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**Growth and Contraction
of Domestic Fisheries:
Hawaii's Tuna Industry in the 1980s**

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INTRODUCTION

Hawaii's commercial fishing industry is undergoing a rapid transition. New tuna fisheries are developing while the old leader, the skipjack tuna (*Katsuwonus pelamis*) fishery, has declined. The skipjack industry lost its international market with the closing of the Castle and Cooke cannery in 1984; at the same time its domestic market share shrank in response to competition from other local tuna fisheries. Furthermore, availability of the skipjack tuna resource around Hawaii apparently declined and fishing costs increased, further exacerbating problems for the industry.

This paper examines events that are restructuring the fishing industry in Hawaii. Particular attention is given to the effects on the skipjack industry of (1) the closing of the tuna cannery, (2) the changed availability of skipjack around Hawaii, (3) the increasing costs of fishing for skipjack, and (4) competition from other tuna species in the Hawaii fresh-fish market. The first three sections of the paper describe recent tuna fisheries developments in Hawaii. A section on marketing tuna in Hawaii follows. The last section discusses policy issues relevant to expansion of domestic tuna production.

SKIPJACK TUNA INDUSTRY AND CANNERY OPERATIONS

For almost 70 years the skipjack tuna industry was Hawaii's major commercial fishery, supplying 68 percent of the state's annual landings (over 4,000 tonnes on long-run average), 42 percent of its annual ex-vessel revenues (\$4 million in 1986 prices), and almost 100 percent of its seafood exports.¹ In recent years annual skipjack production declined to approximately 1,300 tonnes, worth \$2.7 million. This decline in total catches is shown in Figure 1. Pole-and-line skipjack now constitutes

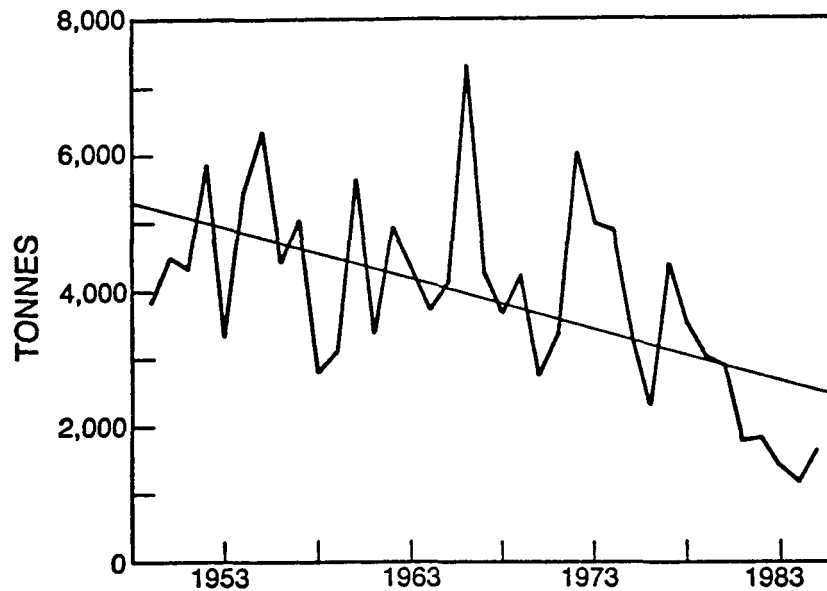


Figure 1. Skipjack tuna catch around Hawaii 1948-1983

Source: Skillman 1987.

about 22 percent of all tuna catches in Hawaii, down from a long-run average of 80 percent.

This fishery, known locally as the *aku* fishery, has existed since at least the turn of this century. Before World War II there were as many as 26 wooden-hulled vessels employing 300 fishermen using pole-and-line technology to fish with live bait for skipjack tuna. Over the years the skipjack fishermen have adopted only such minor technological advances as partial conversion to fiberglass poles. The vessels have crews of eight to ten and must forage for bait in Hawaii's harbors and bays before each trip. Today only eight vessels are actively fishing; one larger steel-hulled vessel is tied up waiting to be sold. Until 1984 the vessels sold both to the fresh market and to the tuna cannery; now they sell their catches entirely on the domestic fresh-fish market.

F. Walter Macfarland, a pineapple planter, founded Hawaii's tuna cannery, Hawaiian Tuna Packers (HTP), in 1917. He brought fishermen from Japan, built two gasoline-powered sampans, and signed five of the then-existing sailing sampans to supply the cannery with tuna. This facility packed up to 100,000 cases by 1922 (Castle and Cooke, Inc. 1977).

The existing four-line cannery building was constructed in 1932 at Kewalo Basin, the major commercial fishing harbor in Honolulu. The U.S. military took over the entire fishing fleet during World War II and converted the cannery to production of airplane gas tanks. After World War II HTP purchased about half of all skipjack catches from the re-

maining bait-boat fleet (17 vessels) and imported frozen tuna to supplement these domestic catches, processing about 72 tonnes of canned tuna per eight-hour day. HTP marketed the canned product under the Bumble Bee and Coral labels. The cannery also turned out Figaro cat food, fishmeal, and solubles used as additives for cattle and poultry feed. It was the site of the only commercial ice plant on Oahu, with a production capacity of 77 tonnes of ice per 24-hour day and a cold storage facility with a capacity of 1,760 tonnes. HTP also managed a shipyard on its Kewalo Basin premises.

The cannery changed ownership several times from 1917 onward. Castle and Cooke acquired it after World War II and owned it in one form or another until closing it down in 1984 because of corporate cash flow difficulties.² In 1985 Castle and Cooke sold the cannery, without the shipyard, to a group of Hawaii investors, the WRAF Corporation, who intend to integrate the cannery into a marine-oriented tourist center.³ Under conditions of the 40-year land lease with the State of Hawaii, the WRAF Corporation must use the premises for a "minimum one-line fish cannery and the manufacture, storage, and sale of ice. Other permitted uses include the sale of seafood products, beverages and fishing equipment, a seafood restaurant, and supporting facilities. The lessee must also purchase all excess tuna as defined in and required by the lease for the purpose of assisting the local fishing industry" (Honolulu Star-Bulletin 1986). Rental for the land is \$111,600 for 1987 and \$125,550 for 1988. For each of the next ten years the rent will be \$242,000 or 6 percent of gross receipts, whichever is greater. The lease also requires an expenditure of at least \$300,000 in capital improvements at the site.

Reopening the cannery, even on a smaller scale, is an important economic and political issue in Hawaii for several reasons. First, the cannery employed over 400 persons. Second, the loss of cannery sales cost the skipjack fleet at least \$500,000 in annual sales. Third, the skipjack fleet receives lower prices for its fresh-market sales and has reduced its production levels in response to the loss of the cannery market. Last, loss of an outlet for surplus skipjack tuna destabilized prices on the domestic fresh-fish market. (These cross-price effects are discussed below in the section on marketing.)

Even if the cannery reopens, the Hawaii fleet in its current status is unlikely to be able to catch enough tuna to fully supply the cannery. A one-line cannery requires about 18 tonnes a day (4,000 tonnes a year) to operate at full capacity. The average skipjack vessel in this fleet historically caught about 275 tonnes per year. At this level of productivity, the maximum the nine-vessel fleet could produce is about 2,475 tonnes a year. However, these vessels would sell first to the fresh market

(historically around 1,045 tonnes per year), leaving about 1,300 tonnes to sell to the cannery.⁴ Using only the locally caught skipjack, the cannery would be operating at about 35 percent of capacity. It could, however, draw on frozen imports, summer surpluses of domestically caught yellowfin tuna (*Thunnus albacares*), and landings from the distant-water albacore (*Thunnus alalunga*) fleet for supplemental supply.

On the other hand, reopening the cannery could attract new investment into Hawaii's skipjack fleet, either traditional pole-and-line boats or vessels with new technology. If these new entrants expect to be able to sell on the domestic market, their catches would have to maintain the high standard of skipjack available through the existing pole-and-line technology. Any new vessel entering the skipjack industry would also face competition in the fresh market from other Hawaii tuna fisheries, which have grown rapidly over the past ten years. In summary then, closing the cannery forced investors in the skipjack industry to consider processing techniques and market channels that had been postponed by reliance on the cannery. If the cannery reopens, some of this investment may yet be undertaken and lead to increased production.

Long before the cannery closed, there was an apparent change in resource availability of skipjack tuna around Hawaii. During the same period, the 1970s, industry production costs also increased. Therefore the closing of the cannery in 1984 may have been only the culminating event that threw the industry into decline. These resource and cost issues are discussed in the next section.

SKIPJACK RESOURCE CHANGES AND PRODUCTION COST INCREASES

Since 1974 the size distribution of catches has shifted from larger skipjack to smaller skipjack, with no documented change in fishing patterns. Large-size tuna as a percentage of total catches dropped from 64 percent in the 1964-73 period to 36 percent in the 1974-82 period (Table 1). Because large fish command a higher price in both Honolulu's fresh markets and cannery markets, the changed size distribution directly affects fishermen's revenues. The change in size of fish caught is estimated to have cost the industry about \$362,000 per year in sales (Hudgins 1986). The causes of this change in size distribution are not yet clear. It may be that fishing pressure elsewhere in the Pacific by purse seine vessels and/or in the Northwestern Hawaiian Islands by Japanese pole-and-line vessels has decreased the availability of skipjack to Hawaii fishermen or that biological factors have affected fishing productivity.⁵

Table 1. Average annual size distribution of skipjack tuna catches around Hawaii 1964-1982

Period	Percentages			
	Large ^a	Medium	Small	Extra small
1964-73	64.1	16.1	15.5	4.1
1974-82	36.3	23.2	28.3	12.0

Source: Hudgins 1986, 12.

^aLarge = over 6.8 kilograms.

Medium = 3.6 to 6.8 kilograms.

Small = 1.8 to 3.6 kilograms.

Extra small = under 1.8 kilograms.

Along with the changed size distribution within catches came a decline in total tonnes caught, resulting in a loss of an additional \$1 million per year in sales. For example, during the peak fishing years 1970-78 skipjack catches averaged over 3,200 tonnes a year; by the 1980s total skipjack production had declined to 1,300 tonnes annually. This decline in catches can be attributed primarily to the changing availability of skipjack around Hawaii rather than to cost increases or attrition in the fleet (Hudgins 1986).

Production cost increases, however, also have reduced long-run earnings and profitability in the skipjack industry. Pole-and-line skipjack fishing in Hawaii is relatively high in cost because of such fixed expenses as insurance and a high labor component compared to, for example, purse seine operations elsewhere in the Pacific. By 1983 total costs for an average vessel in the fleet exceeded the revenues as catches declined. With no profits to invest, the fleet's capital base depreciated. As fixed input prices for repairs, insurance, and loanable funds rose during the 1970s, the residual crew share also declined. A rise of 95 percent in inflation-adjusted prices for skipjack tuna during the 1970s may have been the only factor permitting some vessels to continue operating in the face of increasing costs and declining catches.

All but one of the existing vessels are at least 40 years old and require regular maintenance, without which they cannot get insurance. (Insurance is required for entering U.S. government harbor areas to gather baitfish; thus inability to get insurance can put a vessel out of the fishery.) These types of fixed costs are about 20 percent of total costs. The cost picture is further complicated by the fact that the larger vessels have operating-cost problems whereas the smaller vessels have fixed-cost problems. If fuel costs, about 22 percent of total costs,

continue to decline, the larger and/or better maintained vessels will benefit. Insurance will, however, continue to be a problem as rates continue to increase (Pooley 1987).

OTHER TUNA FISHERIES

While the skipjack vessels have been affected by the closing of the cannery and by rising costs and resource problems, the other tuna fisheries in Hawaii have begun to grow and become competitors in the fresh-fish market. Estimates of the production of these other tuna fisheries are shown in Figure 2 and Table 2. State of Hawaii statistics report that these other fisheries comprise 55 percent of commercial tuna landings, substantially greater than their share before 1979.

These fisheries are most easily classified by gear type: the longline fishery for yellowfin, bigeye (*Thunnus obesus*), and albacore tunas and other large pelagics; the small-scale handline and troll fisheries for yellowfin and bigeye tunas; and the distant-water fishery for albacore tuna. There is also a large recreational tuna fishery for which few data are available.⁶

The longline fishery for yellowfin and bigeye tuna, and more recently albacore tuna, was traditionally Hawaii's second-largest fishery, highly prized for sashimi. The number of longline vessels declined in the 1960s and 1970s but began to recover by 1980. The number of long-

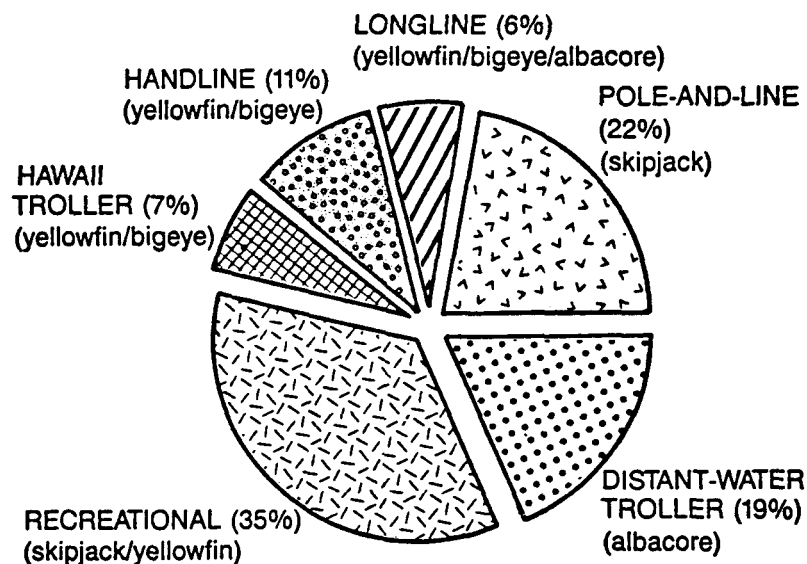


Figure 2. Estimated Hawaii tuna catches by fishery mid-1980s

Adapted from Table 2.

Table 2. Estimate of Hawaii tuna fishery production mid-1980s

Fishery*	Catch in tonnes	Value \$m
Pole-and-line (skipjack) ^a	1,300	2.7
Longline (yellowfin, bigeye, albacore) ^b	370	1.7
Handline (yellowfin, bigeye) ^c	615	2.1
Hawaii troller (yellowfin, bigeye) ^d	410	1.1
Subtotal domestic commercial tuna landings	2,695	7.5
Recreational (skipjack, yellowfin) ^e	2,050	5.3
Distant-water troller (albacore) ^f	1,100	1.1
Total tuna landings	5,845	13.9

*This table shows *unofficial* estimates, presented to indicate relative magnitudes of production in Hawaii's tuna fishery. Because of inconsistencies in data reporting, the figures are estimated from the most accurate available sources, which are identified for each fishery. In some cases, only estimates based on knowledge of current operating characteristics could be made. Actual Hawaii Division of Aquatic Resources (HDAR) commercial tuna landings for 1984 were 2,745 tonnes valued at \$6.5 million.

^aData are from HDAR 1985 monthly summaries (preliminary) and 1984 data by gear type.

^bData are extrapolated from HDAR 1984 total tuna landings for longline vessels, and reflect 2.86 X more boats reporting.

^cData are HDAR 1984 handline tuna totals for gear types 3, 8, and 9.

^dData are HDAR 1984 totals for tuna by gear type 6.

^eData are from unpublished National Marine Fisheries Service (NMFS) Marine Recreational Fishing Statistical Survey (MRFSS) results for 1981. Values are based on average commercial troll tuna prices in 1984. The MRFSS data have not been verified and are subject to significant variation.

^fData are based on one Hawaii trip per vessel, 60 short tons (54 tonnes) per trip, 20 vessels in the 1986 season. Values are current Honolulu delivery prices, which include transshipment discount.

liners operating in Hawaii today is difficult to determine. However, it is possible that the fleet has tripled since 1975 to approximately 40 vessels in 1986 (Honda 1987). There are also several multipurpose vessels that use longline gear during periods of peak tuna demand. Total catch for all these longline vessels could be as much as 370 tonnes per year (\$1.7 million). These landings are marketed primarily on the Honolulu fresh-fish market and on the U.S. mainland. Bicatches of mahimahi (*Coryphaena hippurus*, *C. equiselis*), wahoo (*Acanthocybium solandri*), and various billfishes are sold in fresh-fish markets throughout Hawaii.

The fastest-growing fishery in Hawaii has been the tuna handline fishery (*palu ahi* and *ika shibi*) on the island of Hawaii. Using very small vessels (10 meters) and traditional fishing techniques, the fishery began with night fishing in the early 1970s. It grew to at least 200 vessels

by 1981, then declined between 1981 and 1985. These small vessels can be very profitable because they have low operating and fixed expenses and because opportunity costs for labor are frequently low. This fishery is especially subject to fluctuations in the near-shore availability of tuna and to weather conditions that affect launching, recovery, and fishing effectiveness.

Annual catches of tuna—about 90 percent yellowfin—in the handline fishery could exceed 615 tonnes (\$2.1 million). Most of the tuna is sold at the Hilo auction on the island of Hawaii, but some is shipped directly to the Honolulu auction or sold under contract for resale in Honolulu or on the U.S. mainland. Marketing has been constrained by a “burnt tuna” problem, which discolors the meat and substantially reduces its value. Nonetheless, handline-caught yellowfin, bigeye, and albacore tuna have become major competitors with skipjack in Hawaii’s fresh-fish market.

There are also commercial and charter boat fleets that troll for tuna and sell on the domestic market; some recreationally caught tuna is also sold. Hawaii’s commercial troll fishery supplies approximately 410 tonnes of tuna annually (\$1.1 million).

The combined annual catches of Hawaii’s non-skipjack tuna fleets, exclusive of the recreational catch, total approximately 1,400 tonnes (\$4.9 million). Up to 25 percent of this catch may be exported directly to the U.S. mainland. The remainder—a substantial increase over the 1960s and 1970s—is sold on the fresh-fish market in Hawaii. Recreational catches, possibly the largest of all the fisheries, may exceed 2,000 tonnes annually (estimated value \$5.3 million), but this is poorly accounted.⁷

Finally, a part of the U.S. distant-water albacore trolling fleet began using Hawaii as a seasonal base in the late 1970s. By 1982 some 75 distant-water albacore vessels (average size 20 meters catching about 40 tonnes per trip) were fishing the grounds above Midway Islands at the northern end of the uninhabited Northwestern Hawaiian Islands. Many of these vessels transited through Honolulu; some offloaded catch. However, with the decline of world tuna prices, the high salt content of brine-frozen products, and the closing of the Honolulu cannery, the cost of fishing in the central North Pacific became prohibitive for many vessels. Fewer than 25 vessels, 4 of them based in Hawaii, fished these waters in 1986. Total U.S. albacore catches in the central North Pacific in the mid-1980s (not all landed directly in Hawaii) were approximately 1,100 tonnes, valued at \$1.1 million. New techniques, including flash-freezing, are being developed by some vessels to enhance fleet revenues. The albacore fleet is not expected to have an important impact on tuna marketing in Hawaii in the future, though it may provide an indirect benefit if vessels home-port in Honolulu or

stop over for supplies. However, to the extent that some of these vessels make landings for the domestic fresh-fish market, there may be a substantial impact on bottomfish or pelagic markets.

As these other tuna fisheries developed, marketing practices became more sophisticated, extending outside Hawaii. Although no reliable estimates are available, it is probable that the growth of these fisheries, especially the handline fishery for yellowfin, affects prices and sales of skipjack in the market. Arrangements for marketing tuna in Hawaii are described in the next section.

TUNA MARKETING STRUCTURE

Annual seafood purchases of all species by Hawaii retailers for resale to the public are estimated to be \$110 million (23,600 tonnes), with the population of Hawaii consuming twice the national average of seafood (Hudgins 1980b). Figure 3 indicates the source of Hawaii's retail seafood supply.

Tuna caught by Hawaii fishing vessels is about 2,800 tonnes (12 percent) of Hawaii retail sales. Hawaii vessels catching other pelagics and bottomfish provide about 5,900 tonnes (25 percent) to the retail sector

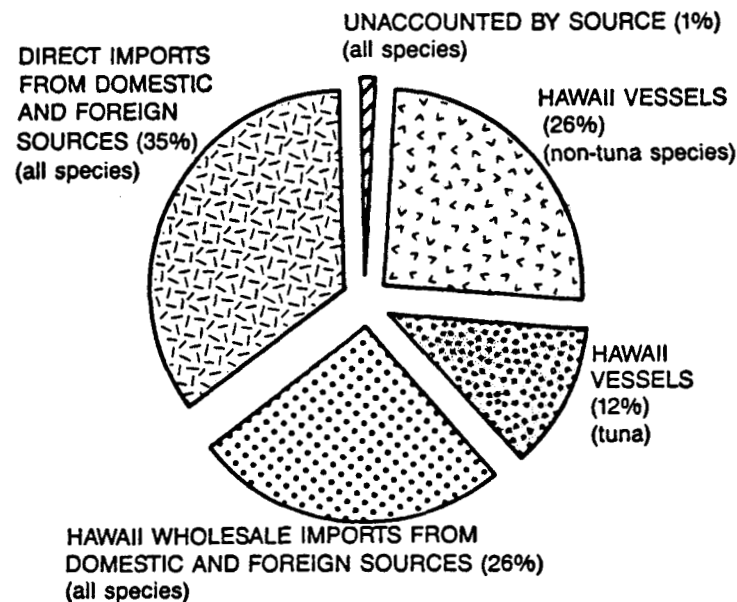


Figure 3. Hawaii retail seafood supply by source, percentage of total purchases (23,050 tonnes) 1983

Sources: Cooper and Pooley 1982; Higuchi and Pooley 1985.

for resale. Wholesalers provide about 6,100 tonnes (\$23 million), 26 percent, from domestic and foreign overseas sources to local retailers for resale. The rest of the fish and seafood consumed in Hawaii, about 34 percent valued at \$30 million, is imported directly from mainland U.S. suppliers or from foreign suppliers, with a small percentage coming from unspecified local sources (Cooper and Pooley 1982; Higuchi and Pooley 1985).

Much of this marketing is done through bilateral arrangements between wholesaler and retailer and is therefore difficult to examine directly. There are, however, two auctions and two fishermen's cooperatives that are central to marketing tuna in Hawaii. One auction, located near downtown Honolulu on Oahu, is expected to move to the new cannery complex; the other is in Hilo on the island of Hawaii. These auctions are markets for fresh large-size tuna and for bottom-fish. (Only small amounts of skipjack pass through the auctions because skipjack is marketed primarily through the fishermen's cooperatives.) Wholesale dealers are the center of the auction system, which is based on the Japanese model of sale by individual large tuna and by individual lot of smaller fish. Both auction organizations have adapted to the times, welcoming a wider number of local buyers, assisting them in transactions with buyers and sellers from outside Hawaii, and promoting restaurant sales of fish to improve prices. The auctions also provide a number of functions to the commercial fishery (including short-term financing in some cases) which insure that the auctions maintain their centrality to the overall fish market.

Two fishermen's cooperatives have historically marketed skipjack tuna in Honolulu: the Tuna Boat Owners Association (TBOA) and the United Fishing Agency (UFA), which also runs the Honolulu auction. The cooperatives traditionally compete to supply the wholesale tuna market, which then resells to retail outlets. TBOA manages only skipjack vessels; UFA manages both skipjack and other vessels.

Before the cannery closed, TBOA vessels pooled their catches and determined shares of total sales revenues by formula. Each vessel's share was based on its contribution (weighted by size of fish caught) to the cooperative's total catch. The cooperative's sales manager allocated the fish between fresh and cannery markets to maximize revenues. When the cannery closed and membership in the cooperative declined, TBOA's role in marketing diminished, and the cooperative became more administratively oriented, handling such matters as providing health insurance and coordinating fuel and ice purchases for members. The strength of the cooperative was its ability to withhold a certain portion of the catch from the fresh market and sell it to the cannery, recognizing that other independent sellers of skipjack would be price follow-

ers. This action resulted in relatively high prices on the fresh market and higher revenues for the skipjack fleet as a whole. It was in the interest of both larger and smaller skipjack vessels to market cooperatively in order to maintain prices over time, as shown in Figure 4. The high-producing vessels, in particular, were able to make catches up to their capacity under the cooperative marketing arrangement and still capture a portion of the higher fresh-market price benefit.

As the range of tuna species available on the local market increased, marketing and market shares have become more important. Today, with the cannery closed, roughly 25 percent of total tuna catches are sold through the local fresh-fish auctions. Another 45 percent of the tuna catch is marketed by the cooperatives. The rest (30 percent) is marketed through contract arrangements between individual vessels and local retail outlets (restaurants and small grocery stores).

Price instability for all species in the fresh-fish market since 1984 is said to be a direct result of excess summer skipjack being put on the market during June, July, and August in competition with auction-sold yellowfin, bigeye, and albacore tuna. Reducing skipjack sales to the fresh market and selling the excess to the cannery would maintain prices on the fresh market. Price maintenance and an alternative sales outlet are especially critical in summer, when the large-size skipjack are caught. If the cannery reopens, a possibility to enhance revenues for the current skipjack fleet will exist in addition to more stability overall for fresh-fish sales.

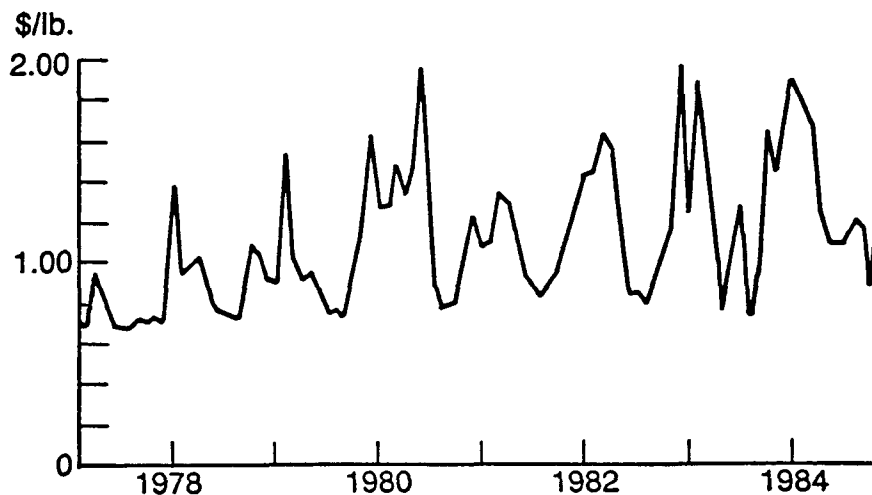


Figure 4. Monthly Hawaii fresh tuna market price trends 1977-1984

Sources: Hudgins (1980a) and unpublished industry data.

Sales of fresh tuna have become more fully integrated into one wholesale market for all tuna in contrast to the segmented markets that existed when the cannery provided an outlet for skipjack. Historically, there has been little observable cross-elasticity between skipjack prices and other tuna prices because the markets were not integrated. (Stronger cross-elasticities imply that the price of one tuna species is affected by the quantity sold of another.) With the restructuring of the skipjack industry so that more skipjack is sold in the fresh market, it appears that these cross-elasticities among tuna species have become stronger. The cross-price effects in the future may radiate throughout the entire fresh fish industry, resulting in losses to other than skipjack producers. Without the cannery sales for the pole-and-line skipjack fleet, all fresh-fish producers in Hawaii will face increased competition until the market stabilizes over the longer term.

INSTITUTIONAL CONSIDERATIONS

The commercial fishing industry in Hawaii is a small contributor to the state's overall economy, similar in scale to other products in Hawaii's diversified agriculture sector. Table 3 shows that locally caught seafood comprises as little as 0.1 percent of direct income to the gross state product, although the overall fishing industry, including a cannery, contributes more through processing, transshipment, and wholesale/retail activities. Nonetheless, fishing is notable for the extent of its integration into Hawaii's social structure, the importance people place on access to fishing activities, and the perceived potential of fisheries expansion within the U.S. 200-mile zone.

Both the federal and state governments have encouraged fishery development projects, but most of the emphasis over the past ten years has been on non-tuna fisheries. Many in the fishing industry believe that government should play at most a facilitating role, leaving fishing operations and even fisheries development to private firms. Both U.S. and Hawaii governments have substantial fisheries research and development presences in Hawaii, but their application to tuna fisheries has diminished since the mid-1970s.

Although development of fisheries infrastructure was highlighted in the State of Hawaii Fisheries Development Plan (1979), the fiscal constraints of the U.S. government have substantially reduced the revenue-sharing grants available for harbor, launching ramp, and other fisheries developments. Despite this, Honolulu has generally adequate infrastructure facilities, and the increased movement of transient fishing vessels through the area—especially for the lobster, albacore tuna, and bottomfish fisheries—has increased the level of support available to

Table 3. Value of production in selected Hawaii industries 1983

	Value in \$m	% of total value ^a
Sugar (including processing)	410	3.00
Pineapple (including processing)	219	2.00
Defense	1,848	13.00
Tourism	3,974	28.00
Flowers and nursery products	36	0.30
Aquaculture (raw product)	1	0.01
Commercial fishing (raw product)	10	0.07
Other agriculture (raw product)	115	0.80
Other primary industry and all secondary	7,739	54.00
Gross state product	14,352	100.00

Source: State of Hawaii 1985.

^aPercentages do not add to 100.0 due to rounding.

local fleets. On the other hand, the limited access to launching ramps for small-scale commercial fishing boats and the unavailability of ice are significant constraints for fisheries development on the neighbor islands.

Other tuna industry problems include seafood quality and baitfish availability. The state's Seafood Product Promotion Committee, which has codified seafood availability, handling practices, and nomenclatures, has played a major role in improving tuna quality. Although considerable funds have been spent on baitfish research, including aquaculture facilities, only a pilot project on the island of Maui shows any near-term promise, and it may be terminated for lack of federal funding.

PERSPECTIVES ON THE TUNA INDUSTRY

The tuna industry in Hawaii is in a transition marked by changing production levels and developing market channels. The skipjack tuna industry has apparently suffered production declines because of the reduced availability of the resource and the closing of the cannery. At the same time, Hawaii's other tuna fisheries have expanded alternative markets for their fresh and frozen product, in particular through vigorous development of overseas markets. This expansion of market channels has had a salutary effect on the entire wholesale seafood industry in Hawaii and has assisted the development of the longline and handline tuna industries and the handline bottomfish industry.

However, the further development of domestic and overseas markets depends on three factors: the growth of the tourist market for seafood in Hawaii (6 million visitors per year), the increased availability of air cargo transportation between Hawaii and the overseas markets, and the modernization of marketing practices by Hawaii seafood dealers.

Despite the complexities and the transitional nature of these developments in the state's tuna fisheries, there is an important conceptual issue to be seen in Hawaii's case. That is, in order to increase production, a domestic fishery will at some point look to external market sales.⁸ The development of canneries or sizable transshipment facilities may develop external sales and maximize value added from locally produced tuna, but risks attend such a development pattern. The external market (in Hawaii's case, the tuna cannery) appears to provide a stable outlet for surplus production. However, the external market itself is subject to international competitive price pressures and, in the case of a non-locally owned cannery, sales to the external market may depend on corporate decisions unrelated to the domestic industry. Conditions in the domestic industry and external dependence on the cannery both contributed to the transformation of the Hawaii skipjack industry in the 1980s.

If a fishery begins production on a small scale and expands to industrial scale to supply an external market, the two production levels are linked by the scale of the fishing fleet and by market interactions felt primarily in the domestic seafood sector. Industrial development may not involve a smooth transition from one level of production to another. Production at the output level required for an international commercial market implies more capital investment and higher fixed costs and therefore less flexibility in the face of changing production or market conditions. To amortize this larger investment, the fishing fleet will need to produce at near-full capacity and have a reliable sales outlet for its catch. Large-scale investment undertaken in response to *potential* sales in the externally linked market could lead to collapse of the industry if it must rely solely on domestic sales. In this event the higher-cost vessels would become marginally profitable while their catch of larger volumes of fish would jeopardize the economic well-being of the smaller vessels in the domestic fleet.

An important corollary issue obvious from the Hawaii skipjack industry case is the consideration of not only the degree of capitalization of the fleet relative to available markets but also the type or scale of capitalization. The skipjack industry in Hawaii, although contracted, will survive, precisely because it is based on small-scale technology. When the Hawaii cannery closed, the skipjack industry could either have moved to a lower long-run level of production or collapsed com-

pletely. The actual outcome depended on the type of technology adopted by the Hawaii industry over the years. As it was, the pole-and-line technology is relatively small in scale, and although there will be some attrition if the cannery remains closed, a portion of the fleet will remain to supply the domestic market for fresh skipjack whether the cannery reopens or not.⁹ The remaining vessels will be those with relatively lower costs. If the technology had been larger in scale, and therefore dependent upon cannery sales, the cannery's closing might have brought about the complete failure of the skipjack fleet in Hawaii. Had the fleet had distant-water capabilities, the cannery's closing might have led to its deployment elsewhere in the Pacific.

It is difficult to assess the relative impacts of the many events that led to the restructuring of the fishing industry in Hawaii: closure of the cannery, decreased availability of the resource, increased production costs, and competition in the market from other tuna fisheries. The future of the skipjack industry is clearly tied to developing new market outlets for surplus production, maintaining fresh-market revenues, and containing costs. The future of the whole tuna industry in Hawaii will depend on continuing to pursue new markets as well as fulfilling current market demands with high-quality fish.

NOTES

1. Data are from unpublished monthly summary reports on commercial landings from the Hawaii Division of Aquatic Resources (HDAR).
 2. In 1956 Bumble Bee Seafoods traded 12 percent corporate interest to Castle and Cooke in exchange for the cannery. Castle and Cooke again acquired direct ownership of the cannery in a corporate merger with Bumble Bee Seafoods in 1961 and continued operations until 1984.
 3. The four owners of WRAF Corporation are Rex Y. Matsuno (Suisan Co., Ltd., of Hilo, Hawaii), two principals of the United Fishing Agency, Ltd., of Honolulu, and William R. Zappas, a shopping center developer from California.
 4. Historical prices would be maintained at about 1,045 tonnes per year sold to the fresh market and 1,550 tonnes allocated to an alternative market. A fleet of 17 vessels of the current average size would sustain both a one-line cannery and the fresh skipjack market using only local production.
 5. Boggs and Pooley (1987) review current problems in the skipjack industry with respect to both biology and economics.
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6. As many as 15 percent of the Hawaii population engage in the small-boat recreational fishery. Most of the recreational catch sold goes directly to small stores and outlets rather than to established markets and so is not accounted for in official surveys or records.
7. Hawaii Division of Aquatic Resources (HDAR) data on commercial landings have been hampered by incomplete reporting of some large tuna vessels and by the lack of a reporting requirement for the recreational category.
8. In the Hawaii case several species are marketed on the U.S. mainland, which is analogous to an external market linkage.
9. The actual skipjack fleet without cannery sales will most likely be four to five vessels. The outcome depends on the skipjack fleet's competitive position relative to other tuna fleets in the domestic fresh market (Hudgins 1987).

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