	0.20	2,320
1995	2,270	0.88	320	0.12	2,590
1996	1,820	0.93	130	0.07	1,950

Sources: * WPRFMC, 1997

** Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

Exporting countries are ranked in Table 3-4, according to quantities of fresh yellowfin tuna imported by Hawaii during the 1992-1996 period.

Table 3-4

Fresh Yellowfin Tuna Imports, Honolulu
Top 10 Exporting Countries
1992-1996

Exporting Country	1992	1993	1994	1995	1996
	(kg)				
Fiji	208,442	168,282	130,340	254,851	280,607
Marshall Is.	77,608	174,185	197,987	61,608	0
Philippines	42,568	121,748	39,794	22,697	12,317
Indonesia	57,876	67,602	22,678	11,701	47,381
Australia	31,155	5,647	16,388	16,206	16,043
FSM	17,342	38,294	2,346	1,395	1,021
Taiwan	1,161	0	13,969	0	14,031
China	0	0	9,458	8,978	4,246
F. Polynesia	7,180	2,029	5,159	312	0
Kiribati	0	575	13,414	341	0
TOTAL	443,332	578,362	451,533	378,089	375,646
Pacific Islands	310,572	383,365	349,246	318,507	281,628
% of Total	0.70	0.66	0.77	0.84	0.75

Source: Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

Albacore Tuna

Table 3-5 compares the relative contributions of domestic catches and imports of albacore tuna to the total Hawaii supply from 1992-1996. Domestic longline landings have increased dramatically since 1994 (WPRFMC, 1997). Fresh albacore imports have also increased substantially but reliance on imports dropped from a high of 13% in 1994 to 5-7% in 1995 and 1996.

Table 3-5

Contributions of Domestic Catch and Imports To Hawaii's Fresh Albacore Tuna Supply
1992-1996

YEAR	Domestic Catch *		Imports **		Total
	MT	% of Total	MT	% of Total	MT
1992	410	0.91	40	0.089	450
1993	500	0.96	20	0.038	520
1994	590	0.87	90	0.132	680
1995	1,450	0.95	70	0.046	1520
1996	1,360	0.93	100	0.068	1460

Sources: * WPRFMC, 1997

** Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

Pacific island exports of fresh albacore to Hawaii have increased substantially since 1994. Table 3-6 shows the top exporting countries. Fiji produced 80% or more of this product every year except for 1995. Customs data for 1997 are not complete but Samoa is expected to be among the top five producers of Hawaii albacore imports.

Table 3-6

Fresh Albacore Tuna Imports, Honolulu Top 5 Exporting Countries
1992-1996

Exporting Country	1992	1993	1994	1995	1996
			(kg)		
Fiji	40,041	17,288	71,999	45,325	93,190
Australia	251	0	13,987	22,552	9,831
F.Polynesia	0	0	4,942	0	0
Samoa	0	0	853	0	0
Marshall Is.	0	0	0	336	0
TOTAL	40,292	17,288	91,781	68,213	103,021
% Fiji	0.99	1.00	0.78	0.66	0.90

Source: Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

3.1.2 Frozen Tuna

Hawaii imports frozen yellowfin tuna loins and steaks from U.S. west coast producers. The quantities are difficult to estimate because no U.S. Customs records are generated.

Skipjack tuna loins are the other frozen product imported by Hawaii in relatively large amounts. This product of Japan is used in Hawaii almost entirely for processing dried *aku* (skipjack tuna). Only 82 MT of raw material were imported in 1996, compared to 249 MT in 1992 (U.S. Customs data).

Imports of frozen, carbon monoxide-treated tuna blocks ("saku") from processors in the Philippines and Indonesia have increased recently. Several retailers purchase the product from distributors and thaw it to prepare "fresh" *poke*.

3.1.3 Incidental Non-Tuna Species

Expansion of Hawaii's longline fishery has increased the commercial catch of incidental, non-tuna pelagic species, as well as of tuna. Annual landings of blue marlin by all fishing gear types (longline, handline, troll) rose to 850-900 MT in 1995-1996, a 40% increase from catch levels in the early 1990s. Domestic landings of striped marlin were highly variable during the 1992-1996 period, but they averaged nearly 500 MT per year. An average of 400 MT/year of mahimahi and 200 MT/year of wahoo (ono) were landed by commercial longline, handline and troll fishermen during the five-year period (WPRFMC, 1997). Smaller quantities of moonfish and large-scale black pomfret (*monchong*) were also produced.

All of the incidental pelagic species are valued for restaurant and retail consumption in Hawaii. Limited quantities are imported, mostly from Pacific island countries, to supplement the domestic supply. U.S. Customs data on seafood imports combines the incidental pelagic species with other marine fishes, so quantitative trends in imports are unknown. Fiji has been the largest source of non-tuna, longline by-products entering Hawaii in recent years.

One component of Hawaii's longline fleet targets fresh broadbill swordfish but most of the catch is exported to the continental U.S.A. and there is a limited Hawaii market for this species. Annual landings have varied substantially in the past five years, from a high of 5,800 MT in 1992-1993 to a low of 2,700 MT in 1995-1996 (WPRFMC, 1997).

3.2 U.S. WEST COAST FISH SUPPLY

3.2.1 Fresh Tuna and Incidental Species

The U.S. west coast lacks a domestic longline fleet, although swordfish is being landed there by a dozen Hawaii longliners fishing the eastern Pacific during the 1997 El Nino. Generally, the only fresh tuna of local origin is landed by tuna purse seine vessels which target small bluefin and by gill-net vessels which catch small bluefin incidentally in the swordfish fishery. Both are seasonal fisheries.

Purse seine caught bluefin enter the California market from mostly July through September. The fish are of marginal quality and, consequently, they sell for low prices. Gill-net bluefin enters the market mostly from June through November, coinciding with the swordfish gillnet season. The latter fish have acceptable quality and good fat content but their shelf life is shorter than that of longline tuna.

Fresh tuna enters the west coast predominantly from domestic suppliers in the Hawaii and the U.S. Gulf and Southeast and from foreign suppliers in Central and South America and the Indo-Pacific. In recent years, the foreign sources have displaced some of the market share previously held by the domestic sources.

In the 1980s and early 1990s, the Gulf domestic longline fishery set the standards for fresh yellowfin tuna grading and pricing in U.S. domestic markets. In the early years of the fishery, longline vessels often sold their tuna catch by the boat load. The composition of tuna grades (no.1, no.2, no.3) was estimated by Gulf buyers based on past experience with particular vessels, captains and crews. In general, boat loads of tuna sold for prices slightly above the buyer's estimate of the prevailing U.S. market price for no. 2 grade yellowfin.

The more recent trend has been toward individual grading of tuna landed by Gulf longliners. Fish is unloaded at privately-owned docks and dock operators compete for longline landing business by helping the vessels sell their tuna catches to wholesalers. Fish are graded and sold after the price structure for different grades is negotiated with wholesalers.

Increasing competition has caused dock operators to overgrade tuna sold to wholesalers, who have to downgrade up to 10% of the fish for re-sale. Consequently, Gulf buyers are exploring alternative sources of fresh tuna and are diversifying into other products. Through this process, many Gulf tuna wholesalers have become importers of fresh tuna from Central and South American sources.

Gulf-origin yellowfin tuna has been displaced on the east coast by lower-priced imports and Gulf producers have shifted marketing emphasis to the west coast. In the past 5 years, however, the supply of Gulf tuna has been inconsistent. Gulf tuna no longer sets price standards for the west coast fresh market. Also, grading of no. 1 Gulf yellowfin is reported to be less reliable than in the past. No. 2- tuna are often graded dockside as no. 2 and any fish with red muscle are graded as no. 2+.

Hawaii's importance as a no. 2 tuna supplier to the west coast has diminished in the past 5 years. Distributors who used to purchase heavily now rarely buy the no. 2 product from Hawaii because pricing is not competitive with other sources. Hawaii continues to supply premium tuna to west coast distributors and specialty wholesalers who service the *sushi* bar and high-end Japanese retail market niches. High quality bigeye tuna is the principal export from Hawaii.

In the past 5 years, there has been a remarkable increase in U.S. fresh tuna imports from Central and South America. Major longline fisheries in Costa Rica, Venezuela and Trinidad produce a mix of yellowfin and bigeye tuna. Ecuador has become the predominant supplier of fresh bigeye, which is caught mostly by a handline, not longline, fishery. The west coast is also well supplied with swordfish loins, mahimahi, escolar, thresher shark and other incidental pelagic species from Central and South American sources. Marlin cannot be sold in California but South American producers export substantial amounts to the east coast.

Approximately 80% of the Central and South American fish imports enter the U.S.A. through Miami International Airport. Smaller quantities of fresh tuna are air shipped from Ecuador and Costa Rica to Los Angeles International Airport (LAX). Los Angeles directly receives less than 20% of the tuna imports, so U.S. Customs' records for the Los Angeles port of entry account for only a minority of the actual amount of fish exported. Nevertheless, Table 3-7 indicates the extent of reliance on Ecuador and Costa Rica for fresh bigeye tuna.

Only since 1996 have Pacific island exports accounted for more than 5% of the combined fresh bigeye and yellowfin imports received in Los Angeles. Table 3-7 lists the top producers of fresh bigeye tuna imports during the 1992-1996 period. Fiji is the largest Pacific island source of this product. Recent development of a small-scale domestic longline fishery in Samoa has stimulated bigeye tuna export from that area as well. French Polynesia also has a rapidly expanding domestic longline fishery. Except in 1994, when a French longline company joined with a Hawaii marketer to export fresh tuna to the U.S.A., most of the catch has been needed to meet high local demand for fresh fish.

Table 3-7

Fresh Bigeye Tuna Imports, Los Angeles
Top 10 Exporting Countries
1992-1996

Exporting Country	1992	1993	1994	1995	1996
			(kg)		
Ecuador	331,458	223,760	381,577	380,271	199,066
Costa Rica	82,635	39,251	79,067	100,818	162,539
Fiji	1,204		36,190	4,931	14,416
Indonesia	28,204	270			13,193
Philippines	2,002	13,667	14,298	1,953	16,392
Taiwan	35,081	4,536			
Australia					33,824
Samoa					17,010
F. Polynesia		1,165	17,950	2,831	367
Singapore	3,376			1,808	11,704
TOTAL	483,960	282,649	529,082	492,612	468,511
Ecuador + C. Rica	0.86	0.93	0.87	0.98	0.77
% Total					
Pacific Is.+Austr.	0.001	0.001	0.036	0.008	0.14
% Total					

Source: Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

The quality of tuna from Costa Rica and Ecuador has improved significantly in recent years and the west coast has become increasingly dependent on these sources to meet the growing demand for *sashimi*-grade fish. Fresh tuna from Venezuela and Trinidad are reported to be of lower quality (although generally acceptable as no. 2 grade) but this fish is channeled largely into the U.S. east coast market and is not a significant factor in the west coast tuna supply.

Table 3-8 lists the top producers of fresh yellowfin tuna imports during the 1992-1996 period. Fiji is the largest Pacific island source of this product. Recent development of a small-scale domestic longline fishery in Samoa has stimulated yellowfin tuna export from that area as well. Chinese longline fleets were licensed to fish in the FSM during the early 1990s and large quantities of fresh tuna were transshipped to Japan from bases in Chuuk, Pohnpei and Yap. The Taiwanese-owned transshipment company bought "reject" tuna from the boats at a low price and selected the better quality fish for fresh export to the west coast. Buyers familiar with the product report that much of the tuna was unusable in the fresh market due to poor quality. The Taiwanese company pulled out of FSM bases in 1995.

Table 3-8

Fresh Yellowfin Tuna Imports, Los Angeles
Top 12 Exporting Countries
1992-1996

Exporting Country	1992	1993	1994	1995	1996
			(kg)		
Taiwan	452,586	994,228	968,240	725,734	439,734
Philippines	453,147	843,076	563,277	561,482	558,189
Indonesia	165,553	318,218	481,144	751,307	861,949
Malaysia	28,839	295,289	210,914	54,790	64,619
Fiji	12,603	6,138	5,045	127,729	101,263
Singapore	0	0	0	0	140,865
FSM	4,064	56,658	37,528	0	805
Thailand	0	0	0	11,585	32,638
Samoa	0	0	1,917	9,472	27,184
Ecuador	5,873	6,846	16,980	4,218	347
Costa Rica	4,022	0	7,235	13,803	2,323
Sri Lanka	0	0	18,978	0	4,714
TOTAL	1,126,946	2,520,453	2,311,258	2,265,260	2,251,770
Pacific Islands	16,667	62,796	44,490	137,201	129,252
% of Total	0.015	0.025	0.019	0.061	0.057

Source: Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

Pacific island countries, in particular Fiji, are the principal source of fresh albacore tuna entering the west coast. They have accounted for nearly all of the west coast supply of fresh albacore since 1993 (Table 3-9).

Table 3-9

Fresh Albacore Tuna Imports, Los Angeles
Top 5 Exporting Countries
1992-1996

Exporting Country	1992	1993	1994	1995	1996
			(kg)		
Fiji	66,420	78,883	104,326	248,523	521,475
Taiwan	120,340	0	0	0	0
Cook Is.	0	0	25,517	40,890	3,543
Samoa	0	0	4,869	26,218	9,872
F. Polynesia	0	0	2,839	5,197	22,644
N. Zealand	3,506	0	1,654	4,879	10,339
Australia	0	0	1,266	1,350	13,293
Ecuador	5,452	1,426	0	4,835	0
Philippines	0	3,538	0	0	0
Tonga	0	0	0	1,109	307
TOTAL	195,718	83,847	140,471	333,001	581,473
Pacific Is., NZ, Austr.	69,926	78,883	140,471	328,166	581,473
% Total	0.36	0.94	1.00	0.99	1.00

Source: Derived from U.S. Customs data, summarized by National Marine Fisheries Service, Southwest Region, Long Beach, CA

Fiji has been the leader in opening the west coast to Pacific island exports of fresh tuna and non-tuna incidental species. Beginning about 7-8 years ago, a major San Francisco seafood distributor began using tuna and by-products from Fiji's domestic longline fishery. A niche market was developed in northern California for medium size tuna (14-26 kg dressed weight) and for other pelagic species. Lower-priced products from Fiji displaced some Gulf and Hawaii fish.

One of the longline fleets in Fiji has begun directing incidental species to the Los Angeles market through a Japanese tuna distributor. The northern California experience is being repeated in southern California. U.S. Customs data do not provide sufficient detail to quantify import trends for particular incidental species.

Major fresh tuna distributors on the west coast have commitments to supply regular customers. To accomplish this requires multiple suppliers because no one or two sources produce fish with enough consistency. Buyers keep as many sources as possible and continually add new sources to stabilize their fish supplies and to protect their reputations as reliable distributors. It is common to change between tuna sources seasonally and even weekly based entirely on the need to maintain continuity in product supply.

3.2.2 Frozen Tuna

Several seafood processing companies in Seattle and Los Angeles import large quantities of frozen tuna loins from the Indo-Pacific. This product is not consistently recorded in U.S. Customs' data for west coast ports of entry. On a nationwide basis, importation of frozen loins rose from approximately 27,000 MT in 1993-1994 to nearly 40,000 MT in 1996 (U.S. Customs data).

Processors in Singapore and Indonesia supply about 75% of the product but, in 1996, tuna loining and freezing operations in the FSM exported over 70 MT to Los Angeles (U.S. Customs' data).

Reject-grade yellowfin tuna provides the bulk of the raw material for loining. In French Polynesia, however, albacore and yellowfin tuna are loined and frozen at sea by catcher/processor longline vessels. The sea-frozen product is shipped to the west coast, where it enters a higher quality market niche than the conventional shore-frozen product.

The amount of frozen, carbon-monoxide treated tuna blocks ("saku") entering the U.S.A. has increased substantially in the past two years. An estimated 500+ MT was shipped by ocean freight to the west coast in 1997 but much of this was destined for east coast markets.

4. RECENT DEMAND AND PRICE TRENDS FOR MAJOR LONGLINE SPECIES

This section analyzes recent trends in fresh tuna demand and price for major tuna species and incidental longline species.

4.1 NO. 1 BIGEYE AND YELLOWFIN TUNA

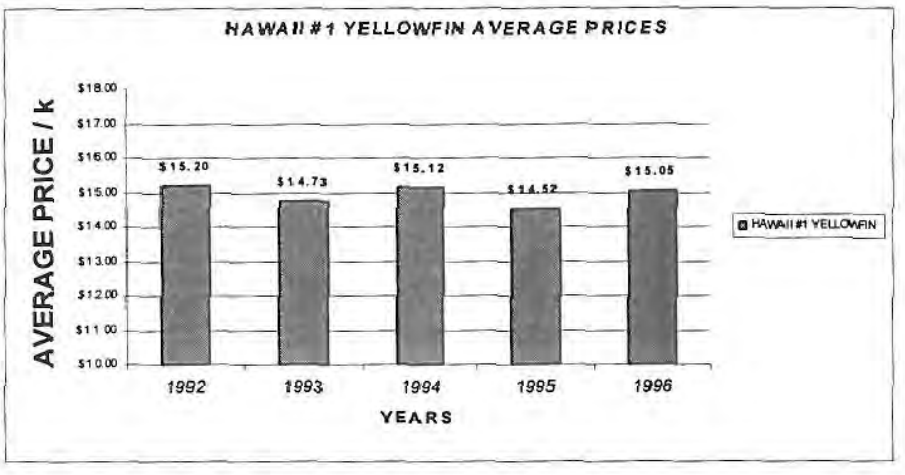
Hawaii has a long history of no. 1 fresh tuna consumption, especially in raw preparations. Premium tuna was also traditionally used in the specialized *sushi* and *sashimi* market niche in Los Angeles but high quality tuna did not enter mainstream cuisine on the west coast until about 10 years ago.

4.1.1 Hawaii

Trends in the estimated annual average price of longline-caught no. 1 bigeye tuna and no. 1 yellowfin tuna in Hawaii are shown in Figure 4-1. The starting point for these estimates was a National Marine Fisheries Service, Honolulu Laboratory data base for Hawaii longline fish landings and revenue. Data for 1992-1996 were used to estimate average monthly and average annual ex-vessel prices for longline tuna and incidental species. The average prices were adjusted for specific tuna grades by adding average price premiums for no. 1 and no. 2 tuna. The average price premiums were based on fresh tuna price-quality relationships recorded for over 8,000 individual fish transactions at the Honolulu fish auction (Bartram, et al., 1996). Fresh tuna are sold whole at the auction, so prices were adjusted by 20% to account for the fish weight that is lost by heading and gutting. Throughout this study, prices are given for dressed, headed and gutted (h&g) fish, which is the usual form imported.

In recent years, the average no. 1 bigeye price has ranged from US $15.70 – 17.80/kg (dressed fish weight). In a strong market, monthly average prices reached highs of US $20-22/kg (dressed fish weight) and in a weak market, monthly average prices reached lows of US $13-14 for no. 1 grade. No. 1 yellowfin has sold for average prices of US $14.50-$15/kg (dressed fish weight) in recent years. In a strong market, monthly average prices reach highs of US $16-17/kg and in a weak market, monthly average prices may drop to lows of US $12-13/kg for the no. 1 yellowfin.

Figure 4 - 1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AVERAGE PRICE / k
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$16.00
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$13.00
$12.00
$11.00
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$15.20
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1992
1993
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YEARS
HAWAII #1 YELLOWFIN


WEST COAST
#1 YELLOWFIN AVERAGE PRICES
AVERAGE PRICE / k
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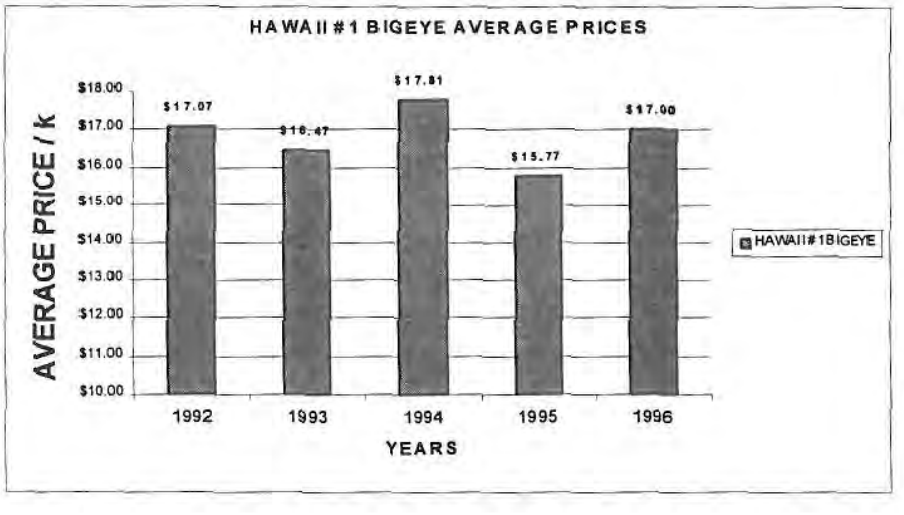
YEARS
WEST COAST #1 YELLOWFIN


HAWAII #1 BIGEYE AVERAGE PRICES
AVERAGE PRICE / k
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$15.00
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$11.00
$10.00
$17.07
$16.47
$17.81
$15.77
$17.00
1992
1993
1994
1995
1996
YEARS
HAWAII #1 BIGEYE

During the 1992-1996 period, the annual average price for no. 1 yellowfin tuna in Hawaii fluctuated within a smaller range of price (US $0.68/kg range) than no. 1 bigeye (US $2.04/kg range). Bigeye is the preferred species for premium *sashimi* and it sells for US $1.00-2.00/kg more than no. 1 yellowfin in Hawaii. Higher price volatility for no.1 bigeye tuna seems to be linked to wide fluctuations in fish quality from winter to summer and to fluctuations in tourist arrivals and spending, Hawaii's economy has been stagnant in recent years. Fresh fish remains a staple food in the diets of many residents but the demand for luxury foods, including high-quality tuna, is related more closely to tourism.

The price of no. 1 yellowfin tuna in Hawaii is often higher than for Gulf no. 1 yellowfin. West coast tuna buyers sometimes dismiss this difference as "Hawaii pricing itself out of the market." Hawaii has a strong market for *sashimi*-quality tuna but this, in itself, does not provide a complete explanation of the higher price. The answer seems to be that the no. 1 tuna grade in Hawaii is calibrated somewhat differently in the Gulf. In Hawaii, a no. 1 tuna must have red muscle with high transparency, firm texture and good remaining shelf life. In the Gulf, muscle color alone is given much more emphasis in grading tuna. Typical longline boat loads can reportedly produce 50% no. 1 grade tuna in the Gulf, whereas it is unusual for the no. 1 grade to comprise more than 25% of a longline boat load in Hawaii (Bartram et al., 1996).

4.1.2 U.S. West Coast

In recent years, the image of fresh yellowfin and bigeye tuna in the continental U.S.A. has changed from a specialty seafood to a mainstream product. Seafood marketers and consumers, especially on the west coast, now recognize and value good quality tuna. Recent trends have been toward more sophisticated and discriminating purchasing of fresh tuna. Gone are the days when, in the words of a Los Angeles tuna distributor: "any quality of tuna was acceptable as long as no one got sick."

There is increasing interest in all pelagic fish species but a strong dichotomy has developed between *sashimi*-grade tuna and affordable fish. Demand is growing only for better quality tuna. "Fry grade" fresh tuna (no. 2- and no. 3), which once sold in large quantities, is no longer in much demand. Grading terminology has changed in conjunction with demand, so that tuna that is destined for cooking can no longer be marketed as "fry grade."

Los Angeles has a well-established market niche for high grade *sashimi* tuna. The principal customers are *sushi* bars and Japanese specialty food retailers. The premium product for this niche is no. 1+ bigeye tuna with layered fat.

For less specialized restaurants which serve raw or seared tuna, layered fat is not a requirement but clear red tuna muscle is paramount. The product best suited for this niche is no. 1 yellowfin tuna. Historically, domestic producers in the Gulf and Southeast U.S.A. have been the major suppliers of no. 1 yellowfin and Gulf fish has been the benchmark for no. 1 tuna pricing on the west coast.

Recent trends in the annual average price for Gulf and Southeast no. 1 fresh yellowfin (delivered west coast) are shown in Figure 4-1. The estimates are derived from a weekly newsletter, "Seafood Price Current," published by Urner Barry Publications. The original data were adjusted to reflect air shipping of fresh tuna from the Gulf to the west coast, which costs approximately US $0.77/kg.

As previously discussed, no. 1 yellowfin tuna from the Gulf is usually landed on the U.S. west coast at prices US $1.00-1.50 lower than no. 1 yellowfin prices in Hawaii. In 1995, however, the annual average price of Gulf no. 1 yellowfin landed on the west coast equaled the Hawaii price.

The annual average price for west coast no. 1 yellowfin tuna has ranged from US $12-13.50/kg (dressed fish weight) in most recent years, except 1995, when the average price rose to US $14.50/kg (dressed fish weight). Except for 1995, the recent range in average no. 1 price has been small, about US $1.00/kg. West coast spot market prices for no. 1 yellowfin tuna can reach highs of US $16-18/kg (dressed fish weight) and lows of US $8-10/kg (dressed fish weight).

The large supply of Central and South American tuna has widened the range of prices for fresh tuna in west coast markets. Prices for no. 1 tuna attain levels never before experienced and prices for no. 2 tuna drop to levels never before experienced. The explanation for fluctuations in no. 1 price above previous thresholds is the increase in demand for high-grade fish, not only for the *sashimi* use but also for searing and cooking in mainstream cuisine. The premium grades of tuna have gained a broader-based clientele who are more willing to pay for the best fish when supply is low and prices are high.

This appreciation for top-grade tuna has come about because of exposure to no. 1 bigeye and yellowfin tuna from Central and South America. The high risk and high cost of shipping no. 1 tuna to Japan from Central and South America has encouraged exporters to market premium tuna on the west coast. The net returns for premium tuna can be as high as if the fish were marketed in Japan and the risk is lower.

Although access to premium fish has raised appreciation and buying standards for fresh tuna on the west coast, major distributors rarely import no. 1 tuna from Hawaii because of its higher price. The exceptions are buyers who service the *sushi* bar and Japanese specialty food markets.

4.2 NO. 2 BIGEYE AND YELLOWFIN TUNA

Many customers who desire *sashimi*-grade tuna are discouraged by the high prices of true no. 1 grade fish. This has created a demand for and further subdivisions of the no. 2 quality grade. The so-called "no. 2+" is the quality level of choice for tuna used in fine dining. The most important attribute in this market niche is clear, red tuna muscle. The no. 2+ can provide this while falling short of the no. 1 grade in other attributes, especially muscle translucency. According to major west coast buyers, tuna with clear, red muscle was more available and more affordable 10 years ago. Tuna that used to be graded as no. 2 are now considered no. 2+ fish if they have the desired attributes.

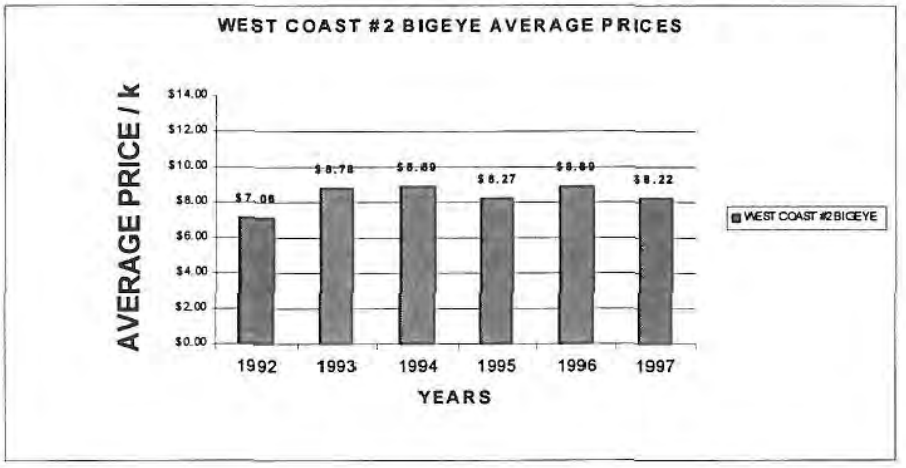
4.2.1 Hawaii

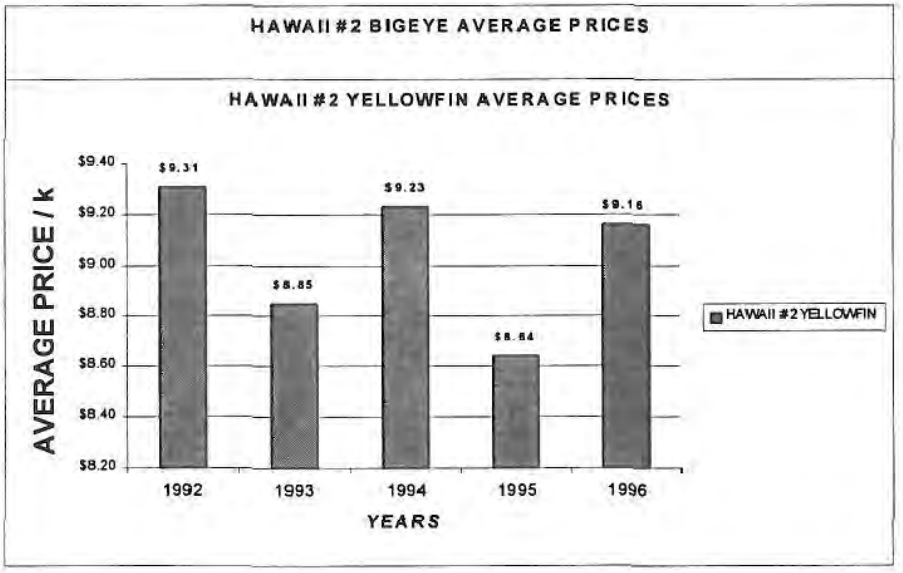
Average annual prices for Hawaii no. 2 longline-caught bigeye and yellowfin tuna are estimated in Figure 4-2 for the years 1992-1996. The estimates were calculated using the same data bases and in the same manner as for no. 1 tuna price estimates. No. 2 tuna are used for diverse products, including lower-end *sashimi*, *poke*, seared and grilled tuna. Bigeye tuna commands higher average prices than yellowfin in the no. 2, as well as no. 1, quality grade. Hawaii buyers tend to accept the softer texture of bigeye because they prefer its brighter red muscle and longer shelf life.

In recent years, the average prices for no. 2 bigeye have been in the range of US $10-12/kg (dressed fish weight), much higher than west coast average prices for no. 2 bigeye tuna imports from South America. The variation in annual average price for Hawaii no. 2 bigeye is much smaller than for the no. 1 grade. When the Hawaii market is strong, the monthly average price for no. 2 bigeye tuna can reach US $13-16/kg (dressed fish weight). When the market is weak, the monthly average price can drop to US $7-8.50/kg (dressed fish weight).

The annual average price for Hawaii no. 2 yellowfin tuna has ranged from US $8.60-9.30/kg (dressed fish weight), in many years US $2.00/kg lower than the no. 2 bigeye tuna average. Year-to-year variation in average no. 2 yellowfin price is low, not more than US $0.50/kg. In a strong market, the monthly average price for no. 2 yellowfin tuna climbs to highs of US $10.40-11.30/kg (dressed fish weight) and, in a low market, the monthly average price may fall to lows of US $6.60-7.35kg (dressed fish weight).

Figure 4 - 2


WEST COAST #2 BIGEYE AVERAGE PRICES
AVERAGE PRICE / k
$14.00
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$0.00
$7.06
$8.78
$8.89
$8.27
$8.89
$8.22
1992
1993
1994
1995
1996
1997
YEARS
WEST COAST #2 BIGEYE


HAWAII #2 BIGEYE AVERAGE PRICES
HAWAII #2 YELLOWFIN AVERAGE PRICES
AVERAGE PRICE / k
$9.40
$9.20
$9.00
$8.80
$8.60
$8.40
$8.20
$9.31
$8.85
$9.23
$8.64
$9.16
1992
1993
1994
1995
1996
YEARS
HAWAII #2 YELLOWFIN

4.2.2 West Coast

Concurrent with higher spot market fluctuations in no. 1 tuna prices on the west coast are spot market price fluctuations for no. 2 tuna lower than previously established thresholds. Central and South American producers are not as easily deterred by low prices as Gulf or Hawaii producers. The cost of air freight is low (US $0.77/kg from South America to Miami), so suppliers in Latin America can continue to export fresh tuna even when the market is weak and oversupplied. This practice has increased dependence on consignment selling, without pre-negotiation of price between sellers and buyers before shipment.

No. 2 fresh tuna prices on the west coast are driven largely by the supply of Central and South American tuna, especially bigeye. Recent trends in the annual average price for no. 2 fresh South American bigeye tuna (delivered west coast) are shown in Figure 4-2. The estimates are derived from a weekly newsletter, "Seafood Price Current," published by Urner Barry Publications. The original data were adjusted to reflect air shipping of fresh tuna from Miami, where the bulk of South American tuna enters the U.S.A., to the west coast. This raises the west coast landed cost approximately US $0.77/kg.

The annual average prices for no. 2 imported bigeye have been relatively stable since 1993, fluctuating in a small range between US $8.20 to $8.90/kg (dressed fish weight). High fluctuations in the market can send spot prices as high as US $12-13/kg (dressed fish weight), whereas low fluctuations can reduce spot prices to US $5-6/kg (dressed fish weight). The west coast price for no. 2 bigeye tuna is usually US $1.50-2.00/kg (dressed fish weight) lower than in Hawaii.

West coast tuna buyers have a strong preference for no. 2 yellowfin. They prefer the firm muscle texture of yellowfin to the softer-muscled bigeye, even though the muscle color of the latter is brighter red. Consequently, no. 2 yellowfin can often be sold as no. 2+ fish for a premium of US $1.00/kg (dressed fish weight) above the no. 2 bigeye price. Since 1993, the premium has raised the west coast price for no. 2 yellowfin higher than the Hawaii price by US $0.63-0.73/kg (dressed fish weight) based on an annual average. In fact, yellowfin tuna that are a good no. 2 grade by Hawaii standards can be exported to the west coast as no. 2+ fish.

4.3 NO. 2- AND NO. 3 BIGEYE AND YELLOWFIN TUNA

The value of no. 2- and no. 3 grade yelllowfin and bigeye tuna is diminishing as a fresh product and the market price is discounted. The principal defects of this fish are pale muscle color and soft muscle.

No. 2-/3+ tuna can be marketed on the west coast only when there are low supplies of better-grade tuna. The average price is about US $5/kg (dressed fish weight). Distributors are often forced to average low prices for poor quality tuna with high prices for good quality fish received in the same shipment.

The west coast market price for no. 3 tuna is often too low to cover the cost of fresh export (US $2.20-3.30/kg dressed fish weight). Most fresh tuna shipments received on the west coast contain some fish of questionable quality and, in many shipments from the Indo-Pacific, 20-30% of the tuna are no. 3.

Much of the lower-grade tuna is re-distributed to the east coast, where it is more acceptable as a fresh product. The east coast price is linked more to tuna supply than to quality. Good prices for lower-grade tuna are possible when the east coast is under supplied. If east coast buyers do not need fish, they can be as discriminating as their west coast counterparts in rejecting poor quality fish. As east coast buying standards rise, there will be fewer windows of opportunity to sell low quality tuna.

Hawaii tuna buyers are also emphasizing better quality and purchasing of no. 2- and 3+ tuna has declined in the retail sector, where a major use of these grades is for *poke*. Seafood retailers provide several explanations for this trend. The first is that skipjack tuna (*aku*), preferred to yellowfin and bigeye (*ahi*) by many consumers of *poke*, has been well supplied to the market in recent years and is filling the niche for lower-grade yellowfin and bigeye tuna. The second is that consumers themselves are becoming better educated about fish quality, partially through exposure to poor quality tuna. Consumers appear to be more wary of roadside tuna vendors who may sell products of questionable quality. Another factor that is credited with a shift in Hawaii consumer preference away from low-grade fresh yellowfin and bigeye tuna is the growing awareness of substitute species, especially albacore tuna and marlin, which provide better value (higher quality for prices equivalent to low-grade yellowfin and bigeye).

4.4 ALBACORE TUNA

In recent years, a grilling market for fresh albacore has developed in the U.S.A. and there appears to be significant growth potential in the retail sector. Albacore satisfies retailers' need for affordable pelagic fish with an extended shelf life. The muscle of fresh albacore is usually paler and softer than that of yellowfin tuna. Albacore muscle, however, is highly translucent and has a fresh appearance that will last many days longer than yellowfin loins, which discolor rapidly when displayed for retail sale. Albacore accounts for most of the recent growth in retail tuna sales, especially on the east coast and in northern California. When yellowfin and bigeye tuna are in short supply in Hawaii, albacore is often substituted to prepare *poke*. When the former species are available, however, they are preferred in raw fish products because of their redder muscle.

Depending on their diet and area of capture, albacore may also have red, instead of the more common pink and white muscle. In both Hawaii and U.S. west coast markets, red-muscled albacore is readily substituted for yellowfin and bigeye tuna, but red albacore comprise only a small share of total albacore landings, so two-toned albacore muscle is the norm.

Estimates of average Hawaii ex-vessel prices for longline-caught albacore tuna indicate remarkable stability in recent years. As seen in Figure 4-3, the average price varied between US $3.10 to $3.54/kg during the 1992-1996 period. High and low price variability from the average (in response to strong and weak market cycles) appears to be narrowing in the Hawaii market. Annual high prices reach US $4.40-5.90/kg (dressed fish weight), whereas annual lows fall to US $1.75-2.60/kg (dressed fish weight).

An intensive study of fresh tuna transactions at the Honolulu fish auction during the summers of 1995 and 1996 suggest that buyers pay a US $0.30-0.80/kg (dressed fish weight) premium for "red" albacore when yellowfin tuna is readily available. The premium is larger when there is a low supply of yellowfin and bigeye tuna (Bartram et al., 1996).

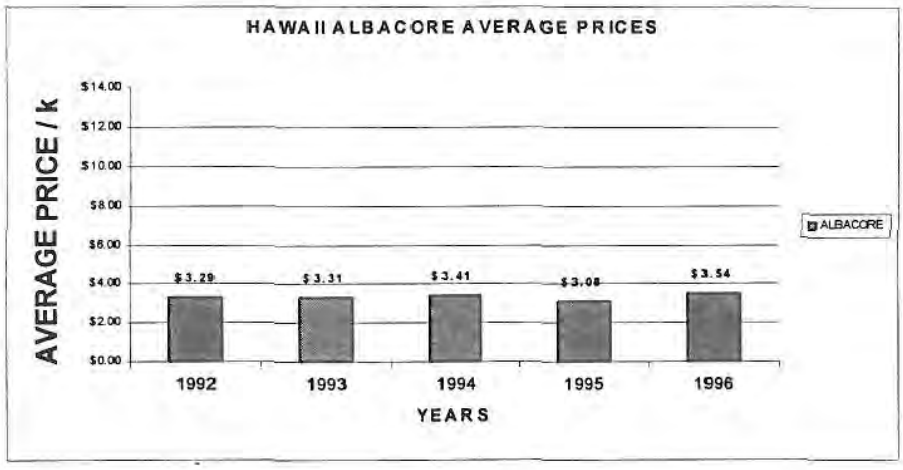
No historical data are available to determine price trends for fresh albacore tuna on the U.S. west coast. The recent range of price has been from US $4-5kg for dressed albacore.

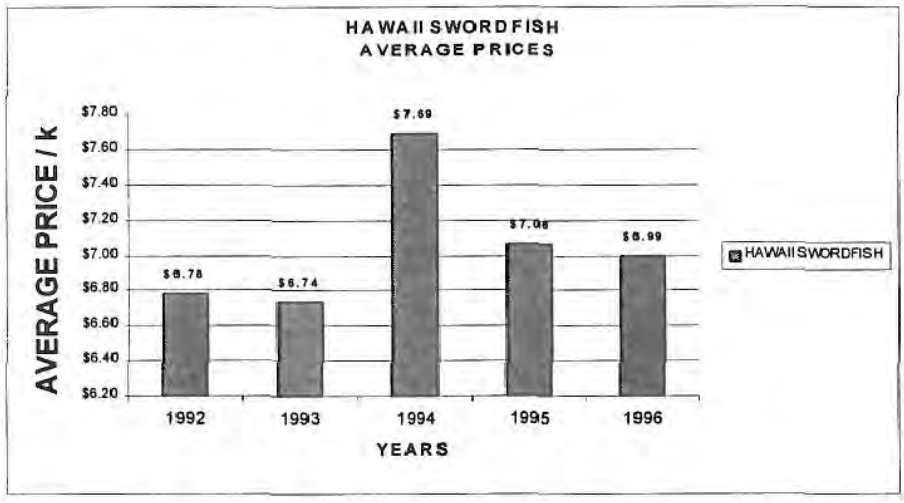
4.5 UNDERSIZED TUNA

Fresh tuna smaller than 27 kg (dressed fish weight) are sold at discounts from the prices described in Section 4.1-4.4. The discount for fish in the size range from 18-27 kg (dressed weight) is generally about US $1.10/kg below the market price for large tuna of the same quality. The discount for fish in the size range

from 14-17 kg (dressed weight) is generally about US $2.20/kg below the market price for large tuna of the same quality.

Figure 4 - 3





4.6 BROADBILL SWORDFISH

Hawaii's longline fishery lands large quantities of fresh broadbill swordfish, all in dressed form. Marketing of this fish usually takes place at the port of landing in Honolulu but the bulk of the product is exported to the continental U.S.A. Hence, *trends in Hawaii ex-vessel prices for swordfish are actually a reflection of price* trends in the major markets, particularly the east coast.

Figure 4-3 shows that average swordfish prices varied within a small range (from US $6.75 to $7.05/kg) in all recent years but 1994, when the average climbed to US $7.70/kg. During the last 5 years, annual high prices reached US $7.75-9/kg, while annual low prices dropped to US $4.45-6/kg.

Unless specifically targeted by longliners, such as in Hawaii and Australia, broadbill swordfish is a relatively insignificant by-catch of the tuna longline fishery.

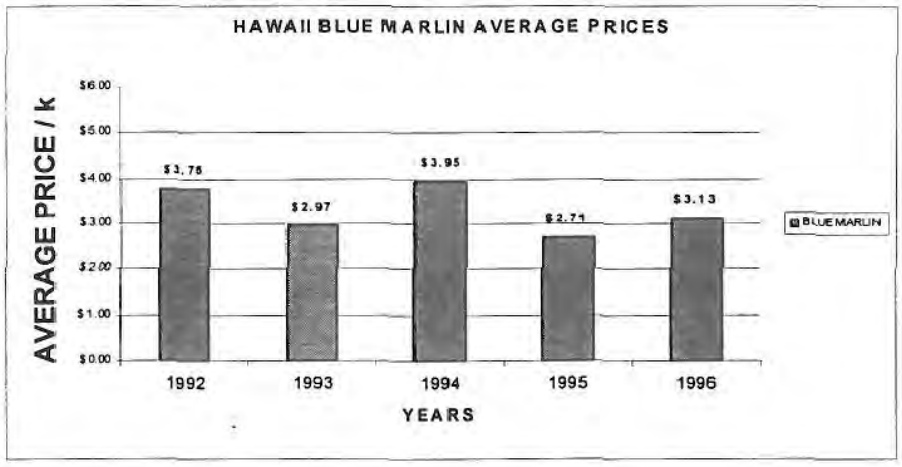
4.7 INCIDENTAL NON-TUNA SPECIES

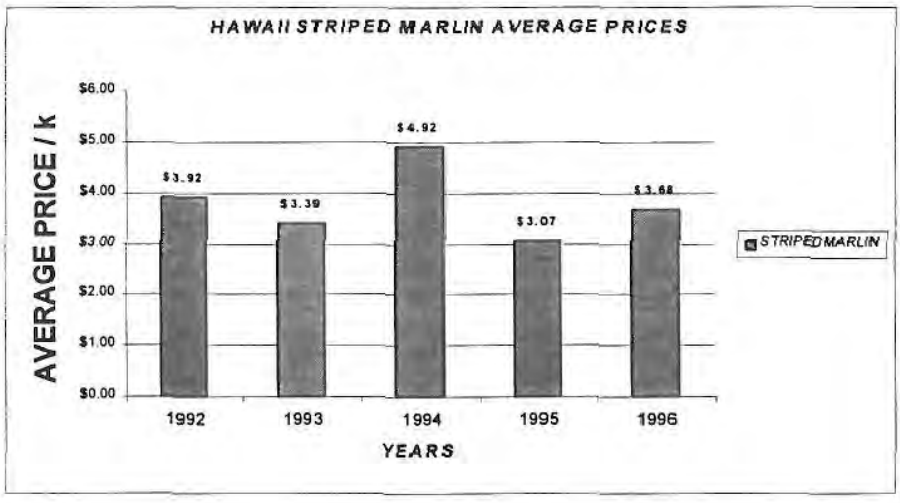
Incidental non-tuna species from longline fisheries are not marketed in large quantities, so there is limited information on price trends for most species. In general, market prices for non-tuna pelagic species are higher in Hawaii than on the U.S. west coast.

Blue marlin and striped marlin are the major by-products of the Hawaii longline fishery. Marlin often substitutes for fresh tuna, especially in *poke*. Estimated average ex-vessel prices for longline-caught marlin are shown in Figure 4-4 for recent years. The annual average price for blue marlin peaked at US $3.95/kg (dressed fish weight) in 1994 but is usually in the range of US $2.70-3.15/kg (dressed fish weight). In a strong market, monthly high prices reach US $4.75-5.90/kg (dressed fish weight), but in a low market, average monthly prices can fall to US $1.30-2.75/kg (dressed fish weight).

Some striped marlin have high fat content and can be utilized for *sashimi*. These fish command higher prices than the more abundant, leaner marlin. The annual average price for longline striped marlin usually varies between US $3.10-3.70/kg (dressed fish weight) but, in 1994, it soared to an average of US $4.90/kg (dressed fish weight). In a strong market, prices reach as high as US $5.20-6.70/kg (dressed fish weight) and, in a weak market, prices fall to as low as US $1.60-2.30/kg (dressed fish weight). Marlin have protected gamefish status in California and cannot be sold.

Figure 4 - 4


HAWAII BLUE MARLIN AVERAGE PRICES
AVERAGE PRICE / k
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
$3.76
$2.97
$3.95
$2.71
$3.13
1992
1993
1994
1995
1996
YEARS
BLUE MARLIN


HAWAII STRIPED MARLIN AVERAGE PRICES
AVERAGE PRICE / k
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
$3.92
$3.39
$4.92
$3.07
$3.68
1992
1993
1994
1995
1996
YEARS
STRIPED MARLIN

Large moonfish (> 40 kg) landed by Hawaii's longline fishery and processed into "racks" (by removing most of the head and the lower body) could be sold to wholesalers in Hawaii for an average price of about US $5.50/kg. The supply of moonfish is inconsistent, however, and there are correspondingly price fluctuations that are difficult to predict.

West coast market prices for incidental longline species are strongly influenced by Central and South American supplies. A species of oilfish known as escolar is highly valued in southern California, where the wholesale price is typically US $6.00 to $6.50/kg (dressed fish weight). Thresher shark is imported from South American producers at prices below US $4/kg (dressed weight).

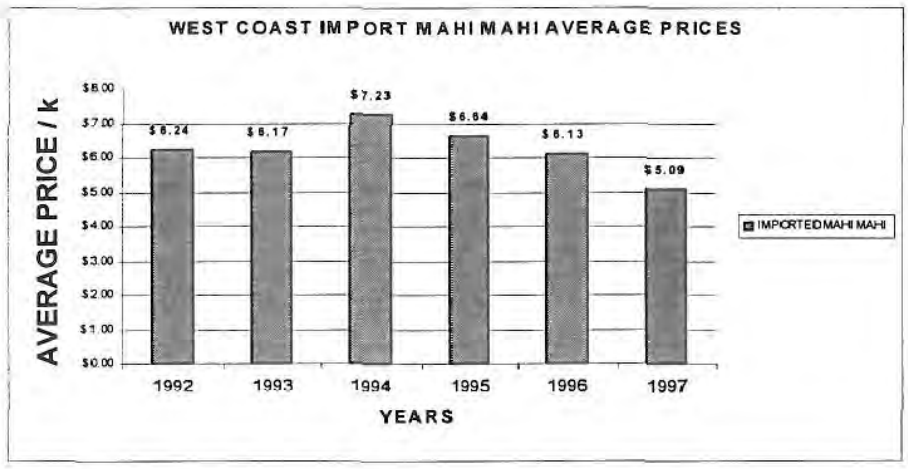
Brokers who sell longline by-products to both markets report that the west coast price for several incidental species is generally US $2.20/kg lower than the Hawaii price. Pacific island exporters are often content to receive the lower prices available on the west coast rather than expose shipments of incidental longline species to high price volatility in the Hawaii market.

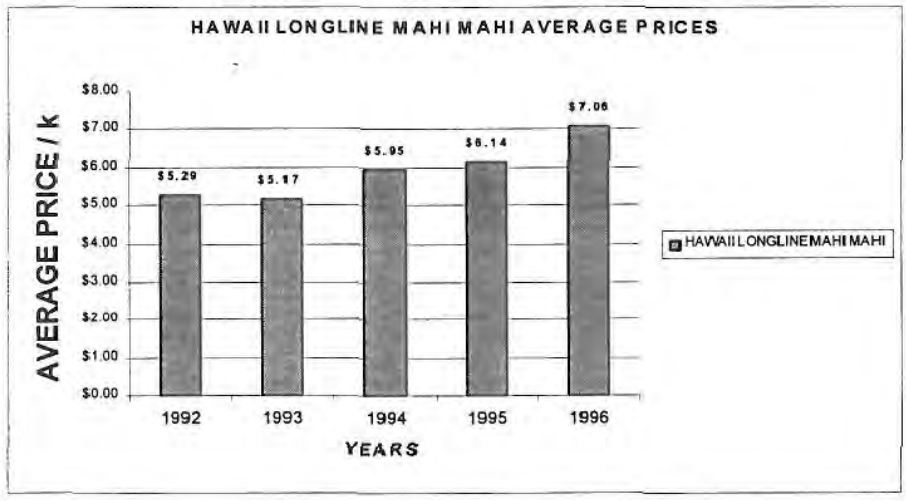
Fresh mahimahi and ono (wahoo) are popular restaurant fish in Hawaii. Fish caught by trollers making day trips receive price premiums for higher quality than longline-caught fish. Estimated average ex-vessel prices for longline-caught mahimahi and ono are shown in Figure 4-5 for the years 1992-1996. The annual average price for ono peaked at US $7/kg (dressed fish weight) in 1994 and has declined since then. In 1992-1994, longline-caught ono sold for higher prices than longline-caught mahimahi. Since 1995, however, longline ono prices have dropped and mahimahi has become the more valuable species.

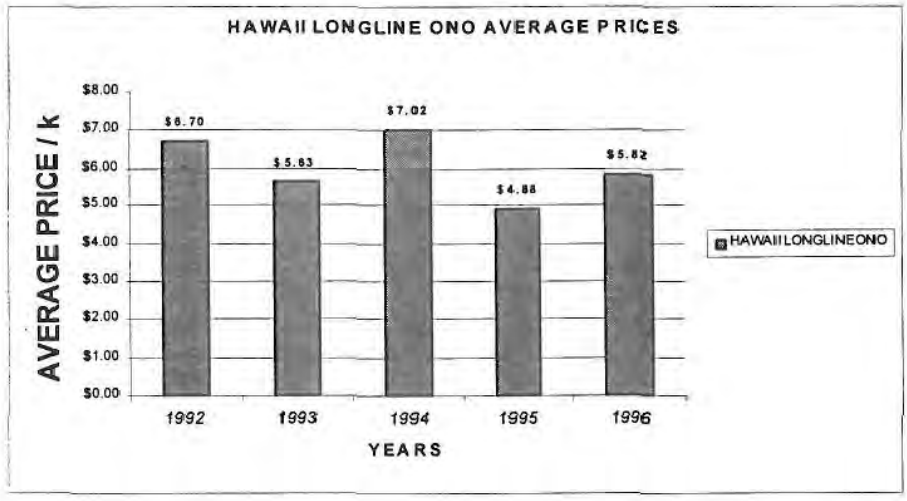
Seasonally, mahimahi prices in Hawaii can reach monthly high averages of US $9-10/kg (dressed, bullet-cut fish weight) can fall to monthly low averages of US $2.70-5/kg (dressed, bullet-cut fish weight). Ono prices also fluctuate seasonally in Hawaii, with monthly high averages in the range of US $7.50-9.70/kg (dressed fish weight) and monthly low averages in the range of US $3.27-5/kg (dressed fish weight).

The west coast price of mahimahi and ono is strongly influenced by South American imports. Fresh mahimahi is imported in dressed form with the collar removed and the belly flap trimmed back (known as a "bullet cut"). The average west coast price for mahimahi increased steadily to US $7/kg (dressed, bullet-cut fish weight) during the 5-year period (Figure 4-5). In 1992-1994, west coast average prices for imported South American mahimahi were higher than average ex-vessel prices for longline mahimahi in Hawaii. More recently, Hawaii prices have been higher.

Figure 4 - 5


WEST COAST IMPORT MAHI MAHI AVERAGE PRICES
AVERAGE PRICE / k
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
$6.24
$6.17
$7.23
$6.64
$6.13
$5.09
1992
1993
1994
1995
1996
1997
YEARS
IMPORTED MAHI MAHI


HAWAII LONGLINE MAHI MAHI AVERAGE PRICES
AVERAGE PRICE / k
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
$5.29
$5.17
$5.95
$6.14
$7.06
1992
1993
1994
1995
1996
YEARS
HAWAII LONGLINE MAHI MAHI


HAWAII LONGLINE ONO AVERAGE PRICES
AVERAGE PRICE / k
$8.00
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
$6.70
$5.63
$7.02
$4.88
$5.82
1992
1993
1994
1995
1996
YEARS
HAWAII LONGLINE ONO

4.8 FROZEN TUNA

Tuna loins are an almost inevitable by-product of large-scale longline fisheries in the Pacific islands. Frozen yellowfin tuna loins (and smaller quantities of albacore and bigeye tuna loins) are imported in ocean container quantities by west coast fish steaking companies. The import price for frozen yellowfin loins is relatively low, US $3.10-3.50/kg landed west coast. A small price premium is available for sea-frozen quality product, for which at least one importer will pay US $3.85/kg landed west coast. Frozen albacore tuna loins are imported for US $5.50/kg landed west coast.

5. SEASONALITY IN MARKETS FOR LONGLINE FISHERY PRODUCTS

This section provides charts that quantify seasonal variation in market prices for fresh tuna and major longline incidental species. Monthly average prices for each species during the period 1992-1996 are expressed as a percentage of the average annual price for the 5-year period. Above average prices can be expected in the months with a seasonal factor above 1.00. Below average prices can be expected in the months with a seasonal factor below 1.00.

Seasonal fluctuations in fish prices above and below the annual averages are generally explained by variations in supply and demand through the year.

5.1 GRADE NO. 1 BIGEYE AND YELLOWFIN TUNA

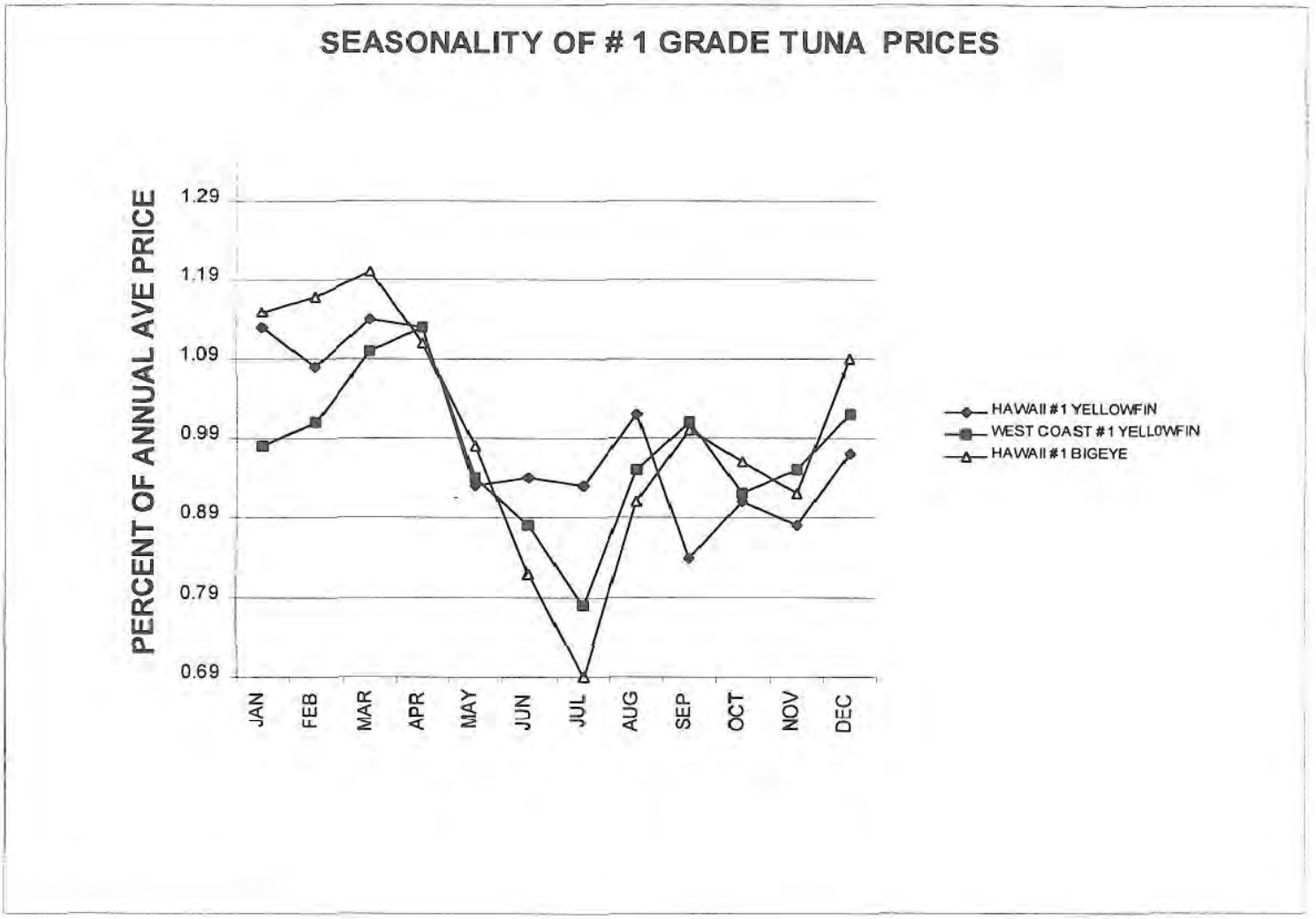
Figure 5-1 reveals strong seasonality in market prices for no. 1 bigeye and yellowfin tuna. Above average prices for Hawaii no. 1 bigeye and yellowfin and for west coast no. 1 yellowfin generally occur from January through April and in the month of December. The price peak during the early part of the year is associated with the season of low tuna production in Central and South America. The price peak in December is explained by the high demand for good quality tuna associated with Japanese year-end food traditions.

Hawaii no. 1 bigeye and west coast no. 1 yellowfin prices are about average in the month of September and Hawaii no. 1 yellowfin prices are about average in the month of August.

Prices are considerably below average Hawaii no. 1 bigeye and west coast no. 1 yellowfin in June and July. Gulf of Mexico and South American production of good quality yellowfin tuna is highest during this period and the west coast is often oversupplied. Hawaii no. 1 yellowfin prices are somewhat below average during June and July because the Hawaii market is well supplied with product.

The period of lowest average price for no. 1 yellowfin in Hawaii is September through November, when winter bigeye of better quality enters the Hawaii market and is the preferred product for the *sashimi* market. There is wide seasonal variation in the quality, and hence the price, of Hawaii bigeye tuna. This is reflected by major fluctuations in the average price for no. 1 bigeye. Seasonal price rises of 1.1 and higher than the annual average occur in the January-April period, whereas seasonal price factors of 0.8 or lower than the annual average occur in the months of June and July.

FIGURE 5 - 1


SEASONALITY OF # 1 GRADE TUNA PRICES
PERCENT OF ANNUAL AVE PRICE
1.29
1.19
1.09
0.99
0.89
0.79
0.69
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
HAWAII #1 YELLOWFIN
WEST COAST #1 YELLOWFIN
HAWAII #1 BIGEYE

5.2 GRADE NO. 2 BIGEYE AND YELLOWFIN TUNA AND ALBACORE TUNA

Figure 5-2 shows seasonality patterns for no. 2 bigeye and yellowfin tuna prices that are very similar to the patterns for no. 1 tuna. The causative factors are also the same.

Although albacore tuna prices mimic the same pattern as no. 2 bigeye and yellowfin in Hawaii, the seasonal effects are more extreme. A sharp spike in albacore tuna price occurs in the month of September, probably because this period is a time of transition from yellowfin to bigeye tuna in Hawaii. Albacore is exceptionally abundant during the fall months and it often fills a shortfall in the supply of *ahi*.

The months of October and November are generally regarded in Hawaii's seafood industry as a time of slow sales. During this period, the demand for fresh tuna is largely satisfied by the winter run of good quality bigeye tuna. Albacore plays only a minor role in the Hawaii tuna market at this time and the price drops sharply. The fresh tuna market in Hawaii strengthens considerably in December but albacore remains a secondary species and the price is still below the annual average.

5.3 BROADBILL SWORDFISH

Hawaii swordfish prices show a distinct seasonal variation, as shown in Figure 5-3. Hawaii prices tend to be above the annual average in January-February when east coast production is low and the national market is undersupplied. Hawaii prices also rise above the annual average in June-July because this is the period of lowest production in Hawaii's longline fishery for swordfish. The largest declines below average occur in the September-December period when swordfish production peaks in Hawaii.

Moon phase has a pronounced effect on swordfish catch rates and market prices. Fishing is best before full moon, so supplies go up and prices drop when boats land swordfish in unison after the full moon. Catch rates are lowest after full moon, so when these smaller catches are landed before the full moon, the market is undersupplied and prices rise.

FIGURE 5 - 2

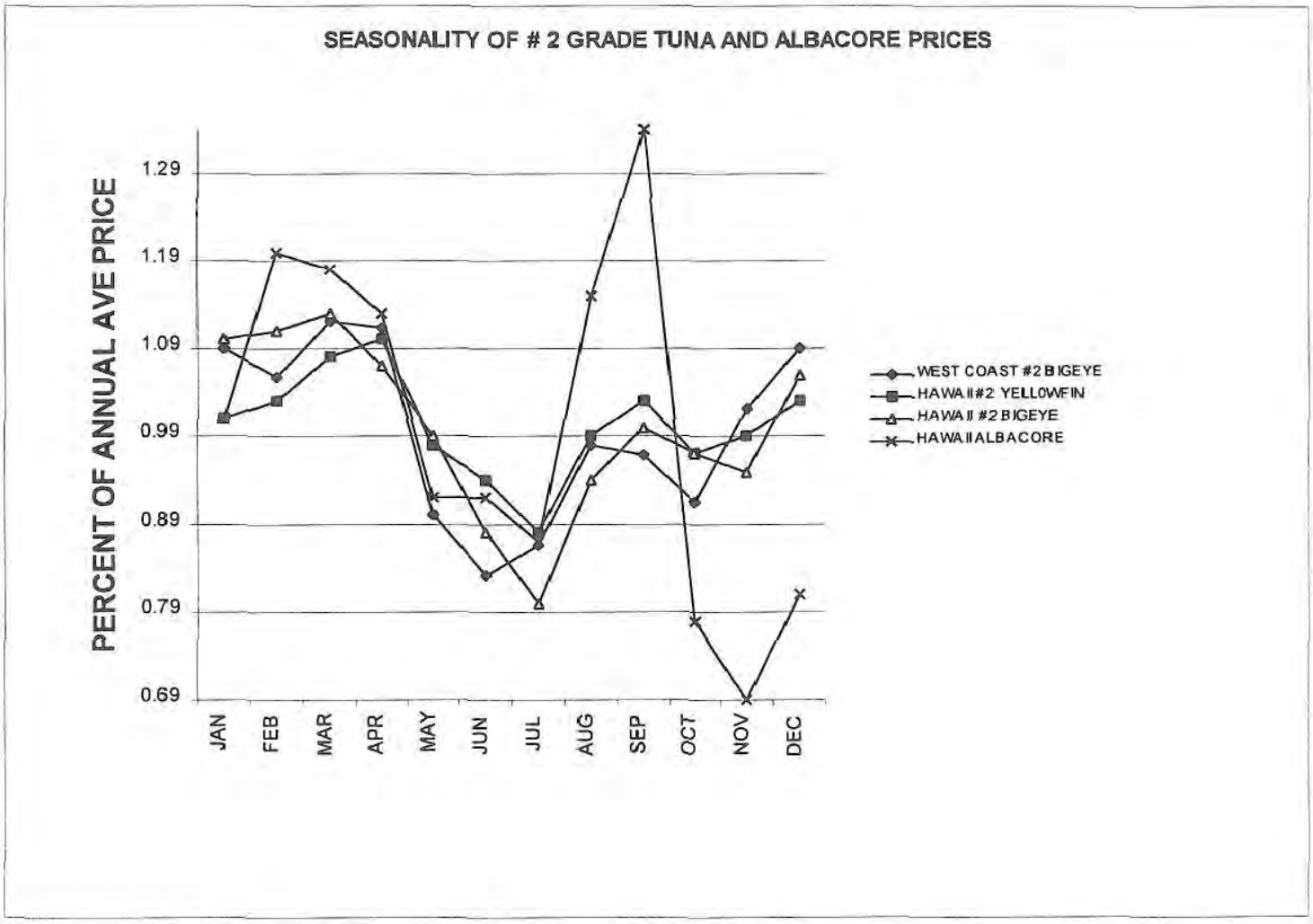
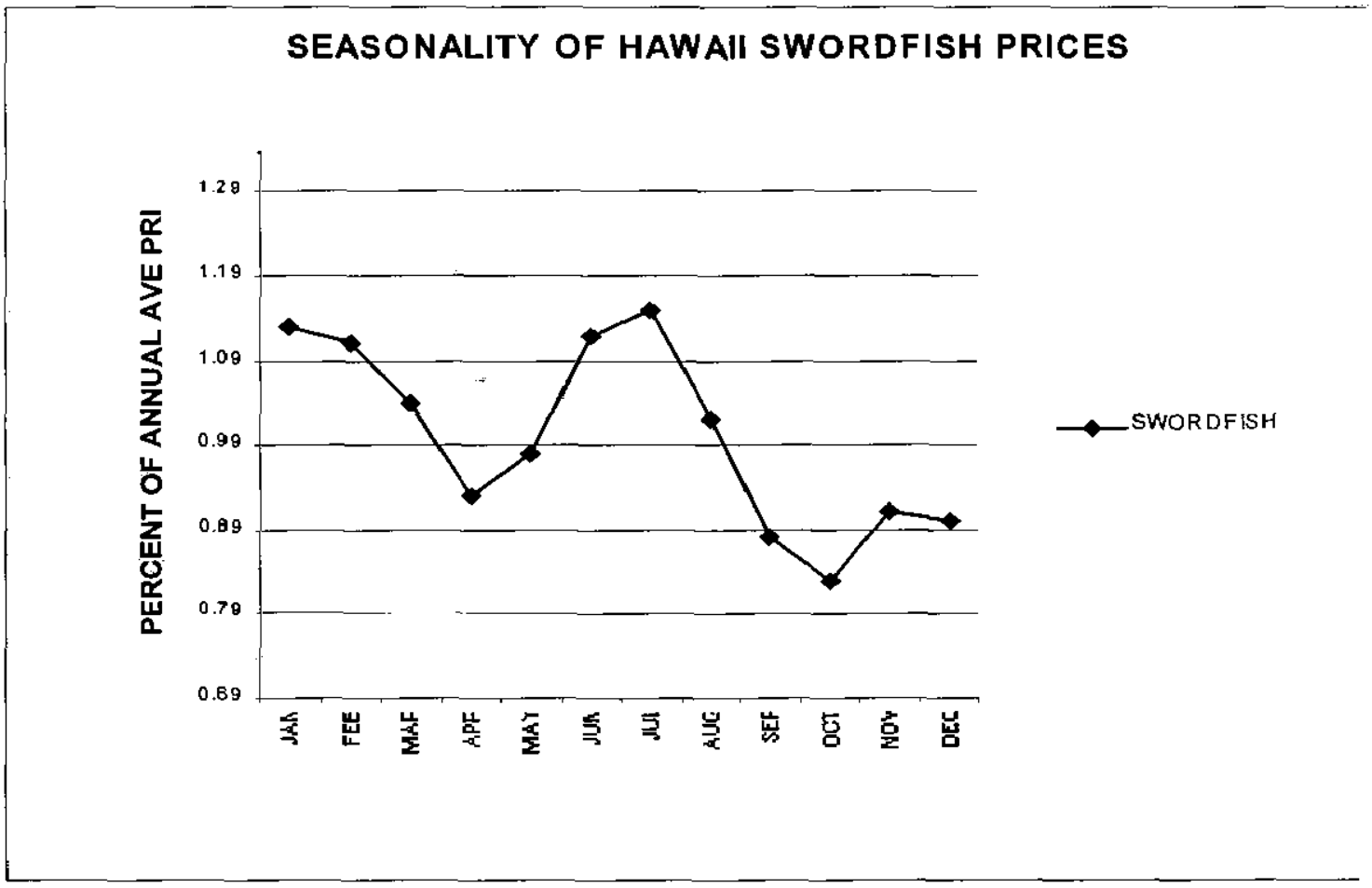

SEASONALITY OF # 2 GRADE TUNA AND ALBACORE PRICES
PERCENT OF ANNUAL AVE PRICE
1.29
1.19
1.09
0.99
0.89
0.79
0.69
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
WEST COAST #2 BIGEYE
HAWAII #2 YELLOWFIN
HAWAII #2 BIGEYE
HAWAII ALBACORE

FIGURE 5 - 3


SEASONALITY OF HAWAII SWORDFISH PRICES
PERCENT OF ANNUAL AVE PRI
1.29
1.19
1.09
0.99
0.89
0.79
0.69
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
SWORDFISH

5.4 INCIDENTAL LONGLINE SPECIES

Hawaii market prices for blue marlin and striped marlin display similar patterns of seasonal variation, as shown in Figure 5-4. Seasonal fluctuations in the prices of fresh marlin are more pronounced those of fresh tuna. Fresh marlin prices that are far above average (1.2 or more) tend to occur in the February-April period, in September and December. The early months of the year are a period of chronic shortage in the supply of tuna and associated species. September is a time of transition from the summer yellowfin tuna season to the winter bigeye tuna season. Marlin is a good substitute when there is a tuna shortage between the seasons, as well as in the month of December, when demand in tuna and tuna substitutes is highest and tuna may not be affordable for some consumer groups.

Hawaii marlin prices that are far below average (.80 or lower) tend to occur in June-July, a period when tuna production is high and marlin are perceived as secondary, lower-value fish. Another low point occurs in October, when marlin landings are highest in Hawaii and a good supply of bigeye tuna reduces marketers' interest in substitute species.

Hawaii market prices for longline mahimahi and ono fluctuate considerably throughout the year, as shown in Figure 5-5, but patterns are less distinct than for tuna, swordfish or marlin. Ono exhibits larger seasonal fluctuations in market price than any other longline species. In January-February, when landings of ono by the small-boat trolling fleet are lowest in Hawaii, the price reaches the highest levels (1.3) above the annual average. In May, when ono spawning season begins in Hawaii, catches by small-boat troll and handline fleets often reach high levels and the price falls to the lowest level (.65) below the annual average. The most stable price period is from August through December, after the peak in the small-boat trolling season for ono, when the seasonal price factor is 0.95-1.05.

Average market prices for Hawaii longline mahimahi are far more stable than for longline ono. Seasonal highs (1.15+) occur in January-February, coinciding with the period of lowest mahimahi landings by Hawaii's small-boat trolling fleet. Except for seasonal lows (.80-.85) during the October-November peak in the trolling season for mahimahi, longline mahimahi prices remain within .9 to 1.05 of the annual average the rest of the year.

West coast prices for imported South American mahimahi display a completely different seasonal pattern. Price highs (1.15+) occur from June-September and price lows (.85 and lower) occur in the January-March period. Seasonal effects are slight at other times. Seasonality in pricing coincides with fluctuations in South American production.

FIGURE 5 – 4

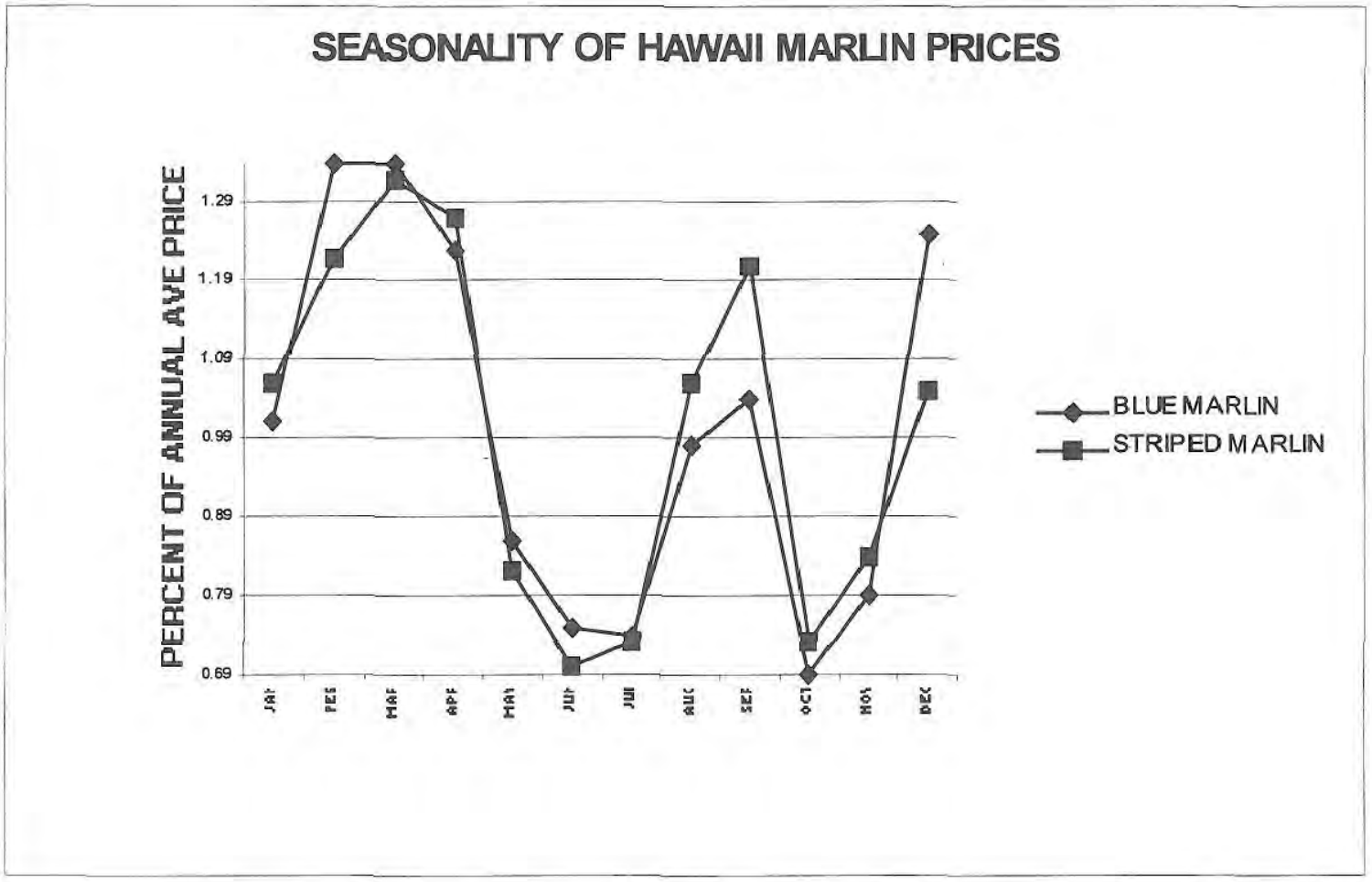
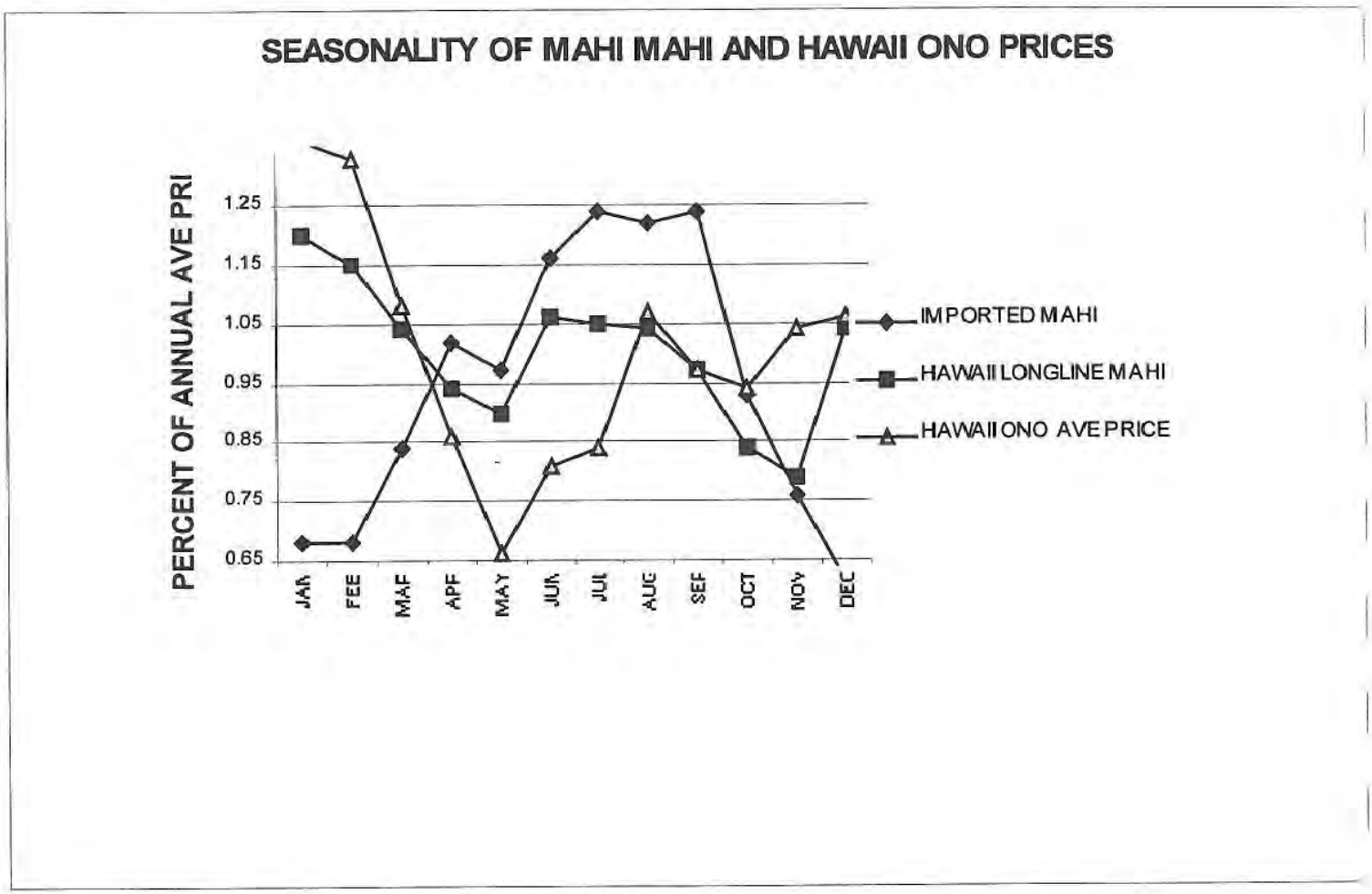

SEASONALITY OF HAWAII MARLIN PRICES
PERCENT OF ANNUAL AVE PRICE
1.29
1.19
1.09
0.99
0.89
0.79
0.69
BLUE MARLIN
STRIPED MARLIN

FIGURE 5 - 5


SEASONALITY OF MAHI MAHI AND HAWAII ONO PRICES
PERCENT OF ANNUAL AVE PRI
1.25
1.15
1.05
0.95
0.85
0.75
0.65
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
IMPORTED MAHI
HAWAII LONGLINE MAHI
HAWAII ONO AVE PRICE

6. PROJECTED DEMAND, SUPPLY AND PRICES FOR MAJOR LONGLINE SPECIES

Fresh tuna and other longline products are globally traded and they are presently available from at least 50 different countries. Any single producer or producing area represents only one of many potential sources for U.S. tuna buyers. Despite increasing tuna production from Central and South America, major seafood distributors are concerned about possible discontinuity in future supplies. Some west coast buyers believe that there is higher turnover of fresh tuna supply businesses and fewer reliable suppliers than previously.

The demand for fresh tuna and longline by-products will continue to grow slowly but steadily, as it has in the past decade. Pacific island longline fisheries could claim a larger market share but fulfilling this potential will depend on satisfying U.S. buyers preferences for fish species, sizes and grades.

Hawaii's longline fishery will continue as the principal supplier of fresh tuna and associated species for that market and will drive Hawaii market prices in the near future. Central and South American sources will continue as the major suppliers of fresh tuna and other longline products to the U.S. west coast and these imports will largely determine prices in the near future.

Currency exchange rates between exporting and importing countries can have a greater impact than market price fluctuations on the amount of revenue received by Pacific island tuna exporters. For example, depreciation of the yen against many currencies since mid-1995 has caused a decline in value of tuna exports sold in Japan. Since the exchange rate rose to 130Y:USD in late 1997, producers in Indonesia have increased exports of no. 2 tuna to the U.S.A. Some Fiji fresh tuna is also being diverted from Japan to U.S. markets. Presumably, diversions occurred because of a more favorable exchange rate between the US dollar and local currencies.

6.1 NO. 1 BIGEYE AND YELLOWFIN TUNA

Forecast: *Hawaii's economy is expected to remain stagnant in the short term but Hawaii will continue to be the best market for true no. 1 bigeye and yellowfin tuna. The average annual price for imported no. 1 tuna should be stable, between US $14-15/kg (dressed fish weight) but expect better than average prices for the December-April period than lower than average prices during the rest of the year.*

The Hawaii and west coast (especially Los Angeles) fresh tuna markets interlock in purchasing of no. 1 fresh tuna. The driving force is demand for premium tuna for *sashimi.* Even when the market for high quality tuna is weak in Hawaii, the price for no. 1 tuna will remain high in Hawaii if there is strong demand from the west coast. Because of the interlocking of Hawaii and west coast markets, there is almost always unsatisfied demand for no. 1 tuna. The fish must meet buyers' expectations for high quality to receive the expected price premium.

6.2 NO. 2 BIGEYE AND YELLOWFIN TUNA

Forecast: *The U.S. west coast should provide the best export opportunities for large no. 2 and no. 2+ yellowfin tuna (> 27 kg dressed weight) in the near future. Quality standards will continue to rise in this market, possibly causing further subdivision of the no. 2 grade of yellowfin. Exporters can expect average annual prices of US $9-10/kg (dressed fish weight) for yellowfin tuna with clear, red muscle. Prices are sensitive to supply. Seasonal fluctuations or large-scale diversion of Indonesian (or other) no. 2 tuna away from Japan to U.S. markets will drive the average price US $3-4/kg higher or lower than the annual average.*

Hawaii will remain a better market than the continental U.S.A. for smaller no. 2 yellowfin tuna (< 27 kg dressed weight) and for all sizes of no. 2 bigeye tuna. Carefully coordinate the timing of exports to achieve the best possible prices because no. 2 tuna prices are extremely supply sensitive in Hawaii's weak economy. Annual average prices of US $9/kg are possible for large tuna (> 25 kg dressed fish weight) if exports satisfy quality expectations. Smaller tuna will sell for discounts of US $1-2/kg lower. Expect better prices from December-April than during the rest of the year.

West coast buying standards for no. 2 tuna are rising, so quality/price relationships will be continue to receive close scrutiny. Because of tradeoffs between quality and price, upscale restaurants which serve lightly cooked or seared tuna for fine dining will demand west coast grade no. 1 (equivalent to Hawaii grade no. 2+). Restaurants which grill tuna will request west coast no. 2 tuna (which can be satisfied by Hawaii grade "solid no. 2" fish).

The no. 2+ and no. 2 tuna market is the niche that Pacific island exporters should target. Yellowfin tuna will remain strongly preferred to bigeye in the no. 2 tuna market on the west coast. No. 2 bigeye is more acceptable in the Hawaii market. Large tuna (> 27 kg dressed) will continue to be preferred to smaller fish in all markets.

6.3 NO. 2- and NO. 3 BIGEYE AND YELLOWFIN TUNA

Forecast: *Tuna with pink muscle color (grade no. 2-) or with pale and burnt muscle (grade no. 3) are increasingly unacceptable in Hawaii and the U.S. west coast. Marketing windows open only when the supply of good tuna is extremely low. These east coast is the only fresh market remaining in the U.S.A. where low quality tuna can be sold consistently. As east coast marketers and consumers become more familiar with tuna quality, resistance to low grades will increase and fresh marketing opportunities will narrow.*

In the short term, no. 2- fresh yellowfin and bigeye tuna are unlikely to sell for more than US $5.00/kg (dressed fish weight). Grade no. 3 yellowfin have no chance for profitable fresh export because the fish would rarely sell for more than US $3.30/kg (dressed h&g fish weight).

Processing frozen loins is an alternative for tuna grades that have little value as fresh exports. The frozen loin price fluctuates within a small range and it has not exceeded US $3.85/kg landed west coast in recent years. The return is better, however, than the alternative -- selling the same fish for canning.

Some of the largest longline fishing fleets in the Indo-Pacific are sacrificing tuna quality for high-volume production. Large amounts of low-grade tuna (especially yellowfin) landed by these fleets are rejected for shipment to the Japanese *sashimi* market. The U.S. east coast is the only viable fresh market remaining for low quality tuna. When east coast buyers have an adequate supply of fresh tuna, they limit purchases of marginal tuna which enters the U.S.A. in Los Angeles.

If the yen continues to depreciate against the U.S. dollar (the trend since mid-1995), fresh exports of low no. 2 grade tuna to the U.S.A. will increase substantially, especially from Indonesia and Malaysia.

It would be prudent for Pacific island suppliers to grade fresh tuna tightly and reject low no. 2 and no. 3 tuna for fresh export. Much of the no. 3 longline tuna can be processed into frozen loins. No. 4 tuna are usually frozen for canning.

Freezing and freezer storage facilities are necessary for both cannery tuna and tuna loins. Reliable, affordable ocean shipping links to overseas buyers are also required for both product forms. Loining requires, in addition, skilled tuna butchers and processing facilities which operate under HACCP standards for seafood safety.

Some west coast buyers recognize the higher quality of a quick-frozen tuna loin with a good shelf life compared to a slow-frozen loin. The price premium that is presently available for higher quality is small, however.

6.4 FRESH ALBACORE TUNA

Forecast: *The Hawaii market and U.S. east coast are often better choices for fresh albacore export than the U.S. west coast. The average price in Hawaii is about US $5/kg (dressed fish weight), but the market is extremely sensitive to fish supply, so exporters need to be cautious any time the Hawaii longline fishery is landing albacore tuna. If Hawaii is oversupplied, fresh albacore can be exported to the west coast where it generally will sell for US $4-5/kg (dressed fish weight).*

Albacore tuna is gaining recognition in Hawaii as a substitute for yellowfin for certain preparations, especially *poke* (raw cubed fish mixed with relishes). Hawaii and the U.S. east coast are higher-priced markets for albacore than the U.S. west coast but Hawaii is easily oversupplied and price volatility is high. The best opportunity for fresh albacore export to the Hawaii market is in the northern hemisphere winter season, when the price is higher than average. Much of the fresh albacore supplied to east coast buyers is transshipped or re-exported from Hawaii, so prices in the two markets are often linked.

Red-muscled albacore is differentiated from pink albacore and the former receives a price premium of about US $0.50/kg, except when the market is flooded with yellowfin or bigeye. As albacore enters market niches that were traditionally dominated by yellowfin and bigeye tuna, albacore grades will be further differentiated according to subdivisions of quality.

Albacore is best known to U.S. consumers as the premium canned tuna species ("white meat"), but in the *sashimi* and grilled tuna markets, it ranks behind other species in buyers' preference. This situation could change with greater exposure to the fresh product. Exclusive designation as the only "white meat" tuna might be a selling point for fresh albacore. The relatively low price of fresh albacore tuna in relationship to its quality provides marketers and consumers with excellent value.

Retail demand will continue to grow with greater promotion and consumer education. One San Francisco distributor predicts that west coast retailing of affordable pelagic fish will develop to east coast levels. Fresh albacore is the ideal retail tuna because its shelf life as loin is much longer than that of fresh yellowfin tuna, which discolors rapidly. If the rate of growth in the retail sector does not outpace the supply of fish, price increases are expected to be minimal.

Pacific island longline fisheries will remain as the principal suppliers to the west coast. Exporters with access to cannery buyers often prefer to receive the U.S. canning price for frozen albacore rather than risking fresh export. If cannery prices fall, however, the fresh market may become more attractive.

6.5 INCIDENTAL NON-TUNA SPECIES

Forecast: *Hawaii will continue to offer the best export market for incidental, non-tuna longline species because fish prices are generally about US $1/kg higher than for the same species on the west coast. Hawaii is extremely sensitive to fish supply, however, so exporters need to be cautious any time the Hawaii longline fishery is producing substantial by-catches of any species. If Hawaii is oversupplied, incidental species can be exported to the west coast. Fresh mahimahi, escolar and swordfish can be profitably exported when windows of above average price open in the west coast market. Otherwise, incidental species rarely sell for more than US $5/kg (dressed fish weight).*

The value of incidental longline species is higher in Hawaii than on the west coast but the Hawaii market is very sensitive to supply and there is high price volatility. Exporters should communicate closely with Hawaii buyers to avoid shipping incidental species into an oversupplied market.

In west coast markets, the dichotomy between high-quality tuna and affordable pelagic fish is predicted to widen. Fresh albacore will satisfy some of the demand for affordable quality. The role of longline incidental species will become more important as prices for good-quality yellowfin and bigeye tuna rise too high for the average retail consumer. Marlin species, which have the best potential as tuna substitutes, cannot be sold in the State of California, however, and their status as protected gamefish is unlikely to change.

Pacific island fresh mahimahi exports can be competitive on the west coast seasonally, usually in the spring and early summer (northern hemisphere), when spot market prices reach highs of US $8.25-10.70/kg (dressed, bullet-cut fish weight). Pacific fresh exports cannot compete during low market cycles when low spot prices drop to US $3.20-4.50/kg (dressed, bullet-cut fish weight)

The U.S. Food and Drug Administration (FDA) rejects imported broadbill swordfish containing more than 1.0 ppm of methyl mercury. Every "lot" of imported swordfish has to test under 1.0 ppm before FDA will release it for sale in the U.S.A. To avoid delays associated with testing and release procedures, swordfish exporters can obtain a "green card" that relieves them from testing of every shipment after they have made 5 shipments which test below the critical limit (1 ppm). The qualifying process is costly and time consuming. Each test costs US $350. Swordfish damaged by sampling cannot be sold and the cost of air freight and fish in the first 5 shipments can be lost.

Few exporters find this process cost-effective unless swordfish is their principal export. Longline fishing for tuna produces small quantities of swordfish as an incidental catch. The cost of obtaining the "green card" is too high for Pacific island exporters who might wish to include one or two swordfish with each fresh tuna shipment. FDA is reevaluating the critical limit of 1.0 ppm methyl mercury and is expected to announce a revision in the near future. Most industry sources expect the limit to be raised to 1.5 ppm or perhaps higher.

7. MARKET ENTRY STRATEGIES

Fresh tuna markets in Hawaii and the continental U.S.A. are supplied by many sources, including Pacific island countries. Export to these markets can be profitable but it involves considerable risk and expense. Success requires skillful management and coordination of all facets of the tuna business.

Reliable air transportation links to overseas destinations are a prerequisite for fresh fish export of any kind. If air freight is not a deterrent, an export strategy can be formulated. It should begin with a good understanding of U.S. buyers' expectations for fresh tuna imports. Satisfying these expectations will require proper handling, processing and grading of the catch to meet marketers' requirements for product quality and shelf life. Once grading standards are established and implemented, the most important factor is developing good relationships and close communication with overseas buyers.

Pacific island tuna marketers should be guided by the following principles:

7.1 Sell All Species and Grades of Fish

It is unrealistic for longline fishing and seafood export to develop with the assumption that all of the catch will be tuna or that all of the tuna will be of premium quality. Market prices vary for different species, sizes and grades of tuna and non-tuna. A broad marketing strategy is needed to market all grades and sizes of fish, including those which do not meet quality or size requirements for fresh export.

Depending on the specific area and season of longline fishing, incidental non-tuna, such as marlin, wahoo, mahimahi, and other species, may comprise a significant percentage of the total catch. Seasonal and spot marketing opportunities for incidental longline species should not be overlooked. The extra income from marketing non-tuna pelagic fish can make the difference between profit and loss.

7.2 Consider Less Risky Marketing Options

Exporting fish to overseas markets is justifiable only if the net economic return to exporters and fishermen is greater than the return from marketing the same catch locally. Before incurring the higher risks and costs of exporting, seafood marketers should thoroughly examine domestic sales opportunities, as well as potential markets in nearby islands, where there may be population centers or tourist destinations.

7.3 Evaluate Cost and Feasibility of Air Freight

Air freight represents a large portion of the cost of overseas marketing. Ultimately, the feasibility of exporting fresh tuna depends on commercial airline routes, levels of service, schedules and freight rates. Marketing practices should be able to adapt rapidly to changes in particular routes or freight rates. Long-distance tuna export is inadvisable if the cost of air freight to the market destination is more than 50% of expected market price.

7.4 Careful Grading

The suitability of tuna for fresh export is determined by "grading" each fish. Accurate grading is essential to separate tuna with export potential from fish of lesser value and to meet the expectations of overseas fish buyers. The grader determines the best destination for each fish based on good market communication about expected prices for particular species, sizes and quality levels. Even if fish have the desired characteristics at the time of grading, a determination should be made of their remaining shelf life. If fresh tuna is exported at the end of its usable shelf life, the fish can easily lose one-half to a full grade of value while in transit to overseas markets.

U.S. tuna buyers continue to raise their buying standards. Only no. 1 and no. 2 grades can be exported to Hawaii or the west coast with confidence. When U.S. markets are weak, caution should be exercised in shipping even good quality tuna.

Grading criteria may be more or less rigorously imposed, depending on the skill of the grader and on market conditions. Tuna grading in Hawaii and U.S. west coast markets is supply sensitive. Buying standards are more relaxed when tuna supplies are low and are more stringent when supplies are large. When low supply and strong demand combine, inferior quality tuna that would normally be rejected may be profitable to export. The marketing windows for this product are narrowing, in part because of buyers' concerns about the possibility of histamine formation in low quality tuna.

Lack of grading skill can cause economic losses in two ways. If tuna are graded lower than their actual quality, the exporter loses the premium that could have been received for higher quality. The second possibility is if low quality tuna are sold, either intentionally or mistakenly, to customers expecting higher quality fish. This scenario, which is all too common for Pacific island exports, not only results in claims for credits or outright rejection of fish by the buyer, but also reduces the buyer's confidence and the seller's credibility as a reliable supplier. When grading errors are discovered after tuna have reached overseas markets, the sales price may not cover the cost of transportation and marketing.

Tuna grading skills develop with years of experience and only the most rudimentary level of grading can be taught through short-term training exercises. Pacific island tuna exporters could accelerate the learning process by sending key personnel to Japan or Hawaii tuna markets. Grading skills could be improved in a few weeks through exposure to thousands of fresh tuna. Training organized around individual supplier-buyer relationships would be more effective than government sponsorship although government support of travel expenses would be appropriate in some cases. Some U.S. buyers would be willing to subsidize room and living expenses for trainees because their apprenticeships would reduce the export of low quality fish that are unprofitable for both sellers and buyers.

7.5 Select Overseas Buyers Carefully

Pacific island tuna exporters should closely investigate the credentials and reputations of prospective overseas tuna buyers. References should be requested and checked before commencing business relationships. A good buyer will have a good reputation in the industry. Buyer(s) should provide ready access to detailed market price and sales information for each shipment and forecast market conditions for planning future shipments. There should be rapid feedback on product quality and financial settlements for each shipment.

Many fresh tuna exporters are small businessmen with limited working capital. Their marketing decisions may be greatly influenced by the lure of fast payment or pre-payment. Rapid remittance (6 days or faster) is one of the attractions of the Japan tuna market but in the U.S. seafood industry, c.o.d. payment or pre-payment for fresh fish is very unusual and may actually raise suspicions about the motives of the buyer. Seven-day payment terms are possible from some U.S. buyers and in some situations. Terms of remittance available from the majority of buyers range from 14 business days to 30 days.

Fresh tuna and other longline fish products are usually exported to Hawaii and the U.S. west coast on consignment for sale by auction or negotiation. In consignment sales, the price is not pre-determined but is based on competitive bidding or negotiation for the product. Although risky, consignment sales often achieve the highest economic returns for exporters. It is often possible for exporters to obtain baseline price commitments from buyers for delivery of specified grades of tuna. Many buyers will add price premiums if tuna quality is better than expected or if there is an unexpected rise in the market strengthens. Conversely, if tuna quality is lower than specified or if the overall market weakens, buyers will discount prices from the pre-arranged baseline.

There are three general choices of buyers for export to Hawaii or the U.S. west coast:

a) Ship fish to one or more tuna specialist importers/brokers on consignment or at a loosely-negotiated prices. Prices are linked to expected fish grades or are set at a base level, with the possibility of price premiums for fish that are better quality than expected or when the overall market strengthens. Fish exported in this manner are re-distributed and sometimes re-exported based on the experience and judgement of buyers who specialize in the fresh tuna market.

b) Ship fish to the Honolulu fish auction for sale through competitive bidding. Prices are based on spot market purchasing by fish companies which buy at the auction.

c) Ship fish to one or more major wholesalers who process a wide variety of marine products for end users, mostly restaurants and retailers. Prices are based on wholesale level sales to a highly diversified customer list.

Marketing roles are not always so clearly distinguished. Some importers also function as wholesalers and some wholesalers also function as retailers of fresh tuna and associated products.

Option b) can be a good seasonal choice, especially in the northern hemisphere winter when there may be periods of low domestic tuna production in Hawaii. The Hawaii spot market is extremely sensitive to tuna supply and price volatility is high. The price of fresh tuna fluctuates widely with fish quality, supply and demand. Imported tuna may sell at discounts because of the buyers' unfamiliarity with and suspicion of new suppliers.

Option c) can be a good choice if wholesalers are conscientious about channeling tuna of different grades to the best possible market niches and if they are able to resolve problems that arise with fish that are not of the expected quality and when credits are requested by secondary buyers.

Option a) is often the best choice on a year-round basis because distributors can generally blend imported tuna into normal sales activity without having to discount prices or expose the product directly to the volatile spot market. Distributors provide a higher level of service than wholesalers, who handle a wide variety of marine products.

The cost of air freight is usually too high for Pacific island exporters to directly ship small quantities of fresh tuna to diverse customers. The most cost-effective method for small suppliers to gain access to the broadest customer base is by consignment to a tuna distribution specialist in Hawaii or the U.S. west coast. A

distributor can split a minimum shipment (one MT) of fresh tuna by species, sizes and grades among numerous secondary buyers. Hawaii and west coast tuna importers compete by offering exporters high standards of service and rapid terms of payment.

7.6 Be a Reliable Supplier and Good Communicator

Specialized tuna distributors have commitments to supply steady customers with regular amounts of fish. To obtain a steady supply, tuna distributors purchase from the spot market as well as directly from fishing fleets and exporters. Long-term relationships between exporters and distributors can be mutually advantageous. The importer can blend imports into normal sales activity and the exporter, by contributing to a more stable business climate for the importer, can expect fair treatment.

It is helpful in such a relationship for the supplier to offer fresh tuna on a regular basis. Through steady business, the distributor can familiarize his customers with particular tuna sources and suppliers so that they are encouraged to pre-order. Discontinuities in supply inhibit this process, so buyers are more wary of buying when tuna from unfamiliar suppliers and sources is offered.

Good communication skills will further the supplier-buyer relationship and help to avoid costly errors. Close communication with buyers is essential to forecast market trends. Before shipping, it is essential to determine if the expected prices justify export. Shipments should be scheduled to arrive so tuna can clear U.S. Customs and be marketed quickly. Customs clearance and marketing is delayed when fish are received just before the weekend or U.S. holidays.

7.7 Control Temperature of Exported Tuna

Fresh tuna and associated fish species should never be graded or packed for export unless core temperatures are close to 0°C (32°F). In warm tuna, readings of muscle color are subject to misinterpretation.

U.S. seafood buyers generally reject tuna imports if they are received with core temperatures exceeding 7.2°C (45°F). Certain importers may impose even stricter temperature standards because of the new U.S. government food safety (HACCP) system, which will apply to U.S. and foreign seafood processors. When tuna exports arrive at U.S. market destinations with internal temperatures above (4.4°C, 40°F), the quality and even safety of the product may be questioned.

Much of the fresh tuna shipped from Pacific islands is not adequately packed to keep fish from arriving overseas with internal temperatures above the critical limit. Packing should protect product temperature for a minimum of 48 hours in

transit. In many cases, this will require the use of aluminum foil-backed bubble insulation that is one-half inch thick and a frozen gel-to-fish weight ratio of 1:7. These standards are essential whenever fish shipments transfer aircraft or have to be transshipped to reach overseas markets.

7.8 Meet HACCP Requirements

One of the more common seafood illnesses is caused by the formation of a natural toxin (histamine) in tuna and tuna-like (scombroid) fish species as a result of decomposition caused by temperature abuse in handling. The need for temperature controls for seafood quality is not a new concern but the recently implemented HACCP (Hazard Analysis and Critical Control Point) safety system for U.S. seafood processors and foreign processors exporting to the U.S.A. will greatly increase scrutiny of domestic and imported tuna. The new HACCP regulations, administered by the U.S. Food and Drug Administration (FDA), call for monitoring and record keeping to ensure compliance with critical limits for food safety. These limits include specific time/temperature controls for tuna and other scombroid fish in which histamines can form at high temperatures.

Pacific island tuna exporters can meet HACCP standards if they:

--Prepare a HACCP plan to control tuna temperatures from the time of capture, through shoreside processing and packing, until fresh exports are received in overseas market destinations. Many Pacific island tuna exporters will need to improve fish handling and packaging systems before fish temperature control is satisfactory.

--Keep records of fish temperatures at critical control points and write "corrective action reports" whenever fish temperatures go above critical limits.

--Establish good manufacturing practices and sanitation procedures for shoreside processing activities and keep daily records of compliance.

--Guarantee in writing that product specifications established by U.S. buyers are being met.

--Furnish U.S. buyers with copies of the HACCP plan and be prepared to furnish, upon request, monitoring records of proper fish temperature control and sanitation.

--Arrange with U.S. buyers a method to verify that exported tuna is processed in accordance with the written HACCP plan and product specifications.

The FDA considers CO as-treated tuna an adulterated product and has advised an inquirer that CO gas treatment of tuna to enhance its color is a clear violation

of the Food, Drug and Cosmetic Act. Tuna exposed to CO as a residue of wood smoke may be acceptable to FDA, although there has been no final decision (NFI, 1997).

To satisfy HACCP regulations, tuna exposed to CO as an emission of wood smoke would need to be processed under controls which prevent the formation of dangerous levels of histamine. The critical seafood safety issue for this product, which is marketed as "lightly smoked" tuna, is that it retains its unnaturally red pigmentation for weeks after thawing, disguising decomposition and a potential histamine hazard. Marketers and consumers would be aware of decomposition in untreated raw tuna because it discolors rapidly. To safeguard the public from the potential hazard, a HACCP plan for lightly smoked tuna would have to have more "critical control points" than a plan for untreated tuna products. Labeling of CO-treated tuna would be a particularly critical control. If all packages of lightly smoked tuna were labeled "use or discard 7 days after thawing," there would be much less risk that aged product could disguise decomposition and potentially dangerous levels of histamine.

7.9 Process and Freeze Loins From Low Grade Tuna

Tuna lower than no. 2 grade has diminishing value as a fresh product. Intentional or unintentional export of low quality fish is inadvisable because the return will not usually cover the cost of marketing. A separate export plan is needed, therefore, for low grades of tuna.

There are presently no high-value markets for no. 3 grade longline tuna. The best alternative is to process loins and quick freeze them, accumulating quantities (15+ MT) that can be shipped by ocean container to fish steaking companies on the U.S. west coast.

The market ceiling for frozen yellowfin tuna loins is relatively low (US $3.85/kg landed west coast). A small price premium is available for loins that are vacuum packaged before freezing to protect against oxidation. It is far less risky to market frozen loins than to attempt to export fresh loins, which have an extremely limited shelf life.

Tuna loining, although labor intensive, does not require an elaborate or costly processing facility. The basic requirement is for a processing area that is enclosed from the open air (preferably air conditioned) and is easy to clean. On the other hand, quick freezing and storing an inventory of frozen product until an ocean container quantity is accumulated involves a large capital investment in freezing facilities and high operating costs for electric power.

8. LOGISTICAL PROCEDURES

Proper handling from the time of capture through distribution and marketing is essential to prolong the shelf life of fresh tuna and to prevent rapid change in their original levels of quality. Special procedures for proper shipboard handling are detailed elsewhere (Bartram 1996; Nakamura, et al., 1988; Williams, 1986). This section discusses other procedures that are critical to the success of fresh tuna export.

8.1 Skillful Grading

Evaluation of tuna muscle quality is highly subjective because the critical characteristics (texture, color, quality, fat content) vary along continuous scales. The grader only has access to a small section of muscle on which to base an assessment of a whole tuna.

Grading is accomplished by visual examination of a small sample of tuna muscle. There are several methods of sampling: (1) cutting a notch near the tail of a tuna to reveal underlying muscle; (2) removing a wedge of muscle near the tail of a tuna; or (3) using a tool to remove a small core of deep muscle tissue. To avoid false readings, samples of muscle near the tail and from the center of the fish are sometimes compared.

For the most discriminating *sashimi* buyers, the fat content of fresh tuna is paramount. For most other U.S. fresh tuna market niches, however, muscle color is the most heavily weighed grading criteria but it is not the only one. Muscle clarity (transparency), firmness and a perception of "freshness" and remaining shelf life are other critical factors. In addition to grading tuna muscle, experienced tuna graders look for evidence that fish were landed alive and were given the individual care needed to prolong shelf life.

8.2 Monitoring Fish Temperatures In Transit

Battery-powered data loggers can be used to obtain a continuous history of time and temperature from the time of packing (or even earlier) to arrival in overseas markets. Thermal histories recorded during transport can verify whether packaging and transport conditions provide adequate refrigeration in transit. Temperature spikes can be pinpointed and corrective actions taken.

8.3 Packaging

Fresh tuna should be properly packed for export. Ambient temperature of the packing area regulates the initial temperature of the shipping carton environment. A warm initial temperature accelerates thawing of gel ice and reduces its effectiveness as a refrigerant while the shipment is in route to overseas markets. An air conditioned or refrigerated environment will lower the initial air temperature and prolong a cold environment inside the shipping cartons.

Packaging has four components. The inner component is the fish itself surrounded by adequate frozen gel packs (gel-to-fish weight ratio of 1:10 for direct shipments, but 1:7 for airplane transfers) to shield product from heat transfer while in transit. The chilled product is surrounded by a layer of thermal barrier material or styrofoam with adequate insulating properties. The insulated fish package is shipped in a double-corrugated, wax-impregnated carton, with a 3-mm polyliner to prevent leakage. The polyliner should be taped closed and the seams of shipping cartons should be taped to retard heat transfer into the box.

Many airlines require that perishable, time-sensitive products, such as fresh tuna, be shipped suitably packaged to survive for 48 hours at ambient air cargo conditions. Fresh fish shipments from Pacific islands often have to endure 72 hours in transit before they are received and re-iced by buyers.

Shipments which change aircraft or are transferred between airlines should be protected using one-half inch thick aluminum foil-backed bubble insulation ("space blanket") or one-piece styrofoam coffins which have much better insulating properties than pre-cut styrofoam inserts. The "space blanket" material takes up less space and allows for larger payloads of fish. This material is sold in rolls, which can be cut to fit specific packaging needs.

With prohibitions on the use of wet ice and limitations on the availability and amount of dry ice (due to carbon dioxide gas emission), gel packs are the best choice of refrigerant to pack with fresh fish exports. It is prohibitively expensive to ship pre-manufactured gel bags to Pacific islands. Gel bags can be hand made using bulk-purchased plastic bags, a powder-based gel chemical and a simple sealing machine.

Gel is also available in lightweight strips that can be hydrated in water and then frozen into blankets of gel ice. The frozen strips thaw too quickly to be effective for shipping fish long distance and they are not recommended for Pacific island fish exports.

For the majority of Pacific island countries, all packing materials have to be imported. To reduce cost, these supplies are shipped by ocean freight. It is common for ocean freight to arrive months after goods have been ordered. Therefore, ordering should be done well ahead of actual need.

8.4 Air Freight

The absence of regularly scheduled airline service and air freight capacity in some island areas is a major constraint to the export of Pacific island longline fishery products to Hawaii and the U.S. west coast.

Japan-flag and Taiwan-flag longline fleets often use feeder aircraft to facilitate fresh tuna transshipment to Japan from Indo-Pacific source areas that have limited or unreliable scheduled airline service. Aircraft (usually 727 or 737 jets) are either leased or chartered for this purpose by the fishing fleets themselves or by transshipment agents. The feeder planes transfer their fish cargoes, usually in Guam or Saipan (Northern Mariana Islands), to commercial airlines bound for Japan.

Owning or leasing aircraft to transfer fresh tuna has not proven economically feasible for fishing and transshipment companies that have attempted it. This is probably due to underutilization relative to the high fixed costs of owning the airplane. Several fishing fleets operating in the western Pacific are taking advantage of charter service available from the National Fisheries Corporation (NFC) of FSM. Two NFC 727 jets can be chartered based on a fixed price for a trip or based on a per kg rate with a minimum payload of fish.

Depending on payloads, distance and factors affecting aircraft weight and take-off (especially landing strip length), the cost of chartering ranges from US $1.00-2.00/kg of tuna transferred. In addition to removing the burden of operating and air freighter from fishing companies themselves, the NFC operation provides a specialized service dedicated to the needs of the regional fresh fish export industry.

The charter option is not realistic for fresh tuna exported to Hawaii (or onward) because the minimum payload for a single charter to operate economically is 15 MT. Only the Japan market is large enough to absorb high volumes of tuna without a detrimental effect on price. Existing distributions systems in Hawaii and the west coast would be overloaded by the arrival of 15 MT of fresh tuna in a single shipment.

Fresh exports to Hawaii and the west coast are typically at a level of one or sometimes two LD-3 containers per shipment, each LD-3 containing about 1,000 kg of fresh tuna. These exports rely entirely on scheduled airline routes and levels of service. When airport transfers of fresh tuna are necessary, exporters should employ freight forwarders. A forwarder can prepare onward documentation, handle in-transit cargo under bond, pre-alert the consignee and fax documents for destination clearance, pay any fees associated with transshipment, arrange chill storage for fish in transit and transport fish to transshipping airline.

8.5 Shipping Documentation

Fresh fish exports from the Pacific islands have to be cleared by the U.S. Customs and the U.S. Food and Drug Administration (FDA) before they can be released to importers in Hawaii or the west coast. To avoid delays in customs and FDA clearance, complete and correct documentation should accompany each fish shipment to the U.S.A and copies should also be faxed ahead to the importer.

The following documentation is required:

Air waybill—contract between shipper and air carrier

Pro forma invoice – value of shipment; used for customs and statistical purposes, by either or both exporting and importing country

Packing list – number of shipping cartons and their individual contents (number, species, sizes, grades of tuna)

HACCP documentation

Customs clearance specialists are employed to speed the process. The importer is responsible for product care and handling from the time a fresh tuna shipment lands in the U.S.A until the fish are sold.

8.6 Terms and Methods of Payment

In Hawaii and the continental U.S.A., most overseas seafood business is done on open account terms. Payment is usually made by wire transfer on agreed terms, which range from as quickly as 7 days to as long as one month after a fish shipment is received.

An alternative method of trade is through letter of credit (LC). LC is more common in frozen fish transactions which involve ocean container quantities (15+ MT) of product. LC requirements for small-volume, fresh fish transactions would disadvantage Pacific island exporters because U.S. buyers would be forced to tie up money that could otherwise be used as working capital.

Many seafood suppliers in the U.S.A. reduce the risk of exporting by purchasing export credit insurance, which insures overseas accounts receivable. It would be highly beneficial if this form of insurance were available to Pacific island tuna exporters.

9. ASSESS LIKELY RETURNS TO PACIFIC ISLAND TUNA EXPORTERS

9.1 Fresh Tuna Export Decision Spreadsheet

Fresh tuna marketing decisions should have a rational basis. Pacific island tuna suppliers need to be better informed about their export choices. This section provides a tool to clarify export choices for Pacific island fresh tuna.

Table 9-1 provides a spreadsheet that allows comparison of Hawaii and Los Angeles fresh tuna markets with Japan. By entering air freight costs and packaging costs for their particular locations and actual or simulated market prices, Pacific island suppliers can customize the spreadsheet to obtain projections of net return for different grades of fresh tuna.

To use Table 9-1, a supplier must obtain projections of landed price (1) for the estimated time of arrival in Hawaii or Los Angeles. Prices offered by U.S. buyers are for particular grades of fresh tuna. Unless tuna are graded carefully enough to satisfy buyers' preferences, the matrix will be of little predictive value. It is critical for exporters acquire grading expertise, especially knowledge of how to subdivide the no. 2 grade according to prevailing standards in Hawaii and Los Angeles. The Hawaii standard grades differ somewhat from the grading terminology used in Los Angeles. A Hawaii no. 2+ yellowfin or bigeye tuna is usually equivalent to a Los Angeles no. 1-. A Hawaii solid no. 2 yellowfin is usually equivalent to a Los Angeles no. 2+ tuna, and so forth.

The distribution of tuna grades from Pacific island longline fisheries is typically:

Hawaii Grade	% of Catch
No. 1	5 - 10%
No. 2+	10 - 15%
No. 2	25 - 40%
No. 2-	20 - 25%
No. 3	15 - 30%
No. 4	5%

The majority of tuna available for export will usually belong to sub-divisions of the no. 2 quality grade. Decisions about export marketing destination, therefore, are most likely to be based on the expected price for no. 2 quality gradations. Exceptions to this pattern can be managed very simply. If a fishing vessel lands an unusually high percentage of no. 1 tuna, the target market should almost always be Japan, rather than the U.S.A. The fresh market prices for no. 3 and

no. 4 tuna are too low to justify export as a fresh product. There are no good alternatives for low tuna grades except to process cooking-grade loins or to freeze fish for sale to canners.

Packaging costs (2) vary, depending on whether fish cargo can be directly shipped to market or has to be transferred. Transfers involve airport layovers and possible misconnections; hence, shipping cartons must be lined with a heavier grade of insulation and additional gel ice than direct shipments.

Air freight rates (7) are entered from Table 9-1a for the appropriate shipping scenario: direct shipments or transfers with through rates (3), with added costs for certain transshipment routes (4). Routings with limited service or airplane cargo capacity are italicized. The air freight information is current as of October 1997. Airline schedules, level of service and cargo rates change frequently, however, so this portion of the matrix will require continual updating. To derive the freight cost per kg of fish (7) requires an adjustment for packaging weight (6). The adjustment factor depends on whether packaging is conventional (for direct shipments) or heavy-grade (to control exposure to high temperature during cargo transfers or transshipment).

Costs incurred at the market destination include U.S. Customs clearance by a customs broker (higher in Hawaii than in L.A.), handling and distribution, and sales commission. When shipped on consignment to the Honolulu fish auction or to Hawaii or west coast importers/distributors, the standard marketing commission is 10% of the selling price. This charge can be estimated in the spreadsheet based on projections of landed market price.

Pacific island tuna exporters are interested in comparisons between U.S. Japan tuna markets. When the currency exchange rate was about 125Y=USD, west coast tuna buyers regarded 800 Y/kg as a key indicator in the Japanese fresh tuna market. When average prices fell below this level, no. 2 grade tuna was likely to be diverted away from Japan to U.S. markets. With devaluation of the yen, the U.S. market will become an attractive alternative for fresh tuna exports at a lower average price level in Japan.

Marketing reports from Japan provide high and low prices and the average price for tuna sales. A study of fresh tuna price/grade relationships found a reasonable correlation between the average price in Japanese sales reports and the no. 2 price in Hawaii (Bartram, et al., 1996). Pacific island exporters are advised to use the price for Hawaii no. 2 grade tuna as the basis for comparison with the Japan market average. In Table 9-1, a currency exchange rate of 130Y=USD is used. The Yen/USD exchange rate was rising in late 1997. An up-to-date rate should always be entered before running the spreadsheet.

To allow comparison of equivalent products, the likely net return from U.S. markets, where tuna are sold as dressed (h&g) fish, should be adjusted to the most common market form in Japan, which is head-on, gilled and gutted (g&g) fish. Tuna weight loss is about 10% from g&g to h&g. For meaningful comparison with potential net returns from U.S. markets, tuna prices in Japan should be adjusted to net returns. Pacific island exporters typically receive about 65% of the tuna selling price in Japan.

Table 9-1
Fresh Tuna Export Decision Spreadsheet

	(US $/kg dressed, h&g fish weight)					
Market Destinat.	**Hawaii**	**L.A.**	**Hawaii**	**L.A.**	**Hawaii**	**L.A.**
Tuna Grade	**2+**	**1-**	**2**	**2+**	**2-**	**2**
Landed Price (1):						
Weak Market						
Average Market						
Strong Market						
Packaging Cost (2):						
Direct Shipment	0.34	0.34	0.34	0.34	0.34	0.34
Transfer Planes	0.50	0.50	0.50	0.50	0.50	0.50
Shipped wt/fish wt						
Direct shipment (5)	1.25	1.25	1.25	1.25	1.25	1.25
Transfer/transship (6)	1.35	1.35	1.35	1.35	1.35	1.35
Enter Air Freight (7)						
(3)+(4) from Tab. 9-2						
x (5) or (6)						
Clear US Customs(8)	0.17	0.10	0.17	0.10	0.17	0.10
Handling in U.S.A. (9	0.11	0.11	0.11	0.11	0.11	0.11
Sales Comm. (10)						
(10% x 1)						
Cost of Marketing						
(11)=						
(2)+(7)+(8)+(9)+(10)						
Proj. Net Return						
(12) = (1) - (11)						
Weak Market						
Average Market						
Strong Market						
H&G/G&G Factor (13			0.9	0.9		
(12 /0.9)						
Y:USD exchange (14			130	130		
Japan equivalent (15)						
(12) / (13) x 14						

Table 9.2
Air Freight Factors for Table 9-1

	(US $/kg shipped wt.)	
Air Freight Direct (3)		
From: To:	Hawaii	L.A.
Apia, Samoa	1.14	1.44
Auckland, NZ	2.01	2.05
Belau	2.90	3.19
Cook Is.	1.70	2.90
FSM (Chu., Pohn.)	1.90	
FSM (Kos.)	1.65	
Guam	1.65	2.05
Majuro, Mars. Is.	1.25	
Nadi, Fiji	1.50	1.46
Nuku'alofa, Tonga	2.15	2.15
Saipan, NMI	2.00	2.90
Sydney, Aust.	1.81	1.91
Air Freight Transfer(3)		
From: To:		
Nuku'alofa/Nadi to:	1.70	1.46
Solomons/Nadi to:	1.35	1.62
PNG/Sydney to:	1.98	1.98
Air Frt. Transship (4)		
Add cost to (3)		
Apia - Auck.	0.83	0.83
Apia - Nadi	0.92	0.92
Nauru - Nadi	1.59	1.59
N. Cal. - Auck.	0.63	0.63
Vanu. - Auck.	0.63	0.63
Yap - Guam	1.40	1.40

9.2 Yellowfin Tuna Export Scenario

In Table 9-3, the spreadsheet is demonstrated for a hypothetical fresh tuna marketing scenario. This exercise assumes that a company based in the Solomon Islands wants to evaluate likely returns from exporting fresh yellowfin tuna to Hawaii or Los Angeles against the Japan marketing alternative. This company is assumed to have the services of a skilled grader who is able to subdivide no. 2 tuna into sub-grades suitable for U.S. buyers at the price levels projected.

Fresh tuna exported from the Solomon Islands to Hawaii or the U.S. west coast would probably be transshipped through Nadi, Fiji, so the tuna would need to be shipped with heavy-grade insulation and extra gel ice for proper fish temperature control.

The scenario in Table 9-3 suggests that, for average or strong U.S. market and at an exchange rate of 130Y=USD, it could be worthwhile to export no .2 fresh yellowfin tuna the U.S.A. when the average price in Japan is below 1,200 Y/kg (which is frequent). For the example given, the Hawaii market would provide a marginally return than the Los Angeles market.

To realize the expected returns in U.S. markets, however, the need for careful and highly accurate tuna grading cannot be overemphasized. The grades of fresh tuna shipped to Hawaii or Los Angeles must meet buyers' quality expectations or net returns will be far lower than estimated. The net returns projected in this exercise are unlikely to be realized until the necessary grading expertise has not been developed in the Pacific islands.

Similar exercises could be conducted, incorporating actual price projections or simulated prices, for any Pacific island area that is already exporting or has ambitions to export fresh tuna to the U.S.A.

Table 9-3
Application of Export Decision Spreadsheet:
Fresh Yellowfin Tuna Scenario

	(US $/kg dressed, h&g fish weight)					
Market Destinat.	**Hawaii**	**L.A.**	**Hawaii**	**L.A.**	**Hawaii**	**L.A.**
Tuna Grade	**2+**	**1-**	**2**	**2+**	**2-**	**2**
Landed Price (1):						
Weak Market	9.45	9.45	7.30	7.30	5.25	5.25
Average Market	13.50	13.50	9.20	9.20	6.60	6.60
Strong Market	16.20	16.20	10.40	10.40	7.45	7.45
Packaging Cost (2):						
Transfer Planes	0.50	0.50	0.50	0.50	0.50	0.50
Air Freight Transfer(3)						
From/to:						
Solomons/Nadi to:	1.35	1.62	1.35	1.62	1.35	1.62
Shipped wt/fish wt						
Transfer/transship (6)	1.35	1.35	1.35	1.35	1.35	1.35
Air freight/kg fish (7)	1.82	2.19	1.82	2.19	1.82	2.19
Clear US Customs(8)	0.17	0.10	0.17	0.10	0.17	0.10
Handling in U.S.A. (9)	0.11	0.11	0.11	0.11	0.11	0.11
Sales Comm. (10)						
Weak Market	0.95	0.95	0.73	0.73	0.53	0.53
Average Market	1.35	1.35	0.92	0.92	0.66	0.66
Strong Market	1.62	1.62	1.04	1.04	0.75	0.75
Cost of Marketing (11)= (2)+(7)+(8)+(9)+(10)						
Weak Market	3.55	3.85	3.33	3.63	3.13	3.43
Average Market	3.95	4.25	3.52	3.82	3.26	3.56
Strong Market	4.22	4.52	3.64	3.94	3.35	3.65
Proj. Net Return (1)-(11)						
Weak Market	5.90	5.60	3.97	3.67	2.12	1.82
Average Market	9.55	9.25	5.68	5.38	3.34	3.04
Strong Market	*11.98*	*11.68*	*6.76*	*6.46*	*4.10*	*3.80*
H&G/G&G Factor	0.9	0.9	0.9	0.9	0.9	0.9
Yen/US $ exchange	130	130	130	130	130	130
Net from Japan sale	*0.65*	*0.65*	*0.65*	*0.65*	*0.65*	*0.65*
Equivalent in Japan						
Weak US Market			882	816		
Ave. US Market			*1,262*	*1,196*		
Strong US Market			1,502	1,436		

9.3 Fresh Albacore Tuna Export Scenario

The decision matrix could also be used to guide marketing decisions for albacore tuna by comparing the net returns from fresh exports versus sale to U.S. canneries. This is demonstrated in Table 9-3 for a hypothetical scenario in Samoa, where there are large albacore landings by small longline vessels. Exporters can freeze albacore and sell it to U.S. canners in American Samoa or they can ship fresh exports to Hawaii or the U.S. west coast.

Table 9-4 shows that albacore is likely to receive more than U.S. cannery price when exported to an average or strong fresh market in Hawaii. When the Hawaii market is weak or the west coast market is average or weak, the cannery price is higher than the likely return from fresh export.

Table 9-4

Application of Export Decision Matrix: Fresh Albacore Tuna Scenario

	(US $/kg dressed wt)	
Market Destinat.	**Hawaii**	**L.A.**
Landed Price (1):		
Weak Market	3.60	3.30
Average Market	4.95	4.00
Strong Market	6.05	4.95
Packaging Cost (2):		
Direct Shipment	0.34	0.34
Air Freight Direct (3)		
From/to:		
Apia, Samoa	1.14	1.44
Shipped wt/fish wt		
Transfer/transship (6)	1.25	1.25
Air freight/kg fish (7)	1.43	1.80
(3+4)/5 or 6		
Clear US Customs (8)	0.17	0.10
Handling in U.S.A. (9)	0.11	0.11
Sales Comm. (10)		
Weak Market	0.36	0.33
Average Market	0.50	0.40
Strong Market	0.61	0.50
Cost of Marketing		
(11)=		
(2)+(7)+(8)+(9)+(10)		
Weak Market	2.41	2.68
Average Market	2.55	2.75
Strong Market	2.66	2.85
Proj. Net Return		
(1)-(11)		
Weak Market	1.20	0.62
Average Market	2.41	1.25
Strong Market	3.40	2.10
Equivalent cannery		
dressed/whole wt	0.8	0.8
kg per MT	1,000	1,000
Weak fresh market	1,494	775
Ave. fresh market	3,006	1,563
Strong fresh market	4,244	2,625

10. SPECIALIZED TUNA PRODUCTS

The increasing supply of low-quality fresh tuna produced by some Indo-Pacific longline fleets has created opportunities to manufacture value-added products, such as frozen loins, smoked and dried tuna, and reconstituted, meat-analog products. These uses provide an alternative to canning for grade no. 3 tuna.

10.1 Innovative Canned Tuna Products

The U.S. canned tuna industry has not developed innovative canned tuna products, such as marketed in Europe and Asia.

10.2 Meat Analog Products

Most of the recent efforts to develop specialized tuna products in the U.S.A. have focused on meat analog foods (tuna hams, sausages and hot dogs), which try to promote tuna's resemblance to meat. Such reconstituted products may have potential but U.S. markets have not yet been fully tested or evaluated. When attempted on a small scale by processors or retailers trying to add a new line of value-added items, meat-like tuna products have generally not been successful.

Large U.S. frozen tuna steaking companies have succeeded in developing tuna burgers from process trimmings. Finding satisfactory ingredients to bind tuna burgers has posed a problem, however. Non-U.S. processors without previous experience with tuna are beginning to manufacture meat analog products, such as tuna cutlets, burgers and smoked rolls by applying surimi technology. A Canadian firm has adapted the methods of a German master sausage maker to the manufacture of salmon sausages and the process may also have potential for tuna.

10.3 Smoked and Dried Tuna

Hawaii fishermen and fishing clubs often smoke or dry some of their own catches for home consumption and parties. Many seafood retailers (and roadside vendors) smoke or dry fish in-house to diversify their line of products. Large grocers purchase smoked marlin and dried skipjack and yellowfin tuna from small-scale commercial processors. Two larger-scale fish smoking companies operated in Hawaii in the late 1980s and early 1990s but both have gone out of business.

Smoked tuna products are not widely marketed on the west coast. A few seafood restaurants and retailers prepare smoked tuna as a specialty of the house. Albacore tuna is the best raw material for such products. Seattle salmon smokers are reluctant to smoke tuna, in part because of the extra cleaning which the grills must receive after smoking skin-off products such as tuna. Production costs for smoked tuna products are at least $US 11/kg in high-wage areas. This pushes the retail price beyond the threshold for mass marketing of the product. Large grocery chains on the west coast would regularly stock a smoked tuna product if its wholesale price were less than US $11/kg. To cover the cost of production and transportation and allow a reasonable profit, smoked tuna could be sold to distributors for about US $14-15/kg. With a typical retail markup, the consumer might pay US $18-19/kg.

Consumer preference has shifted away from dry, salty and bland smoked tuna to moister, flavorful and less salty products. Satisfying current preferences requires the use of modern methods to impart strong flavors and high-technology smoke ovens to control heat and humidity. Finished products made on a small scale often lack consistency in texture and flavor. Much of the problem is caused by the use of home or restaurant smoking equipment for commercial scale processing. Furthermore, better products can often be smoked by using swordfish, moonfish and other pelagic species in place of tuna.

Hawaii retains a traditional market for tuna jerky but there is a strong preference for skipjack tuna as the raw material for this product. There is no established market in the continental U.S. for dried tuna jerky, as there is for beef jerky. Tuna jerky is often marketed in Hawaii as a bar snack or specialty gift for travelers who observe the Japanese *omiyage* tradition of returning home with gifts for family and friends.

Tuna jerky could be produced to be shelf stable, without the need for refrigeration. It could then be shipped to distant markets by ocean, rather than by air freight. It is difficult, however, to imagine a buyer who would be interested in purchasing an entire container load (15 MT of product) of tuna jerky. It might be feasible to ship smaller quantities from areas where ocean freight can be consolidated for shipment.

10.4 Carbon Monoxide-Treated Tuna

Carbon monoxide treated frozen tuna blocks, sold under the names of "saku" and "lightly smoked" tuna, have achieved notable success in penetrating the Hawaii and continental U.S. markets. Japan has banned import of any CO-treated product in which CO residue exceeds 200 micrograms/kg. The U.S. FDA also considers CO gas treatment of tuna to be a clear violation of the Food, Drug and Cosmetic Act. FDA may allow importation of tuna exposed to CO residue from wood smoke but no final decision has been announced.

10.5 Home Meal Replacement

"Home meal replacements" (HMR) are a phenomenon that is changing the U.S. prepared food market. They are fully prepared take-home entrees that can be microwaved or oven heated for rapid preparation and serving. Packaging is an important selling point and absolute convenience is critical. The recipe should simulate the restaurant experience of a relatively sophisticated and tasty meal.

The HMR market primarily consists of families in higher income brackets who want quality and convenience and are willing to pay for it. Several U.S. fish steaking companies have entered the HMR market with frozen tuna, swordfish and mahimahi fillets that have been pre-seasoned and pre-seared. Additional seasoning is included in the package to be added to the HMR before reheating and serving.

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Polynesian Airlines
Quantas Airlines
United Airlines