
# COOPERATIVE FISH-PRODUCT-ACCEPTABILITY PROJECT WITH QUARTERMASTER FOOD AND CONTAINER INSTITUTE

What factors affect the acceptability of fishery products by personnel of the Armed Forces? Are some species of fish more acceptable than others? Does the freshness of the fish--within reasonable limits--make any marked difference? In what cooked forms do fish show most appeal to a serviceman? The answers to these questions should point the way to an increased use of fish by the Armed Forces; ultimately they could result in improvement in the civilian per-capita consumption of fish.

Table 1 - Summary of Samples Prepared for Quartermaster Food and Container Institute Acceptability Tests

| Species of Fish | Treatment of the Raw Fish | Frozen Products Prepared from Each Species in all Series. 1/ |
|---|---|---|
| (A) Haddock (Melanogrammus aeglefinus) | Series 1. Frozen in brine (5° F.) at sea, thawed in water (65° F.) ashore.<br>Series 2. Stored in ice for 2 days. | Fillets: 5-lbs. per package1/. |
| (B) Ocean perch (Sebastes marinus) | Series 3. Stored in ice for 3 days.<br>Series 4. Served in ice for 10 days. | Squares: Raw, breaded, 4 ozs. each, 20 per package.<br>Sticks: Cooked, breaded, 1 oz. each, 72 per package. |

1/ Additional samples of whiting (Merluccius bilinearis) and pollock (Pollochius virens) fillets in series 1 were prepared for comparative purposes and individual evaluation.

The first phase of a contemplated extensive program to answer these questions was started this past summer (1954). This first year's investigation is a cooperative venture, with the U. S. Fish and Wildlife Service's Boston laboratory doing the bulk of the work of preparing the required large-scale samples, and the Quartermaster Food and Container Institute arranging for large-scale taste penels to test the samples after various storage periods. The investigation will not be completed until the last taste-panel test late next spring. This progress report is made to furnish details of the samples prepared by the Fish and Wildlife Service.

In the planning stages even this first phase of the whole program expanded rapidly. A simple study to compare the acceptabilities of fillets from three or four different species of fish was quadrupled by considering the factor of freshness. It was decided to prepare fillets from fish stored in ice for two days, for five days, and for ten days, as well as from fish frozen fresh at sea. Then, in view of quite recent developments in fresh fish processing, the program was multiplied again. The phenomenal success of precooked fish sticks seemed to warrant their consideration alongside of the old standby, fillets. At the same time a third product, breaded fish

squares, more or less intermediate between fillets and fish sticks, was included. The size of each sample was cut in half when it developed that the results would be statistically significant and otherwise adequate if half of the samples were examined only after zero and after nine months' storage and the other samples were tested only after three and after six months' storage. Yet this half replicate study design still required a minimum of 50 pounds of finished product for each sample, and there were 48 samples.

The fortunes of fishing, weather, and equipment forced changes in the original design. It was not possible to secure all 48 samples of comparable histories. For two species, haddock and ocean perch, the full set of required samples, 12 for each, was prepared. In fact, with the design spoiled, it was necessary and fortunately possible to prepare full replicate size samples (100 lbs.) for these two species. For two species, whiting and pollock, only fillets prepared from fish frozen fresh at sea were assigned to this program. Extra samples of fillets and fish blocks, prepared from frozen and from iced whiting, pollock, flounder, and cod, intended for possible use in this program, may prove of value in the Service laboratory's other research studies.

As an incidental supplementary cooperative project, the Fish and Wildlife Service laboratory personnel prepared and shipped special lots of layer-packed fillets and of unbreaded uncooked fish sticks. These are to be used to prepare experimental samples of vacuum-dehydrated products.

All of the experimental samples were prepared from fish caught on three trips (sailing dates: June 28, July 14, and August 9) of the Service's experimental vessel Delaware. Although the trips were intended to secure data on the operation of the vessel's freezing and storage equipment, the fishing activities were devoted primarily to securing the fish of specific known histories needed for this cooperative project. A technologist from the Quartermaster Food and Container Institute was aboard the vessel on each trip to assist in supervising the handling and identification of each experimental lot.

Although the final samples were prepared from only 10 lots of fish, nearly 20 special experimental lots varying in size from 1,000 to 2,000 pounds were delivered and processed into fillets and blocks. Fish delivered by the first trip on July 5 were used in trial runs to reveal operational difficulties and to prepare samples which could be used if necessary. The finished samples to be used in the large taste-panel tests were prepared from fish delivered by the second trip on July 27 and the third trip on August 24.

Four commercial fish-processing firms (in Chelsea and Gloucester, Mass.) cooperated by filleting and skinning the several lots of fish. The lots of frozen fish were first thawed in the laboratory's special circulating water-thawing tank. From each lot at least 100 pounds (only 50 pounds in the cases of the single whiting and pollock samples) were packaged as fillets wrapped in cellophane, six wraps per five-pound carton. The remaining skinless fillets, at least 240 pounds from each lot, were packed as $7\frac{1}{4}$-pound blocks in a standard waxed container. All processing operations were closely observed and checked by one or more technologists to avoid any mixing of sample lots. The fillets and the blocks were frozen either in the laboratory's plate freezer or in readily available commercial freezers.

The frozen fish blocks were processed by a cooperating firm (in Gloucester) into squares of fish approximately 3 by $\frac{1}{2}$ by $3\frac{3}{4}$ inches and into sticks approximately $\frac{5}{8}$ by $\frac{3}{4}$ by $3\frac{3}{4}$ inches. The squares and sticks, while still frozen, were dipped in batter and then in breading according to accepted industry practices. The breaded squares were packed 20 to the carton and the cartons (minimum of 20) were returned to the freezer. The breaded sticks were deep-fat fried in vegetable oil according to customary procedures, cooled, and then packaged 72 sticks per carton and at

least 20 cartons per sample. The packs of sticks were refrozen in the company's plate freezers. Each processing operation was closely followed by laboratory technologists who carefully labeled boxes and cartons at every stage.

After all required samples had been prepared, they were collected together at a commercial cold storage and carefully reassembled by the technologists. For the convenience of the testing groups each master carton contained a sample of each processing variation for one species. Thus there were 20 master cartons containing haddock samples and each master carton contained four 5-lb. cartons of fillets (from fish iced 2, 5, and 10 days, and fresh frozen fish), four 20-portion cartons of squares, and four 72-unit cartons of sticks. Twenty master cartons contained similar ocean perch samples. Additional master cartons contained whiting and pollock fillets.

Nearly 3,000 pounds of finished products were shipped to Fort Lee, Richmond, Virginia. There they will be served to Armed Services test groups, representative of all areas of the country and all food preference backgrounds. The tests will be made soon after the samples arrive, and then after 3, 6, and 9 months of storage. Simultaneously part of each sample will undergo technological and chemical testing at the Quartermaster Food and Container Institute in Chicago. The Fish and Wildlife Service has been assured that the results of the tests will be publicized at the end of the investigation and will be made available on a current basis to guide in planning Service research projects for next year.

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## CLEANING FISH AND SHELLFISH FOR CANNING

Among the many quality factors which must have considerable control in canning fish and shellfish to assure a repeat business is that of cleaning the raw product. Oyster, clam, and crab shells are very necessary to the living shellfish, but are extremely hard on the customers' teeth and temper. Fish fins, tails, collar bones, and entrails are important also to the live fish, but in the canned product they are repulsive.

With today's prices of canned sea foods, the consumer has every right to expect the highest quality in every container he buys. It has been repeatedly demonstrated that good cleaning can be achieved at almost any production level. It is essential that the employees responsible for preparing the cleaned raw product be fully informed of the standard of quality expected, namely, that nothing should go into the can which he would not serve in his own kitchen.

--Seafood Scanners, May 20, 1954

# KEEPING QUALITY OF CHILLED DUNGENESS CRAB MEAT PACKED IN HERMETICALLY-SEALED CONTAINERS

Experimental work is being carried out at the Fishery Products Laboratory in Ketchikan, Alaska, to determine the keeping quality of dungeness crab meat when held at temperatures of 32° F. and above prior to freezing or after thawing. This project follows earlier studies which indicated that the storage life of frozen dungeness crab meat could be extended to 42 weeks by packaging the meat in hermetically-sealed, metal containers under vacuum and storing at 0° F. or below.

The data obtained on keeping quality at temperatures above freezing will provide a basis for formulating government purchase specifications and for developing practice recommendations for crab processing plants, wholesalers, shippers, and consumers. Organoleptic tests (color, flavor, odor, and texture), chemical determinations (volatile reducing substances, volatile nitrogen, indol, and pH), and total bacterial counts made at regular intervals will supply the needed information for following the course of spoilage of the product and could eventually lead to objective tests for better quality control.

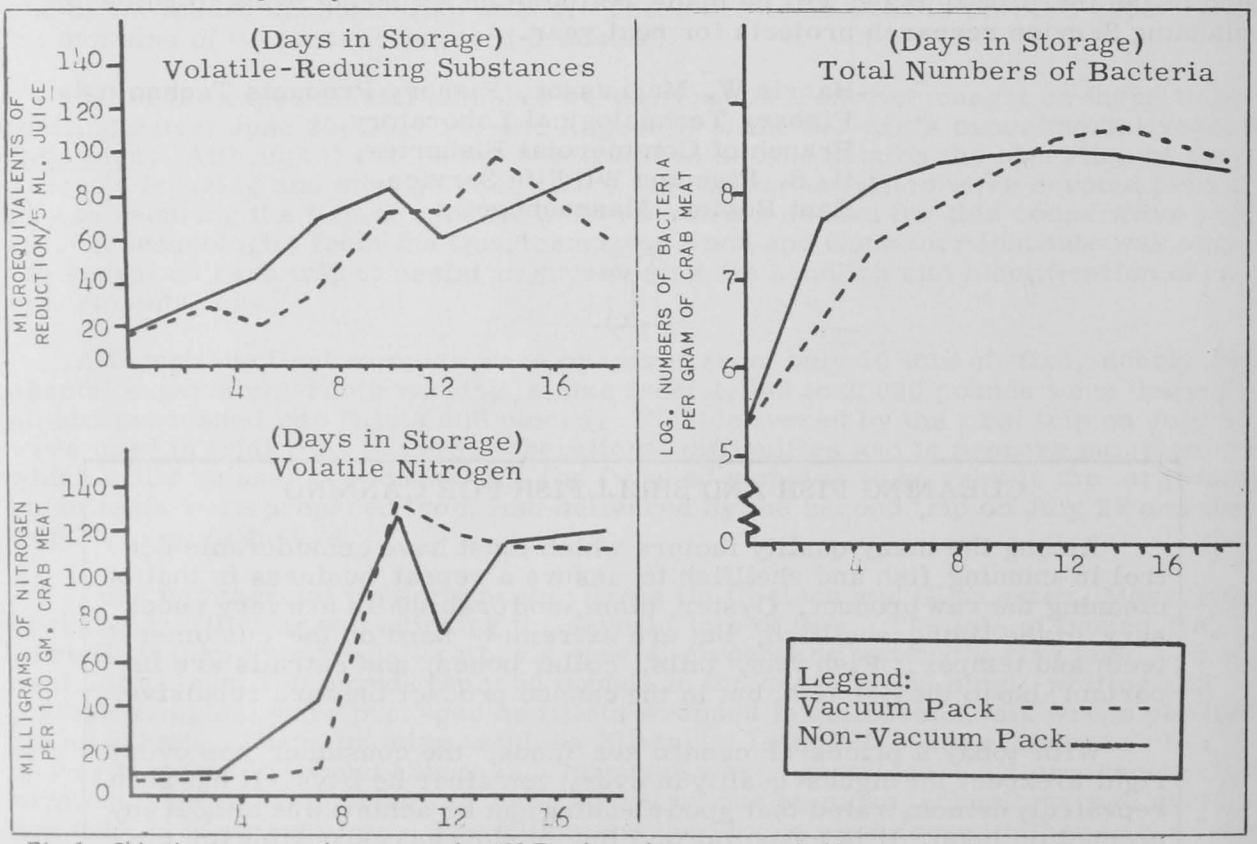


Fig. 1 - Objective tests on crab meat stored at 40° F. The crab meat was packed by two methods: (a) packed in cans and hermetically sealed under high vacuum, and (b) packed in cans and sealed at atmospheric pressure.

The initial experimental work has been on the keeping quality of fresh (unfrozen) crab meat packaged in cans, sealed under a high vacuum or at atmospheric pressure, and stored at 40° F. The data from the organoleptic examination indicated that the storage life of chilled dungeness crab meat stored at 40° F. was 7 days when the meat was packaged dry in cans and hermetically sealed under a high vacuum. The acceptable storage life of crab meat packaged dry in cans and hermetically sealed at atmospheric pressure was 5 days at 40° F.

The information shown in figure 1 represents the results of only one test series. However, in this series there was a definite increase in bacterial count, volatile nitrogen, and volatile reducing substances in the crab meat during storage. It was observed that changes in quality were not detected organoleptically until 2 to 3 days following a significant increase in the number of bacteria.

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## FILL OF CONTAINER FOR CANNED SALMON

Two requirements must be met to achieve a proper fill of container for canned fish: (1) that the net weight of the contents of the container must at least equal the label weight, and (2) that the container must be at least 90 percent filled. To attain the required 90 percent fill of container for canned salmon and taking into consideration the average specific gravity of salmon and the water capacities of various cans used, the following weights are necessary:

| Can Name | Can Size | Minimum Net Content |
|---|---|---|
| 4-pound | 603x405 | 4 lbs. |
| 1-pound tall | 301x411 | 16.2 oz. |
| 1-pound flat | 401x211 | 15.5 oz. |
| ½# st. | 307x201.25 | 8.2 oz. |
| ½# oval | 513x307x103 | 7.8 oz. |
| ½# C. R. | 307x200.25 | 7.75 oz. |
| ½# tuna | 307x113 | 6.8 oz. |
| ¼ pound | 301x106 | 3.75 oz. |

The opinion of official agencies is that all containers packed must be filled at least to the 90 percent level. If one consumer buys a one-pound tall can of salmon that weighs 16.7 ounces, and a second consumer buys a similar can of salmon that weighs only 15.7 ounces; the second consumer has not received the proper weight even though the cans average 16.2 ounces.

--Seafood Scanner, July 1954