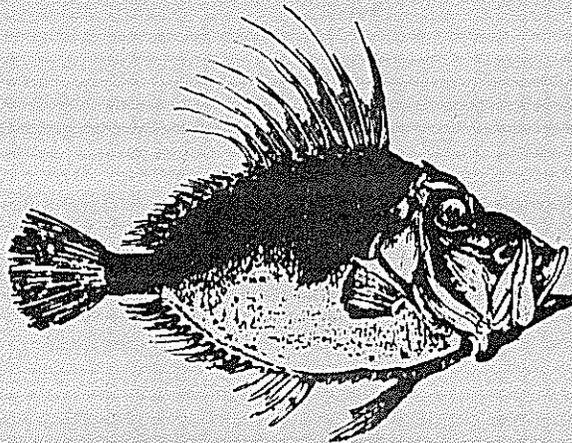


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Abstracts of the

**SIXTH ANNUAL
TROPICAL AND SUBTROPICAL
FISHERIES TECHNOLOGICAL
CONFERENCE OF THE AMERICAS**

April 20-23, 1981
San Antonio, Texas

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DEVELOPING DOMESTIC MARKETS FOR
SOUTHEASTERN SEAFOODS FROM 1977 TO 1980

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Market penetration and expansion has been the goal of the combined efforts of seafood marketing agencies representing states from Virginia through Texas since 1977. These agencies have developed a basic marketing strategy that includes various types of advertising and on-site visits by marketing specialists with seafood wholesalers and retailers. This strategy and the requirements for a successful marketing program are outlined.

The basic target market area has been the Midwestern U.S. Success levels of these marketing efforts have been measured each year. Retailers and wholesalers in the Midwestern U.S. were surveyed regarding their seafood sales success during 1978. Their attitudes regarding the usefulness of point-of-purchase merchandising materials made available by the market promotion teams were also surveyed. Southeastern dealers were also surveyed about their sales success levels and marketing problems regarding Midwest sales in 1978 and again in 1979. This paper presents an overview of the marketing program and of its success in creating seafood sales.

The 1977 program appeared to have positive results on the sales of croaker, mullet and Spanish mackerel for suppliers along the eastern Gulf Coast. Those in other regions reported mixed results. The 1978 promotion of oysters, blue crabs and bluefish was also successful with 53 percent of a sample of seafood suppliers in the Gulf and South Atlantic reporting new and expanded sales in the Midwest. The 1979 survey determined that, of seafood firms having sales in the Midwest, 83 percent had new sales and 87 percent had increased sales over 1978. A larger variety of species was promoted in 1979. The largest percentage of dealers had sales in Chicago and Boston. Over 20 percent of the dealers had sales in at least 10 of the 1979 target cities. New seafood sales were reported in 68 percent of the cities with promotional activity.

THE MARKETABILITY OF PRAWNS (MACROBRACHIUM ROSENBERGII)
IN RESTAURANTS IN SOUTH CAROLINA

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A market survey examined the market potential for prawns (Macrobrachium rosenbergii) in restaurants in South Carolina. Locally produced prawns were provided as whole animals and as tails only products in both fresh and frozen forms to 7 restaurants located in 4 counties. Method of preparation consisted of sauteed, steamed, broiled, stuffed, and microwave-oven cooking. Portion size ranged from 4-10 pieces depending on size, method of preparation, and whether prawns were served whole or as tails. Prices for the various dinners ranged from \$5.95 to \$12.00 per serving.

Most restaurateurs were very receptive to the serving of prawns in their establishments. However, some cooks felt that the preparation of prawns required additional handling not typical of other entrees which they served. Customers were surveyed to assess the acceptability of the prawns. The majority of the 137 sampled consumers indicated they would purchase prawns again. However, acceptance was somewhat related to price and method of serving. Entrees in which prawns were served whole appeared to be comparable in acceptability to entrees consisting of prawn tails only. The most preferred entree consisted of microwave cooking of crab meat stuffed prawn tails.

Based on our preliminary results, it appears that locally produced prawns could have a market in seafood restaurant trade. Additional detailed market research in non-seafood restaurants is needed to more fully assess the marketing opportunities for prawns.

ECONOMIC ANALYSIS OF A POTENTIAL
SARDINE FISHERY IN THE GULF OF MEXICO

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Food and Fiber Center
Mississippi State University

Considerable recent interest has been expressed in establishing a sardine canning industry in the Northern Gulf of Mexico. The fishery would be based primarily on the Spanish sardine (Sardinella anchovia).

Commercial fishermen have determined that catches may be made which are sufficient to support a cannery. The processed product has been found to be acceptable to consumers.

This paper provides an economic framework and analysis of the economic contribution of such a fishery on the economy of the Northern Gulf area. Implications are also drawn for analytical techniques for evaluating other potential fisheries.

DEVELOPING EXPORT MARKETS FOR
SOUTHEASTERN SEAFOOD PRODUCTS

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and the Florida Sea Grant College
University of Florida

Successful development of export markets improves the balance of payments, is consistent with FCMA, and provides an outlet for presently underutilized fisheries in the Southeast. Seafood exports from the southeast historically have been limited but appear to be increasing in recent years. Existence of underutilized stocks suggests expanded production and trade will occur should export markets be developed. Commodity characteristics, market information, business management practices and institutional support are discussed as important factors contributing to expanded export trade. Trade shows, trade missions and training of marketing personnel are reviewed and evaluated as marketing strategies for Southeast fishery products. Surveys of seafood dealers identified (a) leading importers of Southeastern seafood products, (b) major export products, (c) market channels and agents, size structure of export firms, and (d) problems encountered in export marketing. A preliminary evaluation of the export market development programs indicates initial success.

ECONOMICS OF SEAFOOD PROCESSING
IN MISSISSIPPI

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Mississippi State University

Mississippi has a short shoreline relative to other Gulf states and has relatively low reported commercial landings of seafood. Previous estimates of the economic contribution of Mississippi's seafood processing industry based on reported commercial landings have been significantly underestimated.

An indepth survey of seafood processors on the Mississippi coast showed that the total volume of seafood processed and its economic contribution to the state had been underestimated. The volume of shrimp processed in 1978 exceeded the reporting landings by eight times. A similar situation existed for other seafood products. A large proportion of products procured in Mississippi originated in other Gulf states.

Revised estimates of the economic contributions of the seafood industry were made based on survey data which showed the industry to be worth many times the dollar value currently estimated.

OBSERVATIONS OF TORRY METER READINGS VS.
SUBJECTIVE EVALUATIONS OF FIVE GULF COAST FINFISH

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Freshness of fish is traditionally assessed by sensory methods using the senses of sight, smell and touch. This method makes it difficult to establish standards that can be applied in different locations and by different assessors. For this reason, the torry meter was designed to fulfill a need for objective methods for measuring freshness that do not depend on the subjective opinion of human judges. Standard ratings were needed for traditional Gulf Coast finfish. These were obtained on trout, flounder, sheepshead, red drum and black drum. Live, warm fish and fish under just-caught, chilled conditions were appraised. Torry meter readings were taken at intervals and recorded to achieve guidelines for assessing quality. They were compared to subjective evaluations. Additional data was collected from fish house operators using their information on fish age and storage conditions and comparing it to the controlled study. Accuracy and consistency of the meter is affected by temperature, fat content and season of the year due to spawning cycle and availability of food. In addition, a batch of fish caught at the same time and handled and stored identically will spoil at different rates because of variation in chemical composition and bacterial activity.

THE EFFECT OF WATER, BISULFITE AND HYPOCHLORITE RINSES
ON THE MICROBIAL FLORA OF SHRIMP

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Fresh or frozen shrimp were rinsed for 15 min. in tap water, bisulfite (0.15-2.5%) and hypochlorite (12.5-200 ppm) solutions at a ratio of 1 part shrimp to 10 parts rinse and then analyzed for changes in aerobic plate count. All rinses were effective in reducing the microbial load, with water reducing the count between 24 and 43%, bisulfite (4-31%) and hypochlorite (20-43%) reducing it even further, depending upon the concentration used. When two rinses were applied in succession, there was a noticeable increase in bactericidal action (ave. 30%) when hypochlorite followed a bisulfite rinse. This effect was attributed to increased activity of the hypochlorous acid due to the bisulfite lowering the pH on the shrimp surface. Residual chlorine determinations and rinse solution pH's supported this hypothesis. This potentiation effect of bisulfite was not observable following 24 hrs. of iced storage of shrimp and, therefore, was not considered of practical significance under normal conditions of usage.

RAPID METHOD FOR DETERMINING SHRIMP DECOMPOSITION

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The use of a rapid and direct gas chromatograph (GC) technique was investigated for its applicability in determining shrimp quality. The method is based on the in situ vaporization of volatiles from a sample inserted directly into the injection port of the GC. Studied were shrimp sampled at several stages during the processing of breaded shrimp and of collected shrimp samples at various levels of spoilage. Volatile compounds, especially trimethylamine, were detected, and shown to increase as deterioration progressed.

Results indicated that the GC technique was suitable for use with shrimp and proved effective for measuring shrimp decomposition.

Samples of shrimp were also photographed with a scanning electron microscope, and showed structural changes in the tissue correlated with progressive decomposition as measured by the GC technique.

THE DEVELOPMENT OF INDOLE IN SHRIMP
DURING STORAGE AT DIFFERENT TEMPERATURES

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In order to reduce time consumption and expensive instrumentation required by older methods, a modified spectrophotometric method for determining indole in shrimp was developed.

Indole, aerobic plate count (APC), total volatile nitrogen (TVN) and trimethylamine (TMA) were measured during storage of shrimp held on ice, at 4°C, 12°C, and 22°C. Results showed that indole development in shrimp held at low temperatures was very low as compared to the development of traditional spoilage parameters. At higher temperatures, however, there was a good relationship between indole production and other quality indicators. It can be concluded that while indole may be a good indicator of temperature abuse, it is not a universal indicator of decomposition in shrimp.

DIFFERENTIATION OF FROZEN-THAWED AND FRESH SHRIMP

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Shrimp which have been frozen and held for varying periods of time are frequently thawed and sold to the consumer as fresh shrimp. These frozen-thawed shrimp possess a lower ratio of solid tissue substances, as well as shorter shelf life. At present, no method has been developed which differentiated fresh from frozen-thawed shrimp. In an effort to develop a test for this determination, histological, cytochemical, enzymatic and electrophoretic evaluations on both fresh and frozen-thawed shrimp were undertaken.

General tissue stains were used to establish tissue appearance of both fresh and frozen-thawed samples. In addition, both frozen sections and touch preparations were stained for acid phosphatase activity in an attempt to correlate lysosomal rupture with the freezing process.

Enzymatic assays for acid phosphatase, β -N-acetylglucosaminidase, esterase, α -acetylgalactosaminidase, malate dehydrogenase and glutamate dehydrogenase were conducted to compare specific activities of these enzymes in both press juices and tissue homogenates of fresh and frozen-thawed samples. Using polyacrylamide gel electrophoresis, the isoenzyme patterns of malate dehydrogenase isoenzymes in frozen-thawed and fresh shrimp was also determined.

It was the conclusion of this study, that histological preparations can be used by personnel experienced in the interpretation of such slides for differentiating fresh from frozen-thawed shrimp. However, the separation of malate dehydrogenase isoenzymes is the preferred method due to the clear-cut, easy-to-differentiate differences between frozen-thawed and fresh samples.

A PROGRESS REPORT ON THE PURIFICATION
OF PHENOLOXIDASE FROM GULF SHRIMP

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Texas A&M University

The appearance of "black spot" on green headless shrimp is very detrimental to the Texas shrimp industry. Although sodium bisulfite is presently used as an inhibitor of "black spot" or melanosis, disadvantages with the use of bisulfite include discoloration due to "overuse" and potentially hazardous sulfur-gas accumulation in ship holds. In order to identify and evaluate other potential inhibitors against "black spot", more information is needed on the biochemistry of these enzymatic reactions. Phenoloxidase, an enzyme that catalyzes melanosis, has been extracted and purified from Gulf shrimp. The reaction kinetics and the stability of this enzyme against potential inhibitors are presently being elucidated.

QUALITY CHANGES DURING ICED STORAGE
OF WHOLE FRESHWATER PRAWNS (MACROBRACHIUM ROSENBERGII)

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The shelflife of iced freshwater prawns (Macrobrachium rosenbergii) has been estimated to be between 3 and 6 days in undocumented research reports. In an effort to determine the iced storage life of freshwater prawns, one group of whole prawns was blanched at 65°C (150°F) for 15 seconds and a second group dipped in a chlorine solution (50 ppm) for one minute. Treated prawns were stored in ice along with a control (untreated) and evaluated over a 20-day period. Total volatile nitrogen (TVN), pH, microbial and sensory analyses were used to evaluate the samples at regular intervals during storage. The results indicated that neither treatment substantially increased the shelflife of iced prawns. Initial TVN values were high and did not change appreciably during storage. Slight increases in pH and relatively stable TVN values suggested that minimum proteolysis occurred during storage. The total aerobic plate count (TAPC) increased regularly with storage and was not suppressed by the treatments. Sensory scores for color, odor and flavor increased (color darkened; odor and flavor intensified) and texture scores varied but showed no real change. Acceptability scores generally declined over the 20-day storage period with no abrupt change to indicate a clear cut end of storage life.

DEVELOPMENT OF AN ENZYME AFFINITY
ASSAY FOR SEAFOOD PRODUCTS

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Because of their specificity, sensitivity, and relative ease immunoassays have gained wide acceptance as the method of choice for the routine analysis of a wide variety of substances. Such assays include radioimmunoassay (RIA), immunofluorescence and more recently enzyme-linked immunosorbent assay (ELISA).

Each of these techniques require the use of antibodies specific for the substance to be analyzed. Although the production of antibodies against large molecular weight components is relatively straightforward, production of antibodies against low molecular weight substances require conjugation to a carrier biopolymer. Even such conjugation procedures do not always result in the production of antibodies, and when antibodies are formed, they are not always as specific as a given test might require.

The purpose of this study was to develop a general assay system based on the principal employed in immunoassay techniques, but to substitute a specific binding protein for the antibody. Enzymes, in common with antibodies, are proteins which exhibit specific binding toward a variety of substances. However, unlike antibodies, most enzymes are readily available which bind low molecular weight components. Thus, by allowing the enzyme to bind with the substances of interest in a test mixture, but preventing the enzyme from converting that substance to another product, one can utilize the techniques of immunoassay, but not be dependent on the availability of a specific antibody.

It is the purpose of this presentation to discuss the new approach which we have named Enzyme Affinity Assay.

QUANTITATION OF HISTAMINE IN TUNA USING AN ENZYME AFFINITY ASSAY

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Histamine was assayed by an Enzyme Affinity Assay method utilizing the enzyme diamine oxidase (DAO). DAO was adsorbed to a polystyrene test tube and free histamine was allowed to compete with a histamine-enzyme complex for binding sites on the tube. Conditions were optimized such that μg quantities of histamine can be assayed. Conditions for optimal binding of DAO to the polystyrene tubes were established by incubation with varying concentrations of DAO dissolved in deionized water as well as in phosphate buffers of various concentrations and pH. The assay itself was optimized by varying the time allowed for histamine to bind to the DAO and the time free histamine was allowed to compete with the histamine-enzyme complex. The best pH and buffer for this binding was also determined.

Two enzymes were evaluated for the histamine-enzyme complex. Both horseradish peroxidase (HRPO) and β -galactosidase were coupled to histamine using 1-ethyl-3(3-dimethylaminopropyl)-carbodiimide HCl. For assay of HRPO activity o-dianisidine was used as substrate, the reaction terminated by addition of sulfuric acid and the absorbance determined at 480 nm. For the β -galactosidase assay, P-nitrophenyl- β -D-galactoside was employed as substrate and the amount of colored product present after a fixed incubation with enzyme determined.

This method offers the sensitivity and specificity of an enzyme linked immunosorbent assay (ELISA) while requiring far less time for binding of the molecule to be quantitated than does ELISA.

REVIEW OF WASTE MANAGEMENT REGULATIONS AFFECTING
THE SOUTHERN SEAFOOD INDUSTRIES

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Waste management will continue to be a major problem facing the seafood processing industries in the 1980's. The current effluent guidelines for most seafood firms with direct discharge require waste treatment equivalent to 20 mesh screening and appropriate disposal of solids. EPA's concern for the level of compliance with these regulations has recently been demonstrated by letter inquiries mailed to various seafood firms throughout the southeast. The response has indicated compliance is lower than required. These inquiries have increased industry concern for waste management regulations.

Recent changes in permitting procedures will complicate efforts to comply with environmental regulations. Seafood firms must now complete a new consolidated NPDES permit. These permits require a more indepth description of the processing operations. Changes in landfill requirements and increasing energy costs will limit solid waste treatment options. Likewise, if the new administration limits federal assistance for POTW's, seafood firms utilizing municipal facilities can anticipate increasing surcharges for waste treatment.

Despite these current waste management problems, EPA is developing the second level of effluent limitation guidelines mandated for July 1, 1984. Preliminary results indicate these future guidelines may be 70 to 90 percent more restrictive. The controversial proposed technology is dissolved air flotation (DAF). EPA economic studies have indicated the DAF requirements could force closures of 21 percent of the non-breeding shrimp processors in the South and 33 percent of the breeding shrimp firms. Resulting job losses would be 370 and 1590 per respective shrimp category. Industries view DAF as unnecessary, ineffective and will impose severe economic burdens on the industry and associated businesses and communities.

THE CRAWFISH INDUSTRY OF LOUISIANA: A REVIEW

Michael W. Moody and James E. Rutledge
Louisiana State University

Louisiana grows and processes 90% of the nation's crawfish. Last year in Louisiana, more than 60,000 acres were devoted to raising crawfish. The pond production coupled with the wild harvest yielded approximately 25,000,000 pounds. In addition, there are approximately 40 processing facilities in the state that cook, peel and package crawfish tail meat. Demand for live crawfish and crawfish meat usually exceeds supply. Growing markets outside the state have put additional demands upon this seafood.

This paper examines the present state of the Louisiana crawfish industry and discusses in detail crawfish processing methods currently in use.

ALLIGATOR MEAT: AN EVALUATION
OF A NEW SEAFOOD

Michael W. Moody, Paul Coreil and Jim Rutledge
Louisiana State University

The American alligator (Alligator mississippiensis) has legally been hunted for its skin in Louisiana since 1972. Recent legislation permits the marketing of the meat. Alligator meat is regarded as a seafood like other reptiles and amphibians used for human food. Seafood dealers initially were reluctant to handle or process this meat because little data existed on the meat yield, nutritional value or methods of preparation.

In the study, alligators of varying lengths and weights were evaluated for meat yields, nutritional value and other observations. In addition, recommended processing techniques are given.

THE BACTERIOLOGICAL QUALITY AND SAFETY OF
PASTEURIZED LANGOSTINO TAILS

R. Tillman, R. Nickelson and G. Finne
Texas A&M University

In 1978 a pilot project was initiated in Nicaragua to evaluate the potential of a Langostino (Pleurocodes planipes and/or monodon) off their west coast. Although the process used closely resembled a process long established in Chili, it consistently produced pasteurized products that exceeded the aerobic plate count and coagulase-positive Staphylococci standard required for such products. Products exported to the U.S. were placed on "Stop Sale" by the state of Florida and subsequently seized by the Food and Drug Administration.

Samples from detained lots were analyzed for total plate count and total Staphylococci. A new method for determination of degree of pasteurization of Langostino tails was also developed. Analyses showed not only variation in quality among different lots but also within the same lots. Degree of pasteurization as measured by denaturation curves, also showed larger variations. This is indicative that different production lots were combined at the time of exportation.

IMPROVEMENT OF SEAFOOD PLANT SANITATION:
EFFECTS OF A COOPERATIVE EFFORT

A. Amr, Cameron Hackney, James E. Rutledge
and Mike Moody

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(Abstract unavailable at time of publication)

OPTIMIZATION OF DRYING CONDITIONS FOR PRODUCING
STOCKFISH MADE FROM ROE MULLET CARCASS

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A small laboratory fish smoker was retrofitted to be a fish dryer that could provide very steady temperature and humidity conditions. A relative humidity (RH) differential of less than $\pm 1.5\%$ was achieved by a controlling system made from an analog hygrometer, a chart recorder, and a photoelectric detector. Stockfish samples (plain-dried) were produced from roe mullet under 30 to 50°C, 50 to 70% RH, and 0.5 to 1.0 MPH linear air velocity. Performance of various drying conditions was evaluated based on the rate of dehydration, rehydration, and protein extractability by boiling of the samples. Multi-stage drying operation was possible by following either the temperature or the weight changes of the product.

PROTOTYPE COOKERS FOR INVESTIGATING
AQUEOUS COOKING OF DRESSED OR WHOLE FINFISH

T. M. Miller, N. B. Angel, W. B. Wallace
J. I. Weeks, J. W. Stuart and T. Caroon

Wallace Menhaden Products, Inc.; Marine Chemurgics;
Sea and Sound Processing Co., Inc.; Empire Menhaden Co., Inc.;
and Tom Thumb, Inc. (respectively)

Aqueous extracts of frames and edible trimmings were used as cooking mediums for dressed finfish. Stick water from the reduction process was used for cooking whole finfish.

A pilot plant, located at a fish reduction facility for steam and services, was designed for preparation of aqueous extracts, lipid separations, evaporation, and circulation of the cooking mediums to a prototype cooker. Trials involving several species of finfish showed that adequate cooking required lower temperatures than anticipated, that low lipid and phosphatide levels in the aqueous medium improved performance, that steam coils for transferring BTU to the cooking medium worked best when separated to service four heating zones, and that aqueous cooking can save energy.

An improved prototype cooker, built to meet food handling specifications, was installed in a seafood processing plant. Improved heat exchanger design and other innovations made it suitable for a number of unit operations, including preparation of aqueous extracts, removal of lipids, concentration of extracts, aqueous cooking, skinning, and steaming.

Aqueous cooking of whole finfish provides an opportunity to improve thermal efficiency and performance of fish meal plants. An obvious approach is the recycling of hot stick water from the oil separating centrifuges back to the kinds of cookers presently used, or modifications thereof. But at times this stick water contains excessive lipids, or phosphatides, reducing its suitability as an aqueous cooking medium.

A more likely heat exchange medium for fish reduction plants is part of the press liquor, immediately after screening. Reduced flow, accomplished with a separating tank, can provide a continuous supply of underlying clear stick water, low in lipids and phosphatides, which appears suitable for recycling and use in the aqueous cooking of whole fish.

This project was funded by Gulf and South Atlantic Fisheries Development Foundation, Inc., and with matching funds provided by the above companies.

PROCESSING VARIABLES AFFECTING COLOR
DEVELOPMENT ON SMOKED MULLET

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University of Florida

The appearance of smoked fish, especially color, plays an important role in consumer acceptance. Since there is little information describing the effect of processing variables on color formation, this study investigated the effects of brining, drying after brining, and of a smoke-cook versus cook-smoke process on color development.

Within the limits of this study, the major factor influencing color development on smoked mullet was the initiation of smoke prior to drying and cooking. Brining of the fish was also observed to exert a minor but noticeable effect, whereas drying of the brined fish for up to three hours at 45°F before smoking had no effect on color development. It appears that processing variables influencing availability of moisture on the surface of the fish have the greatest effect on color development.

BROWN SHRIMP (PENAEUS AZTECUS) PACKED IN
MODIFIED ATMOSPHERES CONTAINING CARBON DIOXIDE

M. Lannelongue, G. Finne and R. Nickelson
Texas A&M University

Brown shrimps were packed in air and in modified gas atmospheres containing CO₂ and O₂, and CO₂ and N₂. Numbers and types of microbial flora, surface pH, total volatile nitrogen (TVN) and the CO₂ concentration in the packages' head space were determined at regular intervals during storage.

The atmospheres containing CO₂ were effective in decreasing the rate of TVN formation and in inhibiting the growth of spoilage-causing bacteria. A shift from a gram-negative to a gram-positive bacterial population was observed after 6 to 10 days of storage in the samples packed with CO₂. These samples also showed decreases in the initial pH and in the CO₂ head space concentration. Carbon dioxide in the air packed samples reached a concentration of 23.5% after 19 days of storage. Pink discolorations and white spots at the surface of the shrimps started developing on all samples after 5 to 7 days of storage.

ON-BOARD QUALITY CONSIDERATIONS
IN DEVELOPING NEW FISHERIES

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(Abstract unavailable at time of publication)

THE UTILIZATION OF SHRIMP BY-CATCH

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(Abstract unavailable at time of publication)

FISH BY-CATCH FROM SHRIMP TRAWLING

W. D. Allsopp

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A Film

(Abstract unavailable at time of publication)

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