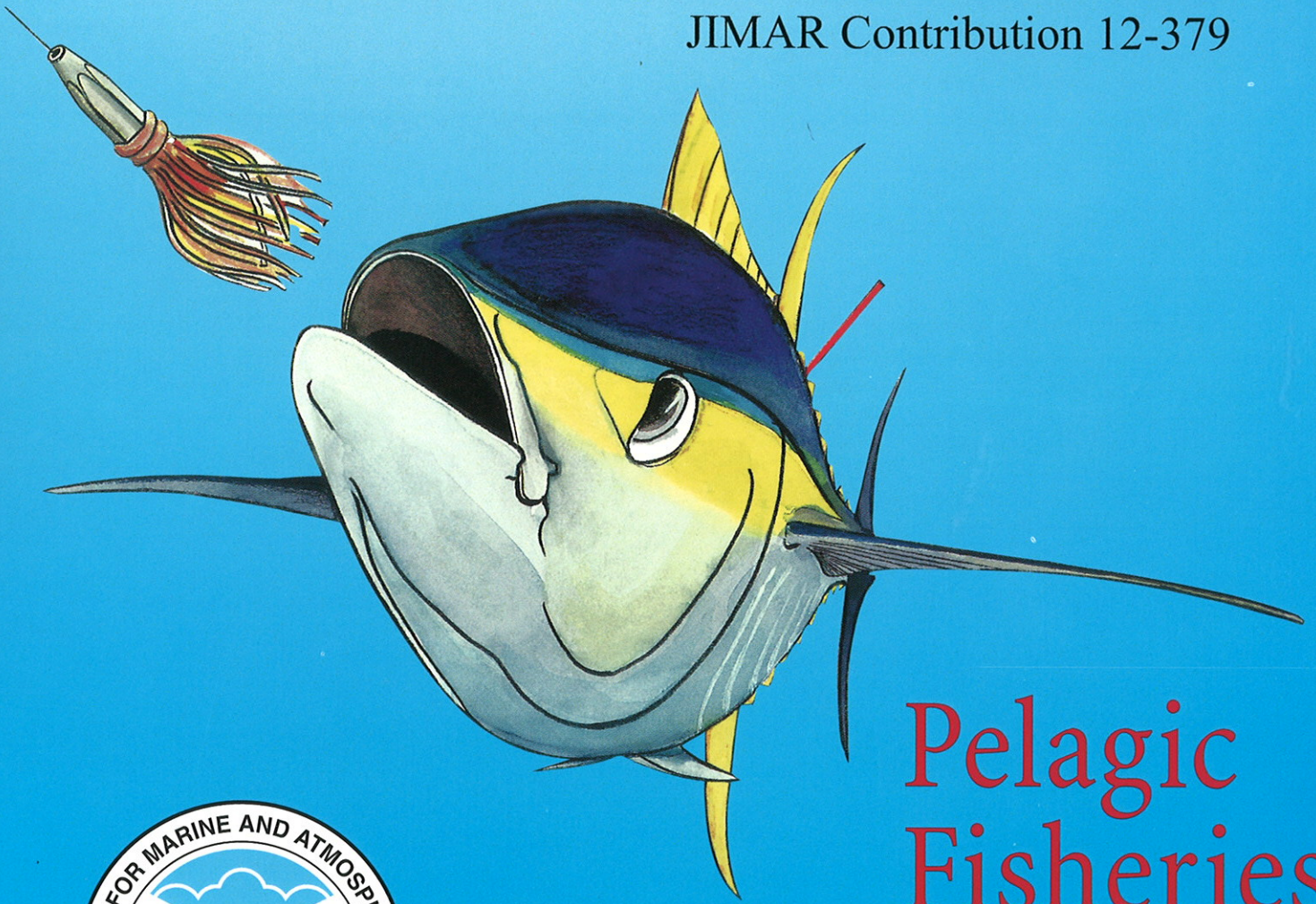


# Hawai'i's Seafood Consumption and its Supply Source

Cheryl Geslani, Matthew Loke, Brooks Takenaka,  
and PingSun Leung

SOEST 12-01

JIMAR Contribution 12-379



Pelagic  
Fisheries  
Research  
Program

# Hawai‘i’s Seafood Consumption and its Supply Sources

Cheryl Geslani  
Dept. of Natural Resources  
and Environmental Management  
University of Hawai‘i at Manoa  
3050 Maile Way, Gilmore 111  
Honolulu, HI 96822

Matthew Loke  
Dept. of Natural Resources  
and Environmental Management  
University of Hawai‘i at Manoa  
3131 Maile Way, AEI 104  
Honolulu, HI 96822  
and  
Agricultural Development Division  
Hawai‘i State Dept. of Agriculture  
1428 South King Street  
Honolulu, HI 96814

Brooks Takenaka  
BT and Associates  
516-E Kawaihae Street  
Honolulu, HI 96825

PingSun Leung  
Dept. of Natural Resources  
and Environmental Management  
University of Hawai‘i at Manoa  
3050 Maile Way, Gilmore 111  
Honolulu, HI 96822

SOEST 12-01  
JIMAR 12-0379

## **Abstract**

This paper serves to fill a gap in the existing literature by mapping the current seafood supply flows from various sources (local, U.S. domestic, and foreign) in Hawai‘i. Not since the earlier works of Hudgins (1980) and SMS Research (1983), have we seen any attempts to update estimates on the apparent consumption of seafood in Hawai‘i.

We estimated the apparent consumption of seafood in Hawai‘i from all commercial sources at an annual average of 29 edible pounds per capita in the 10-year period from 2000 to 2009. When non-commercial catch is included, the apparent consumption of seafood in Hawai‘i increases to an estimated annual average of 37 edible pounds per capita for the same time period. These results suggest non-commercial fishing is an important source of seafood supply in Hawai‘i. Overall, fresh tuna is the single largest consumed species, followed by salmon. The top species caught from non-commercial fishing are the yellowfin tuna and mahimahi.

When measured in edible weight, the majority of Hawai‘i’s commercial seafood supply comes from foreign sources (57 percent) versus local (37 percent) and U.S. domestic sources (6 percent). The leading import sources for Hawai‘i’s seafood from 2000 to 2009 as reported by the USDA Foreign Agricultural Service (USDA-FAS) were Taiwan, Japan, New Zealand, the Philippines, and the Marshall Islands. Local supply becomes the majority source once non-commercial catch is included with 51 percent of the total supply. The remaining total supply comes from foreign sources (44 percent) and U.S. domestic sources (5 percent).

## Table of Contents

1. Introduction.....	1
2. Hawai‘i Supply Chain and Research Objectives .....	2
3. Data and Descriptive Statistics .....	2
3.1 Commercial Landings.....	3
3.2 Aquaculture .....	4
3.3 Non-commercial Catch .....	4
3.4 Foreign Imports and Exports .....	5
4. Methodology .....	7
5. Results.....	7
5.1 Sensitivity Analysis.....	9
6. Discussions .....	10
6.1 Apparent Seafood Consumption .....	11
6.2 Drivers in Hawai‘i’s Seafood Consumption .....	12
7. Conclusion .....	14
Acknowledgements.....	16
References.....	16
Appendix A Select Tables in Live Weight .....	18
Appendix B Seafood Dealer Continental U.S. Trade Questionnaire .....	21

## List of Figures

1. Type of Seafood–Hawai‘i vs. U.S.....13
2. Hawai‘i’s seafood value chain, 2000-2009 average .....15

## List of Tables

1. Hawai‘i apparent seafood consumption data components and sources .....3
2. Hawai‘i commercial seafood landings in edible pounds, 2000-2009 .....3
3. Hawai‘i aquaculture production in edible pounds, 2000-2009 .....4
4. Hawai‘i non-commercial catch in edible pounds, 2003-2009 .....5
5. Hawai‘i foreign seafood imports in edible pounds, 2000-2009.....6
6. Hawai‘i seafood for foreign exports in edible pounds, 2000-2009 .....6
7. Hawai‘i total and per capita apparent seafood consumption, 2000-2009 .....8
8. Hawai‘i net available seafood consumption by source, 2000-2009 .....9
9. Sensitivity analysis of varying waterborne imports from continental U.S. ....10
10. Sensitivity analysis of varying all parameters .....10
11. Historical comparison of Hawai‘i to U.S. seafood consumption per capita  
in edible pounds .....11
12. Global comparison of seafood consumption per capita in live pounds,  
1977 and 2007 .....14
13. Top ten Hawai‘i seafood imports by country of origin-annual average, 2000-2009 14
- A2. Hawai‘i commercial seafood landings in live pounds, 2000-2009 .....18
- A3. Hawai‘i aquaculture production in live pounds, 2000-2009 .....18
- A4. Hawai‘i non-commercial catch in live pounds, 2003-2009 .....18
- A5. Hawai‘i foreign seafood imports in live pounds, 2000-2009 .....19
- A6. Hawai‘i seafood for foreign exports in live pounds, 2000-2009 .....19
- A7. Hawai‘i total and per capita apparent seafood consumption in live weight,  
2000-2009 .....20
- A8. Hawai‘i net available seafood consumption by source in live weight,  
2000-2009 .....20

# 1. INTRODUCTION

As the only U.S. state comprised entirely of islands and located in the remote, central Pacific Ocean, seafood is naturally a significant component in the food diet of residents in Hawai‘i. While it is apparent that Honolulu, ranks consistently in the top 10 U.S. ports for the value of fish landed, its ranking for equivalent fisheries volume is lower, at 31<sup>st</sup> among corresponding port in 2010.<sup>1</sup> In the absence of robust data on seafood in Hawai‘i, we can nevertheless present a good description of seafood expenditures in Hawai‘i by linking various datasets published by various federal and state government agencies.

In 2009, U.S. consumers collectively spent \$23.8 billion on seafood products for home consumption and another \$50.3 billion at food service establishments, including restaurants, carry-outs, and caterers; thereby contributing to an aggregate total expenditure of \$74.1 billion (Hedlund, 2010). The annual seafood consumption per capita is estimated at 16 edible pounds<sup>2</sup> for the entire country in 2009 (NOAA-NMFS, 2011). Although similar information is not available for Hawai‘i in 2009, relevant information from the Consumer Expenditures Survey (CES), U.S. Bureau of Labor Statistics (BLS) for the year 2004-2005 can be substituted and utilized to deduce the seafood consumption by dollar value in Hawai‘i.

As mentioned earlier, Hawai‘i’s location in the Pacific Ocean, combined with a diverse cultural population, contributes to a significantly higher at-home consumption of seafood than the national average. The 2004-2005 CES shows an annual per capita at-home seafood consumption expenditure of \$104 for Honolulu<sup>3</sup> as compared to only \$46 for the entire nation (BLS-CES 2005, 2008). In fact, consumers in Honolulu spent the highest amount on seafood followed by consumers in San Francisco, who spent \$78 annually per capita. Cities in the western states show a higher annual average seafood consumption per capita expenditure of \$53, more than the national average but just about half that of Honolulu.

If we assume that consumers in Honolulu are eating out in similar proportion as the national average, annual per capita expenditures on seafood at food service establishments would amount to \$226. Assuming further that the consumption pattern is similar across the entire state as in Honolulu, it can be estimated that Hawai‘i consumers would have spent about \$133 million on seafood for at-home consumption and \$275 million at food service establishments in 2004-2005<sup>4</sup>; these combined together make up over 11 percent of the total food expenditures.

Additionally, the above estimated total expenditures of seafood at \$408 million represent only the portion spent by the residents of Hawai‘i. In 2005, Hawai‘i visitors spent an estimated \$2.3 billion in food and beverage (DBEDT, 2005). If we further assume that 11 percent of this \$2.3 billion is spent on seafood as the Hawai‘i residents, it would amount to \$256 million. Total expenditures on seafood by Hawai‘i residents and visitors together can

---

<sup>1</sup>Query reports derived from NOAA-NMFS database rank Honolulu as the 9<sup>th</sup> leading U.S. port in terms of commercial fisheries landings by dollar value and 31<sup>st</sup> in terms of commercial fisheries landings by pound-age in 2010.

<sup>2</sup>Edible pounds refer to the portion of seafood that is readily consumed. For example, it includes the dressed up portion of fish or the edible portion of shellfish.

<sup>3</sup>Honolulu is a proxy variable for Hawai‘i because the BLS publishes only consumption expenditures for the City of Honolulu and not the State of Hawai‘i.

<sup>4</sup>It should be noted that 2004-2005 is the latest available information for Honolulu and considered statistically valid by the BLS.

then be estimated as \$664 million. Another note of interest is that expenditures on seafood as reported by the CES have been increasing at an annual rate of 2.2 percent in nominal terms and 0.6 percent in real terms (adjusted for inflation) for the ten-year period of 1994-1995 to 2004-2005. It is now evident that Hawai'i residents and visitors spent significantly more on seafood relative to the entire U.S.

With Honolulu fishery landings valued at \$59.4 million in 2009 (NOAA-NMFS, NOAA Fisheries Website), it is obvious that locally produced seafood cannot meet the market demand in Hawai'i. Hence, this research seeks to quantify and understand how much of the seafood consumed in Hawai'i is sourced outside local waters. Unfortunately, the information is not readily available due to the difficulties in reconciling the various data sources on imports, seafood expenditures and local production. For example, while customs data provide fairly disaggregated imports of various seafood items from foreign sources, interstate trade flow data are rather crude and not comparable with the customs data. Furthermore, it is difficult to convert data consistently from the various sources to a common point in the supply chain. For example, much of the seafood expenditure data are at the retail level, the import data are normally valued either at Freight On Board (FOB) or Cost, Insurance and Freight (CIF), and the production data are commonly valued at ex-vessel.

In 2005, an estimated \$72 million (ex-vessel value) of seafood was made available to the Hawai'i market from commercial fisheries and aquaculture operations in Hawai'i. If we were to assume a 30 percent share of the retail value for the producers (aqua-farmers and fishers), the \$72 million would translate to about \$240 million at retail. This would mean that about 64 percent of seafood had been imported.

## **2. HAWAI'I SUPPLY CHAIN AND RESEARCH OBJECTIVES**

In order to assess the different seafood supply sources, consumption per capita, species and form of seafood consumed, it is necessary to first define, establish and measure the various flows in the Hawai'i seafood supply value chain. From the existing literature, it is clear that crucial information is lacking to piece the whole picture together and, in monitoring the seafood flow at both the aggregated and disaggregated levels. This information is essential to assess the market competitiveness of local versus imported seafood. Additionally, the information is vital for the formulation of public policies that are intended to promote further development of the Hawai'i fisheries and aquaculture industries and their related products.

The primary objectives in this paper are to identify and outline the data sources, assess data completeness and integrity, and utilize appropriate methodologies to estimate the latest seafood consumption in Hawai'i. These estimates are then compared to the U.S. consumption per capita and other similar global per capita and historical estimates.

## **3. DATA AND DESCRIPTIVE STATISTICS**

Consumption in this paper is represented by apparent consumption. Apparent consumption is defined as production plus imports minus exports. The data components and corresponding sources used to calculate Hawai'i's apparent consumption are listed below

in Table 1. Official data for two components of Hawai‘i’s seafood apparent consumption equation are incomplete. They are italicized in Table 1. The methodology used to estimate continental U.S. imports and exports is presented in the next section.

**Table 1.** Hawai‘i apparent seafood consumption data components and sources

	Hawai‘i Production			+	Imports		-	Exports	
	Commercial Landings	Aquaculture	Non-commercial Catch		Continental U.S.	Foreign		Continental U.S.	Foreign
Data Source	Hawai‘i DLNR-DAR + NOAA-NMFS	USDA-NASS	NOAA-NMFS		<i>*US Army Corp of Engineers (waterborne only) + Dealer Survey</i>	USDA-FAS + <i>*Dealer Survey (continental U.S. transshipments)</i>		<i>*Dealer Survey (waterborne and airborne)</i>	USDA-FAS

Note: *\*Italicized* data sources indicate the corresponding data component requires an estimate from multiple sets of information versus a single authoritative published data source. The acronyms used are defined in the text below.

### 3.1 Commercial Landings

The Hawai‘i Department of Land and Natural Resources-Division of Aquatic Resources (DLNR-DAR) in cooperation with the National Oceanic Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS) publishes data on commercial seafood landings. DLNR-DAR/NOAA-NMFS reports 138 reported edible species for the years 2000 to 2009. Table 2 shows the 10-year annual average edible weight for Hawai‘i commercial seafood landings by species from 2000 to 2009. The total annual average weight for the 10-year period was 17.5 million edible pounds and the leading species caught was bigeye tuna.

**Table 2.** Hawai‘i commercial seafood landings in edible pounds, 2000-2009

Species Category	Annual Average (1,000 pounds)	% Total
Bigeye Tuna	6,608	37.8%
Yellowfin Tuna	2,347	13.4%
Other Pelagic	1,803	10.3%
Other Tuna	1,656	9.5%
Billfish	1,551	8.9%
Swordfish	1,455	8.3%
Mahimahi	877	5.0%
Other Fish	827	4.7%
Snapper	307	1.8%
Mollusks, Crustaceans & Aquatic Invertebrates	42	0.2%
Seaweed	11	0.1%
Flatfish & Tilapia	1	0.0%
<b>Total</b>	<b>17,485</b>	<b>100.0%</b>

Source: Hawai‘i DLNR-DAR/NOAA-NMFS, 2000-2009.



The commercial landings data are a compilation of all seafood caught for commercial purposes in Hawai‘i. Any individual or vessel engaged in taking, selling, or offering for sale any seafood for commercial purposes must possess a Hawai‘i Commercial Marine License. Additionally, all licensees are required by law (HRS-189-3) to report their marine catch to DLNR-DAR on a monthly basis.

### 3.2 Aquaculture

Aquaculture data are collected as a complete enumeration conducted by the U.S. Department of Agriculture-National Agricultural Statistics Service (USDA-NASS). The published volume data only reports shellfish and finfish. Shellfish includes marine shrimp, freshwater prawns, crayfish, lobsters, oysters, clams, snails, and abalone. Hawai‘i’s finfish aquaculture industry produces Japanese flounder, Chinese catfish, tilapia, carp, mullet, moi (Pacific threadfin), awa (milkfish), and amberjack (HDOA, 2009). Table 3 shows the 10-year average edible weight for Hawai‘i aquaculture production by species from 2000 to 2009. The total annual average weight for the 10-year period for aquaculture was 623,000 edible pounds. Finfish represents 58.5 percent of all aquaculture products raised in Hawai‘i.

**Table 3.** Hawai‘i aquaculture production in edible pounds, 2000-2009

Species Category	Annual Average (1,000 pounds)	% Total
Shellfish (including aquatic invertebrates)	259	41.5%
Finfish	364	58.5%
<b>Total</b>	<b>623</b>	<b>100.0%</b>

Source: USDA-NASS, various years.

USDA-NASS also reports algae, but only in terms of farmgate value, not volume. Algae, as a category, is Hawai‘i’s most valuable aquaculture crop. It is comprised mainly of *Spirulina* and *Hematococcus* for aquaculture feed additives and human nutritional supplements, and limu ogo (*Gracilaria*) for human consumption (HDOA, 2009). Unfortunately, the volume and percentage of algae produced for human consumption versus feed cannot be determined. For the year 2009, the value of Hawai‘i’s algae production was \$17 million or 53 percent of total aquaculture production versus shellfish that was valued at \$420,000 and finfish at \$4,447,000 (USDA-NASS, 2011). The Hawai‘i Department of Agriculture (HDOA) reports one reason that Hawai‘i aquaculture farmers receive attractive prices for their products is a strong demand for fresh, high quality fish from tourists and Southeast Asia and Pacific Island grocery stores (HDOA, 2009).

### 3.3 Non-commercial Catch

Non-commercial catch data are primarily recreational landings published by the National Oceanic Atmospheric Administration, National Marine Fisheries Service (NOAA-NMFS) under the Marine Recreational Information Program (MRIP). Non-commercial

catch is usually not considered when quoting seafood consumption for an area. However, in the case of Hawai‘i, it adds such a significant portion to available supply especially for *Yellowfin Tuna* and inshore marine species (Hospital et al., 2011). The earliest published year for Hawai‘i’s non-commercial data was 2003. Table 4 shows the 7-year annual average weight for Hawai‘i’s non-commercial catch by species from 2003 to 2009. The total annual average weight in edible pounds<sup>5</sup> for the 7-year period was 11.5 million edible pounds<sup>6</sup>. This average weight is also used as a proxy for 2000 through 2002 throughout this analysis when figuring total apparent consumption per capita from all sources.

**Table 4.** Hawai‘i non-commercial catch in edible pounds, 2003-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Yellowfin Tuna	5,681	49.5%
Mahimahi	1,561	13.6%
Other Tuna	1,398	12.2%
Other Pelagic	830	7.2%
Billfish	787	6.9%
Bigeye Tuna	257	2.2%
Other Fish	757	6.6 %
Snapper	194	1.7%
<b>Total</b>	<b>11,465</b>	<b>100.0%</b>

Source: NOAA-NMFS, 2011.

### 3.4 Foreign Imports and Exports

Data for all foreign imports and exports are available from the U.S. Department of Commerce, which is reported by customs district. The foreign trade data are accessible through the Global Agricultural Trade System (GATS) Online, which is published by the USDA Foreign Agricultural Service (USDA-FAS). The GATS Online contains statistics for any U.S. customs district by country of destination and origin, and by commodity at the 10-digit level of the Harmonized Tariff Schedule (Harmonized System), which is established by the World Customs Organizations (USDA-FAS, 2011). For the years 2000 to 2009, the U.S. Department of Commerce reported 326 different seafood commodities for import into Hawai‘i and 62 different seafood commodities for export from Hawai‘i.

Tables 5 and 6 list the available import and export general species categories from the highest to lowest, 10-year annual average weight, and their relative proportions. Hawai‘i receives the majority of its commercial supply of fish in the category “Other Fish” and “Mollusks, Crustaceans and Aquatic Invertebrates” from foreign sources. Both these categories combined account for almost 70 percent total foreign seafood imports by volume (see Table 5). The total annual average weight for foreign seafood imports for the

<sup>5</sup>The greater part of this paper discusses seafood consumption in edible pounds with some mention of live weight. See live weight conversions for figures mentioned throughout this paper in Appendix A. Weight is converted between live and edible using FAO (unpublished) conversions.

<sup>6</sup>Some industry analysts believe this MRIP figure may have been overestimated.

years 2000 to 2009 was 14.8 million edible pounds and almost 600,000 edible pounds of available seafood for foreign exports (see Table 6).

**Table 5.** Hawai‘i foreign seafood imports in edible pounds, 2000-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Other Fish	5,631	38.0%
Mollusks, Crustaceans & Aquatic Invertebrates	4,718	31.8%
Other Tuna	1,016	6.8%
Other Pelagic	886	6.0%
Tilapia	504	3.4%
Salmon	384	2.6%
Snapper	371	2.5%
Shrimp	356	2.4%
Bigeye Tuna	304	2.1%
Mahimahi	263	1.8%
Yellowfin Tuna	263	1.8%
Swordfish	68	0.5%
Cod/Pollock	44	0.3%
Flatfish	22	0.1%
<b>Total</b>	<b>14,829</b>	<b>100.0%</b>

Source: USDA-FAS, 2011.

**Table 6.** Hawai‘i seafood for foreign exports in edible pounds, 2000-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Other Tuna	175	29.2%
Mollusks, Crustaceans & Aquatic Invertebrates	162	27.1%
Bigeye Tuna	109	18.2%
Other Fish	51	8.5%
Yellowfin Tuna	44	7.4%
Other Pelagic	42	7.0%
Shrimp	11	1.8%
Cod/Pollock	3	0.4%
Salmon	1	0.2%
Flatfish	1	0.2%
<b>Total</b>	<b>599</b>	<b>100.0%</b>

Source: USDA-FAS, 2011.

## 4. METHODOLOGY

In the absence of robust data on Hawai'i seafood imports and exports linking the State with the continental U.S., we utilize 10 years of waterborne commerce data from the U.S. Army Corp of Engineers, Waterborne Commerce Statistics Center (ACE-WCSC, 2010) to estimate an average annual surface shipment of seafood into the state. To estimate the complementary airborne shipment of imports, we surveyed key Hawai'i-based commercial seafood dealers, identified in collaboration with the Hawai'i Seafood Council. We also conducted a survey of corresponding airborne shipment of exports. Finally, we utilized this survey instrument to estimate the proportion of foreign seafood imports to Hawai'i via transshipments passing through the continental U.S.

The survey instrument to each dealer focuses on the seafood sales value, weight, and product form (fresh/frozen or fillet/whole) by species. For each species listed, they were asked the proportion of airborne shipment (imports and exports) and the proportion of foreign transshipments.

To improve the confidence level of the aggregate estimates of Hawai'i's apparent seafood consumption, we applied sensitivity analyses to evaluate possible variations in the various components such as: 1) airborne imports from the continental U.S.; 2) seaborne and airborne exports to the continental U.S.; 3) foreign transshipments via the continental U.S.; and 4) waterborne imports from the continental U.S. The methodology above will begin to define Hawai'i's seafood supply chain by uncovering how much seafood enters and exits the state.

## 5. RESULTS

The findings from the commercial seafood dealers' survey revealed that 100 percent of local seafood exports to the continental U.S. were shipped airborne. Hence, the waterborne data from the U.S. Army Corp of Engineers were utilized solely to estimate Hawai'i seafood imports from the continental U.S. A closer analysis of this waterborne dataset indicates a high degree of variability in the 10-year period from 2000 to 2009. To present a more robust and consistent estimate for waterborne imports, we utilized the total annual average weight of 3.4 million edible pounds for the 10-year period.

The commercial seafood dealers survey also allowed us to estimate the proportion of airborne imports at 65 percent and waterborne imports at 35 percent of all Hawai'i imports from the continental U.S. These figures when applied to the total annual average weight for the 10-year period of 3.4 million edible pounds for waterborne imports to arrive at a total annual estimate of 9.7 million edible pounds of imports from the continental U.S. Likewise, a total annual estimate of 6.3 million edible pounds of Hawai'i seafood imports from the continental U.S. was shipped airborne.

The seafood dealers' survey further allowed us to estimate the amount of foreign transshipments via the continental U.S. at 75 percent of edible weight imported. This means that roughly 7.2 million edible pounds of Hawai'i annual imports from the continental U.S.

---

<sup>7</sup>The identity of the participating seafood dealers must remain anonymous. See Appendix B for an illustration of the completed survey instrument, relating to seafood trade with the continental U.S.

are of foreign origin. For the purposes of analysis in this paper, they are categorized as foreign imports rather than imports from the continental U.S.

Finally, we were able to enumerate the annual seafood exports to the continental U.S. at 1.25 million edible pounds from responses in the dealers' survey. Based on expert opinion from the two leading seafood exporters in the survey and their 40 percent market share, we estimated Hawai'i's annual seafood exports to the continental U.S. at 3.1 million edible pounds.

Because estimates for apparent seafood consumption do not generally include non-commercial catch, the estimates in this paper are presented with and without non-commercial catch, as well as in edible weight, and in live weight in Appendix A. Table 7 shows the estimates of Hawai'i total apparent seafood consumption on an annual average and the various components for the 10-year period from 2000-2009. Excluding non-commercial catch, the apparent seafood consumption on an annual average in Hawai'i is 38.9 million edible pounds. With the inclusion of non-commercial catch, the estimate increases to 50.4 million pounds. On a per capita basis,<sup>8</sup> the seafood consumption on an annual average in Hawai'i is 29 edible pounds without including non-commercial catch and 37 edible pounds with the inclusion non-commercial catch. The contribution of non-commercial catch is significant to the total availability of seafood in Hawai'i.

**Table 7.** Hawai'i total and per capita apparent seafood consumption, 2000-2009

	Hawai'i Production (1,000 pounds)			Imports		Exports		Consumption	
	Landings	Aquaculture	Non-Commercial	US	Foreign	US	Foreign	Total	Per capita (pounds)
Commercial Consumption	17,485	623		2,467	22,075	3,128	599	38,922	28.5
Commercial + Non-commercial Consumption	17,485	623	11,465	2,467	22,075	3,128	599	50,387	36.9

Note: The above values represent edible pounds. Italicized data indicate the corresponding data component requires an estimate from multiple sets of information versus a single authoritative published data source. See Appendix A for the live weight conversion of this table.

Table 8 shows the proportion of net available seafood consumption by source in Hawai'i, with and without non-commercial catch. Excluding non-commercial catch, foreign imports account for 57 percent of all seafood available for consumption in Hawai'i. Local commercial landings account for 37 percent of available seafood consumption while the remaining six percent is satisfied by imports from the continental U.S. With the inclusion of non-commercial catch, available seafood for consumption in Hawai'i shifts to 51 percent of the total from local sources. The proportion of foreign imports drop to 44 percent and imports for the continental U.S. fill the remaining five percent.

<sup>8</sup>The total estimate is divided by the de facto population in Hawai'i which takes into consideration military personnel stationed and tourists visiting the state.

**Table 8.** Hawai‘i net available seafood consumption by source, 2000-2009

Source	Net Available from Source Without Non-commercial Catch (1,000 pounds)	Percentage Without Non-commercial Catch	Net Available from Source With Non-commercial Catch (1,000 pounds)	Percentage With Non-commercial Catch
Local	14,380	37%	25,845	51%
Foreign Imports	22,075	57%	22,075	44%
Continental U.S.	2,467	6%	2,467	5%
Total Available for Local Consumption	38,922	100%	50,387	100%

Note: The net available seafood volume from local sources is derived by subtracting foreign and continental U.S. exports from the aggregate of local production sources. See Appendix A for the live weight conversion of this table.

## 5.1 Sensitivity Analysis

While airborne trade flows and foreign transshipment figures via the continental U.S. are derived from local seafood dealers, the estimates may not be sufficiently precise, given the low survey response rate. Three components in the measure of apparent consumption were estimated from the seafood dealers’ survey: 1) airborne imports from the continental U.S. (using an estimated at 65 percent of total imports for the continental U.S); 2) airborne exports to the continental U.S. (using an estimated 40 percent of total export as represented by the dealers’ survey); and 3) foreign transshipments via the continental U.S. (based on an estimated 75 percent of total imports from the continental U.S. are transshipped from foreign countries). The third estimate, foreign transshipments, does not affect the overall total apparent consumption per capita estimate, but it does affect the percentage of available supply from foreign sources.

As mentioned earlier, we utilized the total annual average weight for the 10-year period of 3.4 million edible pounds for waterborne imports. However, this waterborne dataset from the U.S. Army Corp of Engineers has a high degree of variability for the 10-year period from 2000 to 2009. Sensitivity analyses were conducted to evaluate the possible variations of the three estimates from the dealers’ survey and waterborne imports from the continental U.S. due to the volatile nature of the data from 2000 to 2009. Because the total volume as reported by the dealers’ survey already amounted to 2.7 million edible pounds, we feel that the estimated waterborne continental U.S. imports of 3.4 million pounds may be somewhat underestimated.

Table 9 shows the estimated total apparent consumption and consumption per capita if the waterborne continental U.S. imports were off the mark by 10, 20, 50, and 100 percent, assuming that all the other parameters are at their baseline levels. As shown in Table 9, the swing of the estimated annual consumption per capita can be as high as 7.1 edible pounds. In other words, the estimated annual consumption per capita would have been 35.6 edible pounds (excluding non-commercial catch) and 45.7 edible pounds (including non-commercial catch), if we underestimated the waterborne U.S. continental imports by 100 percent.

**Table 9.** Sensitivity analysis of varying waterborne imports from continental U.S.

Apparent Seafood Consumption				
Catch Source	Excluding Non-Commercial		Including Non-commercial	
% Change in Waterborne Imports from the Continental U.S.	Total (1,000 pounds)	Per capita (pounds)	Total (1,000 pounds)	Per capita (pounds)
-100%	29,209	21.4	43,090	31.5
-50%	34,065	24.9	47,946	35.1
-10%	37,960	27.8	51,831	37.9
<b>Baseline</b>	<b>38,922</b>	<b>28.5</b>	<b>50,387</b>	<b>36.9</b>
10%	39,893	29.2	53,774	39.3
50%	43,779	32.0	57,659	42.2
100%	48,635	35.6	62,516	45.7

We also investigated the effects on the estimated apparent consumption when all the parameters were off the mark simultaneously by 10 and 20 percent respectively. As shown in Table 10, the swing is larger at 6.9 edible pounds if we underestimated all the parameters by 20 percent as opposed to only 3.5 edible pounds if we overestimated all the parameters by 20 percent. Together with the results from the above sensitivity analysis, we feel that we may be off the mark by at most seven edible pounds.

**Table 10.** Sensitivity analysis of varying all parameters

Apparent Seafood Consumption				
Catch Source	Excluding Non-commercial		Including Non-commercial	
% Change in All Parameters	Total (1,000 pounds)	Per Capita (pounds)	Total (1,000 pounds)	Per Capita (pounds)
-20%	34,082	24.9	47,962	35.1
-10%	36,226	26.5	60,106	36.6
<b>Baseline</b>	<b>38,922</b>	<b>28.5</b>	<b>50,387</b>	<b>36.9</b>
10%	42,636	31.2	56,517	41.3
20%	48,353	35.4	62,234	45.5

## 6. DISCUSSION

Non-commercial catch is an important source of the seafood supply chain in Hawai‘i. It accounts for 39 percent of total local production when measured in edible pounds. In combination with local landings and aquaculture, non-commercial catch makes local production the largest source of available seafood in Hawai‘i. Collectively, all three components make up 51 percent of total available supply for local consumption in the state (see Table 8). *Yellowfin Tuna* emerged as the single largest species consumed in edible pounds when non-commercial catch is included in total apparent seafood consumption.

Excluding non-commercial catch, foreign imports are the largest source of available seafood in Hawai‘i, contributing 57 percent of total supply for local consumption in edible pounds (see Table 8). With the inclusion of non-commercial catch, foreign imports account for 44 percent of total seafood supply in Hawai‘i.

Likewise, about 80 percent of commercial landings remain in Hawai‘i, 18 percent are exported to the continental U.S., and two percent are exported to foreign countries. For aquaculture products, 85 percent remain in Hawai‘i, about 15 percent is exported to foreign countries, and a fractional percentage is exported to the continental U.S.

## 6.1 Apparent Seafood Consumption

The last time a study of Hawai‘i’s total apparent seafood consumption<sup>9</sup> was conducted, the primary objective was to determine if Hawai‘i had considerably higher seafood consumption per capita than the U.S. average (Hudgins, 1980). In that study, covering 1970-1977, apparent seafood consumption per capita in Hawai‘i was 1.7 times higher than the entire U.S. when measured in edible pounds. In this paper, we estimate the apparent seafood consumption per capita in Hawai‘i at a marginally higher, 1.8 times than the entire U.S., based on average annual consumption from 2000 to 2009 (see Table 11).

**Table 11.** Historical comparison of Hawai‘i to U.S. seafood consumption per capita in edible pounds

	1970-1977 <sup>1</sup>			2000-2009 <sup>2</sup>		
	Hawai‘i	U.S.	Hawai‘i: U.S.	Hawai‘i	U.S.	Hawai‘i: U.S.
Consumption	20.9	12.4	1.7	28.5	15.92	1.8
Change	-	-	-	36.4%	28.4%	5.9%

<sup>1</sup>All figures for 1970-1977 come from Hudgins (1980).

<sup>2</sup>Data is average from 2000 to 2009 of U.S. per capita use of commercial fish and shellfish from NOAA-NMFS (2001-2010).

The Food and Agricultural Organization (FAO, 2011) provides the U.S. seafood consumption in live weight as recently as 2007. Using live to edible conversions from the FAO (unpublished), Hawai‘i’s seafood consumption in live weight can be determined<sup>10</sup> for the years 2000 to 2009 using the data compiled in this paper. The 2007 live weight consumption for Hawai‘i, without including non-commercial catch, is 55.5 live pounds per person. The FAO (2011) report specifies the 2007 U.S. seafood consumption at 53.0 live pounds per person. In contrast to the Hawai‘i to U.S. per capita consumption ratio of 1.8 in edible pounds, the live weights for Hawai‘i and the U.S. are much closer with a ratio of 1.05.

<sup>9</sup>An additional study conducted by SMS Research on behalf of the NMFS Southwest Fisheries Center’s Honolulu Laboratory in 1983. Analysis was done at the wholesale and retail levels, but only the retail-level results were published in “Total Annual Estimates of Retail Seafood Purchases and Sales (supermarkets, grocery stores, fish markets, and military markets) in 1982” (SMS Research, 1983).

<sup>10</sup>See Appendix A for live weight conversions for figures mentioned throughout this paper.



This contrast can be explained by the varieties of seafood eaten by each population. Our analysis suggests that Hawai‘i consumes more fresh and frozen finfish, whereas the entire U.S. consumes more shellfish and processed seafood. Both shellfish and processed seafood have larger edible to live conversion factors. For example, in converting the edible weight of canned fish to live weight, the FAO uses a factor of 3.0, whereas for fish fillets it uses a factor of 1.62 to determine the live weight. Shellfish have edible to live conversion factors between 2.8 and 9.1.

Figure 1 shows that Hawai‘i consumes more fresh and frozen seafood than processed seafood in the two time periods, 1970-1977 and 2000-2009. Hawai‘i also consumes a higher proportion of fresh and frozen seafood in edible pounds as compared to the entire U.S. in the two periods reviewed. Statistics for the consumption of shellfish and other aquatic animals versus finfish are not available in the existing literature for Hawai‘i from 1970 to 1977. However, in the time period from 2000 to 2009, it is evident that Hawai‘i consumes a higher proportion of finfish and a lower proportion of shellfish as compared to the entire U.S. in edible pounds. These results show that Hawai‘i consumes not only more seafood on a per capita basis as compared to the entire U.S. but also differs in the type of seafood consumed. This noticeable difference in the pattern of apparent seafood consumption explains why Hawai‘i’s per capita live weight is so similar to that of the entire U.S. when it also consumes nearly twice as much, as measured on the basis of per capita edible weight.

## **6.2 Drivers in Hawai‘i’s Seafood Consumption**

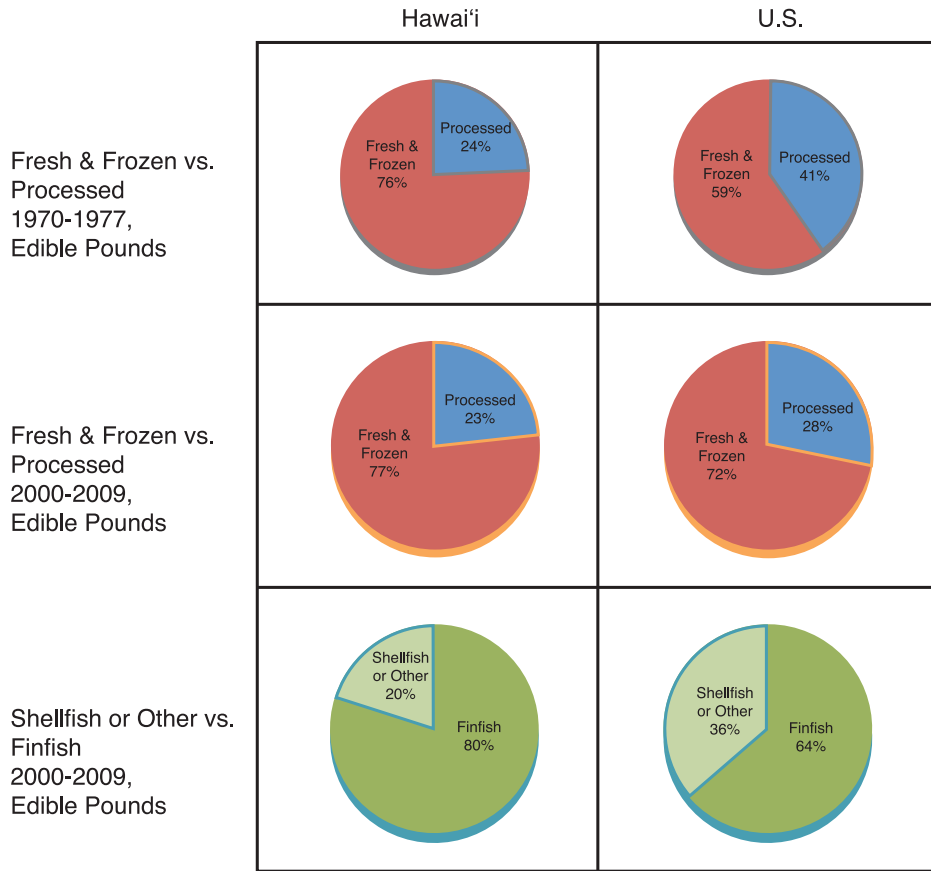
Between the two time periods, 1970-1977 and 2000-2009, the apparent seafood consumption per capita in Hawai‘i by edible weight increased by 36 percent as compared to 28 percent for the entire U.S. (see Table 11). Two trends may have driven Hawai‘i’s higher seafood consumption per capita compared to the entire U.S. over the two time periods: 1) higher visitors count to Hawai‘i; and 2) higher immigrant counts from countries with high seafood consumption.

From 1977 to 2009, the number of visitors to Hawai‘i that stayed overnight or longer almost doubled from 3,413,095 visitors in 1977 to 6,420,448 visitors in 2009 (DBEDT, 1977-2009). The majority of the visitors are from the continental U.S. Given Hawai‘i’s geographic location, these visitors are exposed to seafood that is not usually available to them on restaurant menus. The next highest visitors’ market origin is Japan. The Japanese are known for their high consumption of seafood and Japan is ranked in the top five highest per capita seafood consuming countries in both 1977 and 2007<sup>11</sup> (FAO, 2011). The increase in tourism since 1977 has influenced the higher rate of seafood consumption in Hawai‘i and the large portion of Japanese tourists over this three decade period fueled this growth.

For thousands of years, the Native Hawaiians maintained elaborate fish ponds across the islands to support their local communities; and often fished, trapped shellfish, and collected seaweed to supplement their land based diet. As the population grew over time, Hawai‘i needed to source more seafood beyond its shores. At the height of its plantation economy, immigrant workers came from countries with high seafood consumption including

---

<sup>11</sup>The most recent data from FAO (2011) is 2007 data.



**Figure 1.** Type of Seafood–Hawai‘i vs. U.S.

China, Japan, Korea, the Philippines, and Portugal. Subsequently, the U.S. immigration policy provided favorable preferences to close relatives, which encouraged additional immigrants from these countries to Hawai‘i in the past three decades. A sizable population of Micronesians has also migrated to Hawai‘i under provision of the Compact of Free Association (1985) during the past two decades. Most of these countries had substantially higher per capita fish consumption rates than the United States in 1977 and 2007. Table 12 shows the live seafood consumption per capita in Hawai‘i in comparison to select countries that are represented by the diversity of Hawai‘i’s population in 1977 and 2007. Micronesia consumes far more seafood per capita in live pounds than any other location in the world.

Hawai‘i receives the majority of its commercial seafood supply from foreign sources (57 percent in edible weight; see Table 8). While the countries of origin for foreign transshipments via the continental U.S. are not documented, direct imports by country of origin are well recorded. The leading direct import sources for Hawai‘i’s seafood as reported by the USDA Foreign Agricultural Service (FAS) were Taiwan, Japan, New Zealand, the Philippines, and the Marshall Islands. Table 13 below lists the top ten Hawai‘i seafood imports by country of origin from 2000 to 2009, by product weight and the corresponding dollar value.

**Table 12.** Global comparison of seafood consumption per capita in live pounds, 1977 and 2007<sup>1</sup>

		1977	2007
	Hawai‘i	N.A.	55.5 <sup>2</sup>
	U.S.	33.8	53.1
	World	25.3	36.8
Countries with large minority representation in Hawai‘i	Micronesia	137.4	164.5
	Japan	143.4	134.0
	Portugal	83.5	120.9
	South Korea	80.0	116.2
	Samoa	74.2	102.1
	Philippines	73.9	71.4
	China	12.8	58.4

<sup>1</sup>Data for worldwide live weight per capita consumption is from the FAO (2011); 2007 is the most current available data. Global edible weight figures are not available.

<sup>2</sup>This is the 2007 per capita estimate in live pounds per person using the methodology presented in this paper and excludes non-commercial catch, which would otherwise raise the 2007 estimate to 66.1 live pounds per capita.

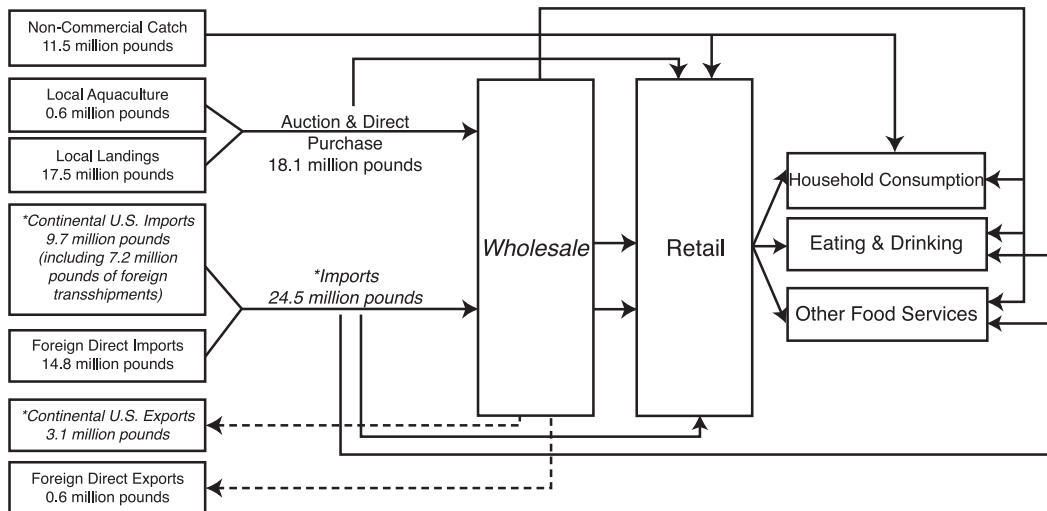
**Table 13.** Top ten Hawai‘i seafood imports by country of origin-annual average, 2000-2009

	Origin	(1,000 pounds)	(\$'000)
1	Taiwan	3,262	2,469
2	Japan	2,017	5,391
3	New Zealand	1,934	3,455
4	Philippines	1,336	2,226
5	Marshall Islands	1,051	2,268
6	Canada	1,017	3,280
7	China	823	2,157
8	Thailand	767	1,434
9	Other Pacific Islands	716	1,652
10	South Korea	663	1,055

Source: USDA-FAS (2011).

## 7. CONCLUSION

This paper attempts to assess the different seafood supply sources, consumption per capita, species, and form of seafood consumed in Hawai‘i. It starts off by defining, establishing, and measuring the various flows in the Hawai‘i seafood supply value chain (see Figure 2). From the existing literature, it is clear that crucial information is lacking and this effort serves to fill that gap by mapping the current seafood supply flows from various sources (local, U.S. domestic and foreign) to present an improved illustration of the



Note: *Italicized* components refer to estimates based on multiple sources of information versus an officially published data source.

**Figure 2.** Hawai'i's seafood value chain, 2000-2009 average

seafood marketplace in Hawai'i. This information is also essential to assessing the market competitiveness of local versus imported seafood.

Additionally, it serves to update the estimates on the apparent consumption of seafood per capita in Hawai'i. In this paper, one of our findings revealed that the proportion of Hawai'i's seafood imports by dollar value, estimated at 64 percent (Section 1, last paragraph), is highly correlated to the proportion of seafood imports by volume in edible weight, estimated at 63 percent (Section 5, Table 8; 57 percent foreign and 6 percent from the continental U.S.).

We were fortunate to arrive at reasonable estimates of the various components of local seafood production as well as the import and export components. As noted earlier, the biggest obstacle is in measuring the level of seafood imports from the continental U.S. This component is especially noteworthy as a portion of foreign transshipments is included in imports from the continental U.S. Additionally, we found that non-commercial catch contributes a significant amount of seafood to the local supply chain, estimated at 39 percent of total seafood production in Hawai'i (equivalent of 8 edible pounds per capita).

Furthermore, we found that while per capita seafood consumption in Hawai'i has increased over time (36.4 percent between 1970-1977 and 2000-2009), the ratio of consumption between Hawai'i and the U.S. has not changed much during the same period (ratio of 1.7 in 1970-1977 to 1.8 in 2000-2009), simply because the entire U.S. has been increasing its consumption of seafood. However, we did find a contrast in the variety and form of seafood eaten by each population. Hawai'i consumes more fresh and frozen finfish, whereas the entire U.S. consumes more shellfish and processed seafood.

Finally, we found that Hawai'i is quite dependent on seafood imports, receiving 57 percent of its commercial seafood supply from foreign sources and another 6 percent from the continental U.S. (see Table 8). Future reliance on foreign sources may decline as exporting countries must satisfy their increasing domestic consumer demands for seafood, driven in part by population and income growth, while simultaneously confronting depletion

pressures in their ocean resources and rising costs of transportation, which is driven to a large extent by higher fuel costs.

With reference to Figure 2, it is clear that the path of future research in the seafood value chain is to assess the level of supply flows from the wholesale sector to the retail sector and beyond to households, eating and drinking establishments (restaurants) and other food services establishments (food catering). Likewise, it is useful to measure import flows directly to commercial retail, eating and drinking establishments and other food services establishments. Lastly, while non-commercial catch is intended for household consumption, it is, nevertheless, interesting to assess its level of contribution (supply flow) to the retail sector.

## Acknowledgements

This publication benefited greatly from the constructive comments and suggestions of the following individuals: Dr. Paul Bienfeng (UHM-SOEST), Dr. Minling Pan (NOAA Fisheries), Dr. John Kaneko (PACMAR, Inc.), Mr. Justin Hospital (NOAA Fisheries), Mr. John Corbin (Aquaculture Planning & Advocacy, LLC) and Mr. Roger Uwate (Consultant). Responsibility for the final content rests with the authors. The authors gratefully acknowledge the funding support from NOAA's Hawai'i Seafood Program (Award No. NA09NMF4520171). The views expressed herein are those of the authors and do not necessarily reflect the views of NOAA or any of its subdivisions. Logistical support for report preparation and publication provided by the UHM JIMAR Pelagic Fisheries Research Program.

## References

- Food Agricultural Organization (FAO). "Conversion Factors EW to LW (average)." Rome, Italy. Unpublished Notes.
- Food Agricultural Organization (FAO). *FAOSTAT*. Rome, Italy. <http://faostat.fao.org/site/368/DesktopDefault.aspx?PageID=368#ancor> (accessed September 6, 2011).
- Hawai'i Department of Agriculture (HDOA). *Aquaculture Development Outlook*. Honolulu, HI, 2009. <http://Hawai'i.gov/hdoa/adp/outlook> (accessed September 6, 2011).
- Hawai'i Department of Business, Economic Development & Tourism (DBEDT). *Hawai'i Data Book*. Honolulu, HI, 1977-2009.
- Hawai'i Department of Business, Economic Development & Tourism (DBEDT). *2005 Annual Visitor Research Report*. Honolulu, HI, 2005.
- Hawai'i Department of Land and Natural Resources, Division of Aquatic Resources (DLNR-DAR) in collaboration with NOAA-NMFS. *Commercial Marine Landings Summary Trend Report*. Honolulu, HI, 2000-2009. [http://hawaii.gov/dlnr/dar/fishing\\_commercial.html](http://hawaii.gov/dlnr/dar/fishing_commercial.html)
- Hedlund, Steven. "U.S. seafood consumption drops in 2009." <http://www.seafoodsource.com/newsarticledetail.aspx?id=4294998771> (accessed January 12, 2012).
- Hospital, Justin, Skaidra Scholey Bruce, and Minling Pan. "Economic and Social Characteristics of the Hawai'i Small Boat Pelagic Fishery." NOAA-NMFS, Pacific Islands Fisheries Science Center. Honolulu, HI, 2011.

- Hudgins, L. "Per Capita Annual Utilization and Consumption of Fish and Shellfish in Hawai'i, 1970-77." *Marine Fisheries Review*, 42 (1980): 16-20.
- SMS Research. "Survey of the Broker and Retail Sectors of the Fish Markets in Hawai'i: Final Report." Honolulu, HI, 1983.
- U.S. Department of Agriculture-Foreign Agricultural Service (USDA-FAS). *Global Agricultural Trade System (GATS) online*. Washington, D.C., 2011. <http://www.fas.usda.gov/gats/default.aspx> (accessed September 28, 2011).
- U.S. Department of Agriculture-National Agricultural Statistics Service (USDA-NASS). *Aquaculture: Number of Operations, Production and Value, by Counties, 1993-2003*. Honolulu, HI, 2004.
- U.S. Department of Agriculture-National Agricultural Statistics Service (USDA-NASS). *Aquaculture: Number of Operations, Production and Value, by Counties, 2004-2008*. Honolulu, HI, 2009.
- U.S. Department of Agriculture-National Agricultural Statistics Service (USDA-NASS). *Aquaculture: Number of Operations, Production and Value, by Counties, 2006-2010*. Honolulu, HI, 2011.
- U.S. Department of Commerce. National Oceanic Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS). *Fisheries of the United States 2009*. Silver Spring, MD. <http://www.st.nmfs.noaa.gov/st1/fus/fus09/index.html> (accessed September 6, 2011).
- U.S. Department of Commerce. National Oceanic Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS). *Marine Recreational Fisheries Statistics Queries*. Silver Spring, MD. <http://www.st.nmfs.noaa.gov/st1/recreational/queries/index.html> (accessed September 6, 2011).
- U.S. Department of Commerce. National Oceanic Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS). *NOAA Fisheries: Office of Science and Technology Web Page*. Silver Spring, MD. <http://www.st.nmfs.noaa.gov/st1/commercial/index.html> (accessed January 5, 2012).
- U.S. Department of Commerce. National Oceanic Atmospheric Administration- National Marine Fisheries Service (NOAA-NMFS). *Fish Watch—U.S. Seafood Facts, September 13, 2011*. Silver Spring, MD. [http://www.nmfs.noaa.gov/fishwatch/trade\\_and\\_aquaculture.htm](http://www.nmfs.noaa.gov/fishwatch/trade_and_aquaculture.htm) (accessed December 10, 2011).
- U.S. Department of Labor. Bureau of Labor Statistics (BLS). *Consumer Expenditures Survey, 2004-2005. West Table 3031*. Washington D.C., 2008.
- U.S. Department of Labor. Bureau of Labor Statistics (BLS). *Table 8. Region of residence: Average annual expenditures and characteristics, Consumer Expenditure Survey, 2005*. Washington D.C., 2008. <http://www.bls.gov/cex/2005/Standard/region.pdf> (accessed January 5, 2012).
- U.S. Army Corp of Engineers-Waterborne Commerce Statistics Center (WCSC). *Cargo By Ports Part 4 Tons Year/Direction Ports Calendar Years 2009-2005*. New Orleans, LA, 2010.

## Appendix A—Select Tables in Live Weight

**Table 2.** Hawai‘i commercial seafood landings in live pounds, 2000-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Bigeye Tuna	9,251	36.5%
Yellowfin Tuna	3,286	13.0%
Other Pelagic	2,962	11.7%
Other Tuna	2,318	9.1%
Billfish	2,171	8.6%
Swordfish	2,037	8.0%
Mahimahi	1,420	5.6%
Other Fish	1,324	5.2%
Snapper	498	2.0%
Mollusks, Crustaceans & Aquatic Invertebrates	92	0.4%
Seaweed	11	0.0%
Flatfish & Tilapia	2	0.0%
<b>Total</b>	<b>25,372</b>	<b>100.0%</b>

Source: Hawai‘i DLNR-DAR/NOAA-NMFS, 2000-2009.

**Table 3.** Hawai‘i aquaculture production in live pounds, 2000-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Shellfish (including aquatic invertebrates)	690	54%
Finfish	588	46%
<b>Total</b>	<b>1,278</b>	<b>100.0%</b>

Source: USDA-NASS, various years.

**Table 4.** Hawai‘i non-commercial catch in live pounds, 2003-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Yellowfin Tuna	8,160	47.5%
Mahimahi	2,590	15.1%
Other Tuna	2,000	11.6%
Other Pelagic	1,369	8.0%
Billfish	1,115	6.5%
Bigeye Tuna	366	2.1%
Other Fish	1,250	7.3%
Snapper	325	1.9%
<b>Total</b>	<b>17,175</b>	<b>100.0%</b>

Source: NOAA-NMFS, 2011.

**Table 5.** Hawai‘i foreign seafood imports in live pounds, 2000-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Other Fish	9,987	37.8%
Mollusks, Crustaceans & Aquatic Invertebrates	9,092	34.4%
Other Tuna	1,422	5.4%
Other Pelagic	1,305	4.9%
Tilapia	817	3.1%
Salmon	767	2.9%
Snapper	600	2.3%
Shrimp	996	3.8%
Bigeye Tuna	426	1.6%
Mahimahi	426	1.6%
Yellowfin Tuna	368	1.4%
Swordfish	96	0.4%
Cod/Pollock	70	0.3%
Flatfish	35	0.1%
<b>Total</b>	<b>26,408</b>	<b>100.0%</b>

Source: USDA-FAS, 2011.

**Table 6.** Hawai‘i seafood for foreign exports in live pounds, 2000-2009

<b>Species Category</b>	<b>Annual Average (1,000 pounds)</b>	<b>% Total</b>
Other Tuna	350	29.0%
Mollusks, Crustaceans & Aquatic Invertebrates	332	27.5%
Bigeye Tuna	219	18.1%
Other Fish	101	8.4%
Yellowfin Tuna	89	7.4%
Other Pelagic	83	6.9%
Shrimp	22	1.8%
Cod/Pollock	5	0.4%
Salmon	3	0.2%
Flatfish	2	0.2%
<b>Total</b>	<b>1,207</b>	<b>100.0%</b>

Source: USDA-FAS, 2011.



**Table 7.** Hawai‘i total and per capita apparent seafood consumption in live weight, 2000-2009

	Hawai‘i Production (1,000 pounds)			+ Imports (1,000 pounds)		- Exports (1,000 pounds)		= Consumption (1,000 pounds)	
	Landings	Aquaculture	Non-Commercial	U.S.	Foreign	U.S.	Foreign	Total	Per capita (pounds)
Commercial Consumption	25,372	1,278		6,752	41,126	4,531	1,207	68,791	50.3
Commercial + Non-commercial Consumption	25,372	1,278	16,786	6,752	41,126	4,531	1,207	85,577	62.6

**Table 8.** Hawai‘i net available seafood consumption by source in live weight, 2000-2009

Source	Net Available from Source Without Non-commercial Catch (1,000 pounds)	Percentage Without Non-commercial Catch	Net Available from Source With Non-commercial Catch (1,000 pounds)	Percentage With Non-commercial Catch
Local	20,912	37%	37,698	44%
Foreign Imports	41,126	57%	41,126	48%
Continental U.S.	6,752	6%	6,752	8%
Total Available for Local Consumption	68,791	100%	85,577	100%

# Appendix B—Seafood Dealer Continental U.S. Trade Questionnaire



Hawai'i Fish and Seafood Product  
Marketing Channel Food Safety  
Evaluation

**For more information:**  
Cheryl Geslani  
geslani@hawaii.edu  
(808) 956-9835

Thank you for taking the time to fill out our quick four-question survey. The goal of this survey is to collect information on the inflow and outflow of fish and seafood directly coming from and going to the continental United States (including Alaska). Locally caught and grown fish and seafood as well as imports and exports from and to foreign countries are tracked by government agencies. However, there is no reliable source of information for the domestic flow, especially by air. Furthermore, there is no way to know exactly how much fish and seafood coming from the continental United States originated from foreign sources. We are asking your assistance to help us approximate this domestic flow. In the end, we hope to generate a more accurate picture of the flow and apparent consumption of fish and seafood in Hawai'i.

If you have any questions, please do not hesitate to contact us with the information listed above. We will inform you of any publication of information related to this survey. Your company's information will be aggregated among other participants and will remain anonymous.

**Question 1-**

Does your firm purchase or sell fish or seafood from or to the continental United States?

Yes  No

If 'Yes,' proceed to Question 2.

If 'No,' thank you for your time. Please return this survey using the enclosed pre-stamped envelope.

**Question 2-Continental United States Finfish Imports or Exports**

Step 1: List all the species your firm imported/exported from the continental United States in the last fiscal year. Fill in the circle if purchased from a local wholesaler. If your firm imports and exports the same specie report the imports and exports separately.

Step 2: Put an X indicating whether your firm imported or exported the particular specie.

Step 3: Estimate in pounds (lbs) and US dollars of the appropriate form and type for the particular specie that your firm imported/exported from the continental United States in the last fiscal year.

Step 4: Estimate the percentage of the appropriate form and type for the particular specie that was imported/exported from the continental United States by air in the last fiscal year.

Step 5: Only for the species that your firm imported, estimate the percentage of the appropriate form and type for the particular specie that actually came from foreign sources and was transshipped through the continental United States in the last fiscal year.

Step 1 Specie Name	Form	Type	Step 2		Step 3		Step 4 By air (%)	Step 5 Foreign Source (%)
			Import	Export	Total Continental Lbs	US Import/Export USD		
EXAMPLE SPECIE A  ● Imported through local wholesaler	Fresh	Whole		X	10000	30000	100%	N/A
		Fillet		X	20000	100000	100%	N/A
	Frozen	Whole	N/A	N/A	0	0	N/A	N/A
		Fillet	X		50000	125000	30%	80%
	Processed	Canned	X		35000	70000	0%	30%
		Dried	N/A	N/A	0	0	N/A	N/A
	Smoked	N/A	N/A	0	0	N/A	N/A	

Step 1		Step 2		Step 3		Step 4	Step 5	
Specie Name	Form	Type	Import	Export	Total Continental US Import/Export		By air (%)	Foreign Source (%)
					Lbs	USD		
○ Imported through local wholesaler	Fresh	Whole Fillet						
	Frozen	Whole Fillet						
	Processed	Canned						
Dried Smoked								
○ Imported through local wholesaler	Fresh	Whole Fillet						
	Frozen	Whole Fillet						
	Processed	Canned						
Dried Smoked								
○ Imported through local wholesaler	Fresh	Whole Fillet						
	Frozen	Whole Fillet						
	Processed	Canned						
Dried Smoked								
○ Imported through local wholesaler	Fresh	Whole Fillet						
	Frozen	Whole Fillet						
	Processed	Canned						
Dried Smoked								
○ Imported through local wholesaler	Fresh	Whole Fillet						
	Frozen	Whole Fillet						
	Processed	Canned						
Dried Smoked								
○ Imported through local wholesaler	Fresh	Whole Fillet						
	Frozen	Whole Fillet						
	Processed	Canned						
Dried Smoked								
○ Imported through local wholesaler	Fresh	Whole Fillet						
	Frozen	Whole Fillet						
	Processed	Canned						
Dried Smoked								

Step 1		Step 2			Step 3		Step 4	Step 5
Specie Name	Form	Type	Import	Export	Total Continental US Import/Export		By air (%)	Foreign Source (%)
○ Imported through local wholesaler	Fresh	Whole						
		Fillet						
	Frozen	Whole						
		Fillet						
	Processed	Canned						
		Dried						
Smoked								
○ Imported through local wholesaler	Fresh	Whole						
		Fillet						
	Frozen	Whole						
		Fillet						
	Processed	Canned						
		Dried						
Smoked								
○ Imported through local wholesaler	Fresh	Whole						
		Fillet						
	Frozen	Whole						
		Fillet						
	Processed	Canned						
		Dried						
Smoked								

**Question 3-Continental United States Shellfish Imports or Exports**

**Step 1:** List all the species your firm imported/exported from the continental US in the last fiscal year. Fill in the circle if purchased from a local wholesaler. If your firm imports and exports the same specie report them separately.

**Step 2:** Put an X indicating whether your firm imported or exported the particular specie.

**Step 3:** Estimate in pounds (lbs) and US dollars of the appropriate form and type for the particular specie that your firm imported/exported from the continental United States in the last fiscal year.

**Step 4:** Estimate the percentage of the appropriate form and type for the particular specie that was imported/exported from the continental US by air in the last fiscal year.

**Step 5:** Only for the species that your firm imported, estimate the percentage of the appropriate form and type for the particular specie that actually came from foreign sources and was transshipped through the continental US in the last fiscal year.

Step 1		Step 2			Step 3		Step 4	Step 5
Specie Name	Form	Type	Import	Export	Total Continental US Import/Export		By air (%)	Foreign Source (%)
					Lbs	USD		
EXAMPLE SPECIE A ○ Imported through local wholesaler	Fresh	In Shell		X	60000	18000	100%	N/A
		W/O Shell		X	5000	25000	100%	N/A
	Frozen	In Shell	N/A	N/A	0	0	N/A	N/A
		W/O Shell	X		5000	12500	30%	80%
	Processed	Canned	X		35000	70000	0%	30%
		Dried	N/A	N/A	0	0	N/A	N/A
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						

Step 1		Step 2		Step 3		Step 4	Step 5	
Specie Name	Form	Type	Import	Export	Total Continental US Import/Export		By air (%)	Foreign Source (%)
					Lbs	USD		
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						
○ Imported through local wholesaler	Fresh	In Shell						
		W/O Shell						
	Frozen	In Shell						
		W/O Shell						
	Processed	Canned						
		Dried						

**Question 4-Continental United States Other Fish and Seafood Imports or Exports**

**Step 1:** List all the species (seaweed, roe, etc) your firm imported/exported from the continental United States in the last fiscal year. If your firm imports and exports the same specie report the imports and exports separately.

**Step 2:** Put an X indicating whether your firm imported or exported the particular specie.

**Step 3:** Estimate in pounds (lbs) and US dollars of the appropriate form and type for the particular specie that your firm imported/exported from the continental United States in the last fiscal year.

**Step 4:** Estimate the percentage of the appropriate form and type for the particular specie that was imported/exported from the continental United States by air in the last fiscal year.

**Step 5:** Only for the species that your firm imported, estimate the percentage of the appropriate form and type for the particular specie that actually came from foreign sources and was transhipped through the continental United States in the last fiscal year.

Step 1				Step 2		Step 3	Step 4
Specie Name	Form	Import	Export	Total Continental US Imports		By air (%)	Foreign Source (%)
				Lbs	USD		
EXAMPLE SPECIE A ROE	Fresh	X		300	2400	100%	50%
	Frozen			0	0	N/A	N/A
	Processed			0	0	N/A	N/A
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						
○ Imported through local wholesaler	Fresh						
	Frozen						
	Processed						

Thank you again for your time. Please return this survey to:

Cheryl Geslani  
 University of Hawai'i at Mānoa – CTHAR/NREM  
 1910 East-West Road, Sherman 101  
 Honolulu, HI 96822  
 or  
 geslani@hawaii.edu

If you have any questions regarding your rights as a research participant, please contact the UH Committee on Human Studies at:  
 (808) 856-5007

