

THE SOUTHEAST U.S. SHRIMP PROCESSING SECTOR: AN ECONOMIC ANALYSIS OF STRUCTURE AND IMPACTS RELATED TO ALTERNATIVE MANAGEMENT MEASURES

WALTER R. KEITHLY, JR. ¹ and KENNETH J. ROBERTS ²

¹Coastal Fisheries Institute, CCEER

Wetland Resources Building

Louisiana State University

Baton Rouge, Louisiana 70803-7503 USA

²Louisiana Cooperative Extension Service and

Louisiana Sea Grant College Program

Louisiana State University

Baton Rouge, Louisiana 70803-7503 USA

ABSTRACT

The Southeast U.S. shrimp fishery has been the focus of considerable attention in recent years, the result of both its size and impacts on other fisheries. Seasonal and/or area closures of the shrimp fishery have been proposed in the Gulf Region as one means of protecting juvenile fish as well as increasing the shrimp yield.

The impacts of seasonal/area closures on the shrimp processing sector, while important to this \$1.0 billion component of the Southeast U.S. shrimp industry, are largely unknown to regulatory agencies responsible for imposing any such restrictions. This paper provides an analysis of 1991 Southeast U.S. shrimp processing activities based on a survey of processors throughout the Region. The results can be used to help assess potential impacts on the processing sector resulting from harvesting regulations.

INTRODUCTION

Expressed on the basis of value, shrimp represented about 60% of the 1991 Southeast U.S. (defined as the coastal states extending from North Carolina through Texas) edible and non-edible commercial seafood harvest. Pounds landed, equalling 167 million (heads-off), received a dockside value of \$480 million. About 85% of the total poundage was Gulf Region based (defined as the coastal states extending from the Florida West Coast through Texas) compared to about 15% in the South Atlantic Region (defined as the coastal states extending from North Carolina through the East Coast of Florida).

The Southeast shrimp fishery has been the focus of considerable attention in recent years, the result of both its size and its impact on other fisheries and/or aquatic organisms (especially turtles). Two examples to support the aforementioned

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

contention are as follows. First, there has been, and continues to be, movement by state and federal regulatory agencies to manage for a larger average size shrimp at harvest as a means of enhancing dockside revenues (the best example of this is the Texas closure). This goal can best be achieved through seasonal and area closures. Second, scientific evidence suggests that the by catch of shrimp trawlers is large. As scientific data accumulate on the impacts of shrimping effort on other fish species, attempts to limit shrimping effort in particular areas/seasons is likely to be forthcoming.

According to unpublished NMFS data, the value of shrimp products processed in the Southeast U.S. equaled \$940 million in 1991. The potential impacts of seasonal/area closures on the processing sector, while important to this \$1.0 billion component of the Southeast shrimp industry, are largely unknown to the regulatory agencies responsible for imposing any such restrictions. The objective of this paper is to examine Southeast U.S. shrimp processing activities at a

sufficient level of detail that would permit analysis of the potential impacts of harvesting regulations on the processing sector.

The paper, in order to achieve the stated objective, proceeds as follows. In the next section, a brief review of Southeast shrimp landings, imports, and processing activities is presented. Then, the methodology used to accomplish the goal is discussed, followed by the results. The paper concludes with a brief discussion of relevant findings and potential management implications.

SHRIMP LANDINGS, IMPORTS AND PROCESSING

a. Landings and Imports

Reported southeast commercial shrimp landings for 1973-90 are given in Table 1 in three-year intervals. As indicated, U.S. warm water shrimp production (i.e., Southeast landings), exhibited little or no upward trend during the timeframe considered with average annual production ranging from a low of 129 million pounds annually in 1973-75 to a high of 188 million pounds annually in 1985-87. While the long-run Southeast U.S. shrimp poundage has been relatively constant, the associated deflated value has fallen sharply due to the decline in the deflated per pound price (Table 1). The per pound deflated price of \$2.59 in 1991-93 was only 67% of the \$3.89 reported in 1973-75 and only 61% of the peak deflated price of \$4.25 per pound reported in 1976-78.

The decline in the deflated Southeast dockside shrimp price and associated value is in response to sharply rising imports (Table 2). As indicated, 1991-93 imports averaging 679 million pounds annually (expressed on a headless shell-on

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

equivalent weight basis) exceeded 1973-75 average annual imports of 243 million pounds by about 140%. Furthermore, the vast majority of the increase was after the 1979-81 period and reflects the growth in the Asian farm-raised shrimp production and subsequent export of much of the production to the U.S. market. (See Keithly et al., 1993 for a more detailed discussion of the U.S. shrimp import market). In general, the domestic and imported shrimp prices average within 5% - 10% of one another when examined in three-year intervals, suggesting one to be a close substitute for the other. This would imply that imported product could be used in processing activities when domestic supply is limited, or vice versa.

U.S. imports of shrimp by product form, expressed on a product weight basis, are presented in Table 3. Shell-on imports advanced from an average of 124 million pounds annually in 1973-75 to 335 million pounds in 1991-93. Imports of peeled shrimp advanced from 82 million pounds to 233 million pounds with the most recent three year period of analysis exhibiting particularly strong growth. Both of these product forms can be used in a variety of processing activities. Breaded and canned imports are relatively small in proportion to the total and, because they are fully processed before entering the U.S., are not subject to any additional processing activities by U.S. processors.

b. Processing Activities

Shrimp represents the primary component of the Southeast U.S. seafood processing industry, generally contributing more than 80% of the total edible production activities by value. According to Keithly et al. (1994), the number of shrimp processing firms in the Southeast U.S. declined from an average of 176 annually in 1973-75 to only 148 in 1988-90. Despite the decline in number of firms, the processing quantity advanced from an average of 190 million pounds annually in 1973-75 to 291 million pounds annually in 1988-90 (product weight). The 1988-90 total was comprised of 101 million pounds of raw headless product, 81 million pounds of peeled product, 104 million pounds of breaded product, and 6 million pounds of 'other' product. In general, Keithly et al. (1994) found production of raw headless and breaded shrimp to be relatively stable during the 1973-90 period, while the production of peeled shrimp increased significantly. The reader is referred to the study for additional information regarding historical activities in the Southeast U.S. shrimp processing sector.

Converted to a headless shell-on weight basis, Southeast U.S. shrimp processing activities averaged 284 million pounds annually in 1988-90 (Keithly et al. 1994). As indicated in Table 1, however, Southeast U.S. shrimp landings averaged only 167 million pounds, indicating a substantial difference between pounds processed and pounds landed. Imported shrimp used in processing

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

activities, to a large extent, accounts for the difference between the two figures. Growth in imports used in Southeast U.S. shrimp processing activities has been documented by Roberts et al. (1992).

METHODOLOGY

As noted, the objective of this paper is to examine Southeast U.S. shrimp processing activities at a sufficient level of detail that would permit analysis of the potential impacts of harvesting regulations on the processing sector. While the National Marine Fisheries Service (NMFS) collects annual processing information from all shrimp processors in the Southeast U.S., this information is not at a level of detail needed to accomplish the aforementioned objective.

While the NMFS shrimp processing database is not at a level of detail needed to accomplish the aforementioned objective, it does provide the population of shrimp processors in the Region. In 1991, a total of 130 shrimp processing firms were active in the Southeast U.S., according to NMFS records. About 95 of these firms reported processed shrimp sales in excess of \$200 thousand. The authors selected a sample from these 95 firms to administer a detailed questionnaire. The questionnaire elicited information on monthly shrimp processing activities for the 1991 calendar year (see Keithly and Roberts, 1994, for a copy of the questionnaire and additional discussion of the sampling techniques and survey). In total, 50 firms throughout the Southeast U.S. were included in the analysis. This represented more than 50% of the population of firms with 1991 reported processed shrimp sales in excess of \$200 thousand. Output among firms with processed shrimp sales less than \$200 thousand represented less than one percent on the industry total and were therefore not considered during the survey process.

For purposes of analysis, surveyed firms were divided into three categories: (1) those with processed shrimp sales of <\$5.0 million, (2) those with processed shrimp sales from \$5.0 million to \$15.0 million, and (3) those with processed shrimp sales > \$15.0 million. These categories are referred to in this paper as small, mid-sized, and large firms, respectively.

Finally, different weights were assigned to the three categories of firms based on the number of firms sampled in each category relative to this population of firms in that category. The data collected from the survey of processors was then extrapolated to the population, based on these weights, to provide an estimate of industry-wide processing activities in the Southeast Region. Hence, all results presented herein are industry estimates derived from the sample of firms (see Keithly and Roberts, 1994, for details). These results are presented in the next section of the paper.

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

RESULTS

Results are presented in two sections. First, an analysis of raw material supplies used in 1991 Southeast U.S. shrimp processing is presented. Then, processing activities are analyzed.

A. Raw Material (i.e., Unfinished Shrimp) Supply

a. Raw Material Types

As noted, Gulf and South Atlantic shrimp processors utilize both domestic and imported shrimp to meet their processing needs. The types of shrimp that they use fall into four basic categories: (1) fresh/frozen heads-on shrimp, (2) fresh/frozen headless shrimp, (3) fresh/frozen raw peeled shrimp, and (4) other peeled shrimp products. The first category of shrimp, i.e., fresh/frozen heads-on, is essentially a domestic product. Fresh/frozen headless shrimp can be of either a domestic or imported origin. The two peeled categories are essentially imported products.

Estimated monthly purchases of domestic shrimp used in 1991 Southeast U.S. shrimp processing activities are reported in Table 4. In total, an estimated 143.1 million pounds of domestic heads-on shrimp and 56.9 million pounds of domestically produced headless shrimp were used in 1991 Southeast U.S. shrimp processing activities. This translates into a total of 148.5 million headless pounds when the heads-on shrimp are converted to a headless weight basis using a conversion factor of 0.63.

Estimated monthly purchases of imported shrimp used in 1991 Southeast U.S. shrimp processing activities are reported in Table 5. As indicated, an estimated total of 103.7 million pounds of imported shrimp (expressed on a headless shell-on equivalent weight basis) was used in 1991 Southeast U.S. shrimp processing activities. This total was comprised of 59.5 million pounds of headless shell-on product and 34.5 million pounds of peeled product.

A comparison of the information contained in Tables 4 and 5 highlights three features. First, the information suggests that the total industry purchases, expressed on a headless shell-on weight, and equaled 244.1 million pounds in 1991. Forty-two percent of these purchases (103.7 million pounds) consisted of an imported product. Hence, while imported product constituted a minority of the raw material used in 1991 Southeast U.S. shrimp processing activities, import usage was sizeable.

A second feature highlighted by a comparison of the data in the two tables is that variation in domestic raw material purchases was substantially higher than that of the imported product. Total Southeast U.S. shrimp landings, as noted in the introduction, equaled 167 million pounds in 1991. About 85% of this total production (144.8 million pounds) was harvested from the Gulf Region. All but 3.0

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

million pounds of the 148.5 million pound domestic purchases by processors (see Table 4) was estimated to be Gulf Region based, which indicates that essentially all of the Gulf Region production is used in processing activities, i.e., total Gulf Region landings equaled 144.8 million pounds and estimated processing activities from Gulf landed product equaled 145.5 million pounds. The variation in the monthly purchases of domestic shrimp essentially mirrors the seasonal nature of the Gulf Region shrimp fishery (see Keithly and Roberts, 1994, for additional details). A final feature highlighted by the data reflects the fact that variation in monthly purchases of imported raw material product was inversely related to the variation in purchases of the domestic raw product. In particular, in the months when domestic raw material purchases were highest (May through August), import raw material purchases are lowest. This suggests that imported product was used seasonally when domestic product is more limited. As discussed by Keithly and Roberts (1994), this was particularly true among small (i.e., processed shrimp sales of <\$5.0 million) and mid-sized (i.e., processed shrimp sales of \$5.0 million to \$15.0 million) firms.

Annual shrimp purchases by size of firm for the 1991 year are presented in Table 6. As indicated, reliance on imports increased in relation to firm size. Among small firms, for example, 11% of total purchases consisted of an imported product (i.e., 3.8 million pounds compared to total purchases of 34.7 million pounds). the share increased to 20% among mid-sized firms and equaled 60% among large firms. This finding is expected, given the fact that the larger the operation, the more difficult it becomes to secure the needed raw material product from domestic sources on a year round basis.

The information contained in Table 6 also suggests that the purchase price of the raw material increased in relation to firm size for comparable raw material products. For example, the domestic product (converted to a headless weight) was purchases by small firms at an average price of \$2.35 per pound compared to \$2.65 per pound among mid-sized firms and \$3.56 per pound among large firms. These differences, as will be discussed later, reflect two factors. First, the average size count of domestic shrimp purchases increased with firm size. Second, dependence on wholesalers increased with firm size which necessitates an additional marketing (cost) level.

b. Shrimp Sizes

For purposes of the study, processors were asked to identify the percentage of domestic and imported 1991 shrimp purchases that fell into the following headless size categories: <30 count to the pound, 31-70 count to the pound, and >70 count to the pound. Purchases of domestic and imported shrimp by size count was estimated based on the responses, the results of which are presented in Table 7.

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

Domestic shrimp. As indicated, estimated industry use of domestic raw material supply was comprised as follows: <30 count shrimp, 24%; 31-70 count shrimp, 39%; and >70 count shrimp, 37%. As firm size increased, the use of larger domestic shrimp, as a percentage of the total by firm size, also increased. For example, <30 count headless shrimp comprised only 16.2% of domestic shrimp usage among small firms compared to 36.2% among large firms. Shrimp >70 headless count, on the other hand, comprised an estimated 46.1% of total domestic shrimp usage among small firms compared to 41.5% among mid-sized firms and only 27.7% among large firms.

Imported shrimp. Mid-sized shrimp (i.e., 31-70 count), as identified by the information contained in Table 7, dominated imported shrimp usage among all three categories of firms. Among small firms, 31-70 headless count shrimp represented 54% of their imported shrimp usage compared to almost 60% among mid-sized and large firms. However, use of small (>70 headless count) imported shrimp among large firms accounted for more than 35% of their imported shrimp usage compared to less than 25% among mid-sized firms and small firms. As will be shown later, much of the imports of the >70 count shrimp by the large firms is used in the production of breaded products and entails the peeled imports.

c. Procurement Source

Domestic procurement. Domestic shrimp supplied can be secured directly from the fishing fleet, from wholesalers/dealers, or from other sources. If secured directly from the fishing fleet, the product can be supplied from a processor's own boats/vessels or from other boats/vessels. Estimated procurement sources for domestic shrimp by Southeast processors in 1991 are outlined in Table 8. In total, an estimated 43% of the domestic supply (60.1 million pounds) was purchased directly from the fishing fleet while virtually all the remaining domestic supply was procured through wholesalers/dealers.

Direct dependence from the fishing fleet for domestic procurement declined in relation to firm size. Among small firms, for instance, 60% of domestic raw material supply was secured directly from the fishing fleet. For mid-sized firms, the share fell to 43%. The share equaled 31% among large firms. The observed decline in relation to firm size is expected, given the different types of operations. Many of the small and mid-sized firms are more seasonal in nature with processing activities heavily dependent on a constant raw material supply throughout the year. Hence, they rely more heavily on wholesalers/dealers throughout the region to provide them with the needed domestic raw material.

The information in Table 8 also suggests that company fleets provide a relatively small share of the domestic supply secured directly from the fishing fleet. In total, only 5.5% of the domestic supply secured directly from the fishing fleet was

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

estimated to come from company boats. The range was from 6.4% among small firms to 4.4% among large firms.

Import procurement. U.S. shrimp imports in 1991 equalled close to 540 million pounds (product weight) with more than 50 countries contributing to the total. Three countries, however Ð Ecuador, Thailand, and china Ð accounted for more than 50% of the total.

As noted, the estimated use of imported shrimp in Southeast U.S. processing activities equalled 103.7 million pounds (headless shell-on equivalent weight) in 1991. Estimated imports from China (32.4 million pounds) accounted for 31% of the total. Ecuadorian imports, estimated to equal 25.1 million, represented an additional 24% of the total. Imports from other countries significantly contributing to 1991 Southeast U.S. shrimp processing activities included Thailand (9.6 million pounds, 9%), Honduras (6.4 pounds, 6%), Indonesia (5.0 million pounds, 5%), Colombia (4.2 million pounds, 4%), and India (4.1 million pounds, 4%).

PROCESSING ACTIVITIES

Processing activities are reported in two sections, In the first section, information on processed quantities and the raw materials used in these processed quantities are examined. In the second section, processed prices are considered.

a. Processed quantities

Monthly information was collected on the production of five processed shrimp products: (1) raw headless shrimp, (2) peeled raw shrimp, (3) peeled cooked shrimp, (4) breaded, and (5) 'other' shrimp products. Based upon the responses by the fifty Southeast firms included in the analysis, monthly industry-wide production of these products was estimated, the results of which are presented in Table 9. As indicated, annual industry-wide production of raw headless shrimp equalled 77.0 million pounds; production of peeled raw shrimp equalled 78.5 million pounds (product weight); peeled cooked production equalled 12.9 million pounds (product weight); breaded production equalled 85.8 million pounds (product weight); 'other' production equalled 4.2 million pounds (product weight). By and large, these numbers compare favorably with data maintained by the National Marine Fisheries Service. Unpublished NMFS data for 1991 indicated production of 94 million pounds of raw headless shrimp, 78 million pounds of peeled shrimp (raw and cooked), and 100 million pounds of breaded shrimp. Total production, expressed on a headless shell-on basis, equalled 265 million pounds. Hence, results from the current study suggest that raw headless and breaded productions are underestimated while peeled production is overestimated (assuming the unpublished NMFS data are accurate). In total, the difference was about 6% (i.e., 249.0 million pounds compared to 265.0 million pounds).

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

The information in Table 9 suggests considerable variation in raw headless, peeled raw, and 'other' production. Variation in the production of peeled cooked and breaded output was much less evident. The reason for the monthly variation in the production of these three products and lack thereof in the production of the other two products can be ascertained from the information contained in Table 10.

As indicated, the output of raw headless shrimp, peeled raw shrimp, and 'other' shrimp was highly dependent on domestic shrimp landings which are also highly seasonal (see Table 4 for monthly domestic purchases). About 85% of industry-wide production of peeled raw shrimp in 1991 was found to be derived from domestic raw product while close to 80% of the raw headless and 'other' shrimp output was domestic raw material product based. In contrast to this finding, only 4% of the peeled cooked product and less than one percent of the breaded product was derived from domestic raw material.

The information in Table 10 also indicates that the overwhelming majority of domestic large shrimp production (i.e., <30 count headless) was used in raw headless processing activities. While size of shrimp used in the production of the different product forms was not differentiated between domestic and imported shrimp, the aforementioned statement can be substantiated with a few facts. First, all Gulf of Mexico production appears to be processed. Second, domestic landings are basically used in the production of three product forms: raw headless, peeled raw, and 'other' shrimp products. However, very little large shrimp is used in the production of the latter two products. Hence, essentially all domestic production of large shrimp must go into raw headless processing activities. Using the same logic, it can be surmised that the overwhelming majority of domestic small shrimp (i.e., >70 count) is used in peeled raw processing activities and to a much lesser extent the production of 'other' shrimp products (due to relatively small total production of 'other' processed shrimp products). Domestic landings of mid-sized count shrimp appear to be distributed somewhat evenly between raw headless and peeled raw activities.

Peeled raw material, as indicated, was used primarily in breading activities and, to a lesser extent, peeled cooked activities. The heads-on raw material was overwhelmingly used in the production of peeled raw output.

Estimated raw headless production of processed shrimp by firm size is presented in Table 11. Large firms accounted for 50% of annual production compared to 33% among mid-sized firms and 17% among small firms. Domestic shrimp accounted for 76% to 80% of raw headless output among all three categories of firms. Large firms, however, used a much higher percentage of <30 count shrimp in their raw headless processing activities than did either the mid-sized or small

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

firms. This finding relates directly to the relatively large purchases of <30 count domestic shrimp by the large firms (see Table 7).

Estimated peeled raw shrimp processing activities by size of firm is presented in Table 12. While domestic raw material served as the basis for the majority of raw peeling activities among all firms categories, there existed a generally lessening of the dependence in relation to firm size. Among small firms, for example, domestic shrimp constituted an estimated 97% of the raw input used in the production of peeled raw shrimp. Among large firms, the share was less than 80%. In addition, large firms used a much lower percentage of small shrimp in their peeled raw activities than did either the small or mid-sized firms. To some extent, this may reflect the higher import usage in the production of peeled raw product in relation to firm size.

Breading activities by size of firm are presented in Table 13. As indicated, the vast majority of breading activities was conducted by large firms. Both groups of firms that processed breaded shrimp used essentially all imported raw material in their breading activities. Mid-sized firms used primarily headless shell-on shrimp in their production of breaded shrimp while large firms depended more on peeled raw material. Mid-sized firms also used a larger count shrimp, on average, in their production of breaded products. Less than 20% of the raw product used by mid-sized firms was <70 count shrimp compared to more than 40% among the larger firms. This likely relates to the fact that peeled imported shrimp, of which large processors are more dependent upon heading operations, tends to be a smaller size count than headless shell-on imported shrimp.

The small number of firms producing peeled cooked and other shrimp products limits meaningful discussion of their products with respect to firm size. Peeled cooked products were overwhelmingly produced by large firms (an estimated 94% of the total). While 'other' products were produced by all firms categories. The number of firms in each category was extremely small (one or two).

b. Prices of processed products

Prices received by processors for the different product forms are reported in Table 14. The weighted average industry price reported for raw headless processed shrimp was \$4.56. Small firms received a much lower price per pound (\$3.74) than did either the mid-sized firms (\$4.78) or large firms (\$4.56). The relatively low price received by the small firms clearly reflects the smaller average size shrimp used in their production of a raw headless processed product (see Table 11). More difficult to explain is the lower price received by large firms when compared to mid-sized firms. One explanation is that some of the large firms that produced only raw headless product acted only as custom packers. The custom

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

packers worked only on commission. As such, the reported sales price is 'artificially' low, since profits are not included.

The industry-wide peeled raw processed price was found to equal \$3.25 per product weight pound. The relatively low price received by mid-sized firms (\$2.87) reflects their high usage of >70 count shrimp in their processing activities (see Table 12). Similarly, the relatively high price received by large firms (\$3.75) reflects their higher use of larger shrimp.

Peeled cooked shrimp received an average price of \$5.44 per product weight pound compared to \$2.95 for the breaded product and \$6.52 for 'other' processed products. Mid-sized firms received a higher price than did large firms for the breaded product reflecting, in part, larger shrimp used in production.

DISCUSSION

The analysis of Southeast processing activities to present clearly highlights a single feature. Any management actions that reduces the overall domestic catch is going to disproportionately impact the raw headless and peeled raw components of the processing industry. Breaded processing activities and peeled cooked processing activities would be only indirectly impacted from a management action. This indirect impact would likely come from increased competition among peelers for the imported product.

Seasonal/area closures that would allow small shrimp to increase in size would primarily impact the peeling (raw) component of the Southeast U.S. shrimp processing industry. As reported by Keithly and Roberts (1994), May and June accounted for more than one-half of the landings of small shrimp (>70 count) in the Gulf Region in 1991. One-third of the peeled raw processing activities, by comparison, occurred in this two month period (see Table 9). Conversely, one-third of the large shrimp (<30 count) were landed in the two month period of July and August in 1991 according to Keithly and Roberts (1994). Estimated raw headless processing activities in this two month period equalled 28% of the total. Hence, a closure in May and June would likely negatively impact peeled raw processing activities but would likely enhance raw headless processing activities.

As regulatory agencies attempt to 'fine tune' shrimp management measures, the impacts on the processing sector should be considered. The information provided in this paper will help to analyze those impacts.

ACKNOWLEDGEMENTS

The authors acknowledge support from the National Marine Fisheries Service, MARFIN Project # NA17FF0376-01.

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

LITERATURE CITED

- Keithly, W.R. and K.J. Roberts. 1994. Shrimp closures and their impact on the Gulf Region processing and wholesaling sector (expanded to include South Atlantic). Final Report to NMFS Contract # NA17FF0376-01.
- Keithly, W.R., K.J. Roberts, and H. Eyster-Kearney. 1994. Structural changes in the southeast U.S. shrimp processing industry. Proceedings of the 46th Gulf and Caribbean Fisheries Institute.
- Keithly, W.R., K.J. Roberts, and J.M. Ward. 1993. Effects of shrimp aquaculture on the U.S. market. Pages 125-156 in U. Hatch and H. Kinnucan, eds Aquaculture: models and economics, Westview Press, Colorado.
- Roberts, K.J., W.R. Keithly, and C. Adams. 1992. Determinants of imported shrimp and their role in the southeast shrimp processing sector. NMFS Technical Memorandum (NMFS/SEFC-305). 33 pp.
- United States Department of Commerce (NOAA, NMFS), Fisheries of the United States (1973-93 various issues).

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

Table 1. Reported Southeast Commercial Shrimp Landings, 1973-93 (3 yr. avgs.).

Time Period	Pounds Landed ^a	Value		Dockside Price	
		Current	Deflated ^b	Current	Deflated
	Mills	----- \$ Mill -----		----- \$/lb -----	
1973-75	128.9	187.9	501.5	1.46	3.89
1976-78	165.3	327.4	702.3	1.98	4.25
1979-81	160.4	412.1	664.0	2.57	4.14
1982-84	153.9	482.0	630.9	3.13	4.10
1985-87	188.3	530.4	628.4	2.82	3.34
1988-90	166.7	449.2	473.2	2.70	2.84
1991-93	156.5	434.5	405.8	2.78	2.59

^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, 1973-93 (3 yr. avgs.).

Time Period	Quantity ^a	Value		Price	
		Current	Deflated ^b	Current	Deflated
	Mill. lbs	----- \$ Mill. -----		----- \$/lb -----	
1973-75	243.3	338.4	897.7	1.39	3.69
1976-78	261.4	458.8	989.0	1.76	3.78
1979-81	262.1	718.8	1,115.5	2.74	4.41
1982-84	387.7	1,143.9	1,493.1	2.95	3.85
1985-87	509.1	1,442.5	1,708.8	2.83	3.36
1988-90	580.4	1,706.2	1,798.1	2.94	3.10
1991-93	678.6	2,015	1,874.5	2.97	2.76

^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).

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

Table 3. U.S. Shrimp Imports by Product Form, 1973-93 (3 yr. avgs.)

Time Period	Product Weight			
	Shell-on	Peeled	Breaded	Canned
	----- Mill. lbs -----			
1973-75	124.2	82.4	1.6	3.4
1976-78	118.9	96.4	1.3	2.6
1979-81	134.4	82.3	3.3	4.3
1982-84	209.2	97.1	8.8	10.7
1985-87	268.3	127.2	1.8	16.7
1988-90	352.8	137.5	1.3	11.7
1991-93	335.5	232.8	1.4	8.9

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

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

Table 4. Estimated Monthly Purchases of Domestic Shrimp Used in 1991 Southeast U.S. Shrimp Processing Activities.

Month	Heads-on	Headless	Total*
----- 1,000 lbs -----			
January	3,172	2,421	4,420
February	1,847	1,681	2,844
March	2,501	1,701	3,277
April	3,520	2,013	4,230
May	24,725	4,918	20,494
June	29,419	5,397	23,931
July	17,378	8,034	18,983
August	11,097	9,107	16,099
September	11,174	6,438	13,478
October	16,657	6,798	17,291
November	14,166	4,948	13,872
December	7,455	3,445	9,584
Total	143,111	56,901	148,513

* Heads-on poundage were converted to a headless basis using a conversion factor of 0.63.
Source: Compiled from Keithly and Roberts (1994).

Table 5. Estimated Monthly Purchases of Imported Shrimp Used in 1991 Southeast U.S. Shrimp Processing Activities.

Month	Headless Shell-On	Peeled Raw and Other	Total*
----- 1,000 lbs -----			
January	5,807	3,048	9,708
February	5,889	3,689	10,659
March	5,197	3,047	9,099
April	5,246	2,600	8,574
May	4,444	2,231	7,299
June	3,210	2,383	6,260
July	3,775	2,257	6,666
August	4,542	2,842	8,181
September	5,127	2,880	8,813
October	5,651	2,816	9,256
November	5,878	3,264	10,056
December	4,708	3,460	9,138
Total	59,474	34,517	103,709

* Expressed on a headless shell-on equivalent weight using a conversion factor of 1.28 for peeled raw and other.
Source: Compiled from Keithly and Roberts (1994).

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

Table 6. Estimated Raw Material Shrimp Purchases Used in 1991 Southeast U.S. Shrimp Processing Activities, by Size of Firm.

	Firm Size		
	< \$5.0 Mil.	\$5.0 - \$15.0 Mil.	> \$15.0 Mil.
Domestic Product			
Heads-on (1,000 lbs)	38,342	63,192	41,567
\$/lb	1.28	1.27	1.68
Headless (1,000 lbs)	6,731	20,860	29,307
\$/lb	3.50	3.86	4.36
Total ^a	30,886	60,671	55,494
\$/lb	2.35	2.65	3.56
Imported Product:			
Headless shell-on (1,000 lbs)	3,841	12,445	43,236
\$/lb	3.23	3.33	3.44
Peeled (1,000 lbs)	0	1,968	32,550
\$/lb	---	3.90	2.87
Total ^b	3,841	14,964	84,900
\$/lb	3.23	3.28	2.85
TOTAL^c	34,727	75,635	140,394

^a Total domestic pounds and price per pound is presented on a headless basis.
^b Total imported pounds and price per pound is presented on a headless shell-on weight basis.
^c TOTAL equals combined domestic and imported raw materials expressed on a headless shell-on weight basis.
 Source: Compiled from Keithly and Roberts (1994).

Table 7. Estimated Purchases of Shrimp (Domestic and Imports) Used in 1991 Southeast U.S. Shrimp Processing Activities (given on a percentage basis) by Size of Firm.*

	Firm Size			Total
	< \$5.0 Mil.	\$5.0 - \$15.0 Mil.	> \$15.0 Mil.	
----- Domestic -----				
< 30 ct. (%)	16.2	16.0	36.2	24.2
30-70 ct. (%)	37.6	41.6	36.1	38.7
> 70 ct. (%)	46.1	41.5	27.7	37.1
----- Imports -----				
< 30 ct. (%)	25.7	16.8	4.4	7.0
30-70 ct. (%)	53.9	58.6	59.7	59.3
> 70 ct. (%)	20.3	24.6	35.9	33.7

* All count size data are provided on a headless weight basis.
 Source: Compiled from Keithly and Roberts (1994).

Table 8. Estimated 1991 Domestic Shrimp Procurement Sources by the Southeast Shrimp Processing Sector.

Procurement Source	Firm Size			Total*
	< \$5.0 mil	\$5.0-15.0 mil	> \$15.0 mil	
Supply From:	----- 1,000 lbs -----			
Fishing Fleet	18,678	26,025	15,359	60,062
Own Boats (%)	6.4	5.3	4.4	5.4
Other Boats (%)	93.6	94.7	95.6	94.6
Wholesalers/Dealers	12,209	34,647	33,539	80,395
Other	0	0	259	259

* The total given in this table (140.7 million pounds) is about 5% less than the 148.5 million pound total reported earlier due to non-response by some firms.
Source: Compiled from Keithly and Roberts (1994).

Proceedings of the 47th Gulf and Caribbean Fisheries Institute

Table 9. Estimated Monthly Production of Shrimp Products by the Southeast Shrimp Processing Sector, 1991.

Month	Product Form ^a					Total ^b
	Raw Headless	Peeled Raw	Peeled Cooked	Breaded	Other	
1,000 lbs						
January	3,744	2,674	1,136	6,924	66	12,766
February	2,903	2,094	943	8,236	69	11,865
March	3,323	2,136	787	8,902	113	12,667
April	3,628	2,663	841	6,515	98	12,109
May	6,825	11,772	1,006	6,309	888	28,151
June	7,238	14,185	1,245	6,072	810	31,193
July	10,329	8,254	1,026	6,056	625	26,731
August	11,283	6,071	1,166	7,239	190	24,778
September	8,302	6,000	988	7,529	204	21,712
October	8,767	8,993	1,051	7,910	410	26,521
November	6,655	8,470	1,290	7,199	463	23,837
December	3,975	5,139	1,401	6,912	256	16,704
Total	76,973	78,452	12,879	85,802	4,192	249,034 ^c

^a Pounds for individual products is given on a product-weight basis.

^b The total is given on a headless shell-on equivalent weight basis. The annual total of 249.0 million pounds is approximately 1.3% less than annual purchases of raw input, expressed on a headless shell-on weight, of 252.2 million pounds. Much of the difference likely reflects the average conversion factors used in deriving the shell-on weight from the different product weights.

^c Horizontal summation of annual totals by product form will not yield the annual total which is given on shell-on equivalent weight.

Source: Keithly and Roberts (1994).

Table 10. Information on Southeast Industry-Wide Production of Different Processed Products.

	Product Form				
	Raw Headless	Peeled Raw	Peeled Cooked	Breaded	Other
Total Output (1,000 lbs)	76,973	78,452	12,879	85,802	4,192
Raw Material (1,000 lbs)					
Heads-on	12,087	118,160	852	0	12,906
Heads-off	70,159	15,209	8,179	20,285	3,268
Peeled	-----	-----	6,050	28,139	437
Supply Sources (%)					
Domestic	78.1	84.8	3.9	0.8	78.6
Imports	21.9	15.2	96.1	99.2	21.4
Size Count (%)					
< 30 ct	40.9	3.8	9.9	10.7	0.0
30-70 ct	50.2	37.3	79.6	49.1	50.2
> 70 ct	8.9	58.9	10.5	40.2	49.8

Source: Keithly and Roberts (1994).

Table 11. Information on Southeast Industry-Wide Production of Raw Headless Processed Shrimp by Firm Size, 1991.

	Firm Size			Total
	< \$5.0 mil	\$5.0-15.0 mil	> \$15.0 mil	
Total Output (1,000 lbs)	13,207	25,107	38,659	76,973
Raw Material (1,000 lbs)*				
Heads-on	5,081	651	6,357	12,089
Headless	10,224	25,265	34,670	70,159
Supply Sources (%)				
Domestic	75.9	76.9	79.6	78.1
Imports	24.1	23.1	20.4	21.9
Size Count (%)				
< 30 ct	22.6	37.4	49.4	40.9
30-70 ct	60.6	54.7	43.7	50.2
> 70 ct	16.8	7.9	6.9	8.9

* Summation of heads-on poundage (x 0.63) and headless poundage does not necessarily equal total output. Some raw material may be lost in processing.
Source: Keithly and Roberts (1994).

Table 12. Information on Southeast Industry-Wide Production of Peeled Raw Shrimp by Firm Size, 1991.

	Firm Size			Total
	< \$5.0 mil	\$5.0-15.0 mil	> \$15.0 mil	
Total Output (1,000 lbs)	17,096	32,895	28,460	78,451
Raw Material (1,000 lbs)				
Heads-on	30,877	51,830	36,153	118,160
Headless	355	5,411	9,442	15,209
Supply Sources (%)				
Domestic	97.9	83.9	77.8	84.8
Imports	2.1	16.1	22.2	15.2
Size Count (%)				
< 30 ct	2.6	2.4	6.2	3.8
30-70 ct	38.9	29.2	45.7	37.3
> 70 ct	58.5	68.4	48.1	58.9

Source: Keithly and Roberts (1994).

Table 13. Information on Southeast Industry-Wide Production of Breaded Shrimp by Firm Size, 1991.

	Firm Size*		Total
	\$5.0-15.0 mil	> 15.0 mil	
Total Output (1,000 lbs)	8,112	77,690	85,802
Raw Material (1,000 lbs)			
Headless	2,840	17,445	20,285
Peeled	1,079	27,060	28,139
Supply Sources (%)			
Domestic	0	0.8	0.8
Imports	100	99.2	99.2
Size Count (%)			
< 30 ct.	18.7	9.9	10.7
30-70 ct.	61.7	47.8	49.1
> 70 ct.	19.6	42.3	40.2

* No firms < \$5.0 million were surveyed that produced breaded shrimp products.
Source: Keithly and Roberts (1994).

Table 14. Estimated Sales Prices Related to Different Processed Shrimp Products, 1991.

Product Form	Firm Size			Weighted Average
	< \$5.0 mil	\$5.0-\$15.0 mil	> 15.0 mil	
Raw Headless	3.74	4.78	4.56	4.56
Peeled Raw	3.12	2.87	3.75	3.25
Peeled Cooked	---	---	---	5.44
Breaded	---	3.47	2.90	2.95
Other	---	---	---	6.52

* Not estimated or not applicable.
Source: Keithly and Roberts (1994).