

Structural Changes in the Southeast U.S. Shrimp Processing Industry

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ABSTRACT

Shrimp is the primary fishery in the Southeast United States, generally accounting for 55%-60% of the total value of landings in the region. Like the domestic fishery, the U.S. import market is sizable, valued at \$1.7 billion in 1990. Together, domestic production and imports support a large shrimp processing sector in the Southeast which supports several thousand jobs, either directly or indirectly.

While domestic shrimp landings have remained essentially stable over the last two decades, imports have more than doubled and have changed in product composition. The increased imports and changing composition have impacted the structure of the Southeast shrimp processing industry.

The purpose of this paper is to examine structural changes in the Southeast shrimp processing industry. The analysis, based on NMFS end-of-the-year surveys of seafood processing establishments, covers the 1973-90 period. Issues considered in the analysis included: (1) changes in numbers of firms and shrimp products produced, (2) changes in productivity measured in terms of firm output and output per worker, and (3) changes in industry concentration and specialization.

In general, results indicate a decline in the absolute number of Southeast shrimp processors but a large increase in productivity per firm, measured on a poundage basis. Because of a decline in the per pound price of the processed products, however, deflated shrimp processing resumes per firm have remained essentially unchanged since the late 1970s.

KEYWORDS: economics, processing, shrimp.

INTRODUCTION

Shrimp is the predominant commercial fishery in the Southeast United States, *i.e.*, the coastal states extending from North Carolina through Texas, generally accounting for more than 50% of the region's landings by value. In 1990, Southeast shrimp landings equaled 175 million pounds (headless weight) and had an associated dockside value of \$454 million.

Though Southeast shrimp landings are large and production also occurs to a lesser extent in the Northeast and Pacific Regions of the United States, the U.S. depends largely on imported shrimp to meet its domestic market needs. Since the mid-1980s, in fact, more than 80% of the total U.S. shrimp supply has been import based. These imports, which originate primarily from two regions of the world, Latin America and Asia, have expanded rapidly since the late 1970s in response to increased world shrimp production and various economic factors (Keithly *et al.*, 1993[a]).

Combined, domestic landings and imports support a large shrimp processing industry in the Southeast United States, with 1990 output valued in excess of \$1.0 billion. The purpose of this paper is to provide an economic analysis of the Southeast processing industry for the 1973-90 period and changes that have occurred in relation to the growth in imports. To accomplish this goal, Southeast shrimp landings and imports are first examined from an historical context followed by an analysis of the Southeast shrimp processing sector. Then, attention is directed towards an analysis of changes in the processing sector in relation to changes in domestic production and imports.

The information presented in the ensuing analysis was based on two sources. Domestic landings and import data were compiled from various issues of Fisheries of the United States (U.S. Department of Commerce). The processing information was compiled from unpublished data provided to the authors by the National Marine Fisheries Service, Fisheries Statistics Division. It represents an annual voluntary end-of-the-year survey of all processing/wholesaling firms. While voluntary, compliance is virtually complete for the Southeast.

DOMESTIC SHRIMP LANDINGS AND IMPORTS

The U.S. harvests sizable quantities of shrimp. These harvests are comprised of both warm-water and cold-water species. The warm-water shrimp is harvested almost exclusively in the Southeast while the cold-water shrimp is harvested in the New England and Pacific Regions. The cold-water shrimp is small relative to the warm-water counterpart and, at dockside, brings only about one-third the per pound price received for the warm-water shrimp.

The warm-water shrimp are short-lived animals and annual harvests tend to fluctuate widely. Year-to-year fluctuation is primarily environmentally induced with changes in salinity, water temperature, etc. during the shrimp's growth cycle all contributing to variation in both the number and average size of shrimp caught (Rothschild and Brunenmeister, 1984).

As short-lived animals, it is generally believed that warm-water shrimp are, from a biological perspective, resistant to overfishing (Poffenberger, 1984). The fishery, however, is thought to be operating at its maximum potential yield, given current management practices, and the amount of effort used to achieve

this maximum is excessive due to the common-property nature of the resource (Blomo, 1981). Thus, even though the size of the shrimp fleet has expanded since the early- to mid-1970s, catch has remained relatively stable in the long run. As indicated in Table 1, for example, the Southeast production of shrimp averaged 161 million pounds (headless) annually for the 1973-90 period. Evaluated in three-year intervals, low interval production of 129 million pounds annually in 1973-75 was within about 70% of high interval production of 188 million pounds reported annually during the 1985-87 period. In general, production tended to fall within the more narrow range of 150 million pounds to 170 million pounds.

The value of Southeast shrimp landings advanced from an average of \$188 million annually in 1973-75 to \$530 million annually in 1985-87, before declining to \$449 million annually during the most recent interval of analysis (Table 1). The corresponding dockside price increased from \$1.46 per pound during the initial three-year period of analysis to \$3.13 per pound in 1982-84, but had fallen to \$2.70 per pound by 1988-90.

Of course, much of the increase in the Southeast shrimp dockside price and related value during the 1970s and into the early 1980s was inflationary based. Evaluated on a deflated basis (1990 Consumer Price Index), the dockside value of the Southeast shrimp harvest peaked at \$702 million annually in 1976-78, based on annual production of 165 million pounds. Though 1988-90 production by poundage was nearly equivalent to that reported in 1976-78, the deflated value of the harvest, averaging \$473 million annually, was only two-thirds of that reported in the peak interval. The pronounced decline in the deflated value of landings reflected the decline in deflated dockside price, which averaged only \$2.84 per pound in 1988-90 compared to \$4.25 per pound in 1976-78. The sharp decline in deflated price and value, by and large, reflected the pronounced increase in imports during the 1980s.

U.S. imports of shrimp during 1973-75, expressed on a headless shell-on equivalent basis, averaged 243 million pounds annually (Table 2). By 1988-90, imports had advanced to an annual average of 580 million pounds and, as indicated by the information in Table 2, most of the growth occurred post 1979-81.

Much of the import growth during the early 1980s was of Ecuadorian origin coinciding with the growth in farm-raised shrimp production in that country. Since the mid-1980s, most of the growth in U.S. shrimp imports has been of Asian origin and also represents a farm-raised product (Keithly *et al.*, 1993[a]).

The current value of U.S. shrimp imports grew from an annual average of \$338 million in 1973-75 to \$1.7 billion in 1988-90. Evaluated on a deflated basis, the annual value of imports doubled during the period of analysis, from \$898 million in 1973-75 to \$1.8 billion in 1988-90.

Table 1. Reported Southeast Commercial Shrimp Landings, 1973-90.

Time Period	Pounds Landed ^a 1,000s	VALUE		DOCKSIDE PRICE	
		Current \$1,000s	Deflated ^b	Current \$/lb	Deflated
1973-75 avg.	128,871	187,882	501,534	1.46	3.89
1976-78 avg.	165,335	327,435	702,331	1.98	4.25
1979-81 avg.	160,361	412,087	664,003	2.57	4.14
1982-84 avg.	153,897	482,026	630,888	3.13	4.10
1985-87 avg.	188,302	530,450	628,445	2.82	3.34
1988-90 avg.	166,689	449,230	473,200	2.70	2.84

^a Expressed on a headless weight basis.

^b The deflated value and price are expressed in 1990 dollars, based on the Consumer Price Index.

Source: U.S. Department of Commerce (1973-90).

Table 2. U.S. Shrimp Imports, 1973-90.

Time Period	Quantity ^a Mill. lbs	VALUE		PRICE	
		Current \$ Mill.	Deflated ^b	Current \$/lb	Deflated
1973-75 avg.	243.3	338.4	897.7	1.39	3.69
1976-78 avg.	261.4	458.8	989.0	1.76	3.78
1979-81 avg.	262.1	718.8	1,115.5	2.74	4.41
1982-84 avg.	387.7	1,143.9	1,493.1	2.95	3.85
1985-87 avg.	509.1	1,442.5	1,708.8	2.83	3.36
1988-90 avg.	580.4	1,706.2	1,798.1	2.94	3.10

^a Expressed on a headless shell-on weight basis.

^b The deflated value and price are expressed in 1990 dollars, based on the Consumer Price Index.

Source: U.S. Department of Commerce (1973-90).

Warm-water shrimp is a narrowly defined commodity that does not receive extensive processing and value-added services which could significantly impact its final form. Differences between the domestic warm-water price and import price should, therefore, be relatively minor. Comparison of the import price (Table 2) and dockside price (Table 1) provides evidence that this is the case.

The import price, in general, fell within 10% of the dockside price when evaluated in three-year intervals and like the dockside price fell sharply on a deflated basis after 1979-81.

U.S. shrimp imports by product form (*i.e.*, shell-on, peeled, breaded, and canned) are presented in Table 3. Shell-on and peeled shrimp dominate import activities. Both of these product forms can also be used as raw material supply by domestic processors. Shell-on imports can be peeled or breaded by domestic processors or, alternately, could be made into specialty products. Peeled imports can be used in breaded activities or specialty products. While small in absolute poundage relative to shell-on and peeled imports, canned shrimp imports exhibited the largest percentage increase during the 1973-90 period.

SOUTHEAST U.S. SHRIMP PROCESSING ACTIVITIES

Shrimp represents the primary component of the Southeast seafood processing industry, generally contributing more than 80% of the total edible production activities by value. An economic analysis of the shrimp processing industry is presented below in three sections. In the first section, some general characteristics of the industry are presented. Then, some features regarding the structure, conduct, and performance of the Southeast shrimp processing industry are outlined. Finally, Southeast shrimp processing activities by product form are considered.

GENERAL INDUSTRY CHARACTERISTICS

The number of firms engaged in Southeast shrimp processing activities, as indicated by the information in Table 4, declined during the 1973-90 period. Overall, the 148 firms processing shrimp, on average, during 1988-90 reflected a 10% decline from the 164 reported during 1982-84 and a 15% decline from the 175 reported annually during 1973-75. A decline in the number of firms was evident during each interval of analysis except during 1979-81 when a marginal increase of one firm was reported.

The quantity processed, as reported in Table 4, is given on both a product-weight basis and a headless shell-on equivalent weight basis (see Keithly *et al.*, 1993[b] for a list of all conversion factors). The product weight includes the meat weight of shrimp used in the processing activities, plus any additional ingredients that may be added such as breaded materials, plus shell weight if appropriate (such as in the case of frozen raw headless). The processed quantity, expressed on either a product weight or a headless shell-on weight basis tended to increase during the period of analysis with the exception of a moderate decline (approximately 5%) in 1979-81. Overall, 1988-90 average annual production of 291 million pounds (product weight basis) represented an increase of 53% when compared to 1973-75 average annual processing activities of 190 million pounds. When evaluated on a headless shell-on weight basis, the

Table 3. U.S. Shrimp Imports by Product Form, 1973-90.

Time Period	Shell-on	PRODUCT WEIGHT		
		Peeled Mill. lbs	Breaded	Canned
1973-75 avg.	124.2	82.4	1.6	3.4
1976-78 avg.	118.9	96.4	1.3	2.6
1979-81 avg.	134.4	82.3	3.3	4.3
1982-84 avg.	209.2	97.1	8.8	10.7
1985-87 avg.	268.3	127.2	1.8	16.7
1988-90 avg.	352.8	137.5	1.3	11.7

Source: U.S. Department of Commerce (1973-90).

increase was nearly 60%, suggesting a relative increase in processing activities that use little additional ingredients or shell, such as peeling.

The current value of Southeast shrimp processing activities increased from an annual average of \$350 million annually in 1973-75 to more than \$1 billion annually in 1988-90 (Table 4). This increase can be explained by two factors. First, as noted, the processed quantity increased by more than 50% during the 18-year period of analysis. Second, the current price of the processed product increased throughout much of the period of analysis before declining after 1982-84.

When adjusted for inflation, the value of Southeast shrimp processing activities declined steadily after the 1976-78 period, despite a general increase in quantity processed. This decline reflects the sharp fall in the real price of the processed product since 1979-81. The observed deflated per pound processed price of \$3.65 per pound (product weight basis) in 1989-90 reflected more than a 45% decline from the 1979-81 price of \$5.75 per pound and about a 25% decline when compared to the per pound deflated price of \$4.96 in 1973-75. This decline likely reflects three primary factors: (1) increased domestic production of processed shrimp, (2) competition from imported processed shrimp, and (3) declining input costs of the raw, unprocessed product.

ECONOMIC STRUCTURE, CONDUCT, AND PERFORMANCE

Several aspects of the economic structure, conduct, and performance of the Southeast shrimp processing industry are presented below. They include (i) productivity within the industry and changes therein, (ii) size distribution of firms within the industry and changes therein, (iii) specialization among firms and changes therein, and (iv) industry concentration and changes.

Table 4. Shrimp Processing Activities in the Southeast United States, 1973-90.

Time Period	No. of Firms	Product Weight	Processed Quantity		Processed Value ^a Current 1,000 lbs	Processed Price ^b Current \$/lb	
			Headless Shell-on Weight \$1,000s	Headless Shell-on Weight \$1,000s			
1973-75 avg.	175	189,793	178,713	350,219	1.85	4.96	
1976-78 avg.	169	229,745	226,357	611,535	1,307,790	2.66	5.69
1979-81 avg.	170	215,525	216,042	769,528	1,238,691	3.57	5.75
1982-84 avg.	164	232,034	230,331	943,291	1,233,409	4.07	5.32
1985-87 avg.	149	270,778	267,235	1,018,748	1,207,085	3.76	4.46
1988-90 avg.	148	291,180	283,644	1,011,923	1,063,406	3.48	3.65

^a The 1990 Consumer Price Index was used to deflate value and price.

^b Expressed on a product-weight basis.

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

Productivity in the Shrimp Processing Industry

Productivity within the Southeast shrimp processing industry was evaluated using two methods. The first was the estimation of production per firm. The second was the estimation of production per worker.

Production per Firm. Production per firm among Southeast U.S. shrimp processors is given in Table 5 for the 1973-90 period. Shrimp processing activities per firm, evaluated on the basis of processed quantity, clearly increased during the period of analysis when examined in three-year intervals. In 1973-75, for example, the average was 1.1 million pounds annually. By 1988-90, the annual average had increased about 80% to 2.0 million pounds. An increase in per firm poundage was particularly evident in 1985-87.

The current value of shrimp processing activities per firm grew from an annual average of \$2.0 million in 1973-75 to \$6.8 million in 1988-90 and growth was steady throughout the period of analysis except during the most recent three-year interval. When evaluated on a deflated basis, the value of shrimp processing activities per firm changed little after 1976-78 despite the increased poundage processed. This reflects the declining deflated per pound price received for the finished products.

Production per Worker. The National Marine Fisheries Service database used in the current processing study includes information on the average number of workers per firm involved in processing activities. However, many shrimp processing firms also produce other species and, unfortunately, processing employment by species is not available on a per firm basis. To analyze shrimp processing activities per worker, therefore, the authors included in the analysis only that group of firms primarily engaged only in shrimp processing activities (defined as > 95 percent of the value of processed sales were shrimp based). In general, this method of analysis included from 60% to 70% of the total number of Southeast shrimp processing establishments on an annual basis.

Selected statistics on estimated per worker productivity in the Southeast shrimp processing industry are presented in Table 6. As indicated, Southeast shrimp processing establishments typically employed from about 40 to 50 production workers, on average, on an annual basis. Pounds of shrimp products produced per worker increased from an average of 28.5 thousand annually in 1973-75 to almost 43 thousand in 1988-90.

Closer examination of the data shows two distinct periods of increasing production per worker. During the first of these two periods, *i.e.*, 1976-78, production per worker increased to 37.2 thousand pounds from 28.5 thousand pounds annually in 1973-75. This increase may have been an artifact of the relatively low domestic supply availability in 1973-75 (see Table 1) which may have resulted in an abnormally low production per worker in that interval. The

Table 5. Per Firm Production of Processed Shrimp in the Southeast United States, 1973-90.

Time Period	Processed Pounds ^a 1,000s	VALUE	
		Current	Deflated ^b \$1,000s
1973-75 avg.	1,087	2,005	5,388
1976-78 avg.	1,357	3,611	7,723
1979-81 avg.	1,271	4,536	7,301
1982-84 avg.	1,412	5,740	7,506
1985-87 avg.	1,813	6,822	8,083
1988-90 avg.	1,963	6,822	7,169

^a Given on a product weight basis.

^b The deflated value is expressed in 1990 dollars and is based on the Consumer Price Index. Source: Compiled from unpublished data provided by the National Marine Fisheries Service, Fisheries Statistics Division.

Table 6. Estimated Per Worker Productivity in the Southeast U.S. Shrimp Processing Industry, 1973-90.^a

Time Period	Avg. No. Workers Per Firm	Processed Quantity ^b lbs	VALUE	
			Current	Deflated ^c \$
1973-75 avg.	46	28,524	52,954	142,736
1976-78 avg.	44	37,153	100,684	215,223
1979-81 avg.	41	37,188	134,978	216,766
1982-84 avg.	44	37,542	155,393	202,930
1985-87 avg.	53	40,458	152,167	180,242
1988-90 avg.	46	42,930	153,464	161,341

^a The analysis of per worker productivity was based only on that segment of shrimp processing establishments primarily engaged in shrimp processing activities, *i.e.*, defined as > 95% of the annual value of a firm's processed seafood sales were shrimp based.

^b Expressed on a product-weight basis.

^c Expressed in 1990 dollars based on the Consumer Price Index.

second period of increasing production was post 1982-84. The post 1982- 84 increase in production per worker likely reflects response to the sharp rise in U.S. imports of shell-on and peeled shrimp which provided U.S. processors an additional supply of raw material product (see Table 3).

The per worker deflated value of shrimp processing activities in the Southeast increased from an average of \$143 thousand annually in 1973-75 to \$217 thousand in 1979- 81. After 1979-81, however, the per worker deflated value of shrimp processing activities in the Southeast fell sharply, averaging just \$161 thousand in 1988-90. This decline reflects the sharp fall in the per pound price of the processed product (see Table 4).

Size Distribution of Firms

To examine the size distribution of shrimp processing firms in the Southeast and changes therein through time, firms were grouped into four size categories based upon their deflated value of processed shrimp sales: (i) firms with annual deflated processed shrimp sales of < \$250 thousand, (ii) firms with annual deflated processed shrimp sales from \$250 thousand to \$1.0 million, (iii) firms with annual deflated processed shrimp sales of \$1.0 million to \$10.0 million, and (iv) firms with annual deflated processed shrimp sales of \$10.0 million or more.

As indicated by the information in Table 7, approximately one-third of the Southeast shrimp processing firms generally reported annual deflated processed shrimp sales of less than \$250 thousand, when examined in three-year intervals. Another 10% to 20% reported annual deflated processed shrimp sales in the \$250 thousand to \$1.0 million range. From about 30% to 40% reported annual deflated sales in the \$1.0 to \$10.0 million range. Finally, the remaining 15% to 20% of the total number of shrimp processors reported processed shrimp sales of \$10.0 million or more. The information contained in Table 7 suggests that, in general, there was little change in the size distribution of Southeast shrimp processing firms during 1973-90 when examined in three-year intervals.

Specialization in the Southeast Shrimp Processing Industry

To examine specialization among firms in the Southeast shrimp processing industry, firms were partitioned based upon the percentage of total processed seafood sales (by value) that were derived from shrimp processing activities. The partitioning was as follows: (i) firms that derived < 50% of total annual processed seafood sales, by value, from shrimp processing activities, (ii) firms that derived from 50% to 95% of annual processed seafood sales from shrimp processing activities, and (iii) firms that derived > 95% of processed seafood sales from shrimp processing activities.

As the information in Table 8 indicates, about two-thirds of the Southeast shrimp processors have traditionally relied upon shrimp processing activities for

Table 7. Size Distribution Among Firms in the Southeast Shrimp Processing Industry, (includes only processed shrimp sales), 1973-90.^a

Time Period	< \$250,000		\$250,000-\$1 Million		\$1 Million-\$10 Million		\$10 Million	
	No. of Firms	% of Total	No. of Firms	% of Total	No. of Firms	% of Total	No. of Firms	% of Total
1973-75 avg.	56	32	33	19	61	35	26	15
1976-78 avg.	54	32	24	14	55	32	37	22
1979-81 avg.	57	34	25	15	56	33	31	18
1982-84 avg.	57	35	18	11	58	35	32	19
1985-87 avg.	41	28	19	13	59	39	31	21
1988-90 avg.	42	28	22	15	63	36	32	21

^a Evaluated on the basis of the deflated value of processed shrimp sales. Source: Compiled from unpublished data provided by the National Marine Fisheries Service, Fisheries Statistics Division.

Table 8. Specialization Among Southeast Shrimp Processing Firms: Processed Shrimp Sales as a Percentage of Total Processed Seafood Sales, 1973-90.^a

Time Period	< 50% of Sales		50% to 95% of Sales		95% of Sales	
	No. of Firms	% of Total	No. of Firms	% of Total	No. of Firms	% of Total
1973-75 avg.	36	21	31	18	107	61
1976-78 avg.	32	19	31	19	106	63
1979-81 avg.	33	19	29	17	108	64
1982-84 avg.	33	20	27	17	104	63
1985-87 avg.	26	17	21	14	103	69
1988-90 avg.	20	13	22	15	106	72

^a Processed sales were evaluated on the basis of value. Source: Compiled from unpublished data provided by the National Marine Fisheries Service, Fisheries Statistics Division.

> 95% of their total processed seafood sales, expressed on a value basis. The percentage in recent years, however, has risen to about 70%. Another 15% to 20% of the shrimp processors have traditionally relied upon shrimp processing activities for 50% to 95% of their total processed seafood sales, with the low end of the range occurring in more recent intervals of analysis. Finally, from slightly less than 15% to about 20% of the Southeast shrimp processors have traditionally relied upon shrimp processing activities for less than 50% of their total processed seafood sales. The proportion of the total firms in this group also fell sharply after the mid-1980s. In general, the information indicates that increased specialization in the Southeast shrimp processing industry occurred after the mid-1980s.

To provide further insight, specialization was also examined on the basis of firm size, measured by annual total deflated processed seafood sales (*i.e.*, shrimp and other seafood products). Four sizes of firms were used in the analysis: (i) those with total deflated processed seafood sales of < \$250,000, (ii) those with total deflated processed seafood sales of \$250,000 to \$1.0 million, (iii) those with total annual deflated processed sales of \$1.0 million to \$10.0 million, and (iv) those with total processed sales of \$10.0 million.

In general, all sizes of firms tended to be highly dependent on processed shrimp sales as a percentage of their total processed seafood sales (Table 9). Furthermore, the dependence appears to increase in relation to firm size. For example, among the smallest group of firms (*i.e.*, those with annual total deflated processed seafood sales of less than \$250,000 annually) about 57% reported that 95% of total processed seafood sales were shrimp based during the 18-year period of analysis compared to 72% among the group of firms with total annual deflated processed seafood sales of \$1.0 million to \$10.0 million annually and 73% among the largest firms (*i.e.*, those with total processed seafood sales of \$10.0 million or more). In contrast, only 6% of the largest group of firms were dependent upon processed shrimp sales for less than 50% of total gross income generated from processed seafood sales during the 18-year period of analysis compared to about 22% of the smallest firms (*i.e.*, those with annual processed seafood sales of less than \$250,000 annually) and about 30% among firms with annual processed seafood sales in the \$250,000- \$1.0 million range. This suggests that shrimp processors tended to become more specialized as they increased in size, as measured by total value of processed seafood sales. This may reflect increased import usage among the larger firms that would permit them to handle shrimp exclusively throughout the year.

Industry Concentration

Concentration among firms in the Southeast shrimp processing industry during 1973-90 and changes therein can be evaluated using several alternative methods. One method commonly employed in applied research is the market

Table 9. Specialization in the Southeast Shrimp Processing Industry in Relation to Firm Size: Processed Shrimp Sales as a Percentage of Total Processed Seafood Sales, 1973-90.

Time Period	< 50% of Sales (%)	50% - 95% of Sales (%)	95% of Sales (%)
Sales < \$250,000a			
1973-75 avg.	25	16	58
1976-78 avg.	23	19	58
1979-81 avg.	24	30	46
1982-84 avg.	19	23	59
1985-87 avg.	23	20	57
1988-90 avg.	15	19	64
Sales \$250,000 - \$1.0 Million			
1973-75 avg.	28	21	51
1976-78 avg.	31	26	43
1979-81 avg.	31	13	56
1982-84 avg.	42	20	38
1985-87 avg.	33	19	48
1988-90 avg.	20	13	68
Sales \$1.0 Million - \$10.0 Million			
1973-75 avg.	19	14	67
1976-78 avg.	17	15	68
1979-81 avg.	18	10	72
1982-84 avg.	20	08	73
1985-87 avg.	14	09	77
1988-90 avg.	16	10	74
Sales \$10.0 Million or More			
1973-75 avg.	08	26	66
1976-78 avg.	08	18	73
1979-81 avg.	05	20	75
1982-84 avg.	04	26	70
1985-87 avg.	09	15	76
1988-90 avg.	02	20	78

^a Sales designations are expressed on a deflated basis and represent total processed seafood sales, *i.e.*, shrimp and other products, of each firm.

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

share approach in which, the market shares accumulated by the largest x firms are analyzed ($x \in N$; N is the total number of firms comprising the industry). Starting with the firm with the largest market share, measured in value of processed shrimp sales, and adding the shares of the next largest firms in succession, produces an estimate of accumulated market shares (measured in terms of value) in the Southeast shrimp processing industry. These shares, evaluated in terms of the largest five, ten, and twenty establishments for the 1973-90 period are given in Table 10.

The largest five Southeast U.S. shrimp processing firms consistently represented from 28% to 30% of the Southeast shrimp processing activities when measure in terms of value while the largest ten firms represented 44% to 47% of the total. The largest twenty firms consistently represented about two-thirds of industry sales. Overall, the market share approach indicated that concentration in the Southeast shrimp processing industry, measured in terms of deflated processed shrimp sales, has remained stable throughout the 1973-90 period.

Because of the changing number of firms in the industry, other measures of concentration were also examined, including the Herfindahl Index and the Hall-Tideman Index (see Keithly *et al.*, 1993[b] for details). While estimates of these indices are not reported herein, they also indicated little change in industry concentration.

SHRIMP PROCESSING ACTIVITIES BY PRODUCT FORM

For purposes of this study, shrimp processing activities were examined on the basis of four product forms: (1) raw headless products, (2) peeled products, (3) breaded products, and (4) specialty products. Selected statistics pertaining to the Southeast processing of these products are contained in Table 11.

As indicated, virtually all of the increase in Southeast shrimp processing activities during the 1973-90 period was based on increased peeling activities. Production of peeled shrimp, expressed on a product weight, advanced from 24 million pounds annually in 1973-75 to more than 80 million pounds in 1988-90 and the increase was consistent throughout the 18-year study period when examined in three-year intervals. The number of firms engaged in peeling activities also increased steadily during the period of analysis. The deflated value of peeling activities, after increasing from an average of \$136 million annually in 1973-75 to \$290 million annually in 1985-87, declined somewhat to \$267 million annually during the most recent interval due to a sharp decline in the deflated per pound price.

Interval variation in the production of raw headless shrimp, to a large degree, reflected changes in reported Southeast shrimp landings (see Table 3). Such a finding is expected, given the fact that imports already arrive in a raw headless or more processed form. From about 55% to 60% of the reported

Table 10. Market Shares of Largest Shrimp Processing Firms in the Southeast U.S., Ranked by Value of Processed Shrimp Sales, 1973-90.

Time Period	Largest Five Firms %	Largest Ten Firms %	Largest Twenty Firms %
1973-75 avg.	30	46	65
1976-78 avg.	28	45	65
1979-81 avg.	30	47	67
1982-84 avg.	30	47	66
1985-87 avg.	29	47	66
1988-90 avg.	28	44	63

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

Southeast shrimp landings were consistently used to produce a raw headless product when evaluated in three-year intervals, except in 1973-75 when the share was marginally lower. The deflated value of Southeast raw headless shrimp processing activities fell sharply after 1976-78, reflecting a declining deflated price for the product.

While the reported number of Southeast shrimp breeding establishments declined during the study period, the processed poundage remained relatively stable when examined in three-year intervals with the exception of a notable increase in 1988-90. While the processed breaded poundage increased substantially during the most recent interval of analysis, the deflated value of Southeast breeding activities declined due to a fall in the deflated per pound price.

The number of Southeast shrimp processing establishments producing specialty products fell sharply during the study period as did the processed poundage and deflated value. Much of the reduction was in canning activities and was largely in response to the substantial increase in canned imports (see Table 3).

DISCUSSION

The information presented in this paper can be used to draw some tentative inferences regarding the relationship between Southeast shrimp processing activities and landings/imports. Some of these inferences are briefly discussed below.

First, a comparison of pounds processed expressed on a headless shell-on weight basis (Table 4) with pounds landed (Table 1) indicates a long-run

Table 11. Shrimp Processing Activities in the Southeast United States, by Product Form, 1973-90.

Time Period	No. of Firms ^a	Processed Quantity		Processed Value	
		Product Weight 1,000 lbs	Headless Shell-on Weight	Current \$1,000s	Deflated ^b
Raw Headless					
1973-75 avg.	106	66,850	66,850	134,025	359,484
1976-78 avg.	108	103,610	103,610	311,204	664,573
1979-81 avg.	118	89,457	89,457	352,943	568,845
1982-84 avg.	126	92,656	92,656	412,950	539,753
1985-87 avg.	113	105,481	105,481	435,438	516,542
1988-90 avg.	111	100,563	100,563	428,930	451,926
Peeled					
1973-75 avg.	43	24,300	32,863	50,539	135,851
1976-78 avg.	52	34,287	45,912	88,225	188,693
1979-81 avg.	56	43,800	60,135	159,976	259,242
1982-84 avg.	61	53,833	73,601	199,346	261,354
1985-87 avg.	64	72,301	96,647	245,407	290,285
1988-90 avg.	66	80,527	108,574	255,714	267,498
Breaded					
1973-75 avg.	46	85,489	54,017	134,435	360,955
1976-78 avg.	38	79,032	50,154	170,874	365,938
1979-81 avg.	30	72,557	46,525	209,521	335,576
1982-84 avg.	26	78,273	49,040	291,051	380,221
1985-87 avg.	26	87,108	53,876	310,467	367,775
1988-90 avg.	26	104,051	66,277	300,205	315,076
Specialty Products					
1973-75 avg.	39	13,154	24,973	31,219	84,877
1976-78 avg.	34	12,816	26,510	41,232	88,586
1979-81 avg.	29	9,712	19,736	47,088	75,028
1982-84 avg.	25	7,272	14,020	39,944	52,081
1985-87 avg.	23	5,888	10,257	27,436	32,513
1988-90 avg.	21	6,040	8,277	27,073	28,907

^a Note: summation of firms by product type for a given interval will not give the total number of firms in the industry (see Table 4) because many firms product more than one product.

^b The deflated value is given in 1990 dollars and is based on the Consumer Price Index.

domestic raw material supply shortage that has increased through time, particularly after 1982-84. For example, the ratio of processed poundage to pounds landed equalled 1.47 in 1973-75 versus 1.51 in 1982-84. By 1985-87 it had increased to 1.62 and increased again to 1.75 in 1988-90. The increased processed poundage and ratio was associated with a rapid increase in U.S. shrimp imports from Asia and, as documented by Roberts *et al.* (1992) these imports have been used extensively in Southeast shrimp processing activities.

Second, the deflated value of Southeast shrimp processing activities, as indicated, has declined in recent years despite substantially higher processed poundage. The decline reflects a lower deflated processed price. The price decline reflects the increased imports since the early 1980s that have resulted in both a lower domestic dockside shrimp price and a lower import price. Lower dockside and import prices translate into lower raw material input prices to the Southeast shrimp processor but also a lower output price.

Third, increased import usage among Southeast shrimp processors appears to have increased productivity and also appears to have resulted in increased specialization. These two factors are, to an extent, interrelated. The increased imported raw material supply availability suggests that shrimp processing activities can increasingly be conducted year round rather than on a seasonal basis that coincides with the seasonal nature of the domestic shrimp fishery. The ability to process shrimp throughout the year would naturally lead to increased shrimp production per firm and worker as well as an increased ability to specialize among firms in the industry. However, the increased import availability has apparently not influenced industry concentration nor the size distribution among firms.

Finally, the peeling component of the Southeast shrimp processing industry has been the primary benefactor of increased imports. As noted, imports cannot be used in the production of raw headless shrimp and increased imports of canned shrimp have largely displaced the domestic canning industry. The increased breeding activities during the most recent interval of analysis indicate that this component of the Southeast shrimp processing industry may also be increasingly using new sources of imported shrimp, *i.e.*, Asian, to meet increased raw material needs.

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