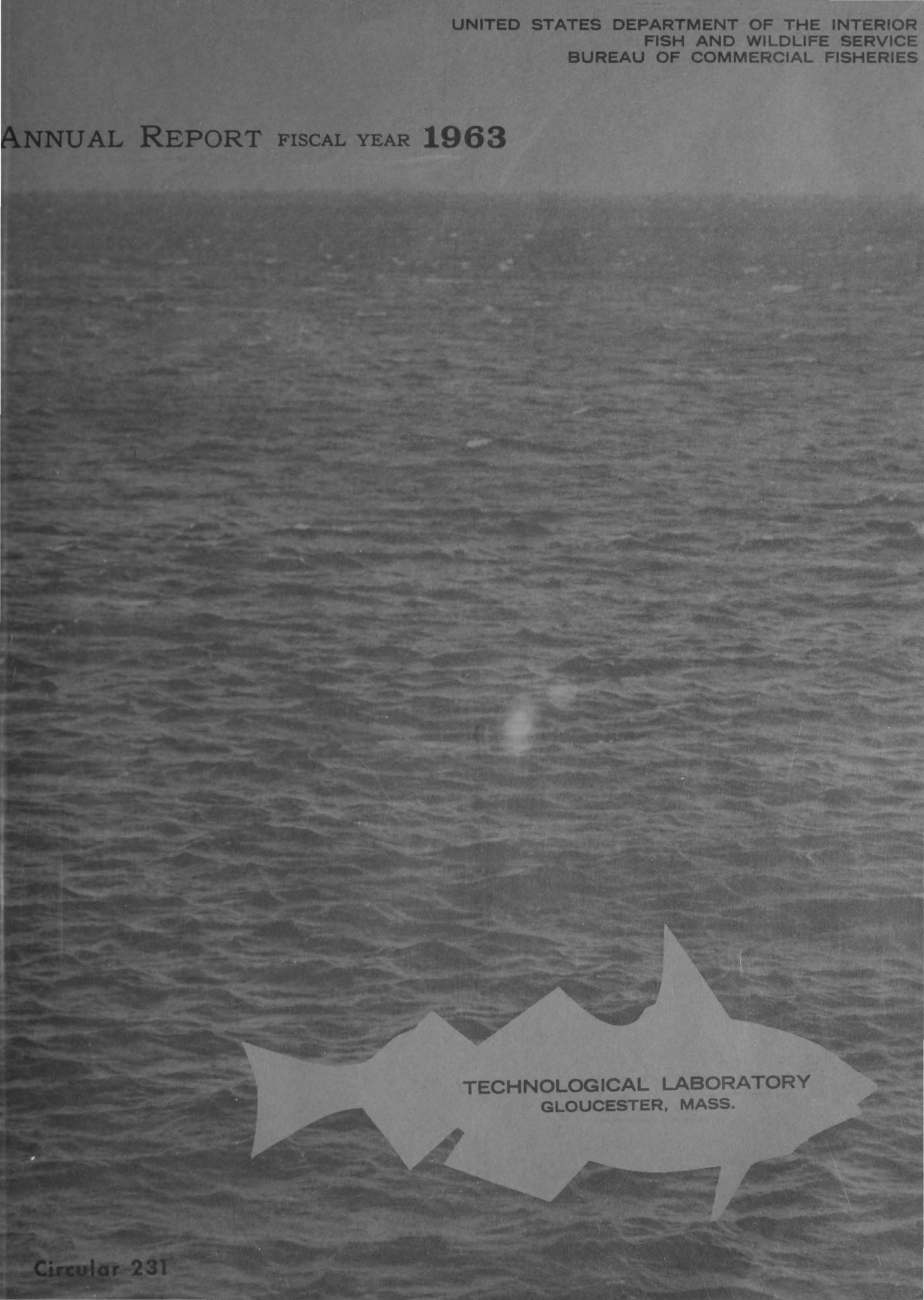
UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

ANNUAL REPORT FISCAL YEAR 1963



TECHNOLOGICAL LABORATORY
GLOUCESTER, MASS.

Circular 231

UNITED STATES DEPARTMENT OF THE INTERIOR
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Annual Report of the Bureau of Commercial Fisheries Technological Laboratory Gloucester, Mass. For the Fiscal Year Ending June 30, 1963

By

Joseph W. Slavin, Laboratory Director

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Annual Report of the Bureau of Commercial Fisheries Technological Laboratory Gloucester, Mass. For the Fiscal Year Ending June 30, 1963

By

Joseph W. Slavin, Laboratory Director

MESSAGE FROM LABORATORY DIRECTOR

During fiscal year 1963, our laboratory made notable progress in several areas of investigation and expanded some existing studies to meet the needs of industry. Fundamental research has been continued in the field of fish-muscle protein and in the chemistry of the flavors and odors of fishery products. We have continued applied studies on the use of ultraviolet light together with refrigerated sea water for holding fish on the vessel and ashore. In our time-temperature-tolerance studies we have completed the collection of information on temperature variability during shipment of frozen fishery products and concluded a cooperative project with scientists of the Fisheries Research Board of Canada on the freezing and thawing of cod. Research on the use of enzymes as biochemical indices of quality in frozen fishery products has been continued and shows promise. Problems associated with the use of liquid nitrogen for freezing fishery products have been delineated and are being investigated. Two new grade standards for frozen fishery products have been developed, and several specifications were published for the Federal Government and for the National Association of State Purchasing Officials. Our studies of preservation by radiation have been expanded to include new species.

The following summaries provide detailed information on our research projects. If there are any subjects on which you desire more information please feel free to ask us.

RESEARCH ON THE CHEMISTRY AND BIOCHEMISTRY OF FISH

By

Maynard A. Steinberg, Assistant Laboratory Director

Many technical problems involving the preservation of fishery products can be solved by fundamental research. Two such problems under investigation at this laboratory are (1) the freezing-induced denaturation of fish-muscle protein and (2) the chemistry of the flavors and odors of fishery products.

PROTEIN RESEARCH

Our previous studies on the relation of protein to fatty acid have been concerned only with the behavior of the proteins of cod. Some of the fattier species of fish--sole and halibut, for example--are known to have greater stability in frozen storage than cod. We have therefore extended our study of protein-fatty acid interaction to other species and have been able to demonstrate a difference among species in the reactivity of muscle proteins toward sodium linolenate (a salt of linolenic acid). For the lean and moderately fatty fishes, the stability of the proteins increased in direct proportion to increasing lipid content of the muscle. The proteins of the oily species show even greater stability but not as much as would be expected, based on the total lipid content. Results of this work (Change in soluble-protein content of muscle extracts after addition of sodium linolenate solution; and effect of lipid content of muscle on protein-sodium linolenate interaction, respectively) suggest that protein denaturation in the intact muscle may be related to both the amount of free fatty acid liberated and the total lipid content of the muscle. (figs. 1 and 2).

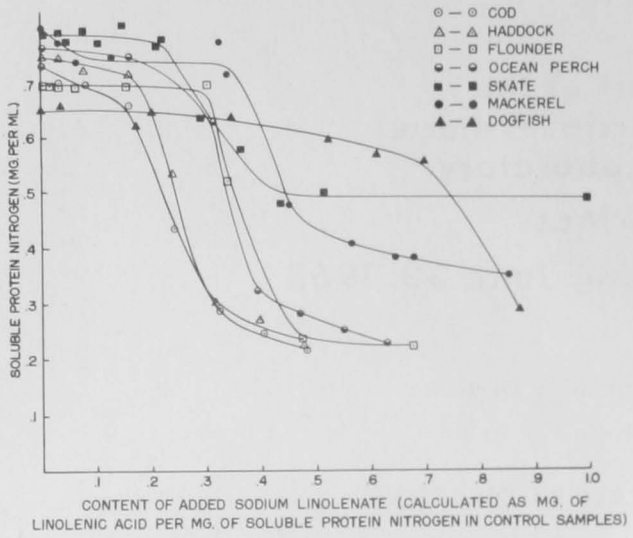

Figure 1.--Change in soluble-protein content of muscle extracts after addition of sodium linolenate solution.

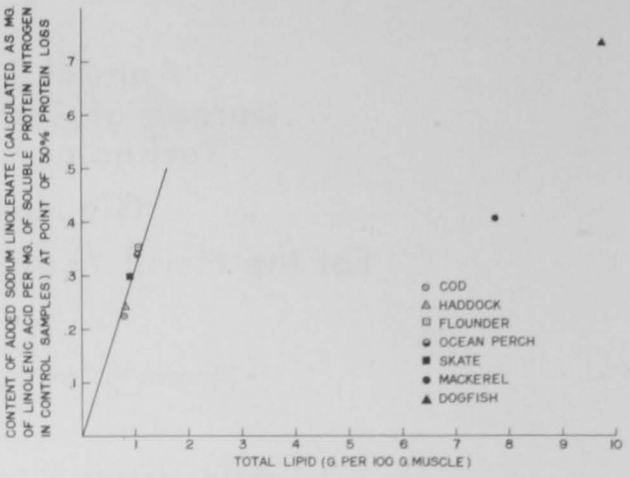

Figure 2.--Effect of lipid content of muscle on protein-sodium linolenate interaction. Values for protein and linolenate contents are taken from Figure 1.

A fraction that has high lipid and low protein content and that is effective in inhibiting the reaction between dogfish protein and fatty acid has been isolated from the extracts of dogfish muscle. The protein apparently is protected through the uptake of fatty acid by the lipid part of this fraction.

Additional evidence has been obtained that supports the hypothesis that the interaction of protein with fatty acid causes denaturation of fish-muscle proteins during frozen storage. Ultracentrifugation showed that small quantities of fatty acid added to protein extract of fresh cod muscle precipitate actomyosin specifically and do not precipitate myosin. This observation is consistent with the findings of other investigators, who have shown that during frozen storage of the flesh, actomyosin extractability decreases at a rate faster than that for either myosin or actin.

FLAVOR-AND-ODOR RESEARCH

The flavor-and-odor research project investigates the spoilage pattern in fishery products by following the flavor and odor changes in fish from the time they leave the water until they are eaten. The mechanism by which fish spoil is extremely complex, because it involves many interrelated variables, such as storage time and temperature, handling techniques, and area where caught. As spoilage proceeds, the day-to-day changes in the flavors and odors are very subtle and their measurement requires sensitive instruments and specific analytical techniques. The techniques developed or improved in this laboratory are designed to separate, detect, and identify the compounds causing the flavors and odors in fresh fish and to show how these change during processing and storage (fig. 3).

The compounds causing the flavors and odors are volatile and are removed from the fish by the use of high-vacuum, low-temperature techniques. The complex mixture obtained is then separated into its components by a gas chromatograph, using a low-temperature-programmed technique.

Two methods are used for identifying the individual compounds. The first method compares the time it takes for the unknown compound to be eluted from the gas chromatograph with the time required for the elution of known chemical compounds. This method is successful only if no two compounds are eluted at the same time. The second method--that of mass spectrometric analysis--is more precise. Since no two compounds have identical mass spectra, there can be positive identification. Unknown compounds are introduced into the mass spectrometer by either of two methods. In the first method, each individual compound must be separated from the complex mixture by other analytical techniques and introduced into the mass spectrometer as a single component. In the second method, the gas chromatograph is used to separate the mixture. As each individual component is eluting from the gas chromatograph, it is introduced directly into the mass spectrometer. Each method has both advantages and disadvantages.

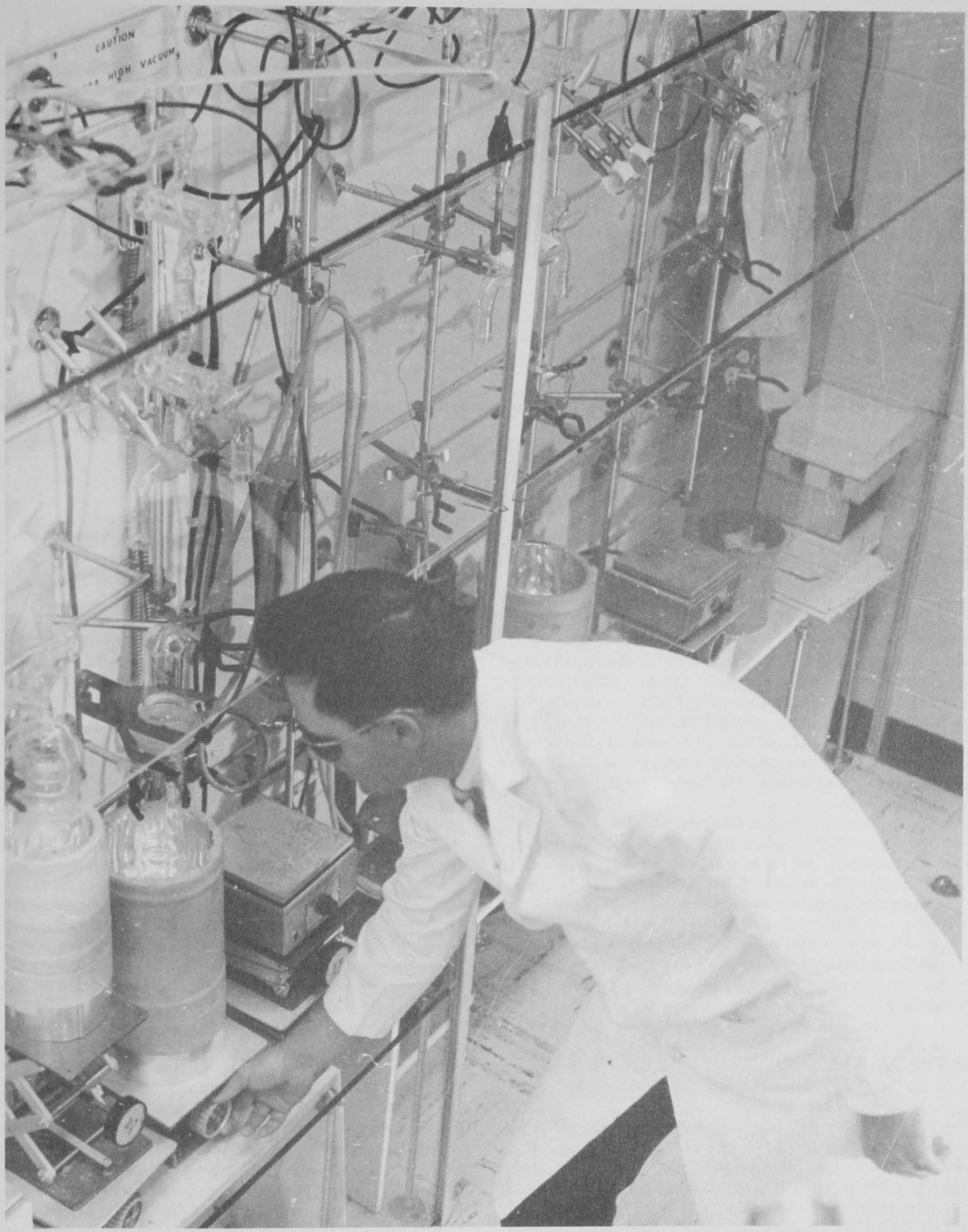

Figure 3.--Volatile compounds that contribute to the flavor and odor of fishery products are collected under vacuum before being separated from each other by the gas chromatograph.

By using a combination of the preceding techniques, we found that the number and concentration of volatile compounds in both haddock and clam meats increased during storage. Cooking resulted in an increase in concentration of some compounds as well as the appearance of several new compounds. The following compounds present in the volatiles from haddock have been identified this year by their retention time and/or by the mass spectrometer: Trimethylamine, methyl mercaptan, methanol, ethanol, methyl ethyl ketone, and diethyl sulfide. These compounds are not unique to fish, for they have been found in other foods. At present, only dimethyl sulfide has been identified in clams.

In other experiments, the volatile carbonyl compounds from haddock were precipitated as their 2,4-dinitrophenylhydrazones (2,4-DNPHs) from the mixture of total volatile compounds. The 2,4-DNPHs were then separated by conventional column chromatography. Two of the carbonyl compounds were identified by their infrared spectra as diacetyl and acetoin.

Since sulfides appeared to be major volatile components of edible fish, a sensitive method for quantitatively following their development is under investigation as a possible objective test for quality.

PRESERVATION AND PROCESSING RESEARCH

By

John A. Peters, Program Leader

The Preservation and Processing Unit, in its program of research on problems of maintaining and evaluating the quality of fishery products from catcher to consumer, worked on two major projects: (1) investigation of new refrigeration techniques and (2) time-temperature tolerance of frozen seafoods. These projects are aimed at helping industry through the application of new techniques in handling fishery products and the accumulation of information on all factors affecting the quality of fish.

The project on improving the quality of whiting (in effect during the previous year) was concluded at the annual meeting of the Massachusetts School Lunch Supervisors with a demonstration of new whiting products developed at this laboratory. The supervisors showed considerable interest in the products as well as willingness to serve whiting more often if good-quality products are readily available.

INVESTIGATION OF NEW REFRIGERATION TECHNIQUES

Applicability to the fishing industry of new techniques in food processing such as the use of ultra-low temperatures available with liquid nitrogen for freezing and storage of fishery products and the use of refrigerated sea water (RSW) instead of ice for the storage of fish aboard the vessel and ashore were investigated.

Effect of Ultra-low Temperatures on the Quality of Fishery Products

Recently there has been much interest in the use of liquid nitrogen in the freezing of various foods. The interest on the part of fish processors has been tempered, however, by two factors: (1) The cost of liquid nitrogen, which would amount to at least 4 cents per pound of product, and (2) the variable success of this technique. With some foods, initial high quality is better maintained when they are frozen in liquid nitrogen than when they are frozen in conventional systems such as contact-plate and air-blast freezers. Other foods, however, crack badly during either freezing or subsequent handling. Since freezing in liquid nitrogen appears, despite these problems, to offer promise in both improved quality of product and increased rate of production, we are investigating its applicability to fishery products.

Preliminary tests of products immersed directly in liquid nitrogen showed that in products such as scallop meats and flounder fillets, the extremely rapid freezing results in cracking and even shattering the product. Freezing in a spray or in the cold gas over a pool of liquid nitrogen reduced damage to the product but also reduced the rate of freezing. Since cracking appears to result from strains induced in the product during freezing and since the amount of strain appears to be a function both of the rate of freezing and of the minimum temperature

to which the product is frozen, we have begun work on applying strain-gage measurements to fishery products being frozen in liquid nitrogen. The results of this work may enable us to establish, for various products, rate specifications that will allow the use of liquid nitrogen for freezing and maximally maintaining the quality of the products.

In the course of this work we have served as advisers to a processor interested in setting up a production line for freezing individual fillets in liquid nitrogen and pointed out many pitfalls to be avoided in his developmental work.

Storage of Fish in Refrigerated Sea Water

Work on our refrigerated sea water (RSW) project was reactivated. An experimental tank and associated refrigeration equipment were installed aboard a commercial vessel engaged in the ocean perch fishery. Results showed promise but not to the degree found in our laboratory tests discussed in the annual reports for 1959 to 1961.

During long-term storage (14 days or more), odors developed in the recirculating RSW and were absorbed by the fish flesh. Frequent changes of water helped but did not eliminate the problem.

The use of an ultraviolet sterilizer in which a thin layer of RSW is exposed to high-intensity ultraviolet radiation appears to offer promise in controlling bacterial growth and subsequent development of odor. Following preliminary tests in which bacterial populations were reduced from 12 million per milliliter to 3 thousand per milliliter in 2 hours, we had an ultraviolet unit designed and constructed especially for our shipboard experiments. Prior to installing this equipment aboard the vessel, we tested it in the laboratory. The results indicated that if the unit operates as well on the vessel as it does in the laboratory, it will be of practical value.

TIME-TEMPERATURE TOLERANCE OF FROZEN SEAFOODS

During this year, work continued on our multiphase, time-temperature-tolerance project. Emphasis was placed on (1) effect of distribution of frozen seafood on quality, (2) laboratory studies on factors affecting quality, (3) biochemical indices of quality, and (4) engineering studies on freezing and cold-storage systems.

Effect of Distribution on Quality

To obtain information on temperatures encountered during shipment of frozen fishery products, we packed small recording thermometers with the products in refrigerated trailers headed for various sections of the country. Twenty truck lines cooperated in these tests, and 65 useable temperature records were obtained.

A statistically significant and considerable difference was found among the mean trip temperatures for the various truck lines. The best trailers (those maintaining the coldest temperature) averaged -6° F., whereas the poorest averaged +19° F. The mean temperature for all trips was +8° F.; 91 percent were 0° F. or higher; 38.5 percent were 10° F. or higher; 20 percent were 15° F. or higher; and 11 percent were 20° F. or higher.

Additional information on temperatures of fishery products during distribution was obtained from records of cold-storage warehouses. The temperature of products arriving by refrigerated trailer at three warehouses averaged 4.1° F. during the year and had little seasonal variation, ranging from about 1.8° F. in January to about 5.5° F. in August.

Temperatures of frozen fishery products in retail store display cabinets were also obtained. We found that product temperatures vary significantly with position in the cabinet. At the rear, the average was 0.9° F.; in the center, 6.1° F.; and at the front, 6.8° F. In 14 percent of the stores, product temperatures were below 0° F.; 76 percent were between 0° and +10° F.; 6 percent were between +10° and +20° F.; and 4 percent were over 20° F. Grouping of the temperature data by chain store also showed considerable variation. In one chain, for example, cabinet temperatures averaged +1.3° F.; whereas in another, they averaged +7.2° F. In 35 percent of the stores, products were stacked above the load line.

Laboratory Studies on Factors Affecting Quality

During the year, our cooperative project with the fishery research laboratories at Halifax, Nova Scotia, and St. John's, Newfoundland, was completed. In this project, we were concerned with the effect of several processing variables on the quality of cod. The variables studied were (1) freezing by contact plates or by immersion in brine, (2) freezing prerigor mortis or postrigor mortis, and (3) thawing with microwave energy or with circulating water.

Thawing by microwave energy of whole and eviscerated fish took 15 to 20 minutes as compared with 3 hours required with circulating water. The microwave thawing did, however, result in localized overheating on the surface of the fish, but this could probably be eliminated by improved design of equipment.

Examinations of the thawed, filleted fish in the raw state showed that (1) freezing

method has no effect on quality, (2) fish frozen prerigor rated considerably higher than those frozen postrigor, and (3) the fish thawed by microwaves rated considerably higher than those thawed by water.

The average scores of taste tests conducted at bimonthly intervals showed no marked preference for any of the samples studied. Scores for texture, however, showed a consistent preference for the samples frozen prerigor mortis. We are now determining whether or not this preference is statistically significant.

The Halifax Technological Station analyzed samples for free fatty acids and extractable-protein nitrogen, which are useful as indicators of quality. The results did not show any differences attributable to the various treatments used.

Preliminary tests were conducted to determine the feasibility of pasteurizing blue crab meat with microwave energy. In the conventional pasteurization method, the shucked crab meat is heated to 170° F. in hot water, the time required being about 75 minutes. By use of microwave energy, the crab meat can be heated to 170° F. in less than 2 minutes. Comparable reduction in bacterial populations was found using the two methods. Our taste panel showed a slight preference for the microwave-pasteurized samples.

Biochemical Indices of Quality

The search for objective methods of determining the quality of fishery products has occupied researchers for many years. After an exhaustive survey of the literature, we found that the existing chemical tests serve only to indicate the degree of spoilage rather than early loss of quality. Moreover, almost none of them is specifically designed to test frozen seafoods, whose patterns of deterioration are very different from those obtained with fresh or iced fish. The evaluation of quality still depends on highly trained taste panels.

The object of our research is to develop an index for early loss of quality in frozen seafoods. Our approach is to correlate the behavior of enzyme systems extracted from fish flesh undergoing frozen storage with loss of quality as determined organoleptically (by taste, smell, texture, and appearance).

Measurement of an enzyme's activity may be interpreted in two general ways: (1) as a loss of intracellular structural integrity--the intrusion into the cytoplasmic fluid of an enzyme originally localized within intracellular particles, or bound to some intracellular structure (for example, particle membranes or endoplasmic reticulum); and (2) as a loss of enzymic functional integrity--an altered response to specific concentrations of substrate, stimulant, or inhibitor.

Several enzyme systems have been explored for changes in kinetics. Of these, two systems--lactic dehydrogenase and diphosphopyridine nucleotide dehydrogenase--have been definitely discarded, as their behavior patterns show no correlation with quality loss. Malic enzyme (ME) and alpha-glycerophosphate dehydrogenase (aGPDH), two of the most promising, have been selected for further experimentation. To date, most work has been done with the malic enzyme, which is present in low amounts in the cytoplasm of fresh fish muscle. There also appears to be some weakly bound ME, which is released by the process of freezing and thawing, so that the concentration in the cytoplasm is about double that before freezing and thawing.

Engineering Studies on Freezing and Cold-Storage Systems

Engineering studies were continued to compare the efficiency of our hot-gas bypass capacity-control system with that of a conventional on-off thermostatically controlled system.

Optimum settings of the various control valves were determined for the capacity-control system with both constant and cycling temperatures, and data were obtained on rates of refrigerant flow and consumption of electrical power for both systems. Figure 4 (Refrigerant flow in hot-gas bypass system) shows the effect on refrigerant flow in various parts of the system of changes in evaporator load. It can be seen that increased evaporator loading results in an increase in the flow of refrigerant in the evaporator, a decrease in flow in the hot-gas bypass line, and a slight increase in flow for the low-stage and interstate cooling. These data may be useful in designing future systems utilizing this method of capacity control.

Mechanically Deicing and Weighing fish

In our annual report for 1959 we reported the results of our tests on a machine that we developed to mechanically remove the ice from fish and weigh them in 500-pound lots as they are unloaded from the vessel. Despite the satisfactory results obtained, industry showed no interest in using the device, so no further work was done on this project. Recently, however, both the processors and the fishermen's union at the Boston Fish Pier have indicated a need for this type of equipment and have been making tests of their own, using our machine. The results have been very satisfactory, and the interested parties are making plans to construct additional units to be used in the unloading of all vessels at the Boston Fish Pier.

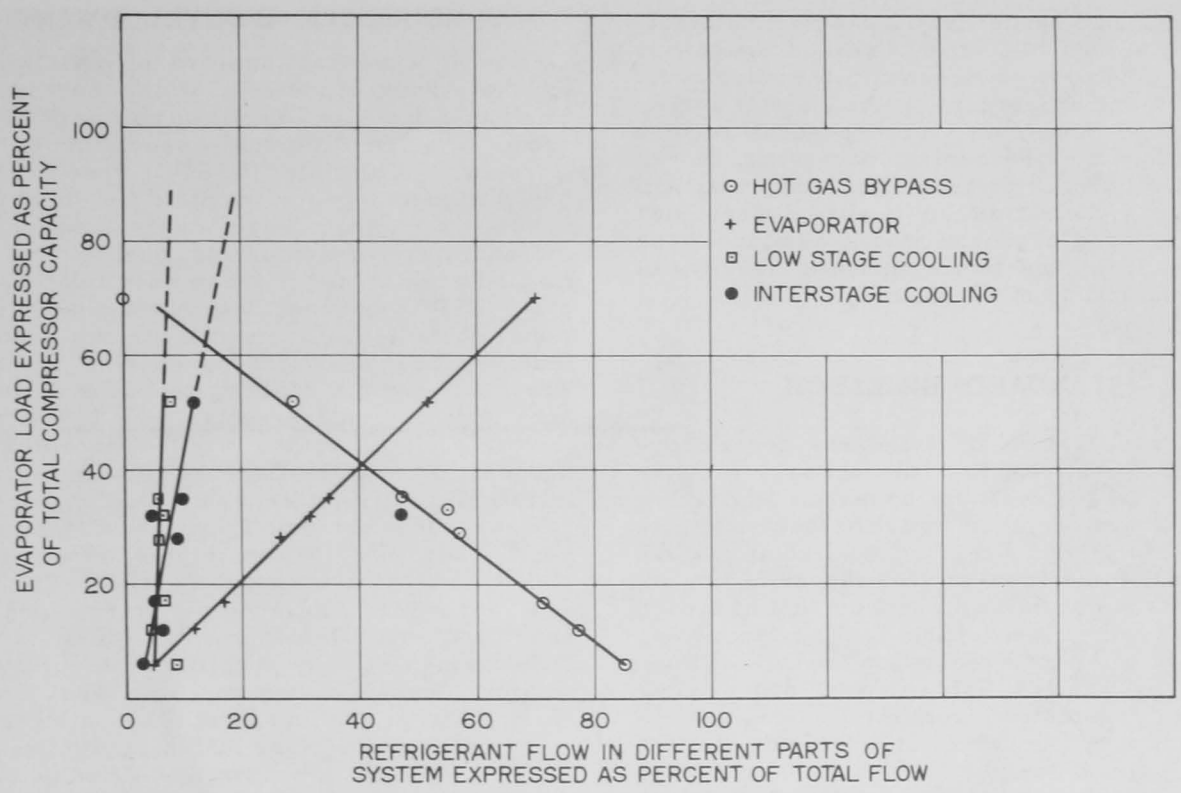

Figure 4.--Refrigerant flow in hot-gas bypass system.

STANDARDS AND SPECIFICATIONS RESEARCH AND DEVELOPMENT

By

Joseph H. Carver, Program Leader

U.S. Department of Interior (USDI) fishery product standards and specifications are voluntarily used by the industry and large groups such as State buying agencies, hospitals, steamship lines, and retail food stores. These documents are objective gages used to upgrade the quality of seafoods reaching the consumer and to promote orderly and efficient marketing. Thus, the consumer is assured of obtaining products of high quality, and the producer is given a "yardstick" by which he can measure and improve the quality of this product. Orderly and efficient marketing is promoted by offering to the distributor and wholesaler exact knowledge on the quality and value of seafoods, thus reducing confusion.

STANDARDS DEVELOPMENT

This laboratory has developed grade standards for 10 of the most important frozen fishery products in New England. These standards are for fish sticks, fish blocks, raw breaded portions, haddock fillets, cod fillets, ocean perch fillets, fried scallops, flounder and sole fillets, raw breaded fish sticks, and fried portions. The last two are new standards published as "Notices of Proposed Rule Making" in the Federal Register during fiscal year 1963. The standard for frozen fried fish sticks was revised and also published as a "Notice of Proposed Rule Making." The standard for raw breaded portions was further amended and prepared for publication. Because of an increased number of field inspectors in key plants across the country, we were able for the first time to test in-plant these four new standards thoroughly prior to publication in order to ensure that these documents truly reflected the quality of the products as produced. Revision of the fish-block standard was also started. These new standards and revisions of older standards are streamlined with respect to terminology and application with no loss of objectivity, thus aiding in a more rapid implementation of the standards.

Our standards were also used in an expanded grading survey made on 312 frozen retail samples of cod, haddock, and ocean perch fillets gathered from nine geographical centers across the country. Results of this survey indicated that the quality of these products could be greatly improved. Poor handling

practices and inadequate packaging materials caused almost half the observed losses in quality; and poor workmanship, the remainder. To aid the producers in supplying better quality fishery products, we issued general recommendations on processing, packaging, frozen storage, coding, distribution, and retailing. Specific information on quality losses was given to each producer whose samples were examined. In the future, grading surveys of this type will be made annually.

STANDARDS RESEARCH

The preparation of standards for fishery products requires that the criteria for different quality levels be based on laboratory data. We have continued work on factors affecting the pickup of breading on fish sticks and portions. Time spent on the processing line affects the apparent fish-flesh content of frozen breaded products by changing the surface temperature of the fish. Delays on processing lines result in warmer fish surfaces and greater transfer of moisture from the fish flesh to the breading. Routine determinations indicate that the fish-flesh content of these portions or sticks is lower than that of similar products that are at a lower temperature when battered and breaded. Other factors such as method of cutting, batter temperature and viscosity, and cooking, cooling, and freezing methods are being or will be studied to determine their effect on the final breading content of the finished product.

SPECIFICATIONS DEVELOPMENT

Federal specifications are primarily used by the Armed Services, which buy in New England alone about 6 million pounds of fishery products a year. National Association of State Purchasing Officials (NASPO) specifications are designed for use by State and local Government agencies. These buyers are becoming increasingly conscious of quality and are making greater use of these specifications and other USDI services. Both types of specifications contain requirements for the products that are needed by the purchasing agencies. They also contain exacting tests for conformance to these requirements.

During fiscal year 1963, the laboratory, in cooperation with the General Services Administration, published Federal specifications for raw breaded shrimp, fresh and frozen fish, canned sardines, canned clams, raw shucked clams, and raw shucked oysters. The last five items were published as interim, or trial, specifications. Developmental work is now underway on Federal specifications for canned shrimp, canned salmon, raw and cooked shrimp, fried scallops, and raw scallops.

In fiscal year 1963, NASPO specifications were published for raw and fried breaded portions, raw or cooked shrimp, and breaded shrimp. These tools were made available to the States for the procurement of high-quality fish portion and shrimp products. Additionally, developmental work was started on NASPO specifications for canned tuna and canned salmon.

Figure 5.--The preparation of specifications requires testing of products to determine quality levels.

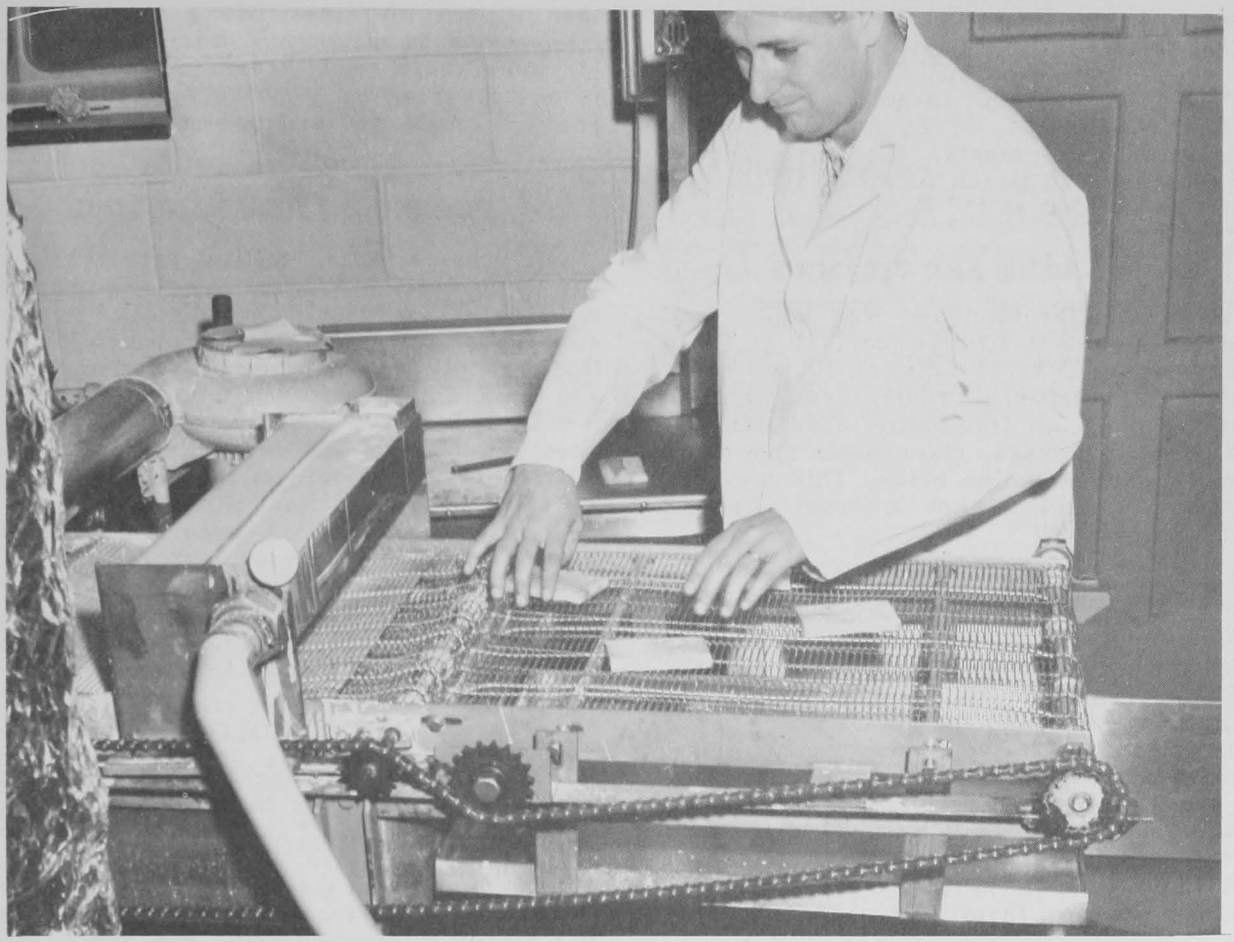

Figure 6.--Determination of the factors that affect the pickup of breading by fish sticks and fish portions requires the use of commercial breading equipment.

RADIATION-PASTEURIZATION RESEARCH

By

Louis J. Ronsivalli, Program Leader

Under contract with the U.S. Atomic Energy Commission, this laboratory has continued its research on the application of atomic radiation to the preservation of fishery products. The fundamental objective of this study is to determine whether low-level ionizing rays of Co^{60} can significantly increase the refrigerated storage life of our economically important fishery products.

The scope of the radiation program has been broadened considerably during the past year, with new projects being started on flavor and odor, packaging, preirradiation handling, and microbiology.

ACCEPTABILITY AND SHELF LIFE

Skinless haddock fillets and soft-shell clam meats were studied previously; the results were highly satisfactory. We found that these two products could be kept in acceptable condition at 33° F. for at least 30 days after irradiation at 250,000 rads and 450,000 rads, respectively, for air-packed (nonvaccuum) products; and 150,000 rads and 350,000 rads, respectively, for vacuum-packed products.

Current studies on skinless pollock and ocean perch fillets are showing results similar to those found for haddock and clams.

Air-packed, skinless pollock fillets and air-packed skinless ocean perch fillets irradiated at 150,000 rads and 250,000 rads, respectively, can be kept in good condition for at least 30 days at 33° F. As with haddock fillets and clam meats, the shelf life of pollock and ocean perch fillets at 42° F. was about one-half that at 33° F.

AMINO ACIDS AND VITAMINS

Analyses of the total and free amino acid content and the B-vitamin content of these products showed that irradiation did not affect their basic nutritional value, even when 10 times the optimum irradiation dose was applied. During storage, clam meats showed an increase in free amino acids. This was due to autolysis and was not a direct effect of irradiation.

FLAVOR AND ODOR

In our flavor-and-odor project, we are using gas chromatography and other techniques to separate and identify the volatile compounds that cause the flavor and odor of fresh fish and to determine what changes occur in these compounds as a result of irradiation and storage. With these techniques we shall be able to identify the particular process variables that cause adverse changes in flavor and odor and will thereby be in a position possibly to control them.

PACKAGING

The common "tin" can has been used almost exclusively for packaging the irradiated fish used in our acceptability studies, because it is known that the can gives maximum protection to the product and does not, in itself, affect flavor and odor. In our packaging project we are investigating other packaging materials such as plastic films. We have selected and are testing several materials that appear to meet our requirements of (1) preventing recontamination by bacteria, (2) being able to withstand normal handling without tearing or bursting, and (3) not imparting off-flavors and odors to the product.

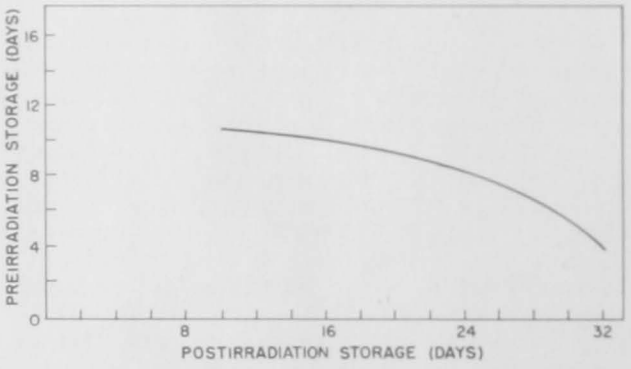

Figure 7.--Relation between preirradiation time of eviscerated haddock stored in ice and the maximum postirradiation shelf life of the fillets (average of three experiments).

PREIRRADIATION HANDLING

Our preirradiation handling project has been set up to determine what effect the quality of the fish at the time of irradiation has on the subsequent storage life of the product. We know that irradiation is most effective when the fish are treated immediately after capture and that it will not improve poor quality. When fish are carefully washed and packed in ice, however, irradiation can be delayed for more than a week and still provide a total shelf life of about 30 days. Figure 7 (Relation between preirradiation time of eviscerated haddock stored in ice and the maximum postirradiation shelf life of the fillets) shows the expected shelf life of irradiated haddock fillets as a function of the iced age of the fish from which they were cut.

MICROBIOLOGY

The microbiology laboratory was established primarily to allow us to determine the bacteriological quality of samples under study by the other projects in the Radiation Program. We have found that the initial total plate counts of reputedly very fresh fish fillets range from 10^3 to 10^6 microorganisms per gram. Since the keeping quality of fish products is a function of the initial bacterial load, the initial bacterial load is important. One of the advantages derived from this study was our ability to relate the consistency of the product quality of a supplier with initial total plate counts.

Taking total plate counts before and after irradiating skinless haddock fillets at 250,000 rads, we found that this dose reduced the bacterial population by about 99 percent (table 1).

Table 1.--Bacterial reduction in haddock fillets by irradiation at 250,000 rads

[Values are averages of duplicates]

Sample	Total plate counts prior to irradiation	Total plate counts after irradiation	Reduction in total plate count
Number	Counts/g.	Counts/g.	Percent
1------	83,000	450	99.5
2------	170,000	200	99.9
3------	180,000	450	99.7
4------	100,000	990	99.0
5------	100,000	1,200	99.0
6------	1,300,000	2,200	99.8
7------	5,500	50	99.1

INSPECTION AND CERTIFICATION OF FISHERY PRODUCTS

By

Philip J. McKay, Regional Supervisory Inspector

The inspection service in the North and Middle Atlantic States continues to expand. Since just last year, the number of inspectors increased from 17 to 21; the continuous-inspected plants, from 10 to 12.

Over 115 million pounds of fishery products were produced in USDI-inspected plants, and over 12 million pounds of fishery products were lot-inspected.

Requests for lot inspection are numerous in New York and are increasing steadily in the Gloucester-Boston area.

In December 1962, the position of Roving Inspector was established. The duty of this inspector is to train all local inspectors in the uniform application of U.S. Standards and Specifications to certified products.

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LABORATORY PERSONNEL

Joseph W. Slavin, Laboratory Director

Chemistry of Fishery Products
Maynard A. Steinberg
(Assistant Laboratory Director)

Chemists
Margaret L. Anderson
Frederick J. King
Joseph M. Mendelsohn

Standards and Specifications
Joseph H. Carver
(Program Leader)

Chemists
Robert J. Learson
John J. Ryan
Richard D. Tenney

Fishery Science Aid
Daniel T. McLane

Radiation Preservation
Louis J. Ronsivalli
(Program Leader)

Chemists
Vincent G. Ampola
Richard O. Brooke
Thomas J. Connors
Donald F. Gadbois
Elinor M. Ravesi

Food Technologist
Julius B. Bernsteinas

Physical Science Technician
Burton L. Tinker

Preservation and Processing
John A. Peters
(Program Leader)

Chemists
Clarence J. Carlson
Edward H. Cohen
Edith D. Gould

Food Technologist
J. Perry Lane

Mechanical Engineers
Enrico E. Aliberte
Daniel W. Baker II

Inspection and Certification
Philip J. McKay
(Supervisory Inspector)

Inspectors
Leroy A. Benner
Clarence E. Blatchford
Thomas Daly
Frank P. Gomes, Jr.
Charles F. Green
Thomas J. Heath
Raymond E. Horton
Frank F. Insetta*
Eugene E. Johnson
John M. Lake
Clarence R. Martin
Ronald R. McCarthy
Joseph Mitchell, Jr.
Melvin A. Mitchell
Salvatore Nicolosi
Frank Piraino
Frank Re
Alphonse E. Ruriane
John W. Sawyer
Albert Thomas
Larry H. White

Administrative Unit
Charles F. Hayes
(Unit Leader)

Secretary to Laboratory Director
Cynthia E. Hillier

Secretaries to Program Leaders
Geraldine P. DuPont
Carol J. Knowles
Marjorie W. Oakes
Sheila J. Pearson
Margaret M. Schwartz

Maintenance Man
Joseph M. Lee

Janitor
Everett J. Burke

* Frank Insetta retired on February 2, 1963, after 20 years of Government service.

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