



NOAA Technical Memorandum  
NMFS - SEFC - 100

A Report on the Available Economic Data for  
the Shrimp Fisheries in the Southeastern  
United States

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U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Southeast Fisheries Center  
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## INTRODUCTION

In an attempt to provide economic data which can be utilized in the development of effective management strategies for the marine fisheries within the southeastern United States, the Southeast Fisheries Center (SEFC) of the National Marine Fisheries Service (NMFS) has prepared comprehensive inventories of available economic data on several commercially important species. This report extends this SEFC task by describing the economic data available on the shrimp fisheries within the southeast. This report, however, is not limited to only a description of the available data sources. It also provides references and brief descriptions of the important analytical research that has been done on these important commercial resources. Since the report primarily addresses the commercial fisheries, Penaeus aztecus, P. setiferus and P. duorarum are the only species discussed.

This report follows the general outline used in other economic data base reports done by the SEFC. A list inventoring the available data is provided in Appendix A. This inventory is presented in outline form under the following general topics; dockside prices and landings, wholesale prices and quantity, retail prices and consumption, imports and exports, vessels, and management. The data inventory for shrimp is slightly different than previous data base reports because it does not contain examples of the data listed in the inventory. The reason for not including examples of the inventoried data is the volume and complexity of the data associated with the commercial shrimp fisheries. A fairly complete list of the literature relating to the data listed in the inventory is provided in Appendix B. This bibliography, however, is not limited to the literature referencing data on the shrimp fisheries; it also provides references to economic analyses which have been done on the shrimp resources in the southeast.

## DATA INVENTORY

This section provides explicit discussions of the data listed in the inventory presented in Appendix A. The outline of this section follows the principle topics enumerated with Roman numerals in Appendix A.

### Dockside prices and landings

Dockside (or ex-vessel) prices and the quantity of shrimp landed are the most fundamental data in shrimp fishery analysis. The federal government has been collecting these data on the shrimp fisheries since the late 1890's. In the mid-1950's the data collection effort by the Bureau of Commercial Fisheries, Department of Interior, was expanded to include area (i.e., identified statistical zones) and depth (ten fathom intervals) for eight size categories for each of the three major shrimp species caught in the Gulf of Mexico. These data are published monthly by the National Marine Fisheries Service (NMFS), formerly the Bureau of Commercial Fisheries, in a report entitled, Gulf Coast Shrimp Data. The data in this current fishery statistic report are catches of shrimp in the respective depth/areal zones. A separate report published by NMFS, entitled, Shrimp Landings, provides the amount and value of shrimp landed at ports in the

eight states in the southeastern United States. From the data in the Shrimp Landings report, a weighted average of the dockside prices can be calculated by simply dividing value by the respective amount of shrimp landed. It should be noted that the data reported in these two publications are slightly different. The data in the Gulf Coast Shrimp Data are catches and those in Shrimp Landings are landings. The distinction is that not all catches made in areas off a specific state may be landed at ports in that state.

Using these two data sets (landings and ex-vessel prices), an important economic relationship can be statistically estimated. This relationship, known as the price flexibility of landings, has been estimated by numerous authors. In an unpublished 1979 report, Poffenberger reviews and summarizes the results of analytical estimates of the relationship between ex-vessel prices and landings. The discussions in that report will not be presented here; however, more recent research by several authors has extended the analytical information about this statistical relationship. Blomo (1979) in his Ph.D. dissertation disaggregated shrimp by sizes into three categories and estimated price flexibilities for the separate categories. This dissertation topic was the pink (*P. duorarum*) shrimp fishery on the west coast of Florida. The concept of estimating price flexibilities by size of shrimp was extended to the fisheries in the entire Gulf of Mexico in a 1980 Master's thesis by Chui. Similar to Blomo (1979), she provides analyses of shrimp prices disaggregated into three size categories. Her analyses are single equation models (whereas Blomo (1979) used a simultaneous equation model) which estimated both direct and cross price flexibilities. The estimation of price flexibilities for separate size categories was extended to all eight marketing categories by Poffenberger in a 1981 unpublished report and more recently in Poffenberger (forthcoming in Marine Fisheries Review).

#### Wholesale price and quantity

Existing published data at the wholesale level are not nearly as comprehensive as dockside or ex-vessel data. This is due to the lack of an easily identified "wholesale price" similar to ex-vessel prices. Wholesale can refer to any level of marketing between the initial sale at the dock to the sale for final consumption. Thus, prices at different levels of "wholesaling" would be expected to vary depending, of course, on the number of times the shrimp have been bought and sold and the amount of value added to the product at the various exchanges. Another complicating aspect is that the flow of shrimp through the market from producer to consumer is not well documented. Prochaska (1976) provides the only published research on this topic and his research is only for the state of Florida.

However, as indicated in Appendix A, some published data do exist on the wholesale quantity and prices. Monthly data on the amount of shrimp in cold storage holdings are collected and published by NMFS. These data measure the size of inventories that processors are holding and are reported in total pounds of product weight at the end of each month. Since these data are only reported once a month, the actual flow of shrimp into and out of cold storage during the month is unknown. Furthermore, no disaggregations on the amount of holdings by size of shrimp are available in the NMFS data.

Wholesale prices are available from several published sources. The New York Market News Report (an NMFS publication) provides daily prices on a very wide spectrum of shrimp sizes received from various geographical locations, both foreign and domestic. This wide spectrum of prices presents a problem from an analytical perspective because a determination of which price to use in the analysis must be made. The second published source of wholesale price data is from another NMFS publication, Shellfish Market Review. This publication provides monthly data from the New York wholesale market for 21-25, 31-40 and 51-60 size categories of shrimp. Data on the quantity of shrimp for these size categories are also available in this publication. A third source is Fisheries of the United States in which monthly prices at Chicago for 26-30 count are published.

Although no analyses have been done on the relationship of price and quantity at the wholesale level, several authors, Doll (1972), Batie (1974), and Sage Associates (1981) have utilized the wholesale data in their respective multi-equation analyses.

#### Retail price and consumption

Like wholesale prices and quantity, retail data are also difficult to define and measure. For example, purchases of shrimp for consumption by a final consumer can take place at virtually any marketing level from dock-side purchases to elegant meals in fine restaurants. Such a large array of potential retail consumption provides the possibility for considerable error in any single measure of retail price or consumption. In an attempt to overcome this data collection problem, the NMFS presents a data series called "apparent consumption" in the monthly publication entitled Shellfish Market Review. This estimate of monthly consumption is calculated by subtracting monthly cold storage holdings from total reported monthly supply (domestic and imports). In the same monthly publication retail prices for two size categories of shrimp, 21-25 and 36-42 shrimp per pound, are reported. These data are reported from the Baltimore, Maryland market; but the data provide no indication of how much of the total retail market is supplied through the market at Baltimore. Furthermore, since the retail price data and the data on "apparent consumption" are not collected from the same source, the use of these two data series in the same analyses should be considered carefully.

No specific retail demand analyses have been performed; however, the three authors noted under the wholesale price discussion (i.e., Doll, Batie, and Sage Associates) have included retail prices and consumption in their respective analyses.

#### Imports and exports

Data on the amount and prices of shrimp imported into the United States are relatively important in economic analyses of this fishery since more than half of the shrimp consumed in the United States are imported. Total pounds of shrimp imported and exported by the U.S. are collected by Customs and reported by NMFS in a publication entitled, Imports and Exports of Fishery Products. This monthly report includes total pounds and value for two product forms -- fresh/frozen and canned. The quantity and value of shrimp exported by the U.S. of both domestically caught and imported

(i.e., resold as exports) are also presented in this NMFS report. Another NMFS publication, Fisheries of the United States, provides annual data on the pounds of U.S. imports and the country from which these shrimp originated. Weekly data on shrimp imports are published in the New Orleans Market News Report (Goldenrod Sheets). These data are provided by size categories for two product types.

Data on shrimp imports are obviously essential in addressing questions concerning trade restrictions (i.e., tariffs, quotas, etc.). The question of import restrictions was the topic of Batie's 1974 Ph.D. dissertation in which she addressed this issue in a very quantitative way. Whitaker in his 1971 Ph.D. dissertation discusses the effects trade restrictions may have on the Latin American countries. His discussion is a more descriptive presentation than Batie's. In a recent report prepared by Sage Associates (1981), they argue that their analytical results indicate that either a tariff or quota (preferably a combination) system is the only means of restoring financial viability to the shrimp harvesting sector.

### Vessel

The data and analyses discussed thus far have dealt only with the various marketing levels for shrimp. For many fishery economic analyses, data on the characteristics of the harvesting sector are crucial. At a primary level, the number of vessels and (at least nominal) fishing effort should be available. Data collected by NMFS on the number of vessels participating annually in the shrimp fisheries are reported in the Fishery Statistics of the United States. These data are presented by state and are exclusive of duplication. That is, a vessel that lands shrimp in more than one state is only counted in one of the states. Data on nominal fishing effort are reported as days fished in the Gulf Coast Shrimp Data. A day fished is defined as 24 hours of actual fishing time in which the trawl is in the water fishing. Days fished in this monthly report are provided by statistical zone and depth as are the catch data discussed in the section on dockside prices and landings. In 1976 a change in the methodology NMFS used to collect and estimate the data on fishing effort was made. Therefore, care should be exercised in comparing 1976 through 1980 fishing effort data with previous or subsequent years.

Data on the physical characteristics of the shrimp vessels greater than five net tons are not published, but are available on the SEFC computer system. These data are available from 1965 through 1977 and consist of hull length, engine horsepower, size of gear, number of crew, year built, etc. (a complete list is provided in Appendix A). The combination of data on individual vessels and the respective amounts of fishing effort are important for both biological and economic analyses. Several studies have attempted to combine these data in order to estimate standardized fishing effort. Griffin, Cross and Nichols (1977) present an analysis demonstrating that the length of the trawl's footrope and the vessel's engine horsepower are the essential variables in standardizing fishing effort. Tydlacka in his 1979 master's thesis uses Griffin et al.'s (1977) method to standardize fishing effort for an arbitrarily selected standard vessel having 45 yards of footrope and an engine of 345 horsepower. In a recent 1981 report Brunenmeister uses five vessel characteristics with principal component analyses to select the combination of transformed

vessel characteristics which best statistically estimates the standard vessel. In both Brunenmeister and Tydlacka fishing effort is standardized in order to estimate various mathematical forms of a surplus production model. Their general conclusions are in general agreement. That is, within the range of the data several variations of the production models provide equally good representations of the data.

A final, but important, topic under the general discussion of shrimp vessels is the costs and revenue of operating these vessels. Considerable research has been undertaken since 1970 to understand and document the financial aspects associated with operating commercial shrimp trawlers. The inventory presented in Appendix A provides a sufficiently detailed description of the respective authors' research and are not reiterated here. Even though considerable research has been done, the extreme heterogeneous array of fishing boats and vessels and more importantly the fishing characteristics of the vessels in the Gulf of Mexico and along the south Atlantic coast create a very complex situation. The studies cited in the inventory, for the most part, are intercept-type surveys and the captain or vessel owner is requested to provide his costs and revenues over the past year. Concern has to be raised regarding the use of this static type of data to reflect the dynamic characteristics of the shrimp vessels. Liao (1979) segregates the vessels in a 1976 survey by the geographical distance from home port that the vessels travelled to fish. The costs and revenues of the respective groups of vessels in this study are analyzed with regard to their mobility. The studies in the Gulf, on the other hand, are unrelated to each other geographically and may or may not provide a comprehensive indication of the Gulf shrimp vessels' operating characteristics.

### Management

Numerous management problems can be identified for the penaeid shrimp fisheries in the southeastern United States. An important management question results from the offshore migration patterns of juvenile and pre-adult shrimp as they are recruited to the commercial fisheries. That is, what is the optimal size at which the migrating shrimp should be harvested. Waters et al. (1980) addressed a similar question in their estimates of the benefits and costs of permitting shrimp to grow to larger, more valuable sizes prior to harvesting. The Gulf of Mexico Council in their 1981 fishery management plan recommended that an areal/seasonal closure be promulgated to protect smaller, unmarketable shrimp during the early part of the brown shrimp season in the fishery conservation zone off the Texas coast and an areal closure in the Tortugas area off the west coast of Florida. Griffin (1980) uses simulation techniques to estimate the potential effects of the Gulf Council's recommended proposal. The SEFC undertook an extensive research program to evaluate the Gulf Council's recommendation which was implemented by the Department of Commerce during the 1981 shrimp season. Jones, Klima and Poffenberger (1981) provides an overview and summary of the SEFC's research efforts to evaluate this closure regulation.

There are, of course, other management problems associated with the penaeid shrimp fishery. Several of the potential problems and various management strategies are discussed in Boerema (1980) and Poffenberger (1981a). These two reports primarily focus on the economic consequences of both the problems and potential management strategies.

As an aid in the evaluation of potential management proposals, two computer models have been developed for the shrimp fisheries in the southeast. These models combine both the biological (fishery) and economic characteristics of the shrimp fisheries into an integrated process for estimating the effects of proposed management. One of the models was developed at Texas A&M University and the use of this model is demonstrated in Griffin et al. (1980) in which the areal/seasonal closure off the coast of Texas is evaluated. The second model was developed at Stanford University and is demonstrated in Khilnani and Tse (1980) which is a case study of the Tortugas shrimp fishery. This model has also been used in a case study of the Texas shrimp fishery that was prepared by Tom and Tse (1981).

#### SUMMARY

This report provides a comprehensive description of the economic data which are available, both published and unpublished, on the shrimp fisheries in the southeastern United States. An outline explicitly listing the available economic data is provided in Appendix A. Appendix B is supplementary to Appendix A in that it provides an extensive bibliography of the literature on the shrimp fisheries. The text of the report discusses the data inventory in Appendix A in more detail and also discusses specific literature on economic analyses of the shrimp fisheries.



## Appendix A

As discussed in the Introduction, this appendix provides an itemized list inventorying the available published and unpublished economic data pertinent to the shrimp fisheries in the Gulf of Mexico and south Atlantic area. Unlike data base reports on other species within the southeastern United States, this appendix does not contain examples of the data inventoried herein. The format of this data inventory follows previous data base reports and is presented in outline form with the major topic areas being identified by Roman numerals. The text of this report provides a more detailed description of the data contained in the inventory. The text also provides references and brief discussions of economic analyses existing in both the published and unpublished literature.

## Data Inventory

### I. Dockside prices and landings

#### A. Monthly data

1. Gulf Coast Shrimp Data - shrimp catch by statistical area, depth for eight size categories for all species existing in the Gulf of Mexico (published by NMFS, Washington, D.C., 1963-1979).
2. Shrimp Landings - landings and value by species by size by state in which the shrimp are landed for both the Gulf of Mexico and south Atlantic area (published by NMFS, Washington, D.C., 1950-1979).
3. State Landings - current fisheries statistics for the separate states within the southeastern United States provides total pounds and value of the landings (published by NMFS, Washington, D.C., 1950-1979).
4. Shrimp Statistics - average ex-vessel price, and landings by count size and state of landing (published by NMFS, SEFC, New Orleans, LA).
5. Data are available on the SEFC computer system (1960-1981).

#### B. Yearly data

1. Gulf Coast Shrimp Data, Annual Summary
2. Shrimp Landings, Annual Summary
3. Fisheries of the United States (published by NMFS, Washington, D.C., 1930-1981).
  - a. Commercial landings and value by major geographical area for the Gulf of Mexico and south Atlantic.
  - b. An index of ex-vessel shrimp prices in which 1967 is the base year.
4. Fishery Statistics of the United States (published by NMFS, Washington, D.C., 1956-1981).
  - a. Annual summary similar to that in Shrimp Landings - i.e., by species, by depth of capture, by area (state).
  - b. Annual catch by type of gear in the respective states.

#### C. Weekly Data

1. Market News Report - New Orleans (published three times weekly, NMFS, SEFC, New Orleans, LA.).
  - a. Amount landed and ex-vessel price by size categories for three geographical areas - western, northern and eastern Gulf of Mexico.
  - b. Data from August, 1974 through December, 1979 are automated on the SEFC computer.

### II. Wholesale price and quantity

#### A. Inventories of frozen shrimp are published in Frozen Fishery Products, NMFS, Washington, D.C., 1972-1980.

1. Monthly and annual data on the amount of freezings and the cold storage holdings.
2. Cold storage holdings are end of the month reports (two categories -- for raw and all other forms).

3. Data are not reported by size or species of shrimp -- only total pounds of product weight in storage.
  4. Prices are not reported.
  5. Data are automated by Fisheries Development Division, Industry Analysis Branch, Washington, D.C., 1960-1981.
- B. Monthly wholesale prices are presented in Shellfish Market Review, NMFS, Washington, D.C., 1960-1981.
1. Prices are reported for the following three size categories; 21-25, 31-40, and 51-60.
  2. Prices are from New York market only.
  3. Data are automated by Fisheries Development Division, Industry Analysis Branch, Washington, D.C.
- C. Monthly wholesale prices at Chicago are published in Fisheries of the U.S.
1. Prices for 26-30 count, brown shrimp, 5-lb. packages.
  2. Prices for raw, breaded, 15-20 count, 4-lb. packages.
- D. Canned Fishery Products, Annual Summary (published by NMFS, Washington, D.C., 1959-1978).
1. Number of standard cases and total value by state.
  2. Packing of miscellaneous shrimp products, total number of cases and total value.
- E. Fish Sticks, Fish Portions, and Breaded Shrimp (published by NMFS, Washington, D.C., 1970-1980 (quarterly report)).
1. Monthly production (in pounds) of breaded and batter-coated shrimp.
- F. Detailed daily wholesale price and quantity data
1. Data published three times weekly by the New York Market News office, NMFS, New York.
  2. Data are primarily for industry use and are unsuitable for analytical purposes.

### III. Retail price and consumption

- A. Annual apparent consumption is calculated and presented in Shellfish Market Review, NMFS, Washington, D.C., 1966-1981
- B. Retail prices are also presented in Shellfish Market Review for the 21-25 and 36-42 size categories as reported at the Baltimore Market.
- C. A cross-sectional survey of selected households in the United States will provide data on seafood consumption. The survey is being done by Market Research Corporation of America for NMFS, Washington, D.C. and a report is forthcoming.

#### IV. Imports and exports

- A. Monthly data are provided in Imports and Exports of Fishery Products, NMFS, Washington, D.C., 1967-1981.
  - 1. Total pounds and value imported for fresh/frozen and canned shrimp.
  - 2. Quantity and value exported of both domestically caught and imported shrimp are provided.
  - 3. Data on imports (pounds) are automated by Fisheries Development Division, Industry Analysis Branch, Washington, D.C.
- B. Annual quantity and value of imported shrimp by country of origin are provided in Fisheries of the U.S., NMFS, Washington, D.C.
- C. Weekly data on shrimp imports by size (eight size categories) and two product types are reported in Market News Reports (Goldenrod), NMFS, SEFC, New Orleans, La. (1974-current).

#### V. Vessel

- A. Number of vessels and fishing effort.
  - 1. Number of vessels is presented in Fishery Statistics of the United States.
    - a. Estimates by state.
    - b. Estimates are exclusive of duplication between states which is necessary because of the mobility patterns of shrimp vessels.
  - 2. Estimates of fishing effort.
    - a. These estimates are measured in days fished which are 24 hours of actual fishing time.
    - b. Data are provided in Gulf Coast Shrimp Data.
    - c. Care should be taken in using these data for 1976 through 1980 because of a change in the data reporting procedure.
  - 3. Data are automated on the SEFC computer system (1960-1975, 1981).
- B. Vessel characteristics.
  - 1. Data for the following characteristics are available.
    - a. vessel name
    - b. documentation number
    - c. year the vessel operated in the fishery
    - d. crew size: full and part time employment
    - e. construction code
    - f. propulsion: type of engine and horsepower
    - g. weight
    - h. length
    - i. year built
    - j. gear code: type and quantity of gear utilized
    - k. auxiliary boats: motor and nonmotor
    - l. region, state and county code.
  - 2. Data are unpublished and are automated on the SEFC computer system (1965-1977).
- C. Cost and revenue data.
  - 1. Griffin (Texas A&M University) has collected data from vessels landing at Texas ports for the following years; 1971, 1973,

1974, 1975, 1977, and 1980. Data for 1971-1977 are published in Warren and Griffin (1978). The 1980 data will be published in a forthcoming contract final report.

2. Duffy and Johnson (1979) present cost and revenue data for bay shrimp fishermen in Louisiana.
3. Roberts and Sass (1979) present data collected from inshore and offshore Louisiana commercial fishermen during 1978.
4. Data from Florida-based Gulf of Mexico shrimp vessels for 1977 are reported in Blomo and Griffin (1978).
5. Liao (1979) presents data for south Atlantic vessels collected during 1976.
6. Rhodes (1980) attempts to update the south Atlantic data in Liao (1979) to reflect 1980 conditions.
7. Texas A&M University has developed and is testing a simulation computer model which uses certain (provided) input parameters to estimate financial cost and revenue budgets for shrimp vessels. A report is forthcoming.

## VI. Management

### A. Plans

1. Christmas and Etzold (1977) prepared a draft management plan for the Gulf of Mexico fishery for the Gulf States Marine Fisheries Commission.
2. Gulf of Mexico Fishery Management Council (1981) prepared a plan which recommended several regulations which have subsequently been enacted as federal regulations.
3. The South Atlantic Fishery Management Council (1981) has prepared a profile of the penaeid shrimp fishery in the south Atlantic as a preliminary for their fishery management plan.

### B. Analyses

1. The Fishery Management Plan for shrimp, Gulf of Mexico Fishery Management Council (1981), contains descriptive background information as well as empirical estimates of the impacts of the (then) proposed management measures.
2. Stanford University has developed an integrated simulation model which has been used to analyze the pink shrimp fishery off the west coast of Florida, Khilnani and Tse (1980) and the brown shrimp fishery off the coast of Texas, Tom and Tse (1981).
3. Texas A&M University has developed a simulation model, Blomo et al. (1978) and Grant et al. (1981). This model has been updated and used to estimate the effects of proposed management on the Texas brown shrimp fishery, Griffin et al. (1981).

## **Appendix B**

This appendix provides a comprehensive bibliography of literature, both published and unpublished, which contains economic data and analyses on the shrimp fisheries in the southeastern United States.

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