TECHNOLOGY'S ROLE IN THE SEAFOOD INDUSTRY

By Harold B. Allen*

BCF's Branch of Technology is a tool for helping the fishing industry. The Branch has inspectors, scientists, engineers, and technicians in laboratories throughout the United States--in Gloucester, Massachusetts; College Park, Maryland; Pascagoula, Mississippi; Ann Arbor, Michigan; Terminal Island, California; Seattle, Washington; and Ketchikan, Alaska. Three are small ones employing 5 to 15 people; 4 are larger and have 15-25 employees. Many of the scientists have advanced degrees in engineering, bacteriology, chemistry, and nutrition.

The Branch also includes a nationwide inspection service with fifty-six inspectors. They work in 10 lot-inspection offices in major cities and in 33 fish and shellfish processing plants.

WHAT ARE THE PROBLEMS?

The technological problems are many and complex. They begin on the fishing vessel--even before the catch is removed from the water. They involve losses in quality when fish are left in gill nets or purse seines too long. Then, as the catch is brought aboard, the technological problems begin to multiply: techniques must be found to preserve or process quickly and economically the wide variety of fish and shellfish taken in different parts of the country.

As we move our catch into shore-based processing plants, or to fresh and frozen fish markets, a new challenge arises: the need to process and market extremely variable and diverse products in competition with other protein foods, such as poultry, eggs, meat, and milk. Processors of these other foods have a distinct advantage. Their raw material is more uniform in size, shape, quality, and perishability and can be handled in large volume. These agricultural foods can be grown and harvested at the ideal time--rather than hunted and caught when opportunity permits.

A new set of problems arises as our fishery products are merged with other foods in the retail distribution chain. With the possible exception of fresh fish, the product leaves the control of industry at that point. The technical and quality problems encountered in the distribution of frozen fish have been highlighted in Consumers Union Reports since 1961. The magazine stated that up to 40 percent of the fish and shellfish tested in the marketplace was substandard in quality; as a possible solution, it recommended adoption by the States of the Frozen Food Code of the Association of Food and Drug Officials of the U. S.--and mandatory Federal inspection from the boat level forward.

A final technological problem is that we have not developed the technical know-how and processing methods to utilize the many abundant species of fish that do not now enjoy wide industry and consumer acceptance. As examples, mullet, mackerel, hake, and shark are not being utilized because industry concentrates on salmon, haddock, and flounder. I believe that products can be developed from these underutilized species that will tempt the consumer and increase sales.

HOW BCF SERVES INDUSTRY

How is Government using its tools--scientists and laboratories--to help industry solve its many problems?

One principal activity is research leading to quality improvement. Studies on improving quality are being carried out in our 7 laboratories. At Terminal Island, for example, we are working to improve the quality of raw tuna as it reaches the cannery by learning more about the effect of harvesting methods and vessel-refrigeration techniques on the condition of the fish. In Alaska, we are developing better means of maintaining the color and flavor in northern shrimp. In Seattle, our scientists have gone to sea on halibut vessels in search of better means of icing and storing the catch in a vessel's hold. A technique was developed for washing the blood from the large dorsal vein, thus preventing the development of dark areas in halibut steaks.

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QUALITY STANDARDS ADOPTED IN 1958

Perhaps the most significant overall quality-improvement program is the development of official U. S. Standards for fishery products, and the inspection service based on these quality standards. Since the program was started in 1958, fifteen standards have been developed and promulgated. Even more Federal and State purchase specifications have been developed. In 1965, 230 million pounds of fishery products were inspected or certified under our program. More than any other, this program illustrates Government and industry cooperation in quality improvement.

Our laboratories in Pascagoula, Mississippi; Ann Arbor, Michigan; and Seattle, Washington, are working to solve microbiological problems encountered by industry. The work by scientists at Ann Arbor has resulted in the development of a three-part smoked-fish sanitation manual: Part I, "Sanitation in the Processing Plant," is being printed and should be available for distribution about March 1967. Part II, "Sanitation on the Fishing Vessel," is in draft status and being reviewed. The first draft of Part III, "Processing Procedures," will soon be completed. The laboratory, industry, the States, and cities, are playing vital roles in controlling bacteriological problems.

UTILIZATION RESEARCH

Another broad area of study where we are finding solutions to problems is utilization research. Industry is not utilizing fully such species as hake, mullet, alewife, and anchovy. Therefore, food and industrial studies are underway in Seattle to develop new food and industrial products. Our present efforts are aimed principally at shark and hake. Work in the future will involve other species. To date, the most promising results have been obtained in such industrial products as refined shark oil and hake fish meal; but excellent shark steaks and hake breakfast sausages have been prepared. These developments may foreshadow basic changes in the species composition of our domestic catch.

FUTURE OF FISHERY TECHNOLOGY

Research is already far advanced in BCF laboratories on processes that will be important to the industry's future. One is radiation preservation of "fresh" fish. The irradiation of fish at the time of packing can double the normal high-quality shelf life--and enable marine species to reach inland markets in prime condition.

Our Marine Products Development Irradiator in Gloucester, Massachusetts, irradiates fishery products and for evaluation, test-ships many of them to army bases and laboratories in different parts of the U. S.

During summer 1966, this research program was expanded to include shipboard irradiation studies. A small irradiator was placed aboard our Gloucester exploratory fishing vessel "Delaware" to study irradiation at the moment of catch. The purpose was to prevent the loss of quality normally experienced at sea. We have been pleased with the preliminary results and feel this approach has much promise.

FISH PROTEIN CONCENTRATE (FPC)

One of our most exciting and far-reaching programs is the manufacture of fish protein concentrate (FPC). The object is to develop a manufacturing process for an inexpensive and high-quality protein food that meets the approval of the Food and Drug Administration. We have now completed the program's first phase with the development of a solvent-extraction process. A petition requesting approval was submitted to the FDA in February 1966. FDA has periodically requested additional data, which we have been providing.

Congress recognized the potential value of FPC when it authorized the leasing and construction of two pilot demonstration plants and the associated research. Once these plants are available, our scientists will be able to carry out engineering and design studies needed by private industry to construct larger, full-scale commercial plants. FPC produced in these pilot plants will be used in feeding studies to test the feasibility of incorporating it in the many different foods consumed in developing countries. In this way, markets will be established for FPC, which will be produced commercially at a later date. We believe the FPC program has a tremendous potential for improving the economic condition of the U. S. fisherman and providing badly needed protein to the hungry people of the world.

BASIC RESEARCH FOR FUTURE

The research that leads us farthest into the future is often termed "basic." Much of it

is underway at Gloucester to determine the fundamental cause of toughening in fish when it is frozen and held in storage. Results have already shown that toughening results from a bonding of the natural protein and oils in the fish meat. If this bonding can be prevented, it may be possible to maintain the full quality and texture of fresh fish in the frozen product.

Similar studies on the basic cause of "fishiness" in fishery products when they are cooked are being carried out in Seattle. These odors are associated with the oxidation of the natural oils in fish. If we can control oxidation--and perhaps thereby control this fishness--it may be possible for a housewife to cook fishery products with no fear that an unpleasant odor will be left in her kitchen.

If we look even farther into the future, we see an area where no technological work is now being done but which has considerable need and promise. Of prime importance is the need to develop space-age fish-handling techniques for use aboard U. S. freezer trawler vessels. Such techniques might include containerization of an entire fish hold so that it could be lifted from the vessel as it reaches dock and be replaced by an empty hold. The vessel then could more quickly return to the fishing grounds.

A refinement of this concept would be to seal the hold after the fish are placed inside and then pump out the air. Replacing the oxygen-laden air with a controlled atmosphere of nitrogen and carbon dioxide could greatly extend the storage life of fish by slowing natural bacterial growth and oxidation. This process would be especially useful in landing high-quality fresh fish.

Another plan might involve irradiation, freezing, filleting, or FPC manufacture at sea. Any of these processes could be undertaken on the fishing grounds with no need for the vessel to return to port. Instead, cargo vessels could bring the finished product to port and supply the fishing vessel with fuel and, perhaps, with replacement crews.

There exist many other far-out possibilities for our industry if we think in space-age terms. I believe we should.

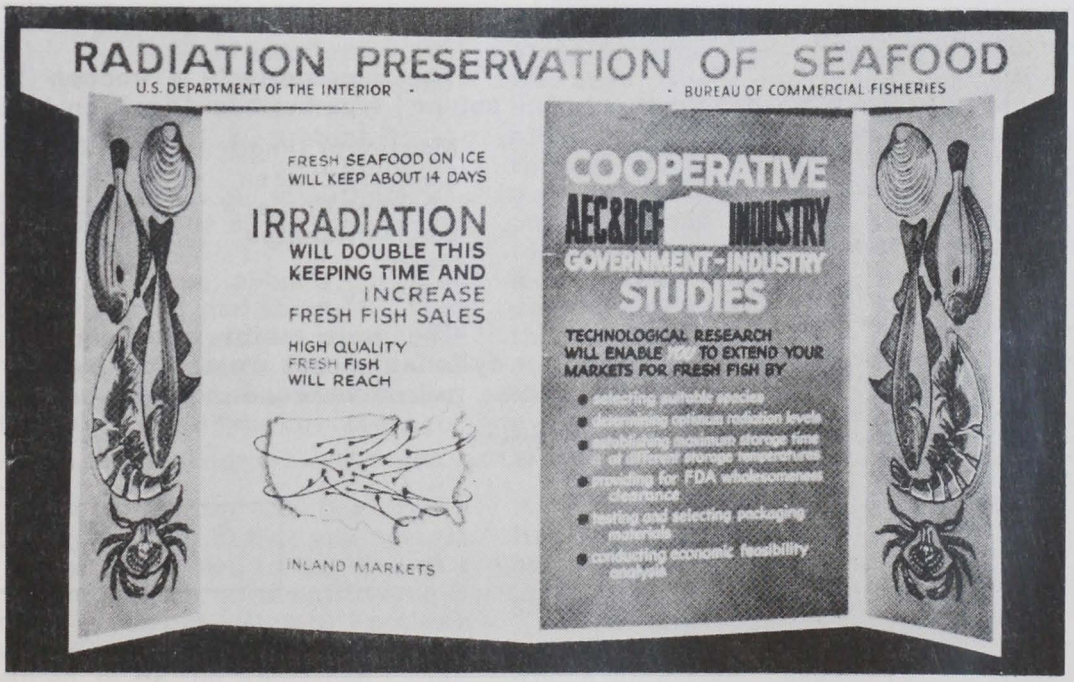

Exhibit demonstrating the usefulness of radiation preservation of seafood.