A Review of World Shrimp Production and Trade: 1980-93

WALTER R. KEITHLY, JR.[1] and YUNSHENG SONG[2]
[1]*Center for Coastal, Energy, and Environmental Resources*
Louisiana State University, Baton Rouge, Louisiana 70803
[2]*Department of Oceanography and Coastal Science*
Louisiana State University, Baton Rouge, Louisiana 70803

ABSTRACT

Shrimp is one of the world's largest fisheries when measured in terms of the value of output. With the increased success of farming activities throughout the world, during the 1980's, world shrimp production, *i.e.*, combined wild and farm-raised harvests, expanded substantially. Trade in this important seafood commodity simultaneously expanded and became more complex in nature.

Two main subject areas are covered in this paper. First, shrimp production by primary producing areas of the world (*i.e.*, Central America, South America, and Asia) are examined during the 1980-93 period and changes therein are related to farming activities. Then, exports of shrimp products by region of the world are analyzed with respect to the two primary import markets, the United States and Japan. Changes in volume of trade, export prices and product composition are evaluated and related to production trends.

Keywords: Japan, Shrimp, Trade, United States

INTRODUCTION

World exports of shrimp, valued in excess of $7.1 billion, constituted about 17% of the $41.2 billion 1993 international trade market in fisheries commodities (FAO Yearbook of Fisheries Statistics, Vol. 77). Trade in shrimp has expanded considerably since the 1980s in response to increased world production of the commodity and favorable economic conditions (Keithly *et al.* 1993). The expansion in world shrimp production and trade has provided many developing countries throughout the world with added income and foreign currency as well as an additional employment base.

The overall goal of this paper is to examine overall trends in production and trade in shrimp during the 1980-93 period. Since the United States and Japan play a dominant role in the international shrimp market, special emphasis is devoted to analysis of trade in these two countries.

To achieve the aforementioned goal, the paper begins with an examination of world trends in shrimp production for the period of study. Then, an analysis of the world export and import markets is presented. In the third section of the paper, the U.S. and Japanese shrimp markets are examined in some detail. The paper concludes with a discussion of relevant findings and additional research recommendations.

WORLD SHRIMP PRODUCTION

Trends in world shrimp production for the 1980-93 period are examined as follows. First, production is evaluated on the basis of several geographic regions (Asia, Central America, South America, United States, and "other"). Then, production is evaluated in relation to the major producing countries of the world. Since much of the shrimp currently being produced throughout the world is of farm-raised origin, this unique aspect of production and expansion thereof is considered in relation to production changes among the individual countries.

Production by Region

Shrimp production, like that of many seafood commodities, is comprised of a combination of wild harvest and farming activities. Estimated total annual shrimp production (*i.e.*, wild and farm production) throughout the world, as indicated in Table 1, expanded from 3.4 billion live-weight pounds in 1980 (approx. 2.1 billion pounds headless weight based on a conversion factor of 0.63) to 5.5 billion pounds in 1993 (3.42 billion pounds headless weight), or by approximately 60%. This translates into a annualized growth rate of approximately 175 million pounds per year.

The majority of world production, as indicated by the information contained in Table 1, is Asian-based. In 1980, an estimated 55% of the world shrimp production was of Asian origin. By 1993, the Asian share had advanced to more than 60%. Overall, the 3.4 billion pounds of shrimp (whole weight) produced in Asia in 1993 represented an 80% increase over 1980 production of 1.9 billion pounds.

Shrimp production in Central America, as shown in Table 1, generally fell in the relatively narrow range of 230 million pounds and 270 million pounds during the period of study with no apparent upward trend. South American production, by comparison, more than doubled during the period of analysis. Annual South American shrimp production has exceeded that reported for Central America since 1983, with the margin widening during the intervening period of time in relation to expanding South American production relative to constant Central American production.

Combined production from Central and South America (428 million live-weight pounds) represented 13% of estimated world output in 1980 and, in general, little change in the contribution to world production from this area was evident during the study period. While production from Central and South America represents a relatively small percentage of the world total, the Region plays a significant role in the international shrimp market in light of the fact that much of its output is destined for the U.S. market. This relationship is examined in greater detail in a subsequent section of the report.

The United States, while being one of the world's two largest importers of shrimp (second only to Japan), also produces significant quantities of shrimp

Table 1. Annual World Production of Shrimp* (in millions of pounds live weight), 1980-93.

	Region					
Year	Asia	Central America	South America	United States	Other	Total
1980	1,967	241	187	357	730	3,482
1981	1,795	245	197	355	717	3,309
1982	1,953	257	246	301	783	3,541
1983	1,972	247	323	265	906	3,713
1984	2,033	256	325	320	959	3,894
1985	2,395	268	304	339	1,037	4,343
1986	2,752	263	309	405	915	4,644
1987	2,998	270	367	365	970	4,970
1988	3,290	248	390	333	956	5,217
1989	3,131	252	382	357	1,035	5,157
1990	3,309	208	402	353	1,064	5,335
1991	3,646	237	472	326	1,127	5,808
1992	3,759	227	486	343	1,154	5,969
1993	3,635	274	410	298	1,136	5,753

Source: FAO unpublished landings data.

* Excludes *Acetes japonicus* species harvested primarily in China and used as paste.

(Table 1). With exceptions, annual live-weight production of shrimp in the U.S. generally ranged from about 300 million pounds to 360 million pounds while the 1980-93 average annual production equalled 337 million live-weight pounds (approx. 212 million headless pounds). No discernable trend in U.S. production was evident during the period of analysis.

Shrimp production from "other" areas, *e.g.*, Europe, Greenland, Australia, and Africa, traditionally averaged about 20% of total world production during the 1980-93 period. Production from these other areas advanced from 730 million pounds in 1980 to 1.36 billion pounds in 1993, or by about 55%. Production from the European countries in 1993 equalled 378 million pounds while production from Greenland equalled 170 million pounds. African production was relatively small, estimated to equal 129 million pounds, while Australian production was just under 50 million pounds.

Much of the growth in world shrimp production since 1980 has, of course, been the result of successful farming activities throughout the world, particularly in Asia and, to a lesser extent, South America and Central America. While estimates of farm-raised shrimp production are subject to a certain degree of error (especially in earlier years before it was monitored more clearly), one estimate places farm-raised production at about 215 million live-weight pounds in 1980 (see Appendix A), equivalent to about six percent of the total world production. By 1992 (the last year for which reliable data are available), estimated farm-raised production had advanced to 1.85 billion live-weight pounds. This estimate suggests that farm-raised production currently exceeds 30% of the total world production. Furthermore, subtracting estimated farm-raised production from the total provided in Table 1 indicates that the 1992 wild shrimp harvest approximated 4.1 billion pounds, or slightly more than 20% above the estimated 3.35 billion pound wild catch in 1980. It is thus evident that the overwhelming majority of shrimp production growth during the 1980-93 period has been the result of expanded farming activities.

Production by Principal Countries

An analysis of production trends in some of the principal countries in Asia and Central and South America is presented herein. (Note: some Caribbean production, principally Cuba, is included with Central America.) The intent is to examine overall change in production and the contribution to that change in relation to farming activities. A detailed analysis of farming activities in the different regions, while important for a more complete understanding of the world market, is outside the scope of this paper. However, such an analysis has recently been completed and is presented in a series of documents (U.S. Dept. of Commerce, 1992[a], 1992[b]) to which the reader is referred.

Asia

Annual shrimp yields among the principal producing Asian countries are provided in Table 2. The nine countries identified therein consistently represented from about 90% to 95% of the total Asian production during the period of study. Production among the three traditionally largest producing countries - Thailand, Indonesia, and India - during the period of analysis ranged from more than 55% of the Asian total during the early 1980s to less than 45% of the total during the 1985-88 period. The relatively low proportion of the total accounted for by these three countries during the later period was related to the relatively large production in China and Taiwan during the same period.

Thailand. Production in Thailand advanced from about three-hundred million pounds in 1980 to almost three-quarters of a billion pounds in 1993 at which point in time it represented 20% and 13% of total Asian and world output, respectively. The majority of shrimp output expansion in Thailand during the period of analysis reflects advances in farm-raised output. Estimated farm-raised output in Thailand increased from about 22 million pounds (live weight) in 1980 to 265 million pounds in 1992 (see Appendix A), suggesting that in excess of 35% of Thailand's annual shrimp harvest is currently of a farm-raised origin.

Indonesia. Indonesia's production of shrimp followed a similar trend to that of Thailand. Production of 736 million pounds in 1993 reflects a 130% increase over the 1980 base of 314 million pounds. Like Thailand, Indonesia accounted for approximately 20% of the 1993 Asian production and just under 13% of total world production. One distinguishing element of Indonesia's shrimp yield reflects the fact that aquaculture operations in Indonesia were well established as early as 1980, with Indonesia's output from aquaculture representing more than a third of the world's estimated total. In 1980, Indonesia's estimated farm-raised shrimp output exceeded 75 million pounds, or approximately 25% of the country's total output (Appendix A). By 1992, the country's farm-raised output had advanced to 330 million pounds, or 42% of the nation's total shrimp yield.

India. India was by far the world's largest producer of shrimp in the early 1980s. Though India's production advanced during the period of analysis, averaging 612 million pounds annually in 1990-93 compared to 450 million pounds annually in 1980-84, its relative share of the Asian and world market fell sharply during the study period due to higher relative production gains among other Asian and world nations. Overall, India's estimated farm-raised shrimp output increased from 22 million pounds in 1980 to 93 million pounds in 1992 indicating that about 15% of India's total annual shrimp harvest is derived from aquaculture activities.

China. China's production of shrimp in 1980, 113 million live-weight pounds, was relatively small compared to many of the other Asian countries

Table 2. Annual Asian Production of Shrimp From Selected Countries (in millions of pounds live weight), 1980-93.

	Country								
Year	Thailand	Indonesia	India	China	Taiwan	Malaysia	Philippines	Vietnam	Pakistan
1980	302	314	553	113	178	185	76	91	57
1981	335	318	362	71	162	209	94	92	66
1982	422	301	364	64	181	149	122	94	59
1983	367	319	426	116	197	169	108	108	61
1984	317	308	449	135	225	155	144	104	61
1985	301	334	513	348	239	153	173	110	59
1986	327	362	475	555	306	161	201	121	59
1987	359	430	435	652	391	161	174	132	66
1988	392	527	478	868	256	161	191	143	65
1989	466	549	499	629	219	161	201	155	52
1990	510	570	544	708	171	161	212	166	62
1991	657	652	664	700	170	158	207	177	71
1992	682	730	623	698	129	163	282	194	59
1993	748	736	617	500	83	164	287	198	77

Source: Complied from unpublished FAO landings data.

(Table 2). Total production expanded rapidly after 1985 in conjunction with significant advances in shrimp farming activities. By 1992, China's total production had increased to almost 700 million pounds, an estimated 70% of which was farm-raised based. China's total production fell sharply in 1993, however, to 500 million pounds. This decline reflects a significant reduction in farm-raised output due to disease (see Rosenberry, 1994, for discussion).

Taiwan. Taiwan's total annual shrimp harvest expanded from 178 million live-weight pounds in 1980 to almost 400 million live-weight pounds in 1987. Thereafter, however, total production fell sharply and equalled only 83 million pounds in 1993. At its peak, *i.e.*, 1987, shrimp farming activities accounted for more than 40% of Taiwan's total shrimp output. The decline in Taiwan's shrimp farming activities after 1987, as identified in Appendix A, was the result of diseases interfering with the production cycle.

Other Asian Countries. In addition to the Asian countries already discussed, Malaysia, the Philippines, Vietnam, and Pakistan also produce significant quantities of shrimp (Table 2). Two of these countries, Vietnam and the Philippines, also report significant farm-raised output (Appendix A).

Central America

Annual shrimp production among the six principal Central American producing countries is identified in Table 3. These six countries generally account for approximately 95% of the total Central American shrimp output.

Mexico, as indicated, dominates shrimp output in the Central American Region, generally accounting for 60% to 70% of the total. Panama, with annual production generally falling in the 20 million pound to 35 million pound range, is the second largest producer in the Central American Region. Production among other Central American countries tends to be relatively minor. As indicated in Appendix A, shrimp farming activities among countries in the Central American Region are also relatively small with the exception of Mexico (which produced about 13 million pounds of farm-raised shrimp in 1992), Panama (9 million pounds), and Honduras (11 million pounds).

South America

South American shrimp production, as indicated by the information contained in Table 4, is primarily situated in two countries - Brazil and Ecuador. Production in Ecuador expanded from 37 million live-weight pounds in 1980 to more than 250 million pounds in 1991 and 1992 before falling somewhat to about 220 million pound in 1993. In 1980, Ecuador's farm-raised shrimp output equalled an estimated 20 million pounds (Appendix A), or almost 55% of the country's total shrimp output. By 1992, Ecuador's farm-raised output had advanced to an estimated 242 million pounds, suggesting that more than 95% of Ecuador's total shrimp output is currently derived from farming activities.

Table 3. Annual Central American Production of Shrimp From Selected Countries (in millions of pounds live weight), 1980-93.

	Country					
Year	Mexico	Panama	Honduras	Nicaragua	Cuba	Costa Rica
1980	171	23	6.5	9.1	12.4	7.7
1981	159	34	7.2	7.6	10.0	10.2
1982	174	33	6.0	5.9	11.6	10.0
1983	175	31	8.8	3.4	9.9	5.9
1984	176	26	8.1	3.5	9.3	9.7
1985	172	41	8.5	3.8	10.7	19.1
1986	168	36	13.1	2.3	10.1	19.2
1987	192	24	11.4	2.4	10.9	13.4
1988	170	21	16.6	3.1	9.8	12.5
1989	172	30	9.4	2.9	8.9	11.5
1990	141	20	11.1	2.3	5.3	11.1
1991	159	29	13.7	4.2	6.3	6.4
1992	149	25	16.9	3.3	5.9	8.0
1993	176	27	25.9	6.3	6.7	10.8

Source: Compiled from unpublished FAO landings data.

Table 4. Annual South American Production of Shrimp from Selected Countries (in millions of pounds live weight), 1980-93.

	Country					
Year	Ecuador	Brazil	Colombia	Argentina	Peru	Chile
1980	37	128	10	1.8	1.8	6.0
1981	44	125	12	6.0	1.4	6.5
1982	65	138	13	17.2	3.5	7.6
1983	98	132	13	42.6	21.4	14.6
1984	88	149	18	51.0	9.4	8.5
1985	80	171	11	22.7	11.3	6.5
1986	117	144	14	15.4	11.2	6.6
1987	175	138	15	6.3	19.7	9.9
1988	184	119	17	40.0	17.4	11.0
1989	175	123	24	26.2	19.5	12.4
1990	189	127	25	22.2	21.8	14.7
1991	264	110	28	18.5	33.4	16.7
1992	252	113	26	54.7	22.7	18.2
1993	222	97	22	39.4	12.2	18.2

Source: Compiled from unpublished FAO landings data.

Brazil's shrimp production tends to be highly variable when examined on a yearly basis. While variable, there appears to be no upward trend in production. In fact, the 97 million pounds reported in 1993 was the lowest yield reported during the 14-year period of analysis.

WORLD SHRIMP EXPORTS AND IMPORTS

Exports of shrimp, in conjunction with the expansion in production, have risen significantly during the 1980-93 period. World exports and imports of shrimp, and changes therein, are examined in this section of the report. To do so, aggregate world exports are first examined. (Note: subject to minor discrepancies, *e.g.*, the time lag between the dispatch of a good from the exporting country and its arrival in the importing country, aggregate exports of shrimp in any given year will equal the aggregate imports.) Then exports and imports among principal trading partners are presented.

Aggregate Exports of Shrimp

World exports of fresh and frozen shrimp (these two categories constitute the overwhelming majority of trade) in 1980 equalled 854 million product weight pounds (Table 5). By 1993, exports had increased about 165% to 2.3 billion pounds. The fact that the increase in world shrimp trade during 1980-93 (approx. 165%) greatly exceeded the 65% increase in world production during the corresponding period indicates that an increasing proportion of world production is being traded on the world market.

While somewhat imprecise due to several issues - different product forms being traded, the issue of re-exporting, etc. - a rough estimate of the proportion of world production being traded can be made by comparing the relevant information in Tables 1 and 5. In 1980, world production, expressed on a live-weight basis, equalled 3.48 billion pounds. This translates to a headless shell-on weight of approximately 2.19 billion pounds. Product weight exports for the year equalled 854 million pounds, or 39% of the world headless-weight production. By 1993, the relevant ratio had advanced to more than 60%.

The value of world shrimp exports in 1980, as indicated by the information contained in Table 5, equalled $2.3 billion. Based on FAO estimates, this represented 15.1% of the total world trade in seafood products. By 1993, the current value of world shrimp trade had advanced more than 200% to $7.1 billion, or 17.3% of the total value of world trade in seafood products.

Much of the increase in value of world shrimp trade during the period of study was, of course, inflationary based. After adjusting for inflation (using the United States CPI, 1982-84 = 100), the value of world shrimp trade advanced by a more moderate 75%, from $2.81 billion to $4.93 billion. The 75% increase in deflated value was significantly lower than the 165% increase in export quantity, reflecting the sharp decline in the real price of the exported product during the

Table 5. Estimated World Exports of Fresh, Chilled, and Frozen Shrimp, [a] 1980-93.

		Value ($ mill)		
Year	Mill.Lbs[b]	Current	Deflated[c]	Deflated Price[c]
1980	854.2	2,314.7	2,809.1	3.29
1981	845.7	2,334.5	2,568.2	3.04
1982	900.5	2,520.1	2,611.6	2.90
1983	972.4	2,720.2	2,731.1	2.81
1984	1,108.5	2,910.8	2,801.5	2.53
1985	1,189.3	2,947.9	2,739.7	2.30
1986	1,462.1	4,235.3	3,864.3	2.64
1987	1,765.8	5,324.5	4,687.0	2.68
1988	1,849.5	5,798.9	4,901.9	2.65
1989	1,873.0	5,546.9	4,473.3	2.39
1990	1,996.3	6,097.2	4,665.0	2.34
1991	2,149.3	6,624.6	4,863.9	2.26
1992	2,259.7	6,844.7	4,878.6	2.16
1993	2,261.0	7,118.2	4,926.1	2.18

Source: FAO Yearbook of Fishery Statistics, Fishery Commodities (volumes 61 and 77).

[a]Data does not include small amounts of canned and other shrimp products.
[b]Poundage is expressed on a product weight basis.
[c]The United States CPI (1982-84 = 100) was used to deflate value and price.

study period (Table 5). Overall, the 1993 deflated price of $2.18 per product weight pound reflects a 34% decline from the $3.29 estimated for 1980. This would tend to suggest that growth in supply during 1980-93 exceeded the growth in demand, ceteris paribus, resulting in a downward trend in the real price of the product.

Exports and Imports Among Principal Trading Partners

Exports

Information pertaining to world exports of fresh and frozen shrimp by principal countries for selected years during the 1980-93 period is presented in Table 6. Though the large amount of information contained in the table prevents detailed discussion, some generalizations can be formalized. First, it is noteworthy that the largest five exporters (by value) have traditionally accounted for approximately 40% to in excess of 50% of the total value of the world shrimp export market while the largest ten countries traditionally contributed from about 60% to almost 70% of the total. Including the next largest five countries indicates that the largest fifteen exporters generally accounted for between 70% and 80% of the total value in world export trade of shrimp.

A second feature highlighted by the information contained in Table 6 reflects the growing significance of the Asian market in the world shrimp export market. Based upon the fifteen countries listed for each year of analysis, it can be surmised that the Asian nations represented a minimum of 38% of the total value of world shrimp trade in 1980 (only a minimum estimate can be presented due to the other category). By 1993, this figure had risen to 57%. Conversely, representation by Central and South American countries in world shrimp export trade (value) fell from a minimum of about 29% in 1980 to about 13% in 1993.

A third feature highlighted by the information contained in Table 6 reflects the growing significance of aquaculture producing nations in the shrimp trade market. Comparing the information contained in Table 6 with that in Appendix A reveals that the five largest exporters of shrimp by value in 1993 were also the five largest producers of farm-raised shrimp the preceding year (a similar finding would also undoubtedly be revealed based on 1993 farm-raised shrimp estimates by country, if available). Three other large producers of farm-raised shrimp in 1993 (*i.e.*, >50 million pounds) - Philippines, Bangladesh, and Vietnam - were also among the fifteen primary exporters in 1993. The only country that produced more than fifty million pounds of farm-raised shrimp in 1992 that did not appear among the fifteen largest exporters in 1993, in fact, was Taiwan. This is because Taiwan's farm-raised shrimp output, which fell sharply after 1987, likely fell even further in 1993. Based on total output, Taiwan's total shrimp production, *i.e.*, natural and farm-raised, fell 35% in 1993 from 1992 to just 83 million live-weight pounds.

Table 6. Estimated World Exports of Fresh and Frozen Shrimp[a] by Principal Countries, 1980-93 (selected years).

Country[b]	Mill.Lbs[c]	$ Mill	%[d]
		1980	
1. Mexico	96.1	495.0	21.4
2. India	105.3	233.3	10.1
3. China	47.9	180.2	7.9
4. Indonesia	67.2	177.9	7.7
5. Australia	26.7	130.7	6.7
Subtotal	343.1	1,217.0	52.6
6. Thailand	39.5	95.8	4.1
7. Hong Kong	28.4	93.6	4.0
8. Ecuador	21.4	71.8	3.1
9. Denmark	49.0	62.1	2.7
10. Malaysia	31.1	57.5	2.5
Subtotal	169.4	380.8	16.5
11. United States	15.9	48.9	2.1
12. Panama	14.5	48.7	2.1
13. Brazil	16.5	45.0	1.9
14. Bangladesh	19.2	38.9	1.7
15. Netherlands	21.0	36.4	1.6
Subtotal	87.2	217.9	9.4
Other	254.6	498.9	21.6
TOTAL	854.2	2,314.7	100.0
1. Mexico	67.1	326.6	10.8
2. India	109.2	254.5	8.4
3. Taiwan	75.9	246.8	8.2
4. Indonesia	64.6	196.1	6.5
5. Ecuador	44.5	158.9	5.3
Subtotal	361.3	1,182.9	39.2
		1985	
7. Hong Kong	43.1	134.3	4.4
8. Australia	27.3	117.0	3.9
9. Brazil	35.2	98.9	3.3
10. Denmark	77.4	94.3	3.1
Subtotal	247.5	584.5	19.3
11. Bangladesh	49.1	78.0	2.6
12. Greenland	59.6	74.4	2.5
13. China	22.0	66.9	2.2
14. Panama	20.2	66.5	2.2

Table 6. Continued

Country[b]	Mill Lbs[c]	$ Mill	%[d]
15. Philippines	17.9	62.5	2.1
Subtotal	168.7	348.4	11.5
Other	411.8	905.9	30.0
TOTAL	1,189.3	3,021.7	100.0
1. Thailand	188.8	806.6	13.2
2. China	261.9	707.7	11.6
3. Indonesia	193.1	650.4	10.7
4. Ecuador	127.9	372.8	6.1
5. India	136.4	346.4	5.7
Subtotal	908.2	2,883.9	47.3
6. Hong Kong	100.2	286.3	4.7
7. Denmark	96.5	230.1	3.8
8. Philippines	53.2	218.7	3.6
9. Mexico	39.1	203.1	3.3
10. Greenland	69.4	174.2	2.9
Subtotal	358.5	1,112.4	18.4
11. Bangladesh	57.3	145.9	2.4
12. United States	31.7	129.8	2.1
13. Australia	25.8	128.6	2.1
14. Singapore	42.8	117.0	1.9
15. Vietnam	66.2	112.3	1.8
Subtotal	223.9	633.5	10.4
Other	507.8	1,468.0	24.1
TOTAL	1,998.5	6,097.7	100.0
1. Thailand	331.2	1,511.1	21.2
2. Indonesia	199.9	813.9	11.4
3. India	212.1	577.5	8.1
4. Ecuador	156.9	445.0	6.3
5. China	158.2	394.3	5.5
Subtotal	1,058.3	3,741.9	52.9
6. Mexico	52.5	295.7	4.2
7. Vietnam	122.2	265.3	3.7
8. Philippin es	50.4	225.3	3.2
9. Denmark	94.9	168.6	2.4
10. Argentina	60.7	168.1	2.4
Subtotal	380.7	1,122.9	15.8
11. Bangladesh	55.1	144.3	2.0
12. Greenland	70.8	139.5	2.0
13. Singapore	46.6	136.7	1.9

Table 6. Continued

14. United States	31.7	122.7	1.7
15. Australia	19.7	108.9	1.5
Subtotal	224.0	652.1	9.2
Other	598.0	1,601.4	22.5
TOTAL	2,261.0	7,118.2	100.0

Source: FAO Yearbook of Fishery Statistics, Fishery Commodities (volumes 61, 75, and 77).

[a] Includes SITC codes 036.11 and 036.2.
[b]Countries for each year are ranked by value of exports.
[c]Pounds are specified on a product weight basis.
[d]Percent of total value of world exports.
[e]The 1993 figures should be considered preliminary and subject to some revision.

Table 7. Estimated World Imports of Fresh and Frozen Shrimp[a] by Principal Countries, 1980-93 (selected years).

Country[b]	Mill.Lbs[c]	$ Mill	%[d]
		1980	
1. Japan	318.1	1,067.8	44.7
2. United States	204.9	689.7	28.9
3. France	54.4	114.2	4.8
4. Hong Kong	38.7	73.1	3.1
5. Spain	23.7	73.1	3.1
Subtotal	639.8	2,017.9	84.5
Other	258.8	369.4	15.5
TOTAL	898.6	2,387.3	100.0
		1985	
1. Japan	404.4	1,330.4	41.7
2. United States	310.1	1,039.9	32.6
3. Hong Kong	62.7	131.2	4.1
4. France	27.3	111.4	3.5
5. Denmark	38.7	90.4	2.8
Subtotal	843.1	2,703.2	84.8
Other	385.1	486.1	15.2
TOTAL	1,228.1	3,189.3	100.0

Table 7. Continued.

	----------1990----------		
1. Japan	626.5	2,494.7	38.3
2. United States	475.6	1,624.3	25.0
3. Spain	156.4	453.8	7.0
4. France	96.9	310.7	4.8
5. Hong Kong	124.5	274.8	4.2
Subtotal	1,480.0	5,158.2	79.2
Other	603.5	1,352.0	20.8
TOTAL	2,083.5	6,510.2	100.0
	----------1993[e]----------		
1. Japan	664.0	2,948.9	39.0
2. United States	567.5	2,110.9	27.9
3. Spain	199.8	521.1	6.9
4. France	64.7	330.5	4.4
5. Canada	43.9	173.3	2.3
Subtotal	1,539.9	6,084.7	80.5
Other	774.3	1,477.3	19.5
TOTAL	2,314.2	7,562.0	100.0

Source: FAO Yearbook of Fishery Statistics, Fishery Commodities (volumes 61,75, and 77).

[a]Includes SITC codes 036.11 and 036.2.
[b]Countries for each year are ranked by value of imports.
[c]Pounds are specified on a product weight basis.
[d]Percent of total value of world imports.
[e]The 1993 figures should be considered preliminary and subject to some revision.

A final feature of the information in Table 6 relates to the significant price differentials for the exported product among the different countries. Mexico's product, for example, has historically been one of the most valuable on a per pound basis ($5.63 per product pound in 1993). India's product, by comparison, was exported at only about one-half the per pound value ($2.73 per product pound) of that reported for Mexico. Price differentials among the major exporters reflect a great many factors including, but not limited to, (1) different species of shrimp being exported, (2) different sizes of the exported product, and (3) different levels of value-added processing activities.

Imports

Japan and the United States, as indicated by the information contained in Table 7, dominate the world shrimp import market. In 1980, for example, these two countries accounted for almost three-quarters of world shrimp imports by value. By 1993, however, their share of the world import market had fallen to about two-thirds of the total.

Overall, Japan's imports increased from 318 million product weight pounds in 1980 to 664 million pounds in 1993, or by about 110%. Imports by the United States for the same period advanced 175%, from 205 million product weight pounds to 567 million product weight pounds. While the per pound price of the imported product was nearly identical for the two countries in 1980 ($3.36 per product weight pound for Japan compared to $3.37 for the U.S.), by 1993, the per pound price of the imported product in Japan ($4.41 per pound) was almost 20% above the U.S. price of $3.71 per pound. As shown in the next section of the report, this increasing price differential may reflect increased imports of a peeled product in the U.S. market which has traditionally sold at a substantial discount when compared to the headless shell-on imported product.

The information in Table 7 also indicates that, excluding the United States and Japan, European countries and Hong Kong dominate the shrimp import market with Canada playing a somewhat lesser role. In general, exports of shrimp were from developing nations to the more developed nations. Interestingly, Hong Kong and Denmark are both reported to be large importers (Table 7) as well as exporters of shrimp, suggesting a large degree of re-exporting in these two cases.

THE U.S. AND JAPANESE SHRIMP MARKETS

Given the relative importance of the United States and Japan in the international shrimp market, it is worthwhile to analyze these two markets separately. Such an analysis is presented below.

U.S. Shrimp Imports

U.S. shrimp imports are analyzed on the basis of product form and region. The analysis, as elsewhere in the report, covers the 1980-93 period.

Imports by product form

The U.S. imports several different shrimp products varying in the degree of value-added activities. These products can be aggregated into four primary classifications: (1) headless shell-on, (2) peeled, (3) breaded, and (4) canned. Quantities of these products, as imported, are presented in Table 8. Quantities of these products, converted to a headless shell-on equivalent weight, are presented in Table 9.

U.S. imports of shrimp, expressed on a product weight basis, advanced from about 220 million pounds in 1980 to more than 600 million pounds in 1993, or by almost 175% (Table 8). On a headless shell-on equivalent weight basis, the increase was from 247 million pounds to 684 million pounds (Table 9).

Shell-on product, as indicated by the information contained in Tables 8 and 9, dominates U.S. shrimp imports. Evaluated on a product weight basis, the shell-on product consistently accounted for about 63% to 70% of total shrimp imports by volume with the exception of the 1991-93 period when the shell-on component fell to just under 60% of the total. When examined on a headless

Table 8. U.S. Imports of Shrimp by Product Type (Mill. Lbs), 1980-93.

	Product Type				
Year	Shell-On	Peeled	Breaded	Canned	Total
1980	138.9	76.3	0.2	4.4	219.8
1981	141.1	74.5	3.0	4.6	223.3
1982	185.1	79.9	3.9	5.6	274.5
1983	217.2	108.8	2.7	13.9	342.5
1984	226.0	103.0	0.3	14.3	343.6
1985	232.9	109.7	0.6	18.0	361.2
1986	262.5	122.2	0.2	16.6	401.5
1987	310.5	150.1	1.2	18.0	479.8
1988	359.2	129.8	1.4	14.9	505.3
1989	373.0	118.8	0.5	11.9	504.2
1990	327.6	164.4	0.3	10.2	502.5
1991	313.9	215.8	1.2	9.8	540.7
1992	352.2	233.4	1.3	9.7	596.6
1993	341.6	250.2	1.8	8.6	602.2

Source: Unpublished data provided by the National Marine Fisheries Service, Fisheries Statistics Division.

Table 9. U.S. Imports of Shrimp by Product Type, Expressed on a Headless Shell-On Weight (Mill. lbs), 1980-93.

	Product Type[a]				
Year	Shell-On	Peeled	Breaded	Canned	Total
1980	138.9	97.6	0.1	10.7	247.3
1981	141.1	95.4	1.9	11.0	249.5
1982	185.1	102.3	2.4	13.5	303.3
1983	217.2	139.2	1.7	33.2	391.4
1984	226.0	131.9	0.2	34.3	392.3
1985	232.9	140.4	0.4	43.1	416.9
1986	262.5	156.5	0.1	39.8	458.9
1987	310.5	192.1	0.8	43.2	546.6
1988	359.2	166.1	0.9	35.7	561.9
1989	373.0	152.1	0.3	28.6	554.0
1990	327.6	210.4	0.2	24.6	562.7
1991	313.9	276.3	0.7	23.6	614.6
1992	352.2	298.7	0.8	23.4	675.2
1993	341.6	320.3	1.1	20.6	683.6

Source: Compiled from data provided by the National Marine Fisheries Service, Fishery Statistics Division.
[a]Imports were converted to a headless shell-on equivalent weight using the following conversions: 0.63, breaded; 1.00, shell-on; 1.28, peeled raw, and 2.52 canned.

shell-on equivalent weight basis (Table 9), the headless shell-on product generally represented from about 50% to 60% of the total import volume. Overall, headless shell-on imports advanced about 145% during the period of analysis to 342 million pounds from a base of 139 million pounds.

U.S. imports of peeled product, evaluated on a product weight basis, advanced more than 225% during the period of analysis from 76 million pounds to 250 million pounds (on a shell-on equivalent weight basis, this represents an increase from 98 million pounds to 320 million pounds). This increase, examined on a percentage basis, was substantially above that of the shell-on product (146%), indicating that the peeled product is occupying a larger share of the total U.S. shrimp market by poundage.

The breaded and canned components of the U.S. shrimp market, as indicated by the information contained in Tables 8 and 9, constitute relatively small shares of the total U.S. shrimp import market. The breaded share of the market, whether evaluated on a product weight or shell-on equivalent weight basis, generally

represented less than one percent of total U.S. shrimp imports by poundage. The canned product which peaked in 1987 at 18.0 million pounds (43.2 million pounds shell-on equivalent weight) represented about four percent of product weight imports for that year (8 percent when evaluated on a headless shell-on equivalent weight basis). Because of the decline in canned imports after 1987 in conjunction with the overall increase in imports, the canned share of total imports had fallen to below two percent in 1993.

The deflated prices for the different import products, expressed on a product weight and headless shell-on equivalent weight basis, are presented in Table 10 (breaded product is excluded due to its minimal market share).. As indicated, the price of the headless shell-on product fell significantly during the period of analysis, from $4.41 in 1980 to $2.65 in 1993 (based on the 1982-84 U.S. CPI). The peeled product price, by comparison, fell substantially less when evaluated on a percentage basis than either the headless shell-on product or the canned product. This may reflect an increase in the average size of shrimp being used in peeling activities during the period of study.

Table 10. U.S. Deflated[a] Import Prices for Different Shrimp Products, Expressed on a Product Weight and Headless Shell-On Equivalent Weight Basis (dollars per pound), 1980-93.

		Peeled Product		Canned Product	
Year	Shell-On Product	Product Weight	Headless Shell-On Weight	Product Weight	Headless Shell-On Weight
1980	4.41	2.94	2.30	2.10	0.88
1981	4.01	2.71	2.11	2.08	0.87
1982	4.18	2.63	2.06	1.93	0.80
1983	4.10	2.65	2.07	1.82	0.76
1984	3.86	2.56	1.99	1.76	0.73
1985	3.42	2.12	1.65	1.64	0.68
1986	3.74	2.40	1.88	1.61	0.67
1987	3.44	2.61	2.04	1.61	0.67
1988	3.11	2.48	1.94	1.60	0.67
1989	2.92	2.15	1.68	1.36	0.57
1990	2.66	2.21	1.73	1.42	0.59
1991	2.71	2.23	1.75	1.52	0.63
1992	2.57	2.16	1.69	1.29	0.54
1993	2.65	2.29	1.79	1.29	0.54

Source: Compiled from unpublished data provided by the National Marine Fisheries Service, Fishery Statistics Division.
[a]Based on 1982-84 U.S. CPI.

Comparing the headless shell-on equivalent weight prices of the different product forms reveals that the shell-on product sells at a premium when compared to the peeled product and that the peeled product sells for substantially more than the canned product. The primary reason for the price differentials likely reflects the different sizes of shrimp used in the different processing activities. Shell-on imports tend to be a larger size count shrimp than that used in either peeling or canning activities. Similarly, the peeled product tends to be a larger size shrimp than that used in canning activities.

Imports by region

Annual U.S. imports of shrimp by region, expressed on a headless shell-on equivalent weight basis, are presented in Table 11. Imports from Asia (headless shell-on equivalent weight basis) increased from 63 million pounds in 1980 to about 400 million pounds in 1993, or by more than 500%. This increase coincides with the sharp rise in the Asian shrimp production (see Table 1). Overall, the Asian share of the U.S. import market, expressed on a headless shell-

Table 11. U.S. Shrimp Imports From World Regions Expressed on a Headless Shell-On Equivalent Weight[a] (Mill. lbs), 1980-93.

Year	Asia	Central America	South America	Other	Total
1980	63.3	120.3	51.0	12.7	247.3
1981	70.3	117.2	52.3	9.7	249.5
1982	92.5	126.8	72.2	11.8	303.3
1983	132.4	124.7	100.7	33.6	391.4
1984	127.9	128.9	102.6	32.9	392.3
1985	164.7	114.3	98.6	39.3	416.9
1986	200.1	124.4	112.5	21.9	458.9
1987	248.6	131.6	146.6	19.8	546.6
1988	288.2	107.9	153.9	11.9	561.9
1989	305.2	104.5	133.3	11.0	554.0
1990	344.4	76.3	126.0	16.0	562.7
1991	357.5	82.1	157.7	17.3	614.6
1992	413.4	78.9	169.6	13.3	675.2
1993	398.7	110.3	159.6	15.0	683.6

Source: Compiled from data provided by the National Marine Fisheries Service, Fishery Statistics Division.

[a]Imports were converted to a headless shell-on equivalent weight using the following conversions: 0.63, breaded; 1.00, shell-on; 1.28, peeled raw, and 2.52 canned.

on equivalent weight basis, equalled close to 60% in 1993 compared to about 25% in 1980.

Annual U.S. shrimp imports from Central America, unlike that observed with respect to Asia, exhibited no upward trend during the period of analysis. This coincides with the relatively long-run stable production in the Region (see Table 1). Overall, the Central American contribution to total U.S. shrimp imports (poundage) fell from almost 50% in 1980 to just over 15% in 1993.

Annual U.S. shrimp imports from South America advanced from 51 million pounds in 1980 to almost 160 million pounds in 1993 when examined on a headless shell-on equivalent weight basis (Table 11). The increase in U.S. imports from South America is consistent with the increased production in the Region. Despite the substantial increase in U.S. imports from South America, the Region's relative share of total U.S. imports advanced only marginally during the period of study (23% in 1993 compared to about 20% in 1980).

Annual U.S. shrimp imports from other areas tend to be relatively minor, generally in the 10 million to 20 million pound range (Table 11). This range constitutes less than 10% of the total U.S. import market.

The information contained in Table 11, when used in conjunction with that contained in Table 1, can be used to estimate U.S. imports from the different regions of the world as a percentage of production in the respective regions. For example, Asian production in 1980 equalled 1.97 billion live weight pounds (Table 1), or approximately 1.24 billion headless weight pounds. U.S. imports from Asia in 1980, expressed on a headless shell-on equivalent weight basis, equalled 63.3 million pounds. Dividing U.S. imports (63.3 million pounds) by headless weight production (1.24 billion pounds) suggests that the U.S. imported approximately five percent of the total Asian production in 1980. The relevant percentages by region for the 1980-93 period are presented in Table 12.

As indicated, U.S. imports from Central America generally represented a large proportion of production in that Region. In 1980, for example, an estimated four-fifths of the total Central American production was exported to the U.S. market. Through time, the proportion fell to a low of 55% in 1991 and 1992 but increased to 64% in 1993.

U.S. imports from South America as a proportion of that Region's total shrimp production equalled an estimated 43% in 1980. By 1993, the proportion had increased to more than 60%. Much of this increase likely reflects increased imports by the U.S. of the Ecuadorian farm-raised shrimp.

Compared to that estimated for Central and South America, the 1980 U.S. imports from Asia as a proportion of that Region's total shrimp production was relatively small (5.1%). By 1993, however, the proportion had increased by more than three-fold to 17.4%. This percentage increase was significantly larger than that estimated for either Central America (where a decrease was evident) or South America where the increase was less than 20 percentage points.

Table 12. U.S. Shrimp Imports from World Regions as a Percentage of Shrimp Production in Respective Regions.

Year	Asia	Central America	South America	Other	Total
1980	5.1	79.3	43.3	2.8	11.3
1981	6.2	75.9	42.2	2.2	12.0
1982	7.5	78.4	46.6	2.4	13.6
1983	10.7	80.2	49.4	5.9	16.7
1984	10.0	79.9	50.0	5.5	16.0
1985	10.9	67.6	51.4	6.0	15.2
1986	11.5	75.0	57.7	3.8	15.7
1987	13.2	77.3	63.4	3.2	17.5
1988	13.9	69.2	62.7	2.0	17.1
1989	15.5	65.9	55.3	1.7	17.1
1990	16.5	58.2	49.8	2.4	16.7
1991	15.6	55.0	53.1	2.4	16.8
1992	17.5	55.2	55.4	1.8	18.0
1993	17.4	63.9	61.6	2.1	18.9

Source: Compiled from information contained in Tables 1 and 11.

U.S. imports from "other" areas as a proportion of total production in those areas, as indicated by the information contained in Table 12, has traditionally been minor. In general, the percentage over the 1980-93 period has varied from less than two percent to about six percent.

In total, the U.S. imported an estimated 11.3% of the total world shrimp production in 1980 (Note: this figure, to a relatively small degree, will underestimate U.S. usage of world production since, as in Table 1, the U.S. also produces about 300 million pounds of shrimp annually). By 1993, U.S. imports as a proportion of world production had advanced to almost 19%. Overall, this increase primarily reflects the greater U.S. utilization of Asian shrimp production and, to a lesser extent, increased U.S. utilization of the South American production.

Japan's Shrimp Imports

Japan's imports of fresh and frozen shrimp advanced from 318 million product weight pounds in 1980 to 663 million product weight pounds in 1993, or by almost 110% (Table 13). While detailed information pertaining to Japan's shrimp imports by product type is not readily available, Niemier and Walsh (1987) reported that about 70% of Japan's total shrimp imports constitute a headless shell-on product.

As indicated by the information in Table 13, the vast majority of Japan's shrimp imports are of Asian origin with a range from about 75% to more than 80%. Imports by Japan from Asian countries more than doubled during the period of analysis from 255 million product weight pounds to 532 million product weight pounds.

Unlike the U.S., Central America and South America constitute only minor segments of the Japanese shrimp import market. Imports from "other" areas, however, are of some significance to the Japanese shrimp import market, often comprising more than 15% of the total. Much of these imports have historically been of Australian origin, though imports from Europe have been expanding.

Japan's shrimp imports in relation to total world production, as indicated in Table 14, advanced from an estimated 14.5% in 1980 to more than 18% in 1993 (Note: to the extent that Japan imports a peeled product, the estimates given in Table 14 may be somewhat lower than the "true" figures). Imports from the Asian Region to Japan comprise from about 20% to 25% of the total annual Asian shrimp yield. Japan's imports from the Central American Region in relation to the Central American total shrimp yield has historically been minor, equalling less than three percent annually since 1985. Similarly, Japan's shrimp imports as a proportion of production in the South American Region fell from about 10% annually during the 1980-85 period to just over 4% during the 1990-93 period. Finally, Japan's annual shrimp imports from "other" areas generally constitute about 10%-15% of total shrimp production in these areas.

Discussion

The information contained in Tables 12 and 14 can be used to evaluate the combined U.S. and Japan's import situation in relation to total world shrimp harvest. In 1980, for example, combined U.S. and Japanese shrimp imports represented an estimated 25.8% of total world shrimp production. By 1993, the relevant share had advanced to more than 37%. The combined Asian share increased from about 26% in 1980 to more than 40% in 1993. The combined Central American share declined from about 85% in 1980 to less than 66% in 1993. The combined South American share, while varying significantly when evaluated on a year-to-year basis, generally equalled from about 55% to 65%. Finally, the combined share from "other" areas generally averaged from about 10% to about 18%.

CONCLUSIONS

World shrimp production expanded significantly during the 1980-93 period. As production increased, world trade in shrimp also advanced. In fact, the increase in world shrimp trade during the 1980-93 period (evaluated on a product weight basis) far exceeded the increase in world production when examined on a percentage basis.

Table 13. Japan's Fresh and Frozen Shrimp Imports From World Regions (in million pounds product weight), 1980-93.

Year	Asia	Central America	South America	Other	Total
1980	255.3	8.8	12.9	41.1	318.1
1981	279.1	8.1	10.8	61.9	359.9
1982	257.0	10.1	14.8	55.7	337.6
1983	249.1	6.9	22.8	48.6	327.4
1984	287.4	5.2	19.0	61.6	373.2
1985	302.0	4.3	22.2	74.7	403.2
1986	375.9	4.0	13.6	76.3	469.8
1987	436.3	4.1	13.4	89.0	542.8
1988	452.8	3.7	19.5	94.0	570.0
1989	471.0	3.2	11.5	95.8	581.5
1990	536.9	3.1	10.4	75.3	625.7
1991	515.2	2.1	12.6	98.1	628.0
1992	498.1	1.8	12.5	89.4	601.8
1993	532.0	3.0	20.9	107.5	663.4

Source: Compiled from information in *Japan Exports & Imports, Commodity by Country* (various issues).

Table 14. Japanese Shrimp Imports From World Regions as a Percentage of Shrimp Production in Respective Regions, 1980-93.

Year	Asia	Central America	South America	Other	Total
1980	20.6	5.8	11.0	8.9	14.5
1981	24.7	5.2	8.7	13.7	17.3
1982	20.9	6.3	9.5	11.3	15.1
1983	20.0	4.5	11.2	8.5	14.0
1984	22.4	3.2	9.2	10.2	15.2
1985	20.0	2.6	11.6	11.4	14.7
1986	21.7	2.4	7.0	13.2	16.1
1987	23.1	2.4	5.8	14.6	17.3
1988	21.8	2.4	7.9	15.6	17.3
1989	23.9	2.0	4.8	14.7	17.9
1990	25.8	2.3	4.1	11.2	18.6
1991	22.4	1.4	4.2	13.8	17.2
1992	21.0	1.2	4.1	12.3	16.0
1993	23.2	1.7	8.1	15.0	18.3

Source: Compiled from information in Tables 1 and 13.

Two countries, Japan and the United States, account for the vast majority of world shrimp imports, though their combined share has fallen in recent years. By comparison, world exports of shrimp were more diversified among many of the producing regions. With few exceptions, major exporters of shrimp were found to be developing countries while the principal importers were found to be developed countries. The study also showed that, with exceptions, the major exporters of shrimp were major producers of farm-raised shrimp.

The study showed that the U.S. and Japan's shrimp imports, when combined, accounted for approximately 25% of the total world production in 1980. By 1993, the share had increased to 40%. While Japan's import market has historically relied primarily on Asian production as the primary supply source, the U.S. import market has historically relied on Central American and South American production as primary supply sources. U.S. imports of shrimp from Asia have, however, expanded significantly in recent years in relation to increased production in the Region.

In general, this study focused primarily on the U.S. and Japanese shrimp import markets. The European shrimp import market has, however, been expanding in recent years. A detailed analysis of this expanding market is warranted in light of the increased competition it may stimulate.

LITERATURE CITED

Food and Agriculture Organization of the United Nations. *Fishery Statistics: Commodities*. 1980-93 (various issues).

Food and Agriculture Organization of the United Nations. Unpublished Landings data: 1980-93.

Japan Exports & Imports: Commodity by Country, published by Japan Tariff Association, 1980-93 (various issues).

Keithly, W. R., K. J. Roberts, and J. M. Ward. "Effects of Shrimp Aquaculture on the U.S. Market: An Econometric Analysis." *In: Aquaculture: Models and Economics*, eds. U. Hatch and H. Kinnucan. pp. 125-156. Westview Press, Inc., Boulder, Co., 1993.

Niemeier, P. E. and R. Walsh. "Japan's Shrimp Supply and Outlook." *In*: Proceedings of the Third Shrimp World Market Conference, eds. P. Menesses, W. Chauvin, and A. Cuccia. pp. 157-75. 417 Eliza Street, New Orleans, La.: Shrimp World Inc., 1987.

Rosenberry, B. "World Shrimp Farming, 1994." Published by Shrimp News International, 9434 Kearny Mesa Road, San Diego, Ca.

U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, NMFS. "World Shrimp Culture, Vol. 1: Africa, Asia, Europe, Middle East, North America." NOAA Tech. Memo, NMFS-F/SPO-5, 1992.

U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, NMFS. "World Shrimp Culture, Vol. 2: Latin America." NOAA Tech. Memo, NMFS-F/SP0-6, 1992.

Appendix A. Estimated Farm-Raised Shrimp Production in Selected Countries and World Total (Mill. Lbs Live Weight), 1980-92 (selected years).

	Year			
Country	1980	1985	1990	1992
Thailand	22	35	242	265
Indonesia	77	110	265	331
India	26	38	75	93
China	4	77	364	485
Taiwan	11	73	55	55
Philippines	3	63	97	55
Vietnam	9	15	77	86
Bangladesh	15	28	37	60
Mexico	0	1	13	13
Panama	1	3	15	9
Honduras	0	1	9	11
Ecuador	20	59	161	242
Peru	2	5	11	11
Colombia	0	Neg.	13	22
World Total	214	547	1,512	1,851

Source: National Economic, Social, and Environmental Data Bank, Globefish Statistics.