# U.S. Industrial Fishery Product Value Up in 1977

The value of industrial fishery products in the United States, American Samoa, and Puerto Rico in 1977 was $190.6 million, some $5.8 million more than the $184.8 million in 1976. In terms of value, the leading producing States were Louisiana ($49.0 million), Maine ($32.7 million), Virginia ($27.7 million), and California ($24.6 million). These values are based on the selling price at the producing plants.

Domestic production, including shellfish meal, was 282,291 tons in 1977 valued at $97.2 million—27,403 tons less than the 309,694 tons in 1976, but $424,000 more than the value of $96.8 million in 1976. Menhaden meal (193,268 tons valued at $71.8 million in 1977) accounted for 68 percent of the total production and 74 percent of the value. Tuna meal declined by 831 tons to 39,228 tons in 1977, but increased in value by $1.7 million.

Anchovy meal in 1977 was 18,871 tons—3,293 tons (15 percent) less than the 22,164 tons in 1976, but $394,000 more than the 1976 value. Meal from alewife, thread herring, and unclassified fish was 19,374 tons in 1977, compared with 19,816 tons produced in 1976. The 9,270 tons of shellfish meal valued at $1.1 million in 1977 was 1,414 tons and $44,000 less than the 1976 production.

Meal from crabs and shrimp in 1977 was 5,745 and 927 tons, respectively, 1,041 and 271 tons less than the 6,772 tons and 1,198 tons produced in 1976. Mixed fish meal declined in 1977 by 116 tons from the 2,714 tons produced in 1976.

The domestic production of fish oil was 133.2 million pounds valued at $28.2 million in 1977—71.4 million pounds and $2.9 million less than the 204.6 million pounds and $31.2 million in 1976. The production of all fish oils decreased in 1977, except for other marine animal oil, which increased 3.0 million pounds. Menhaden oil (116.1 million pounds) declined 70.3 million pounds compared with 1976. With a decline in the production of fish oils (other than liver), imports also declined from 20.9 million pounds in 1976 to 13.7 million pounds in 1977.

Domestic production of fish solubles was 122,330 tons valued at $13.9 million in 1977, down 10,777 tons and $312,000 compared with 1976. The 87,390 tons of menhaden solubles contributed 71 percent of the total 122,339 tons produced in 1977, compared with 72 percent of the total in 1976.

Domestic production of oyster shell products (grit and lime) were valued at $6.7 million in 1977 compared with $6.1 million in 1976. The value of the production of other industrial products was $44.4 million in 1977 compared with $36.4 million in 1976. These other industrial products included agar-agar, animal feeds and fish pellets, clam and crab shells (processed for food serving), Irish moss extracts, kelp products, shark leathers, liquid fertilizers, marine pearl shell buttons, pearl essence, and other products.

Since 1921, the National Marine Fisheries Service and its predecessor organizations have made annual surveys for statistics on the domestic production of industrial fishery products. The data collected include statistics on the production and value of each commodity. The value shown for the products constitutes the gross amount received by the producer at the production point; no deductions are made for commission or expenses. (Source: Current Fisheries Statistics 7502.)

**Summary of U.S. industrial fishery product production, 1977.**

| Product | No. of plants | Quantity (x1,000) | Value ($1,000) |
|---|---|---|---|
| Fish and shellfish meat | 85 | 282 tons | 97,239 |
| Fish body oils | 51 | 133,182 lb | 28,239 |
| Fish solubles | 26 | 122 tons | 13,945 |
| Oyster shell grit and lime ("live and reef shells") | 5 | 264 tons | 6,708 |
| Miscellaneous industrial products | 39 | | 44,441 |
| Total | 123 | | 190,572 |

**Value of U.S. industrial fishery products by state, and plant count, 1977.**

| State | Value ($1,000) |
|---|---|
| Maine (7) | 32,688 |
| Mass. (3) and Rhode Island (1) | 4,347 |
| N.Y. (2) and Pennsylvania (1) | 87 |
| New Jersey (4) | 6,075 |
| Maryland (4) | 1,832 |
| Virginia | 27,677 |
| North Carolina (9) | 8,022 |
| Ala. (1), Ga. (2), and Tex. (1) | 5,222 |
| Florida (3) | 612 |
| Mississippi (4) | 16,638 |
| Louisiana (25) | 48,991 |
| Alaska (3) | 743 |
| Washington (10) | 4,263 |
| Oregon (6) | 741 |
| California (15) | 24,541 |
| Iowa (1), Mich. (1), Minn. (2), Utah (1), and Wisconsin (1) | 2,817 |
| Am. Samoa (2), Hawaii (1) and Puerto Rico (4) | 5,276 |
| Total (123) | 190,572 |

## Ultraviolet Light Might Aid Shellfish Hatcheries

In a continuing effort to develop an effective method of disinfecting seawater used in shellfish hatcheries, microbiologist Carolyn Brown of the NMFS Northeast Fisheries Center, has performed tests using ultraviolet (UV) radiation to kill pathogenic bacteria that harm developing oyster eggs[1]. Working at the Center's Milford, Conn., laboratory, she has shown that certain bacteria present in seawater are completely destroyed by UV irradia-

[1]Brown, C. "Ultraviolet light—an effective disinfectant for shellfish hatcheries?" *In* Proceedings of the International Ozone Institute (presented at the IOI symposium in Los Angeles, Calif., 22-24 May 1978). In press.

tion, thus allowing the seawater to become a suitable medium for rearing fertilized oyster eggs. Shellfish aquaculture activities should experience economic benefits if the continuing tests verify the initial findings.

Adult oysters were spawned (Loosanoff and Davis, 1963) and the fertilized eggs reared in UV-treated and non-UV-treated, 10-m$\mu$ filtered seawater at a density of about 15 fertilized eggs per milliliter. The embryonic cultures were kept at a constant temperature of 26°C for 2 days. Normal development of eggs to the straight-hinge stage in UV-treated seawater averaged 81.3 percent; in non-UV-treated seawater, only 50.3 percent of the eggs developed normally to that stage.

Selected bacterial pathogens in seawater were used to determine the effects of UV irradiation. Individual tanks of filtered seawater were seeded with suspensions of each of four selected shellfish-pathogenic bacteria (pseudomonad #1, vibrio #1, pseudomonad #2, and vibrio #2) to obtain a final concentration of $10^5$ pathogenic cells per milliliter of seawater in each tank. Sterile beakers were filled from each tank with seeded seawater. The remaining seawater was then exposed to UV radiation, and a second series of beakers filled. After UV treatment, samples were taken, hourly for the first 8 hours and then 24 hours. The samples were spread onto agar plates. Bacteriological examinations showed that UV irradiation always destroyed the pathogens used to seed the seawater.

Fertilized oyster eggs were reared in seawater seeded with pseudomonad #1 and in the seeded water after it had been treated with UV light. In the nonirradiated seawater, only 46.0 percent of the eggs developed normally. In the UV-treated seawater, 59.8 percent developed normally; in the control seawater (unseeded, UV-treated seawater) 58.7 percent developed normally.

The data gathered thus far indicate that UV light irradiation should be an effective disinfectant for seawater in shellfish hatcheries when used along with other sanitary practices. Data have shown, however, that seawater exposed to UV dosages greater than the 155,250 $\mu$W/s/cm$^2$ (microwatts per second per square centimeter) used in this study can be detrimental to the development of fertilized oyster eggs. (Source: SEN-80.)

### Literature Cited

Loosanoff, V. L., and H. C. Davis. 1963. Rearing of bivalve mollusks. Adv. Mar. Biol. 1:1-136.

## Storage Characteristics Determined for Several Underused Gulf Fishes

About 175 species of groundfish and 11 major species of pelagics in southeastern U.S. waters are not fully used. The pelagic fish, other than menhaden, remain essentially untouched. To provide the high-quality products necessary to develop new markets, more information is needed on spoilage characteristics of the species. As a first step, the determination of the shelf life of different species is particularly important in deciding whether or not to market new products.

Scientists with the National Marine Fisheries Service are conducting experiments to assess the fresh and frozen shelf life and storage characteristics of several such underused species. Working in the Pascagoula Laboratory of the NMFS Southeast Fisheries Center in Pascagoula, Miss., they have determined the shelf life of fillets, headed and gutted (H & G), steaked, and whole fish, of four species from the Gulf of Mexico[1].

As the studies are extended to other abundant but underused species, fishery management officials will be given an increasing amount of pertinent information on which to base decisions in taking steps to expand the domestic and foreign foodfish markets for U.S. southeast fishery products.

The four species of underused fish selected for the initial studies of refrigerated product storage were Spanish mackerel, king mackerel, croaker, and white trout. They were obtained fresh from a local dealer and were 3 days out of the water when processed. The fish were hand-scaled, headed, gutted, skinned, and filleted or steaked. Croaker, white trout, and spanish mackerel were prepared and refrigerated whole, H & G, and as fillets. King mackerel were prepared as whole fish and as steaks. Fillets, H & G fish, and steaks were packaged in polystyrene food trays and wrapped with polyvinyl chloride sheeting. Whole fish were packed in crushed ice, and all the products were held in a cooler at 4°C. Samples of each product were removed regularly for evaluation.

Microbial evaluation consisted of determining the total aerobic plate count (U.S. Department of Health, Education, and Welfare, 1976). Six experienced panelists determined the physical acceptability (organoleptic) by evaluating the raw products for odor, texture, and appearance. Fish samples were chemically analyzed for oxidative rancidity (Vynche, 1972), total volatile nitrogen (TVN) and Trimethylamine - Nitrogen (TMA-N) (Cobb et al., 1973), pH, and moisture content (Association of Official Analytical Chemists, 1975).

The results (Fig. 1A, B) showed that when the chemical test values significantly changed, the organoleptic and microbial results also changed. The sensory panelists confirmed that TVN values of 16 mg N/100 g of sample indicate early stages of spoilage. When TVN values ranged from about 23 to 28 mg N/100 g of sample, the product was judged spoiled. TMA-N values increased significantly before TVN values, and are probably better indicators of early stages of spoilage. TBA (oxidative rancidity) values never reached a significant level, and the pH and microbial analyses supported the chemical and organoleptic evaluations.

Results show that fillets have a shorter shelf life than H & G fish and that H & G fish spoil more readily than whole fish.

This determination of the shelf life of four species of abundant but underused Gulf of Mexico fishes should be a

[1]Waters, M. E. 1978. Storage characteristics of several underutilized fish harvested from the Gulf of Mexico. *In* Proceedings of the Tropical and Subtropical Fisheries Technological Conference of the Americas. Sea Grant, Texas A & M Univ. Sea Grant Program, College Station, Tex. 77843.

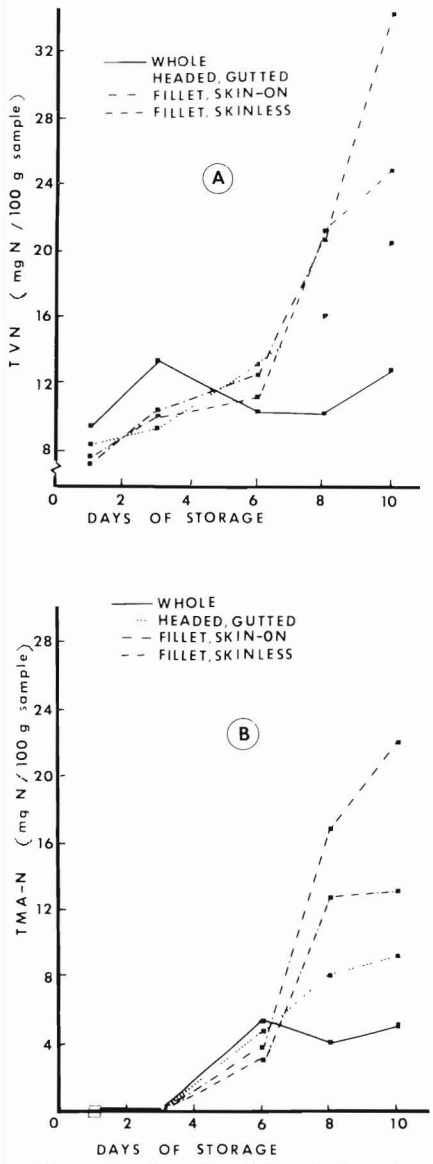


Figure 1.—Results of chemical analyses of samples of white trout held at 4°C for total volatile nitrogen (TVN) (A), and Trimethylamine-Nitrogen (TMA-N) (B). Spoilage odors were noted when TVN content exceeded 16 mg/100 g of sample. Figure 1-B shows that TMA-N content significantly increased slightly before TVN (Fig. 1-A), thus suggesting it might be a better indicator of incipient spoilage. Product spoilage was noted for all species in all processing configurations when TVN values were about 23-28 mg/100 g of sample.

good start in making possible a fuller development of markets by U.S. fisheries. A major result would be more jobs in the fishing industry of the southeastern United States (Source: SEN-81.)

### Literature Cited

Association of Official Analytical Chemists. 1975. Official methods of analysis. Twelfth ed. Wash., D.C., 417 p.

Cobb, B. F., I. Alaniz, and C. A. Thompson, Jr. 1973. Biochemical and microbial studies on shrimp: Volatile nitrogen and amino nitrogen analysis. J. Food Sci. 38:431.

U.S. Department of Health, Education, and Welfare. 1976. Bacteriological analytical manual for foods. Food Drug Admin., Wash., D.C.

Vynche, W. 1972. Direct determination of the Thiobarbituric Acid value in trichloricatic acid extracts of fish as a measure of oxidative rancidity. Fette Seifen Anstrichm. Osland, Belgium 12:1084.

## *U.S.-U.S.S.R. Continue Joint Oceanic Research*

A 3-year extension of the U.S.-U.S.S.R. agreement for joint oceanic research was announced in Moscow in February by Richard A. Frank, NOAA Administrator. Soviet and U.S. scientists at the same time agreed on a series of joint future ocean research projects to be undertaken through 1981.

U.S. and U.S.S.R. cooperative science activities take place under the terms of the Agreement on Cooperation in Studies of the World Ocean, originally concluded in 1973. The Soviet delegation was headed by Academician A. V. Sidorenko, Vice President of the U.S.S.R. Academy of Sciences. Frank emphasized that, as we better understand the influence of the oceans on climate, oxygen, and carbon dioxide cycles, and on the global environment, ocean research becomes of ever greater importance to all mankind. He concluded that further advances in ocean sciences are now even more critical to wise ocean use. Frank noted that the results of U.S.-U.S.S.R. joint research projects have been made available to other countries and therefore benefit the world at large.

Plans for continued scientific cooperation were agreed upon in five areas—studies of the southern ocean (the waters surrounding Antarctica), ocean currents and dynamics (POLYMODE), the Deep Sea Drilling Project, instrumentation intercalibration, and biological productivity and biochemistry.

Southern ocean studies will be continued with investigations of the Antarctic Circumpolar Current by both the United States and the Soviet Union during the austral summers (which are winter months in the Northern Hemisphere) of 1978-79 and 1979-80. The U.S. National Science Foundation provides overall support for the U.S. portion of the program, which will include deployment of current moorings and extensive water column measurements with expendable bathythermographs and conductivity-temperature-depth instrumentation.

The 1977-78 POLYMODE field investigation of eddy-like ocean circulation features in the western North Atlantic, one of the largest physical oceanographic experiments ever undertaken, has now been completed, leading to the highly important data analysis and interpretation phase. A series of joint workshops, theoretical symposia, and scientific assemblies will be held during the next 3 years, and a joint U.S.-U.S.S.R. POLYMODE Atlas will be published in 1981.

The Deep Sea Drilling Program, which is carried out under a separate Memorandum of Agreement between the U.S. National Science Foundation and the U.S.S.R. Academy of Sciences, will focus on three specific problems of Atlantic paleo-oceanography, using the drilling vessel *Glomar Challenger*. Both Soviet and American delegates to the meeting noted the success to date of the International Phase of Ocean drilling.

Intercalibration and standardization work will be continued with exchange and comparative measurements on sea water standards, and intercalibration of oceanographic instruments.

Biological productivity and biochemistry cooperative efforts will continue to be carried out through joint workshops and symposia, as has been accomplished so successfully in the past, with the publication in both languages of the proceedings of two workshops.