

## Per Capita Annual Utilization and Consumption of Fish and Shellfish in Hawaii, 1970-77

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### Introduction

In 1977, the U.S. per capita consumption of edible (meat-weight) fish and shellfish was 5.82 kg (12.8 pounds). It has been speculated that the per capita consumption of fishery products in the State of Hawaii is considerably higher than the U.S. average. No studies have been done to verify this speculation.

This paper is an attempt to quantify the actual consumption in Hawaii for the period 1970-77. This quantification required computation of the total supply of fish and fishery products available in Hawaii. The total supply was then adjusted to edible weight and divided by the population. The result is that the per capita consumption rate in Hawaii for 1977 was about 77 percent higher than the U.S. average.

Foreign imports represented, in 1977, approximately 54 percent of the total supply of fish and shellfish in Hawaii. Therefore, a section and tables are included in which these imports are disaggregated by quantity, value, and type of preparation for 1970-77; and by major product and major country of origin for 1976 and 1977.

An effort was made to calculate the per capita figures with the same methodology as that used in "Fisheries of the United States" (Bell, 1978) where national per capita estimates are

published. The units of quantity and measurement in this report are not exactly comparable in some cases. These measurement discrepancies, as indicated in the table notes, should not hinder the usefulness of these preliminary estimates, however.

### Data and Methods

The State of Hawaii has three major sources of commercial fish and fishery products for human consumption: 1) Local catch, 2) imports from foreign countries, and 3) interstate shipments from the mainland United States. Table 1 gives totals for these sources. Hawaii landings are shown in round (live) weight as reported by the vessels to the State of Hawaii, Division of Fish and Game. Foreign imports and interstate shipments are in net product weight, as recorded at the port by U.S. Customs officials and published by the U.S. Bureau of the Census (1970-77) and the U.S. Army Corps of Engineers (1970-77).

Hawaii per capita utilization of fish and shellfish (Table 2) is determined using total supply of fishery products without adjustment for beginning or ending stocks, foreign exports, or defense purchases. Table 3 gives a comparison of the United States and Hawaii per capita utilization rates. Table 4 gives U.S. per capita consumption of fish and shellfish as published by the National Marine Fisheries Service.

Hawaii per capita consumption in Tables 5-7 is based on pounds of edible (meat-weight) fish. Figures for Hawaii in Tables 5-7 are adjusted for foreign

Table 1.—Total Hawaii supply of commercial fish and shellfish, in thousands of pounds, by source and year, 1970-77.<sup>1</sup>

Year	Local commercial landings <sup>2</sup>	Foreign imports <sup>3</sup>	Interstate shipments <sup>4</sup>	Total
1970	11,282.3	22,960.3	5,896.0	40,138.6
1971	17,159.8	18,681.3	5,764.0	41,605.1
1972	14,754.7	28,953.6	4,682.0	48,390.3
1973	14,382.4	21,346.9	3,950.0	39,679.3
1974	11,323.7	24,467.2	4,068.0	39,858.9
1975	9,724.5	22,015.6	4,362.0	36,102.1
1976	15,272.3	19,846.3	4,094.0	39,212.6
1977	13,763.4	30,991.3	7,650.0	52,424.7

<sup>1</sup>Based on the total supply of edible fishery products, without taking into consideration beginning or ending stocks, exports, or defense purchases.

<sup>2</sup>State of Hawaii, Department of Land and Natural Resources, Division of Fish and Game. Reports in round weight.

<sup>3</sup>U.S. Bureau of the Census (1970-77). Reported in net product weight.

<sup>4</sup>U.S. Army Corps of Engineers (1970-77). Reported in net product weight.

exports of fish and shellfish and shipments of canned tuna and fresh and frozen fish to the mainland United States. Supply of cured fish for consumption includes fish dried, salted, smoked, or kippered whether canned or not. Cured supply does not include local production of cured fishery products. Raw inputs for local production are counted under fresh, frozen, or chilled. Supply of canned fish for consumption includes fish of all preparations in airtight containers, most of which are cans.

The State of Hawaii has three variable components of population in addition to the civilian resident population: Military, visitors, and foreign immigrants. Military includes those who are serving in the armed forces and either actually residing in Hawaii or stationed aboard a ship homeported in Hawaii. Since 1971, the military has stabilized at around 6 percent of total de facto population (those actually present in the State). Military dependents are counted as part of the resident civilian population. There are approximately 1.15 dependents per military member in Hawaii. Visitor population, estimated by the Hawaii Visitors Bureau, during 1978 was around 9 percent of the total population based on the annual average number of visitors present. Approximately 8 percent of the civilian resident population of Hawaii in 1970 were

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Table 2.—Per capita utilization of commercial fish and shellfish in Hawaii by year, source of fish, and two population groups, 1970-77.

Year	Resident civilian and military population					Resident civilian, military, and visitor population					
	Total resident civilian and military population, 1 July (1,000 persons) <sup>1</sup>	Armed forces (1,000 persons)	Per capita utilization			Total resident civilian and military plus visitor population (1,000 persons) <sup>1</sup>	Visitors present (annual average) (1,000 persons)	Per capita utilization			
			Total Hawaii supply (1,000 lb) <sup>2</sup>	Local commercial catch	Interstate shipments and foreign imports			Total	Local commercial catch	Interstate shipments and foreign imports	Total
1970	775.8	53.2	40,138.6	14.5	37.2	51.7	803.4	37.6	14.1	35.9	50.0
1971	800.9	50.8	41,605.1	21.4	30.5	51.9	833.3	41.9	20.7	29.3	50.0
1972	823.3	52.0	48,390.3	17.9	40.9	58.8	865.9	51.3	17.0	38.9	55.9
1973	844.1	58.1	39,879.3	17.0	30.3	47.3	895.9	61.6	16.1	28.2	44.3
1974	855.4	57.5	39,858.9	13.2	33.4	46.6	913.6	66.0	12.4	31.2	43.6
1975	867.9	58.9	36,101.9	11.2	30.4	41.6	927.7	68.8	10.5	26.4	38.9
1976	883.5	57.8	39,212.6	17.3	27.1	44.4	952.7	78.5	16.0	25.2	41.2
1977	894.7	56.5	52,424.7	15.4	43.2	58.6	972.5	86.8	14.3	39.7	54.0

<sup>1</sup> Hawaii, Department of Planning and Economic Development (1978:6).

<sup>2</sup> Table 1, unadjusted for beginning and ending stocks, exports, or defense purchases. Excludes imports of nonedible fishery products.

Table 3.—United States and Hawaii total supply (million pounds) and per capita utilization (pounds) of commercial fish and shellfish by year, 1970-77.

Year	Total supply <sup>1</sup>		Total per capita utilization <sup>2</sup>	
	U.S.	Hawaii	U.S. <sup>3</sup>	Hawaii
1970	11,474	41.13	56.0	51.7
1971	11,804	43.11	57.0	51.9
1972	13,849	49.68	66.3	58.8
1973	10,378	40.94	49.3	47.3
1974	9,875	40.85	46.6	46.6
1975	10,129	36.95	47.4	41.6
1976	*11,555	40.55	53.7	44.4
1977	*10,579	53.63	48.8	58.6

<sup>1</sup>Total supply for U.S. includes nonedible and industrial fishery products not included in total supply for Hawaii.

<sup>2</sup>Population is total resident civilian and military population present on 1 July.

<sup>3</sup>Bell (1978:70).

<sup>4</sup>Preliminary.

Table 4.—United States per capita consumption of commercial fish and shellfish by year and three types of preparation, 1970-77.<sup>1</sup>

Year	Civilian resident population (million persons)	Per capita consumption (lb)			
		Fresh and frozen	Canned	Cured	Total
1970	201.7	6.9	4.5	0.4	11.8
1971	204.3	6.7	4.3	0.5	11.5
1972	206.5	7.2	4.9	0.4	12.5
1973	208.1	7.5	5.0	0.4	12.9
1974	209.7	7.0	4.8	0.4	12.2
1975	211.4	7.4	4.3	0.4	12.1
1976	*213.0	8.2	4.3	0.5	13.0
1977	*214.7	7.8	4.6	0.4	12.8

<sup>1</sup>Bell (1978:72).

<sup>2</sup>Preliminary.

Table 5.—Hawaii per capita consumption<sup>1</sup> of commercial fish and shellfish by year and three categories of preparation, 1970-77.

Year	Total civilian resident population 1 July (1,000 persons)	Per capita consumption (lb)			
		Fresh and frozen	Canned <sup>2</sup>	Cured <sup>3</sup>	Total
1970	722.8	19.4	5.3	1.0	25.7
1971	750.1	20.5	4.6	0.7	25.8
1972	771.3	17.1	6.6	0.8	24.5
1973	785.9	16.7	3.8	0.9	21.4
1974	797.9	14.0	4.7	0.6	19.3
1975	809.0	15.3	3.6	0.7	19.6
1976	825.7	15.3	4.3	0.8	20.4
1977	838.3	17.6	4.0	0.9	22.7

<sup>1</sup>Unadjusted for beginning and ending inventories and military purchases. Adjusted for exports to foreign countries from the Honolulu Customs district.

<sup>2</sup>Includes preserved and prepared which are canned but not included in cured.

<sup>3</sup>Does not include local production.

Table 6.—Hawaii per capita consumption of commercial fish and shellfish by year and three types of preparation, 1970-77 including annual average visitor population.<sup>1</sup>

Year	Total civilian resident population plus visitors 1 July (1,000 persons)	Per capita consumption (lb)			
		Fresh and frozen	Canned <sup>2</sup>	Cured <sup>3</sup>	Total
1970	780.2	18.9	5.0	0.9	24.8
1971	792.0	19.4	4.3	0.7	24.4
1972	822.6	16.0	6.2	0.8	23.0
1973	847.5	15.5	3.5	0.9	19.9
1974	863.9	12.9	4.4	0.9	18.2
1975	877.8	14.1	3.4	0.6	18.1
1976	904.2	14.0	3.9	0.7	18.6
1977	925.1	16.1	3.6	0.8	20.5

<sup>1</sup>Unadjusted for beginning and ending inventories, and military purchases. Adjusted for exports from the Honolulu Customs district.

<sup>2</sup>Includes preserved and prepared which are canned but not included in cured.

<sup>3</sup>Does not include local production.

foreign born persons from the People's Republic of China, Taiwan, Japan, Korea, and the Philippines. All of these

countries have substantially higher per capita fish consumption rates than that of the United States (Bell, 1978:74).

These three components of population may account for over 20 percent of the actual population present in the State at

a given time. For this reason, per capita consumption was calculated for various measures of population which would include these groups.

Table 7.—United States and Hawaii total per capita consumption (pounds) of commercial fish and shellfish by year, 1970-77.<sup>1</sup>

Year	Total per capita consumption	
	U.S.	Hawaii <sup>2</sup>
1970	11.8	25.7
1971	11.5	25.8
1972	12.5	24.5
1973	12.9	21.4
1974	12.2	19.3
1975	12.1	19.6
1976	<sup>3</sup> 13.0	20.4
1977	<sup>3</sup> 12.6	22.7

<sup>1</sup>Population is total civilian resident population.

<sup>2</sup>Unadjusted for beginning and ending inventories and military purchases.

<sup>3</sup>Preliminary.

### Foreign Imports

Imports from foreign countries in 1977 represented 54 percent of the total supply of fish, fishery products, and shellfish in Hawaii. Table 8 gives these imports by year and type of preparation, aggregated over countries. All of these products are designated for human consumption. Values are unadjusted and reflect customs values. Customs value generally represents a value in the foreign country, and therefore excludes U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States. This value may not reflect the actual transaction value.

Table 9 gives imports to Hawaii of fresh, frozen, or chilled fish and shellfish by major country of origin, quantity, and customs value. Relative

rankings of these countries vary between 1976 and 1977. However, the major five countries (New Hebrides, Philippines, Taiwan, Japan, and Panama) are the same for both years. Fiji had no recorded exports to Hawaii in these categories for 1977.

Table 10 gives imports to Hawaii "in cans or airtight containers." Shellfish and anchovies are the major products. In 1972, the major sardine exporting countries were Brazil, United Kingdom, and Denmark. In 1973, only Denmark is recorded as exporting sardines to the Honolulu customs district which is reflected in the much lower 1973 figure. The category marked "other" in this and subsequent tables represents other species which the U.S. Customs aggregates under the heading "not elsewhere specified."

Table 8.—Foreign imports to Hawaii of fish and fish products for human consumption by year, type of preparation, quantity and customs value,<sup>1</sup> 1970-77.

Year	Total		Fresh, chilled, frozen		Cured		Fish in airtight containers		Fish products (pastes, balls, sticks, roe)		All shellfish	
	Quantity (1,000 lb)	Value (\$1,000)	Quantity (1,000 lb)	Value (\$1,000)	Quantity (1,000 lb)	Value (\$1,000)	Quantity (1,000 lb)	Value (\$1,000)	Quantity (1,000 lb)	Value (\$1,000)	Quantity (1,000 lb)	Value (\$1,000)
1970	22,906.3	10,354.8	19,417.9	6,376.9	81.1	78.4	422.1	215.5	481.7	374.8	2,557.5	3,309.2
1971	18,681.2	10,633.1	13,893.0	5,146.2	85.0	86.8	974.3	397.7	810.0	479.1	2,919.0	4,523.3
1972	26,953.6	15,756.6	23,693.8	9,816.9	85.8	147.0	1,317.9	497.3	1,123.5	609.3	2,732.8	4,885.1
1973	21,346.9	13,633.5	16,496.5	7,703.3	119.5	212.9	853.3	381.4	1,222.8	878.9	2,654.9	4,457.0
1974	24,467.2	17,303.3	19,340.0	10,182.8	113.4	145.3	787.5	501.6	1,342.7	854.2	2,903.8	5,819.4
1975	22,015.6	13,393.4	17,320.0	7,815.2	87.0	119.9	816.1	433.1	1,583.2	1,114.0	2,208.8	3,911.1
1976	19,846.3	14,185.4	14,917.3	7,380.1	131.0	163.3	877.3	500.5	1,634.0	1,118.4	2,286.7	5,023.1
1977	30,991.3	22,875.4	26,448.9	15,729.3	94.8	152.6	746.2	521.2	1,367.4	1,151.2	2,314.0	5,321.1

<sup>1</sup>Customs value generally represents a value in the foreign country, and therefore excludes U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States. This value may not reflect the actual transaction value. These values are unadjusted.

Table 9.—Imports of fresh, frozen, chilled fish and shellfish by major countries of origin,<sup>1</sup> quantity, and customs value,<sup>2</sup> 1976 and 1977.

Country of origin	1976		1977	
	Quantity (1,000 lb)	Customs value (\$1,000)	Quantity (1,000 lb)	Customs value (\$1,000)
<b>Fish</b>				
New Hebrides	6,018.9	3,216.3	19,014.7	11,991.0
Philippines	23.6	19.5	3,345.9	865.4
Taiwan	1,878.1	1,411.3	2,749.4	2,019.6
Japan	1,070.7	742.1	727.2	534.2
Panama	3,856.0	1,104.0	185.5	55.7
Fiji	1,180.0	538.7	—	—
<b>Shellfish</b>				
New Zealand	248.1	1,407.9	213.0	1,514.0
Taiwan	134.7	457.5	93.6	369.0
Japan	42.3	129.3	18.6	61.4

<sup>1</sup>Country of origin as determined by U.S. Customs.

<sup>2</sup>See footnote 1, Table 8.

Table 10.—Foreign imports to Hawaii of fishery items, canned and in airtight containers, all manner of preparation, net weight in thousand pounds, 1970-77.

Year	Salmon	Sardines	Tuna	Anchovies	Shellfish	Other	Total
1970	18.6	45.0	95.0	54.6	1,323.6	206.9	1,745.7
1971	45.9	182.5	85.6	153.3	1,218.7	507.0	2,193.0
1972	68.2	389.5	55.2	228.4	1,247.0	576.6	2,564.9
1973	( <sup>1</sup> )	26.9	78.7	242.1	1,225.5	506.0	2,079.2
1974	11.6	21.8	120.0	213.1	1,896.8	401.0	2,666.3
1975	( <sup>1</sup> )	6.5	112.0	358.5	1,315.9	339.0	2,131.9
1976	( <sup>1</sup> )	34.3	139.3	355.7	1,319.8	348.0	2,197.1
1977	11.6	44.2	29.6	305.3	1,243.4	355.5	1,989.6

<sup>1</sup>None reported.

Table 11 reflects edible fishery products by major type of preparation. Tuna, fish fillets, and shellfish compose over 90 percent of the total fresh and frozen imports to Hawaii for 1976 and 1977. The itemized entries under "canned" for 1976 reflect over 60 percent of the total quantity of canned imports to Hawaii and for 1977 over 78 percent. The category "Other fish and shellfish" reflects the sum over type of

preparation of the "not elsewhere classified" specifications.

Table 12 represents estimated per capita consumption of foreign imports by type of preparation, adjusted to pounds of edible fishery products divided by civilian resident population of Hawaii on 1 July of each year.

### Summary and Conclusions

The tabulated data show that the total

per capita consumption of fish and shellfish in the State of Hawaii has been higher than the U.S. average over the entire period 1970-77. Specifically, the following conclusions can be drawn about fish and shellfish consumption:

1) United States per capita total consumption has followed a slight upward trend—from 1973 to 1977, consumption varied between 5.45 and 5.91 kg (12 and 13 pounds).

2) Hawaii per capita consumption for all fish products followed an unclear trend over the period. Consumption declined dramatically from 1972 [11.14 kg (24.5 pounds)] to 1974 [8.77 kg (19.3 pounds)] and has since followed a solid upward trend.

3) Per capita consumption of fresh and frozen fishery products in Hawaii has ranged from 206 percent (in 1971) to 87 percent (in 1976) above the national average.

4) Per capita consumption of canned fishery products in Hawaii since 1973 has been below the U.S. average.

5) Per capita consumption of cured fishery products in Hawaii has been above the U.S. average for the period. Since this does not include local Hawaii production, the cured fishery products consumption rate in Hawaii is actually higher than the data indicate.

These results show that the most pronounced decline in the 1972-74 period occurred in the fresh and frozen category. During this time, factors which may have possibly caused the decline were: 1) A change in tastes due to the public concern over high mercury content in large pelagic fishes. Market observers during this period report that the local fishermen were unable to sell many of their fish and that it is conceivable it would have taken several years for the consumers to return to their higher preference levels for fish. 2) The observed reduction in the quantity of local supply during 1972-74 was possibly a result of a decline in demand due to a change in tastes. 3) At the same time (1972) the visitor population began to grow much faster (12.2 percent annually) than the civilian resident population (2.1 percent annually). This visitor population may exhibit differential consumption rates that are higher or lower than the

Table 11.—Foreign imports of edible fishery products to Hawaii, by principal items, 1976 and 1977.

Item	1976		1977	
	1,000 lb	\$1,000 <sup>1</sup>	1,000 lb	\$1,000 <sup>1</sup>
<b>Fresh and frozen</b>				
<b>Tuna</b>				
Albacore	5,177.6	2,960.8	14,959.8	10,183.9
Skipjack	2,200.2	627.5	2,343.7	598.7
Yellowfin	4,136.3	1,507.9	5,287.8	2,158.9
Fillets	2,494.1	1,832.1	3,253.1	2,358.4
<b>Shellfish</b>				
Clams	29.2	27.8	17.3	26.6
Lobsters	297.6	1,619.8	245.5	1,854.9
Shrimp and prawns	242.9	779.2	137.5	486.9
Other	948.6	551.5	637.4	576.2
<b>Canned</b>				
Salmon	0	0	11.6	22.6
Anchovies	355.7	94.0	305.3	94.4
Sardine				
Not in oil	23.9	8.0	43.7	25.3
Tuna	139.3	128.3	29.6	35.2
Bonito and yellowtail	3.1	7.5	2.2	6.1
Clams	182.1	234.0	174.8	275.7
Shrimp	31.4	57.9	50.5	104.9
Other	510.0	549.5	474.4	768.4
<b>Cured</b>				
<b>Pickled, salted, or dried</b>				
	577.8	1,078.5	719.2	1,278.6
<b>Smoked or kippered</b>				
	81.3	80.5	57.1	80.4
<b>Other fish and shellfish</b>				
Total edible fishery products	19,846.3	14,185.4	30,991.3	22,875.2

<sup>1</sup>See footnote 1, Table 8.

Table 12.—Estimated Hawaii per capita consumption of foreign imports of fish, fishery products, and shellfish by year and type of preparation, 1970-77.<sup>1</sup>

Year	Total civilian resident population, July 1 (1,000 persons)	Per capita consumption (lb)					Total
		Fresh, chilled, frozen <sup>2</sup>	Dried, salted, pickled, smoked, kippered	Fish in airtight containers	Pastes, balls, sticks	Shellfish	
1970	722.6	6.2	0.1	0.6	0.7	0.5	8.1
1971	750.1	4.8	0.1	1.3	1.1	0.7	8.0
1972	771.3	5.5	0.1	1.7	1.5	0.7	9.5
1973	785.9	5.0	0.2	1.1	1.6	0.5	8.4
1974	797.9	3.4	0.1	1.0	1.7	0.4	6.6
1975	809.0	4.7	0.1	1.0	2.0	0.4	8.2
1976	825.7	3.8	0.2	1.1	2.0	0.4	7.5
1977	838.3	2.0	0.1	0.9	1.7	0.3	5.0

<sup>1</sup>Unadjusted for exports, defense purchases, or beginning or ending stocks

<sup>2</sup>Based on imported weight which is net product weight. In some cases this is meat weight; in others, this is whole or round weight. Customs reports only net product weight.

resident population. However, any effect other than an absolute increase in the population is indeterminant. A diminished supply of fresh fish combined with a larger population base would result in a lower observed per capita consumption rate.

Hawaii has a large recreational fishery. The decline in the fresh category may be modified when consumption by recreationalists that is not reported in the commercial catch is taken into consideration. Yearly data for recreational landings as a separate category are not available. A recent study<sup>1</sup> used Kailua-Kona, Hawaii, survey information to estimate gamefish catch by commercial and recreational troller vessels for 1976. The authors' "Estimate I" (Table 4) represents an adjustment to statewide Division of Fish and Game data which accounts for underreporting and differential vessel catch rates by vessel category. When this es-

<sup>1</sup>Cooper, J. C., and M. F. Adams. 1978. Preliminary estimates of catch, sales, and revenue of game fish for the fishery conservation zone around the main Hawaiian Islands, by types of troll and longline vessels and by species, 1976. Unpubl. rep., 10 p. Southwest Fisheries Center Admin. Rep. 24H, Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812.

timate was considered, the total Hawaii supply of fish and fishery products (for 1976) increased from 17,829,909.1 kg (39,212,600 pounds) to 18,432,090.9 kg (40,550,600 pounds), per capita consumption of fresh and frozen fish increased from 6.95 kg (15.3 pounds) to 7.32 kg (16.1 pounds), and total Hawaii per capita consumption increased from 9.27 kg (20.4 pounds) to 9.64 kg (21.2 pounds).<sup>2</sup> Consumption of canned and cured fish are unaffected. It should be noted that the above estimate should therefore be considered as an approximation of one component of total recreational catch, that component caught by troller vessels and sold. Recreational catch that is not sold does not have to be reported.

Estimates of per capita consumption rates and the trends of these rates provide valuable input to research and policy planning. Specific determinants of this consumption have not been addressed here. However, these results have implications in particular for the Hawaii fishing industry, the aquaculture development program in Hawaii,

<sup>2</sup>Population is total resident civilian.

the State of Hawaii Fisheries Development Plan, and Regional Fishery Management Plans.

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