FREEZING FISH AT SEA--NEW ENGLAND
Part 4 - Commercial Processing of Brine-Frozen Fish

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ABSTRACT

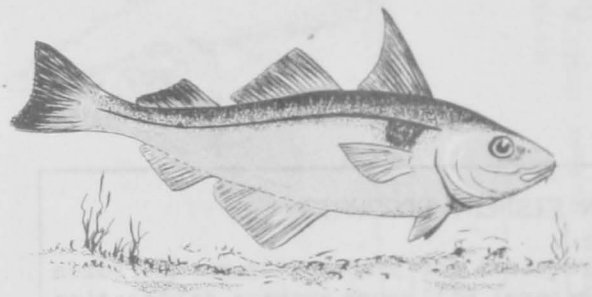
RESULTS OF THE FIRST SEMICOMMERCIAL-SCALE PROCESSING OF ROUND BRINE-FROZEN SCROD HADDOCK UNDER NORMAL FILLET-PLANT OPERATING CONDITIONS ARE DISCUSSED.

INTRODUCTION

This report presents preliminary data and observations resulting from the first semicommercial-scale processing of fish caught and frozen in the round on the Delaware during the fall of 1951. The Service's technological research vessel Delaware (a New England-type trawler) is equipped to brine freeze and store round fish frozen at sea.

FREEZING ROUND FISH IN BRINE

The M/V Delaware operated in the North Atlantic, using standard otter-trawl gear identical to that of the commercial fleet working out of Boston. The fish, when brought on deck, were sorted into these categories: scrod haddock, large haddock, market cod, and flounders. Other miscellaneous fish taken in the trawl were also segregated.



HADDOCK

The major portion of the catch during this period of fishing was scrod haddock; therefore, the emphasis in this particular study was placed on this variety. When the size of a haul was 1,000 to 1,500 pounds, the scrod haddock were divided into two approximately equal lots. The first lot was immediately washed and put into the brine-freezer tank, in approximately 200-pound units for each segment of the rotor. The brine in the tank had previously been brought to 6° F. As soon as the fish were loaded into the brine freezer, the rotor (see Part 3, pp. 16-25) was started. The fish were kept in motion in the chilled brine until completely frozen. After freezing, the fish were then removed from the brine and stored at 20° F. in the refrigerated area located in the after part of the fish hold. The second lot of scrod haddock from the same drag was dressed and iced in the forward part of the fish hold in accordance with normal New England trawler practice.

Whenever an insufficient amount of scrod haddock was taken in a single drag, the fish from one drag were dressed and iced, and those from the next drag were frozen round as prevously described. Since the area in which the fish were taken was the same in both cases, it is believed that no significant variable was introduced by using fish from separate drags to build up stocks of fish for comparison studies.

The other species, such as large haddock, cod, pollock, hake, and flounder (which were caught in minor amounts), were frozen in the same manner as the scrod haddock. These fish were also stored in the refrigerated hold.

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After approximately 4,000 pounds of frozen scrod haddock and 2,000 pounds of other frozen fish were accumulated, the vessel returned to port. As soon as the vessel docked, the round brine-frozen fish were transferred to storage at 0° F. in the cold-storage room at the laboratory. In order to simulate the usual commercial fleet 8- to 10-day cruise period, the iced fish stored in the forward part of the fish hold were left aboard the docked vessel for a total of five days.

PROCESSING FISH ASHORE

ICED FISH: The iced fish were removed from the fish hold, freed of ice in the pokes, placed in boxes, and hauled to a commercial fish-filleting plant where they were processed. At the plant the fish were weighed, scaled, filleted, and packaged in accordance with the company's standard commercial operating procedures. Laboratory-staff members checked on all phases of the operation. The foreman of the plant indicated that this lot of iced fish was equal in quality to the better lots of iced fish normally received from the commercial fishing vessels.

The general appearance and quality of the fillets was comparable in all respects to fillets of good quality prepared in the Boston area. The yield of fillets, using the "half nape" cut for filleting, was 47 percent of the dressed fish weight.

The packaged fillets were delivered to a commercial cold storage plant in Boston where they were frozen and stored.

FROZEN FISH: The brine-frozen fish were held in cold storage for a total of seven days; that is, two days on the vessel at 20° F. and five days in the laboratory cold-storage room at 0° F. At the end of this period, one lot of the round brine-frozen scrod haddock was removed and thawed at the laboratory pilot plant. Approximately 1,000 pounds of fish were put into a galvanized-iron thawing tank, measuring 3 by 3 by 8 feet, containing cold city tap water. A small centrifugal pump in one corner of the tank imparted movement to the water during the thawing process. For this lot of fish the water in the thawing tank was held at about 53° F. by the regulated addition of hot and cold city water; some water was discharged to make room for the added water to maintain the chosen thawing temperature.

The rate of thawing of round brine-frozen fish will be discussed in detail in another report. Suffice it to say that this lot of fish was in the thawing tank at the temperature indicated for 3¾ hours. Previous experiments with fish of this size group at this thawing temperature had established this time as adequate to complete the thawing operation.

At the end of the thawing period the fish were removed from the tank, placed in wooden boxes, weighed, and transported to the commercial filleting plant. Staff members, as before, were present at the plant during the processing of the round brine-frozen fish. They made their own observations at each stage and also secured comments from the workers engaged in each operation. The scaling-machine operator was of the opinion that the round brine-frozen fish scaled with less hand motions than the dressed fish and the scaling was just as thorough. In filleting, the "half nape" cut was used as in the case of the iced scrod haddock. The filleters encountered little if any difficulty in adapting their technique to the round fish. They did comment that the fish were considerably firmer than the iced-dressed fish normally delivered by the commercial fishing vessels. The filleting operation was completed within three hours from the time the fish had been removed from the thawing tank. The plant foreman indicated that the time required to process this lot of fish was comparable to that for an equal amount of dressed fish.

The fillets were carefully examined prior to packaging. No significant differences in appearance were noted between the fillets from the brine-frozen fish and those from the iced fish. The fillets were packaged in an identical manner to that used for the fillets from the iced fish.

The remaining body portions of the fish were collected and the viscera were removed and weighed. These data provided the necessary information to allow calculation of the fillet yield on the dressed fish basis. The amount of visceral material obtained was 10 percent of the weight of the round fish. Yield of fillets from this lot of fish was 49 percent of dressed (not round) fish weight.

A second lot of round brine-frozen scrod haddock was thawed substantially in the manner indicated above except that water at 72° F. was used and maintained at about this temperature during the thawing period of 1¾ hours. This lot of thawed fish was boxed, weighed, and transported to the fillet house for processing in the manner described above for the first lot of round brine-frozen fish. So far as could be determined by the laboratory-staff members and the foremen at the plant there was no significant difference between the second lot of round brine-frozen fish and the first except that the second lot seemed to be slightly less firm. Comments of the workers otherwise were similar to those made for the first round brine-frozen lot. The yield of fillets was 47 percent of dressed fish weight. The appearance of the fillets was pronounced as normal by the company workers and the foreman. Wrapping, packaging, and freezing of the fillets were according to the standard procedures of the company.

The balance of the round brine-frozen scrod haddock was processed in two lots of approximately 1,000 pounds each. Fillet yields were 47 percent of dressed-fish weight in each instance. Observations and comments were substantially the same as for the first lot of round brine-frozen fish processed.

The data as regards yield of fillets from round brine-frozen scrod haddock are presented with reservations, since it is to be expected that the filleters in the plant would either consciously or unconsciously be influenced by the fact that laboratory technologists were observing the operations, and by the fact that the fish represented an experimental lot. Under these conditions, it is entirely possible that the filleters might make a special effort to improve their workmanship, resulting in greater fillet recovery.

The samples of the packaged frozen fillets are now in storage at a commercial cold-storage plant in Boston where they will be held at a temperature of -10° to 0° F. for a period of six months. At intervals of two to six weeks, samples of each of the lots will be taken to the laboratory for comparison by means of taste-test panels. Free drip, press drip, and possibly other physical or chemical methods of evaluation and comparison will be used to supplement these taste tests.

The taste-panel results on the comparison of the fillets from the iced fish versus the fillets from the round brine-frozen fish after three months of storage indicate that there is no significant difference in flavor or appearance. The texture (as measured by resistance to shear) of the fillets from each lot of fish had, however, increased significantly in toughness at the three-month examination as compared with the texture at the previous examinations.

SMOKING OF FILLETS: The commercial processor tested a portion of the fillets obtained from the round brine-frozen haddock for their suitability for the preparation of finnan haddie. The processing procedure standard for that company was used. Finnan haddie prepared from the brine-frozen fish were compared with those prepared from iced fish. The finnan haddie prepared from these two lots was substantially

comparable, except that the processor observed a somewhat less pronounced sheen on the finnan haddie prepared from the brine-frozen fish. He stated, however, that this desirable sheen could possibly be obtained with the round brine-frozen fish by a minor adjustment in the technique of preparing the finnan haddie.

Some of the other miscellaneous species taken in the trawl, such as cod, pollock, and hake, were filleted and smoked by this same processor. Again the smoked fillets prepared from brine-frozen water-thawed fish compared very favorably with smoked fillets of the same species prepared from iced fish.

SUMMARY

The following observations seem to be warranted on the basis of the results of the first semicommercial scale processing of round-brine-frozen scrod haddock under normal fillet-plant operating conditions:

1. Round brine-frozen scrod haddock offer no complications for scaling and filleting aside from the usual period of minor adjustments in the technique used by the workers. In certain steps in the process, such as the scaling of the fish, there may actually be an advantage in favor of the round-frozen fish.

2. The yield of fillets obtained from the round brine-frozen fish was at least comparatively as high as that from control lots of iced, dressed fish.

3. The appearance of the fillets from brine-frozen haddock was in all instances comparable with that of good-quality fillets from iced fish.

4. No new problems are posed in the filleting, packaging, and freezing of fillets from round brine-frozen water-thawed fish. It is, however, recommended that, based on sound fish-handling practices which are as applicable to the thawed as to iced fish, the filleting, packaging, and refreezing process be carried out within a short time after the fish have been thawed.

5. Filleting the whole fish (containing the viscera) rather than the dressed fish apparently posed no problems during the filleting operation.

6. The appearance, flavor, odor, and texture of the fillets from round brine-frozen fish, thawed in fresh water held at 53° F. or 72° F., are quite acceptable.