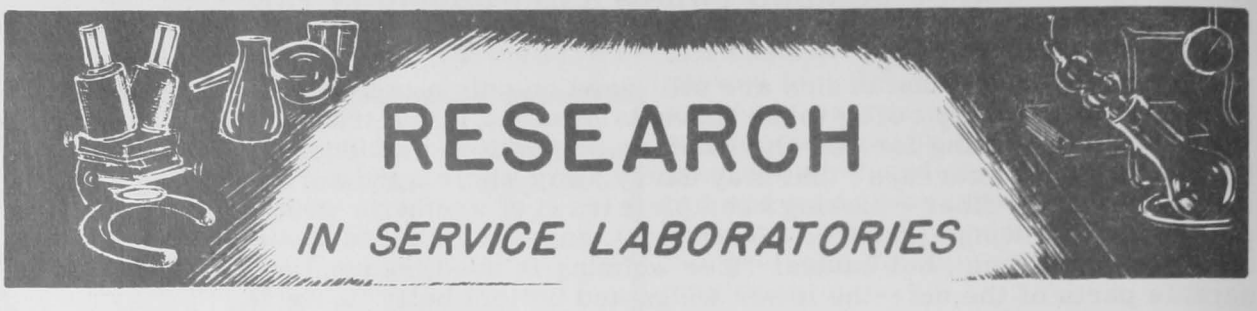

DEVELOPING INSPECTION AIDS FOR SALMON AND HALIBUT

In the development of quality standards for fishery products, the U. S. Bureau of Commercial Fisheries' technological laboratories have recognized the need for selecting criteria which reflect actual differences in quality use of the product. Factors such as dehydration, packaging voids, size and number of pieces, trimming defects, and number of blemishes are easily described and tabulated in the standard or a supplementary manual for the inspectors.

In preparing inspection manuals for the frozen halibut steak standard and the proposed standard for frozen salmon steaks, the Seattle Technological Laboratory of the Bureau found that descriptions of defects relating to appearance, color, or shape were insufficient for orientation and guidance of inspectors. After considering possible use of models, sketches, and illustrative material, color photographs of steaks typifying these factors were selected for study and trial. Two sets of 5" x 7" color prints, numbering 10 prints in a set for each standard, were prepared to illustrate criteria for appearance, workmanship, discoloration, blemishes, and other visual factors considered in the standard. Frozen steaks demonstrating the various defects were selected by laboratory personnel; photographs were taken and the prints prepared by a professional photographer. The cost for each set of prints was a fraction of the cost estimate for preparation of wax or plastic models.

The use of color, proper lighting, and modern color-print techniques yielded a photographic print which reproduces visual factors and defects in a most realistic manner.

To date, experience in the laboratory and the use of the color photographs for demonstration purposes have indicated considerable value for their use as an inspection aid. Ease of use and portability are outstanding assets of the photographs in addition to their reasonable cost. Negatives are stored for future duplication when needed. The experience of both the film manufacturer and the photographer indicate good stability of the dye pigments used in the prints even if subjected to considerable sunlight during use.

It is believed that further studies over a longer period will enable the laboratory to select graded samples demonstrating defects at various score levels for photographic reproduction. Thus, for those factors in which visual identification and comparison are important, the laboratory can assist the inspector in uniform application of criteria through the help of modern photographic techniques.

DEVELOPMENT OF NEW STANDARDS FOR PACIFIC COAST FISH

Towards the end of 1959, the Seattle Technological Laboratory of the Bureau of Commercial Fisheries has completed the exacting work in the preparation of three new standards applicable to Pacific Coast fish. These standards are to be promulgated in the weeks to come and cover frozen salmon steaks, frozen cod fillets, and

frozen ocean perch fillets. The salmon steak standard includes all species of Pacific salmon and was developed after frequent consultation with the industry and a grading survey of 391 samples of commercially packaged salmon steaks.

Both the cod and ocean perch fillet standards were initiated by the Technological Laboratory, Gloucester, Mass. These preliminary drafts were revised after close cooperation with the Seattle laboratory to include the applicable Pacific Coast species. Interchange of personnel, samples, and laboratory data between the two laboratories in addition to consultation with industry in each area has assured the development of unified standards best suited to the needs of processors, distributors, and consumers.

BACTERIOLOGICAL STANDARDS FOR FROZEN FOODS UNDER STUDY

Bacteriological standards for frozen foods were discussed in an October 1959 meeting of officials and members of the industry organization--the National Association of Frozen Food Packers and representatives of the Association of Food and Drug Officials of the United States--primarily Federal and State officials connected with regulatory and control agencies.

A number of reports were presented on recent developments in bacteriological methodology and statistical treatment of bacteriological data. Four agencies, including the U. S. Bureau of Commercial Fisheries, reported on data obtained from bacteriological examination of plant-line samples of various frozen foods. There was a lengthy discussion following the papers, centering around such problems as: (1) Does the frozen food industry really need bacteriological standards? (2) What type of standard, that is, which of the various "indicator" organisms such as total plate count, coliforms, E. coli, enterococci, or staphylococci, best meet the requirements of a bacteriological standard? (3) What are fair and workable limits for each of these classes of microorganisms? And (4) what are the best test methods to recommend for each of these indicator organisms?

It is not surprising, considering the controversial nature of the subjects under discussion, that no definite decision was reached regarding the use of bacteriological standards for frozen foods. It was recommended that more data be collected by all the interested groups and that another meeting be held to further consider the problems involved.

FISH OILS HAVE UNIQUE FATTY ACID COMPOSITION

Research on the fatty acid composition of fish oils has not been carried far enough by chemists of the U. S. Bureau of Commercial Fisheries to give more than a very general idea as to species variation. Actually most fish have a reasonably similar composition with respect to fatty acid distribution such that the following information on fatty acid distribution of "fish in general" probably applies to most species. Whereas there is probably a relatively small difference in composition of fatty acids in fish from one species to another (a difference the Bureau has only begun to investigate), there is a huge difference in fatty acid composition of fish oils as contrasted to that of oils from vegetable or animal sources.

Most fish oils contain 20- to 30-percent saturated and 70- to 80-percent unsaturated fatty acids. At first consideration this may appear to be less unsaturation than in common vegetable oils (e.g., corn oil, which contains 85-percent un-

saturated vs. 15-percent saturated fatty acids). The place where fish oils are outstanding is in the large proportion of highly unsaturated fatty acids. Thus about half of the 70 to 80 percent of the unsaturated fatty acids of fish oils contain 3, 4, 5, or 6 double bonds, whereas corn oil contains only 1 and 2 double-bonded fatty acids. Usually 20 percent or more of the total fatty acids of a fish oil have 5 or 6 double bonds.

Since it is the total unsaturation (which is proportional to the number of double bonds present) which governs the cholesterol depressant effect of an oil, the fish oils have a much higher potential action in this respect than do the vegetable oils.

As has been indicated, there are enough results on variation in composition of fatty acids in different species of fish to give a good appraisal of the different species. Species of herring, mackerel, salmon, menhaden, mullet, sardines, anchovies, and tuna generally contain between 5 and 25 percent oil in the meat with a high variability from sample to sample even of the same species. Probably the degree of unsaturation of the variety of sardine canned from California pilchard is the greatest, but it is not known if it is sufficiently higher than that of the others to make any material difference. Most tuna oils are also highly unsaturated, but canned tuna usually contains added vegetable oil which more than compensates for any advantage that tuna oil otherwise might offer. Of the different species of salmon, pink salmon--one of the least expensive varieties--has a high degree of unsaturated fatty acids.

Most of the common species of fish have relatively low oil content in the range of 0.5 percent to 5 percent. Such species as cod, haddock, halibut, flounder, sole, and ocean perch, as well as the various shellfish are in this category. Such species are valuable in making up diets high in protein and low in oil. What oil does come from the fish is highly unsaturated, though the amount may be so small as to have little or no significant cholesterol-depressant effect.

Bureau research to learn the fatty acid composition of different species of fish is in its early stages. In the next few years it is expected that information will be available to provide more complete answers on the fatty acid composition of many varieties of fish.

NEW PRODUCTS FROM FISH OILS

During 1959, research has been carried out at the Seattle Technological Laboratory of the U. S. Bureau of Commercial Fisheries on the development of new products from fish oils along with investigations relative to determining the different quantities of the component fatty acids found in commercial fish oils. Major attention was given to two products, namely, monoglycerides and acetoglycerides. Gas-liquid chromatography was the principal technique investigated with respect to fatty-acid composition.

MONOGLYCERIDES AND ACETOGLYCERIDES FROM FISH OILS: Monoglycerides and acetoglycerides are prepared from animal fats and vegetable oils and are used in such commercial products as shortenings, emulsifiers, and plasticizers. Such compounds prepared from fish oils may have unique properties in themselves such that they may prove to be valuable in similar commercial products.

Experimentally, it was shown that fish-oil monoglycerides could be easily prepared by a chemical reaction involving the triglyceride oil, glycerine, and a catalyst. An investigation was made to determine the optimum reaction time for the conditions of the process in order to give a high yield of the product, and at the same time to minimize the possible destruction of the high degree of unsaturation present in the original oil.

Acetoglycerides were prepared from the monoglycerides. Results gave little evidence for loss of unsaturation due to the conditions of the reaction. The acetoglycerides were found to be much more amenable to purification by distillation than were the monoglycerides. The acetoglycerides were very light in color and substantially free of odor. This was also true for the monoglycerides.

PURIFICATION OF FISH OILS: The principal objections to the commercial use of fish oils by most industries are that "fishy" odors are often imparted to the final product, such as in paints and soaps, and that the products are often unstable and are easily oxidized. The latter is a result of the chemical make-up and reactivity of fish oils.

An investigation was carried out on the applications of liquid-liquid extraction and molecular distillation of menhaden oil in an effort to produce an oil that possesses improved qualities. Results showed that menhaden oil could be greatly improved from the standpoint of odor and color. Work is continuing to determine the stability of the refined oil.

FATTY ACID COMPOSITION BY GAS-LIQUID CHROMATOGRAPHY: Gas-liquid chromatography is a method of analysis, which involves the vaporization of mixture components in a liquid-partitioning column, and chromatographing or separating the components of the mixture by carrying them through the column in an atmosphere of an enert gas, such as helium. The column is packed with solid particles supporting a nonvolatile partitioning liquid. Separation is accomplished on the basis of differences in partition coefficients for each separate component.

As a result of recent advances in gas-liquid chromatography, a tool is now available for the first time for the complete separation and quantitative analyses of the constituent fatty acids in fish oils. Work during the past year has included the adaptation of certain published techniques to the analyses of major commercial fish oils. The major part of this work was devoted to determining the most satisfactory conditions for the operation of our chromatographic equipment, in order to resolve the some 35 or more individual component acids. This work is continuing.

REFRIGERATED SEA WATER LENGTHENS STORAGE LIFE OF WHITING

Whiting kept in refrigerated sea water have a much longer storage life than when kept in ice, according to tests made by the Gloucester Technology Laboratory of the U. S. Bureau of Commercial Fisheries. The meat of the whiting, although pleasant tasting, is soft-textured and is apt to lose its fresh quality rapidly even when stored in ice. This change is a serious matter to the processing plant whenever it is necessary to hold large quantities of the fish prior to processing.

Because refrigerated sea water has proved successful as a medium for holding other species of fish on the Pacific coast, the Laboratory studied the suitability of this method for holding whiting.

The tests revealed that whiting held in sea water at 30° F. was kept fresh longer than when stored in ice. An expert taste panel declared that 30° F. sea water kept whiting at a high quality level about twice as long as the same fish iced.

This improvement in the handling of a low-cost, abundant species is important to both industry and the consumer.