

## FREEZING FISH AT SEA--NEW ENGLAND

### Part 7 - Pictorial Story of Operations at Sea and Ashore

Freezing fish at sea immediately after catching appears to offer the best prospects for maintaining uniform quality during extended trawler voyages required by an apparent scarcity of certain species of fish and the greater time required to obtain payloads. Upon being landed at port, these fish could be immediately thawed, filleted, and the fillets refrozen, or they could be held in frozen storage ashore for later processing.



THE EXPERIMENTAL FREEZING VESSEL DELAWARE EN ROUTE TO THE FISHING GROUNDS.

The U. S. Fish and Wildlife Service's Branch of Commercial Fisheries for the past five years has been investigating the practicability of such means of handling fish. Though these studies have been part of a refrigeration research program conducted at the various technological laboratories of the Service, the greater part of the work has been carried out at the laboratory located in Boston, Massachusetts. On the basis of preliminary experiments, the method of freezing decided upon for intensive study was that of immersion of the round (ungutted) fish in refrigerated sodium-chloride brine. On this basis, the trawler Delaware, formerly of the New England commercial fishing fleet and now in use by the Boston laboratory, has been outfitted with a brine freezer for freezing the fish at sea and, in addition, refrigerated holds for storing the frozen fish until the vessel arrives at port. A refrigeration plant of the absorption type supplies the refrigeration on the vessel.

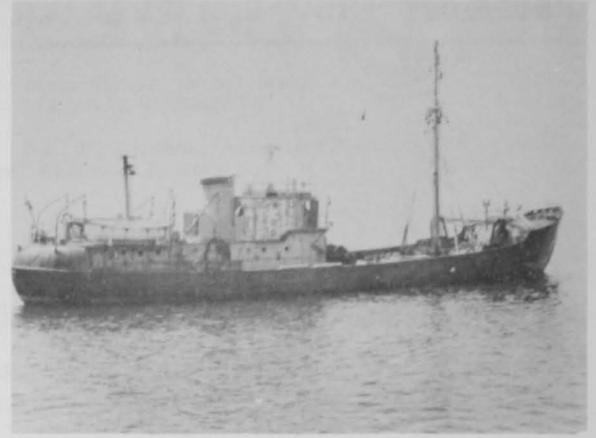
Immersion of the frozen fish in circulating water appears to be the best method of thawing. All freezing and thawing methods are being evaluated on the basis of chemical, physical, and organoleptic tests.

NOTE: PREPARED BY THE TECHNICAL STAFF, FISHERY TECHNOLOGICAL LABORATORY, BRANCH OF COMMERCIAL FISHERIES, U. S. FISH AND WILDLIFE SERVICE, BOSTON, MASSACHUSETTS.

## OFF TO SEA ON A TEST CRUISE



Casting off bow line. The Delaware departs on a test cruise from the North Atlantic Technological Research Station in Boston, Mass.

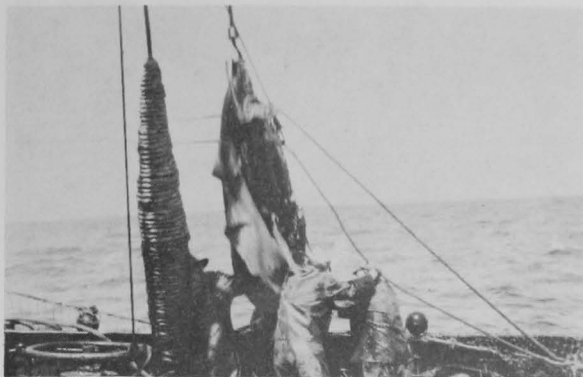


Starboard side view of vessel en route to sea. The Delaware has an over-all length of 148 feet; beam, 25 feet; and depth, 14 feet 8 inches.



The trawl is secured to the rail of the vessel en route to sea. A duplicate trawl is carried on the opposite side of the vessel. Fishing may be done from either side.

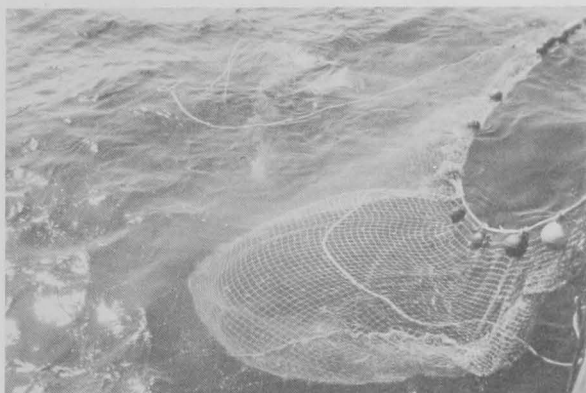
## OPERATING THE TRAWL



In setting the trawl, the cod end is the first part of the trawl to be hoisted over the side.



The wings of the trawl, which spread out to act as a "funnel" for guiding the fish into the cod end, are put overboard next.



The trawl is now in the water and sinking. Floats keep the upper part of the trawl from closing while fishing.

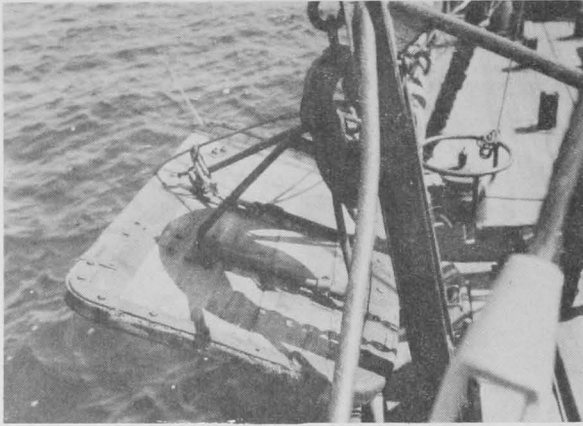


The vessel drifts away from the trawl.

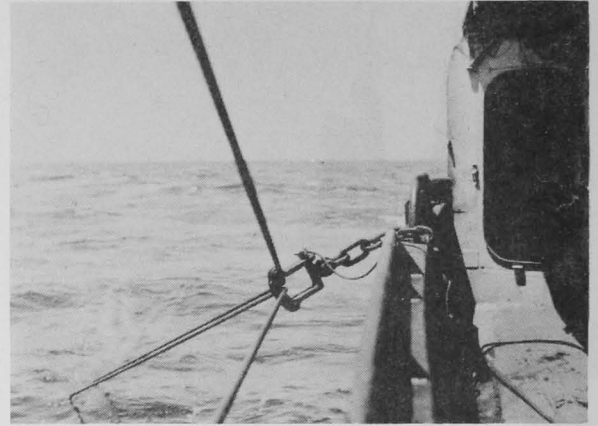
The vessel, under way, circles away from the trawl to avoid entanglement.



## OPERATING THE TRAWL (CONTINUED)

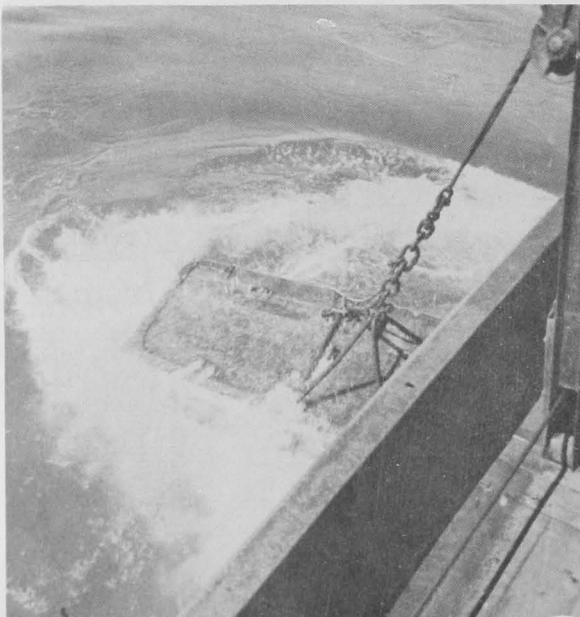


Forward trawl door ready to be dropped over the side. The after door follows immediately. The doors, set at opposite angles, serve to hold the sides of the net open when towed along the ocean bottom.

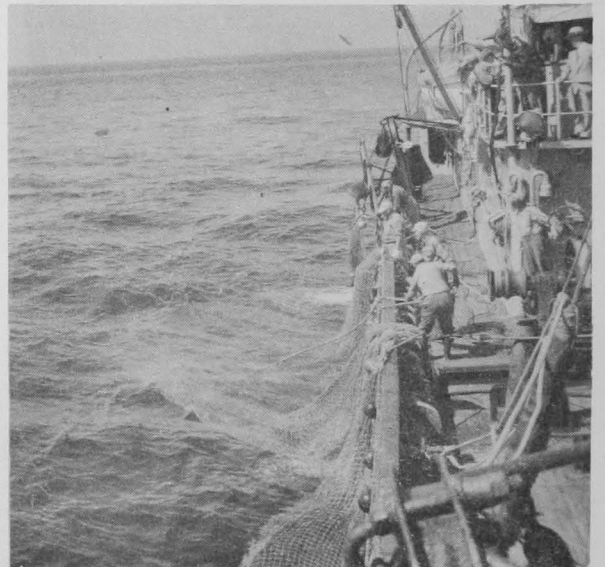


The two lines that tow the trawl are brought together in the towing block near the stern of the vessel, and the vessel now begins the tow. Towing time depends upon the abundance of fish and type of bottom. Time varies from 20 to 90 minutes.

## HAULING IN THE CATCH

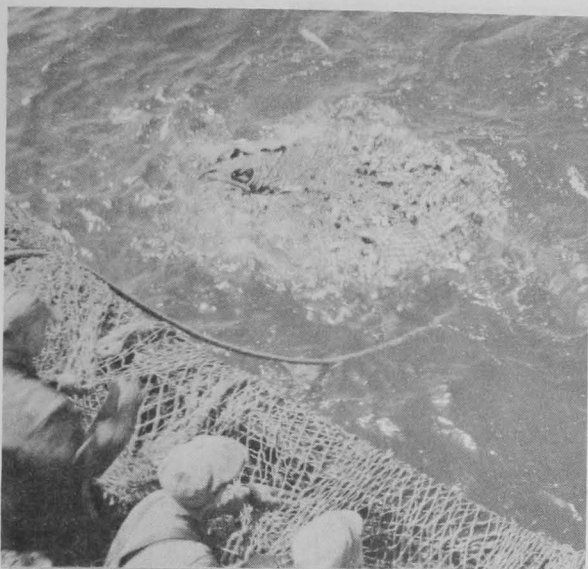


One of the doors "boils" to the surface as the net is being pulled back.



The net float line is being brought to the rail. The wings of the net are then hauled aboard the vessel.

## HAULING IN THE CATCH (CONTINUED)



The cod end of the net, holding a good catch of fish, floats to the surface.



Myriads of gulls participate in the harvest of fish. Sharks are also usually present to get their share of the catch.



The cod end or bag of fish is hoisted aboard. A fisherman releases drawstring at bottom of bag to discharge fish on deck.



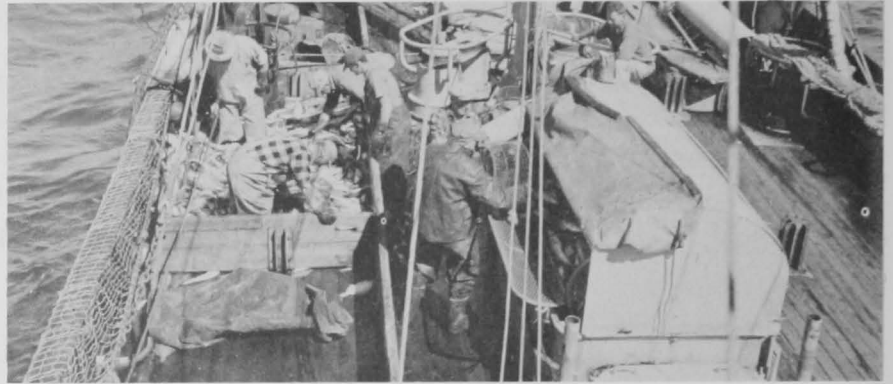
Cod end has been emptied and trawl is again put overboard for another tow.

## HANDLING FISH ABOARD THE VESSEL

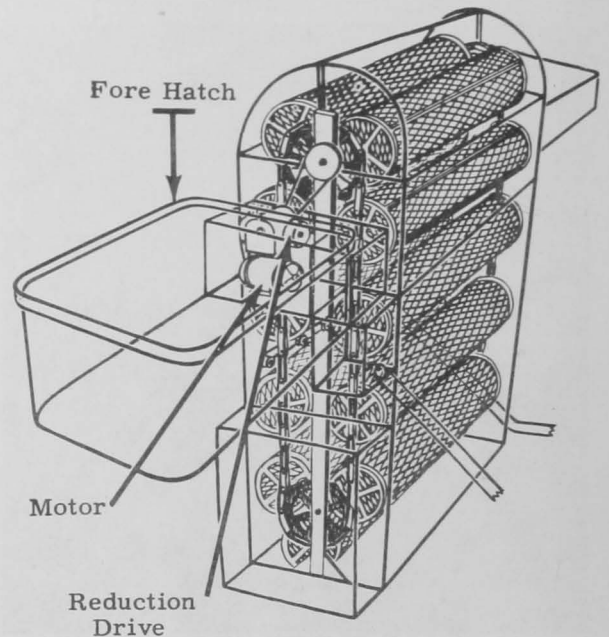


Close-up of a fine catch of scrod and haddock. Fish are held in "checkers" or bins on deck.

The brine freezer, located between the mid and aft hatches, is near the fish in the checkers and may be loaded from either side.



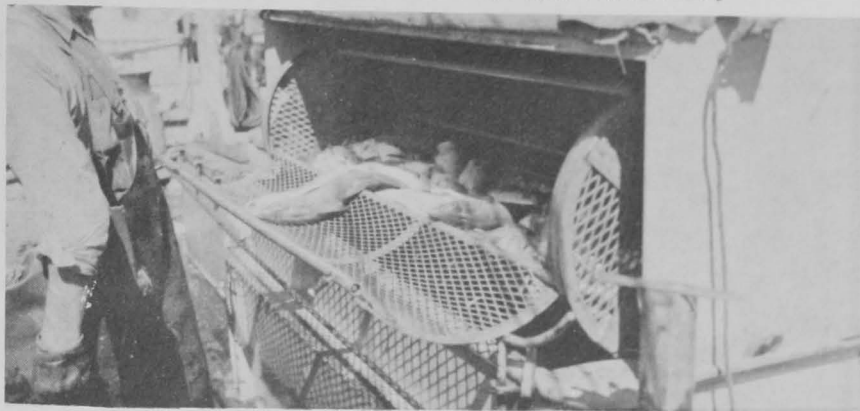
Fish, sorted by size and species, are transferred by baskets to the freezer. Some of the fish are eviscerated and iced for comparison with fish from the same catch frozen at sea.



Eleven expanded-metal, cylindrical baskets hold the fish for freezing. The baskets are conveyed through refrigerated, circulating brine.

## HANDLING FISH ABOARD THE VESSEL (CONTINUED)

Doors on the freezer baskets permit easy loading and unloading at deck level. Each basket holds about 400 pounds of round (ungutted) fish.



After the fish have been placed in the freezer basket, the entire mechanism rotates periodically immersing the fish in the refrigerated brine. Indicator dials on the end of the freezer cover show when each basket is ready for unloading.

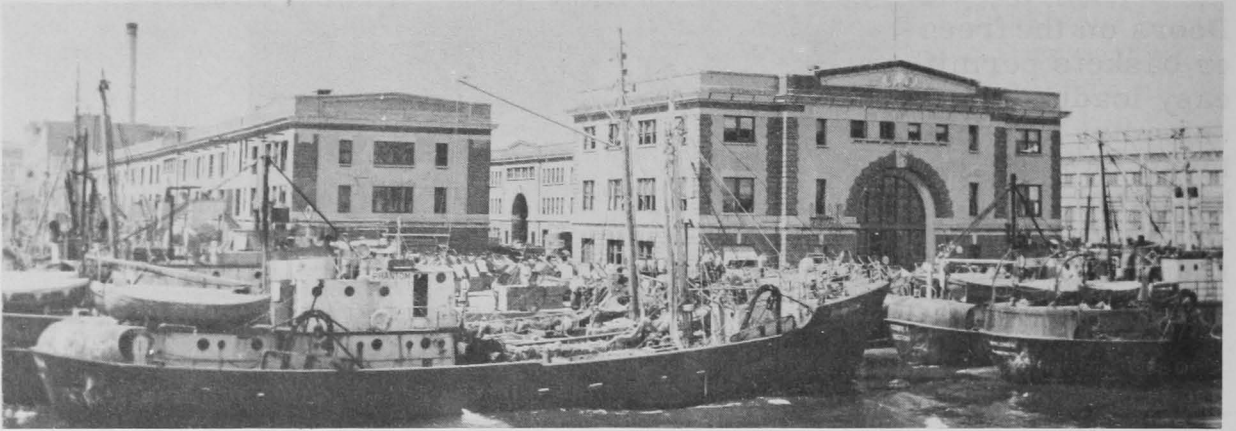


After the fish are frozen, they are unloaded from the baskets then conveyed by chute into the hold.



The frozen-fish hold, refrigerated by coils through which cold liquid is circulated, is maintained between 0 and 10° F.

## HANDLING FISH ASHORE



The Delaware arrives at the Boston Fish Pier to unload part of the catch.



A precedent is established when the Delaware discharges first commercial quantities of round frozen fish at the Boston Fish Pier.



Frozen fish are unloaded into large boxes for holding in commercial frozen storage.



Round frozen fish may be stored for a limited time in commercial cold storage until a backlog of raw material is on hand for efficient processing-plant operation.



## TRANSPORTING FISH TO LABORATORY



The Delaware returns to the pier at the laboratory to unload fish for experimental work.



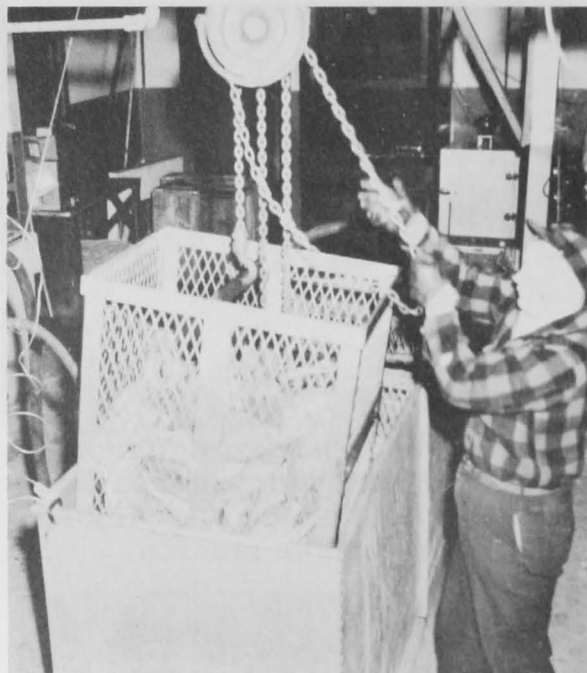
The fish are hauled by truck from the laboratory pier to the shore cold storage and pilot plant for further studies.

## PILOT PLANT OPERATION IN LABORATORY

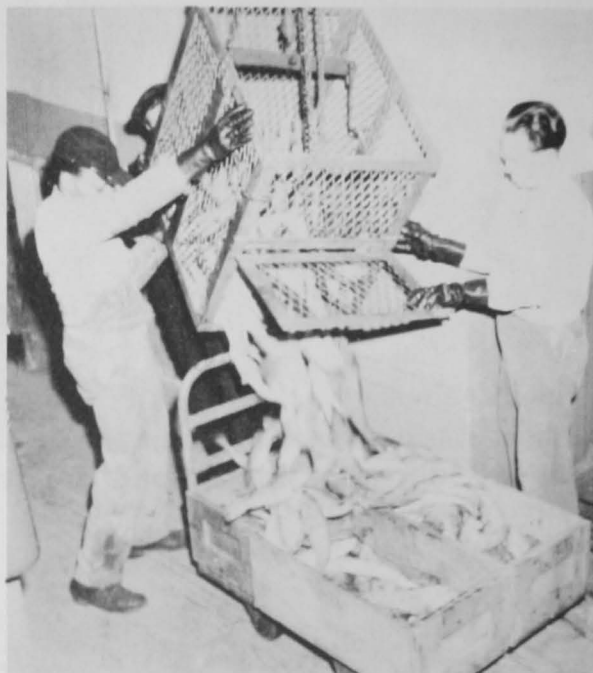
Round frozen fish are dumped into thawing tank. Circulating water at 60° F. is recommended for thawing. Reasonably tight boxes and hogsheads may also be used in place of large thawing tank.



## PILOT PLANT OPERATION IN LABORATORY (CONTINUED)



Defrosted round fish are hoisted from the thawing tank in perforated metal baskets for delivery to scaler and filleting line.



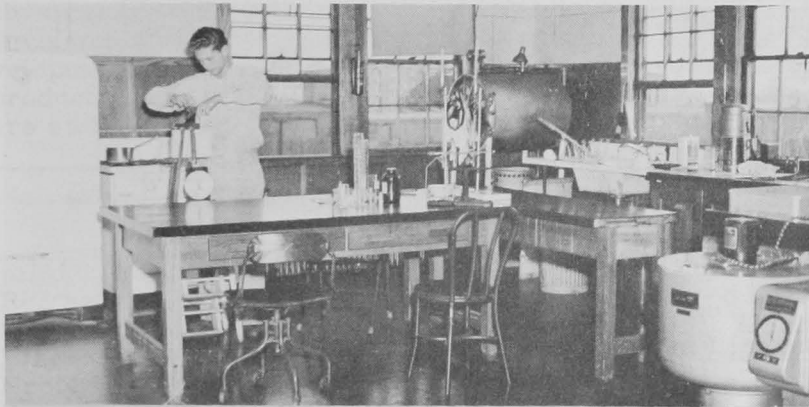
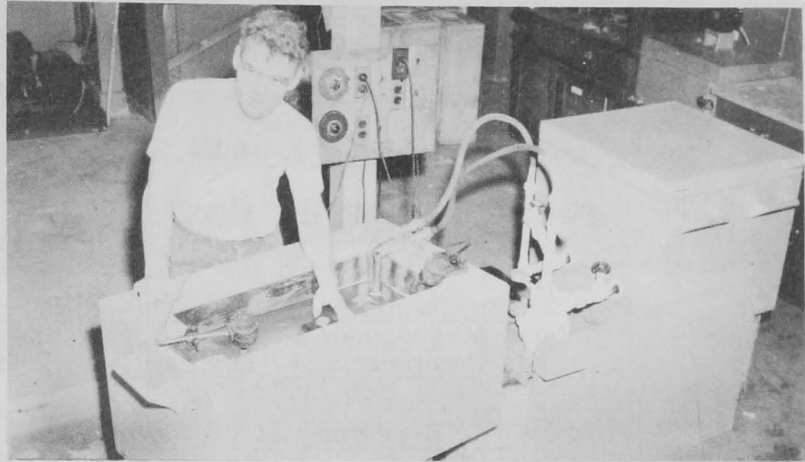
Fish are discharged through door in side of baskets.



Filleting round thawed fish. Note plumpness of fish. No new problems are posed in filleting, packaging, and freezing of fillets from round brine-frozen water-thawed fish. The yield of fillets obtained from round brine-frozen fish is at least as high as that from control lots of iced dressed fish.

## CHEMICAL AND ACCEPTABILITY TESTS

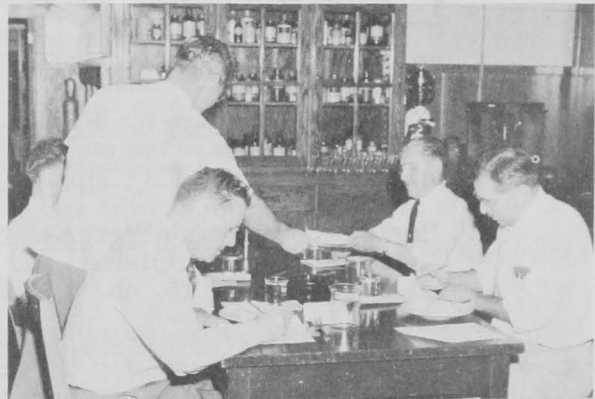
Small-scale freezing tests of fish in brine solution of various compositions and at different temperatures are conducted to determine effect on quality of the fish.



Chemical, physical, and palatability tests are conducted in the laboratory at time fish are landed by the Delaware and at intervals after holding the fish in frozen storage.



Laboratory tests are made on samples of fillets from brine-frozen round fish and from iced-dressed fish to determine comparative quality.



A taste panel composed of industry members determines quality of fillets prepared from round brine-frozen fish and from iced-dressed fish. Large-scale consumer tests of the fillets with families in the Boston area are also being conducted.

Further information regarding the freezing of fish at sea and the processing of the fish in shore plants may be obtained from the Fishery Technological Laboratory, U. S. Fish and Wildlife Service, 61 Sumner Street, East Boston 28, Massachusetts.

Reprints of the following publications are available without charge, upon request:

Freezing Fish at Sea--New England

- Part 1 - Preliminary Experiments, by Jean C. Hartshorne and Joseph F. Puncochar, Commercial Fisheries Review, vol. 14, no. 2, pp. 1-7, Feb. 1952 (Sep. 306).
- Part 2 - Experimental Procedures and Equipment, by H. W. Magnusson, S. R. Pottinger, and J. C. Hartshorne, Commercial Fisheries Review, vol. 14, no. 2, pp. 8-15, Feb. 1952 (Sep. 306).
- Part 3 - The Experimental Trawler "Delaware" and Shore Facilities, by C. Butler, J. F. Puncochar, and B. O. Knake, Commercial Fisheries Review, vol. 14, no. 2, pp. 16-25, Feb. 1952 (Sep. 306).
- Part 4 - Commercial Processing of Brine-Frozen Fish, by C. Butler and H. W. Magnusson, Commercial Fisheries Review, vol. 14, no. 2, pp. 26-29, Feb. 1952 (Sep. 306).
- Part 5 - Freezing and Thawing Studies and Suggestions for Commercial Equipment, by H. W. Magnusson and J. C. Hartshorne, Commercial Fisheries Review, vol. 14, no. 12a, pp. 8-23, Dec. 1952 - Supplement (Sep. 328).
- Part 6 - Changes and Additions to Experimental Equipment on the Trawler "Delaware", by C. G. P. Oldershaw, Commercial Fisheries Review, vol. 15, no. 3, pp. 25-28, Mar. 1953 (Sep. 345).

Fish Frozen in Brine at Sea: Preliminary Laboratory and Taste-Panel Tests, Technical Note No. 22, by S. R. Pottinger, J. Holston, and G. McCormack, Commercial Fisheries Review, vol. 14, no. 7, pp. 20-23, July 1952 (Sep. 318).

A New Liquid Medium for Freezing Round Fish, Technical Note No. 22, by J. A. Holston, Commercial Fisheries Review, vol. 14, no. 12a, pp. 36-40, Dec. 1952 - Supplement (Sep. 331).

A Portable Immersion Freezer, Technical Note No. 24, by C. G. P. Oldershaw, J. A. Holston, and S. R. Pottinger, Commercial Fisheries Review, vol. 15, no. 2, pp. 32-34, Feb. 1953 (Sep. 342).

