SUGGESTIONS FOR HANDLING TRAWLER-CAUGHT FISH

By J. F. Puncochar* and S. R. Pottinger**

INTRODUCTION

Methods of handling fish aboard the vessels engaged in the Atlantic offshore fisheries have changed very little in recent years. During this time, however, constant improvement has been made in vessel construction and equipment. Diesel power has almost entirely replaced steam for the operation of the larger vessels. In addition, some of the vessels are equipped with mechanical refrigeration in the hold. Mechanical refrigeration, supplemented with ice, helps to maintain a proper storage temperature during the comparatively long fishing trips. The crews are being provided with better living quarters on the newer vessels. Automatic indicators record the depth of water continuously, thus shortening the time required in locating the most desirable fishing grounds. On some vessels, ship-to-shore radio communication is maintained so that fish can be landed as desired to maintain an even flow of production. Although many improvements have been made on the vessels and fishing gear, changes in the methods of handling the fish aboard the vessels and ashore have received only limited attention.

By far the greater part of ground species landed at New England ports is brought in by otter trawlers. During the latter part of 1947, a total of 385 trawlers of all sizes were operating in the principal ports of the area. Of this number, 68 were large (151 gross tons or over), 111 medium (51-150 gross tons), and 206 were small (5 net tons to 50 gross tons). Large trawlers average 2.6 trips monthly and are absent 7.5 days. Medium and small trawlers average 2.7 and 5.6 trips monthly and are absent 6 and 1.3 days, respectively. Landings of fish and shellfish for August 1947 totaled 59,166,394 pounds at the principal Massachusetts ports. Of this amount, the trawling fleet landed 45,949,000 pounds.

A number of trips were made aboard trawling vessels during the past several years by personnel of the Division of Commercial Fisheries for the purpose of collecting data and observing methods of handling fish. In addition, information relative to methods followed on individual boats was obtained through interviews with captains, owners, and crews. The findings, as well as recommendations for improving handling methods, are discussed in this report.

HANDLING FISH ABOARD VESSELS

In otter trawl fishing (Figure 1, see p. 11) otter nets or "trawls" are dragged along the ocean bottom by the vessel at a speed of approximately three knots, for a period varying from an hour to an hour and a half. The net is then brought aboard and the closed or "cod" end of the net containing the fish is suspended a short distance above the deck. The closed end of the net, which is pursed with a heavy rope, is then released. The fish fall on deck into "pens" or "checkers" (Figure 2, see p. 12) which are made of sturdy, removable boards called "checker boards." After discharging, the net is examined for tears and, if in good condition, it is immediately placed back into the water to repeat the dragging operation. If badly torn, an alternate net on the opposite side of the vessel is used.

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Repairs to badly torn nets are made when time permits. Fishing is often conducted throughout the 24 hours of a day, the crew being divided into two groups which alternate in shifts, usually of six hours' duration.

Immediately after the net has been returned to the water and trawling has been resumed, the fishermen begin to prepare the fish for storage. Fish, as they are brought aboard, are in excellent condition with the exception of a few that may be torn or bruised when the net is hauled in. Before storage in the hold, most of the varieties are eviscerated, although the smaller species such as flounders, butterfish, and rosefish, which are often found in the net, are generally stored in the round. Evisceration or "drawing" is generally accomplished in two major operations. Standing in the mass of fish, one group of fishermen slit the stomach wall after which the fish are tossed to other "checkers" and evisceration is completed by another group. After separation, the fish are transferred from the "checkers" to the wash-box by means of forks. Continuously circulating sea water is utilized in washing the drawn fish. During washing, the fish are agitated with a three-tined fork. After washing, they are forked from the wash-box into an open hatch, dropping to the floor of the hold. On the small trawlers, the drawn fish are usually washed in the "checkers" with water from a hose and wire baskets are used for lowering the catch into the hold.

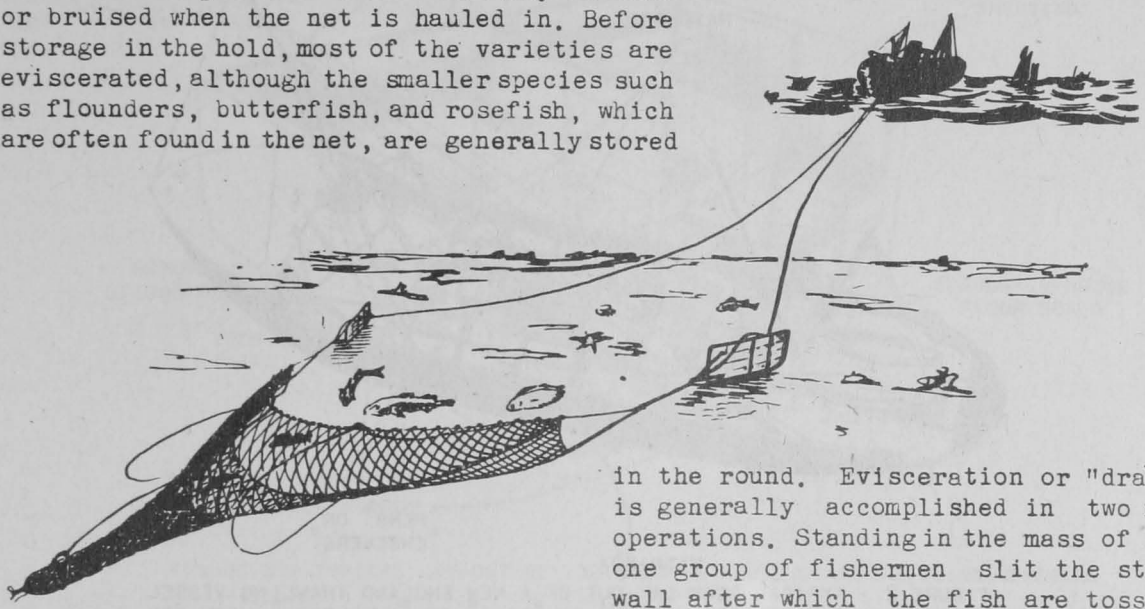

FIGURE 1 - OTTER TRAWL FISHING.

After the drawn fish are put into the hold, most of the viscera and remaining "trash," or commercially unimportant fish, are shoveled overboard and the deck is washed down. No effort is made to separate and save the livers and other waste at present.

Fish are stored in pens in the hold in alternate layers of ice as described by Knake (1946). Three-tined forks are used on the larger vessels for lifting the fish from the floor to the pens. Ice, which is crushed before being put aboard the vessels, is stored in alternate bins of the hold so that it is readily available to all storage compartments. The crushed ice varies in size from fine particles up to pieces as large as the fist.

The quantity of ice used for storing fish varies widely. Small trawlers carry up to 5 tons, medium ones about 15 tons, while approximately 30 tons are carried by the large vessels. The proportion of ice to fish is in the order of one to two or three by weight. More ice is required in warm weather than in cold weather. Pens that are situated near the engine room bulkhead are subjected to

somewhat higher temperatures and, consequently, must be provided with a greater quantity of ice than those in other sections of the hold. Vessels having mechanical refrigeration do not require as much ice as those depending on ice alone because the added refrigeration prevents the ice from melting rapidly.

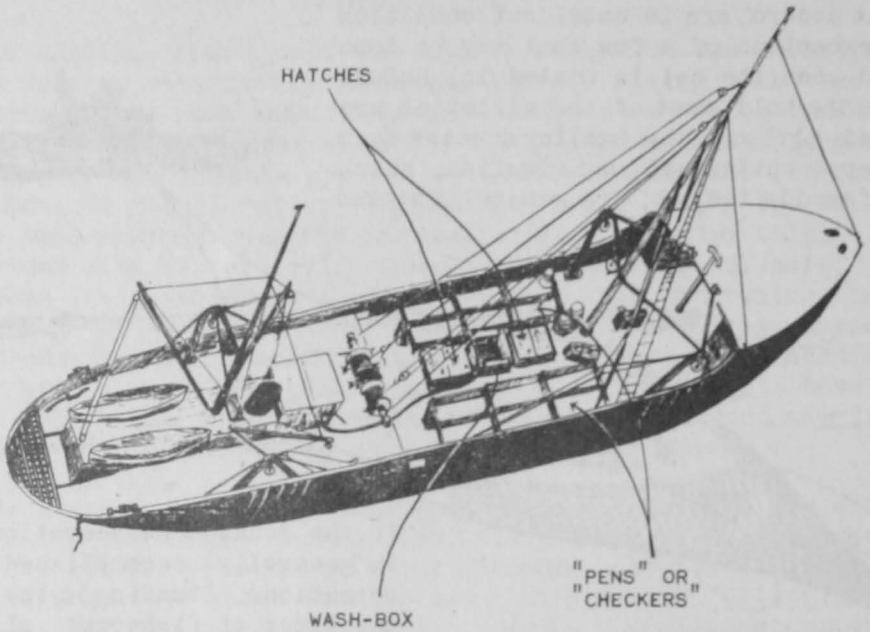

FIGURE 2 - TYPICAL DECK LAY-OUT OF A NEW ENGLAND TRAWLING VESSEL SHOWING ARRANGEMENT OF "PENS" OR "CHECKERS," WASH-BOX AND HATCHES.

Most vessels have holds constructed of wood. The surface of the wood is very rough in most cases, due principally to softening by water and to damage from forks. Some of the newer vessels have cork insulated holds lined with metal.

Several systems of mechanical refrigeration are in use. One system employs the circulation of cold air around the entire hold, between the metal lining and the hull and deck of the boat. Another utilizes cooling coils in the upper part of the hold. Pens for storage are situated on each side of the hold, and on the large trawlers have an average dimension of 4½ feet by 4½ feet wide by 9 feet high. The sides are built up with "pen boards" as the height of the fish and ice increases. The individual pens, divided horizontally by removable boards, vary in depth but they are generally about 5 feet deep in the large vessels. Several newer vessels, however, have pens about half this depth. A passageway or "slaughter house" extends down the center and for the entire length of the hold. This space is often used for storing fish which are caught toward the end of the trip. The "pen boards" are painted in most instances when new, but the paint soon wears off and they are then often used in this condition until discarded. After a short time, they become quite rough and water-soaked. A typical lay-out of the hold of New England trawling vessels is illustrated in Figure 3 (see p. 13).

UNLOADING FISH

Fish are transferred from the vessel to the dock in metal-framed canvas baskets holding from 75 to 125 pounds. A mechanically-operated winch on the vessel is used for hoisting the baskets from the hold. In unloading larger vessels, several

baskets are used simultaneously, one being emptied while the others are being filled. Fish caught toward the latter part of the voyage are generally unloaded first because of greater demand for the fresher fish. Forks are used for removing

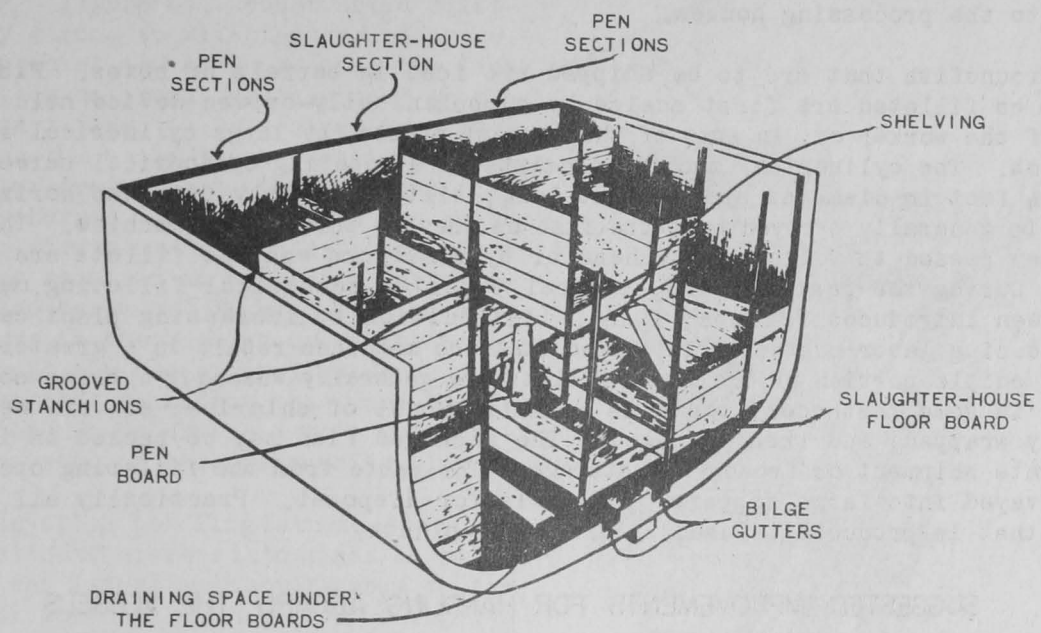

FIGURE 3 - TYPICAL LAY-OUT OF THE HOLD IN NEW ENGLAND TRAWLING VESSELS.

fish such as haddock, cod, whiting, etc., from the pens and for placing them in the unloading baskets. At some ports, shovels are used for handling rosefish and flounders, although this results in the inclusion of considerable ice in the weighing boxes. In certain ports, a 5 percent or more discount in weight is allowed to take care of extra ice.

The method of weighing varies somewhat at the different ports. At one of the principal fishing ports, baskets of fish are dumped into wooden boxes of 500 pounds capacity which are on platform scales. At other ports, fish are usually weighed in the baskets or are dumped from the baskets onto pan scales.

HANDLING ON THE DOCK AND IN THE PACKING HOUSES

After being weighed, fish are forked from the boxes into two-wheeled, wooden carts of about 1,000 to 2,000 pounds capacity, or, more rarely, into boxes having a capacity of about 500 pounds which are carried on small trucks pulled by a tractor. Fish in carts and boxes are usually iced and covered with a tarpaulin if they are to remain on the pier for any length of time prior to packing or processing.

Removal of fish from the carts is accomplished in one of several ways. If barrel orders are to be filled, the fish are placed in barrels by hand or with a grapple hook. The general practice, however, is to fork the fish from the carts, particularly if they are to be placed on filleting tables. In some cases, the carts are tipped so that the fish are dumped onto the floor before being forked onto the tables. In other instances, fish are dumped onto a platform and carried by mechanical conveyors to the filleting room. Several processors use carts having removable bodies which are lifted from the chassis with a hoist and conveyed to the processing room. When boxes are used for bringing the fish from the boats

to the processing plants, they are hoisted mechanically, carried by an overhead conveyor to the desired point, and dumped onto a table or into a hopper. Fish that are weighed in baskets or in pan scales are usually dumped into boxes or barrels if they are to be shipped out, or into boxes or small carts if they are going to the processing houses.

Groundfish that are to be shipped are iced in barrels or boxes. Fish that are to be filleted are first scaled by a mechanically-driven device held in the hand of the worker or, in some of the largest plants, by large cylindrical scaling machines. The cylindrical machine consists of a rotating cylindrical screen drum about 4 feet in diameter and 20 feet long, tilted slightly from the horizontal. Water is generally sprayed onto the fish as they go through the machine. The fish are then passed to filleters by hand or by conveyors and the fillets are cut by hand. During the past 2 years, several types of mechanical filleting machines have been introduced (Ziemba, 1946). In addition to increasing plant capacity and reducing labor costs, it is stated that the machines result in a greater yield of the edible portion of the fish. Fillets are generally washed in a brine solution which, in some instances, contains a small amount of chlorine, and are weighed, usually wrapped, and then packaged. The packaged fish may be packed in ice for immediate shipment or frozen for storage. The waste from the filleting operation is conveyed into large hoppers or barrels for disposal. Practically all of the waste that is produced is used by fish meal plants.

SUGGESTED IMPROVEMENTS FOR HANDLING ABOARD THE VESSELS

Present methods of handling most species of North Atlantic fish aboard the vessels and during the unloading operations are based largely upon the use of forks from the time the fish are eviscerated until they are placed in the baskets for unloading. Further use of forks is frequently encountered from the time the fish are weighed until they are shipped. Consequently, a number of fork holes are made in the flesh of many of the fish. Each of these holes serves as a portal of entry for bacteria, if not actually the site of an inoculation of bacteria into the flesh by the tines of the fork. The fork holes may be a focal point of rapid spoilage under certain conditions and also cause unsightly red spots in the flesh, which are particularly noticeable in fillets.

Further damage to the flesh may be brought about by bruising, thus causing softening, discoloration of the flesh, and subsequent rapid spoilage by enzymes and bacteria. Excessive pressure on the fish in the pens is undoubtedly a major factor in causing bruising, particularly when large, jagged pieces of ice are present. The sharp edges and corners of the large pieces of ice pressing against the fish cause much physical damage. This is further aggravated by the motion of the boat in rough weather.

All of these factors, even though they may seem insignificant if taken separately, become very important when added together. Their cumulative effect over the entire length of the trip will have an adverse influence on the condition and ultimate appearance and keeping quality of the fish.

Various new methods were considered for improving handling practices aboard vessels and at the ports during the course of this study. Very little unutilized space is to be found on a fishing vessel, and, consequently, this has been taken into consideration when making recommendations for changes. Practically all of the changes which are suggested can be made with little or no additional labor and space requirements and at a relatively small additional cost.

A means of eliminating the use of forks for transferring the fish from the wash-box to the hatch that would be practical without prohibitive cost was suggested by Puncochar and Pottinger in an earlier report (1939). A rectangular basket or grating (Figure 4), constructed sufficiently strong to withstand rough usage, and sloped at the ends so that the fish will slide out readily, is placed in the wash-box. When it is desired to remove the fish, one end of the basket is raised, the water drains from the fish and they are discharged directly into the hatch or into wire baskets. No additional space would be required on deck for installation. Another possible means of eliminating forks in the washing operation would be through the use of shallow dip nets to transfer the fish from the wash-box to the hatch. These are used to a small extent in some of the processing plants.

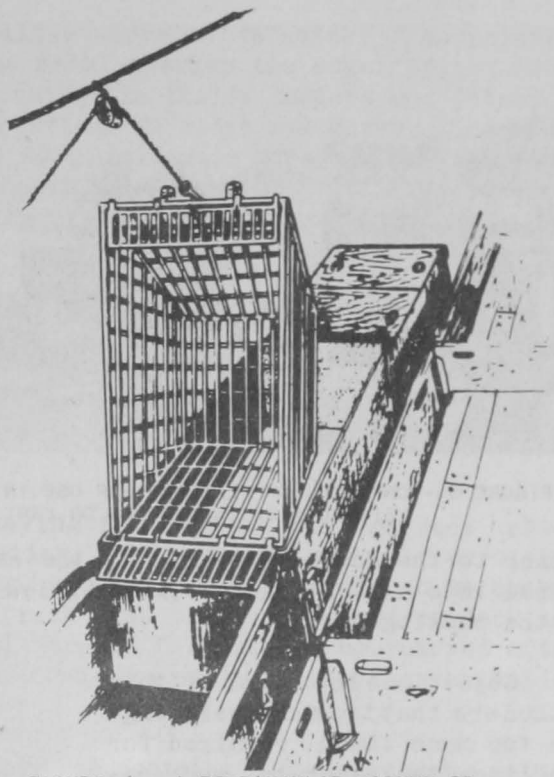

FIGURE 4 - A RECTANGULAR BASKET OR GRATING IN POSITION FOR DISCHARGING FISH INTO HATCH.

The extra handling introduced by the segregation of species into sizes in piles on deck and later transferring them to the wash-box could be minimized by using two wash-boxes or one wash-box with two gratings so that practically all of the drawn fish could be washed as they are eviscerated. The additional handling of the fish with forks when being transferred from the pile to the wash-box increases the possibility of bacterial contamination. Throwing them to one side undoubtedly causes some bruising as well.

The distance that the fish drop from the hatch to the floor of the hold may be as much as 9 to 10 feet. In order to lessen the bruising caused by the impact of hitting the floor from such a height, fish can be lowered into the hold in wire baskets.

Bruising and crushing of the fish in the pens can be reduced through the use of shallower pens as suggested by Ellison (1934) and by Puncochar and Pottinger (1947). Pens of one-half the present depth (5 feet) markedly reduce the amount of physical damage and loss in weight, and result in a better quality of fish upon landing.

SUGGESTED IMPROVEMENTS FOR UNLOADING VESSELS

The problem of handling fish during the unloading of the boats at their destination becomes more complicated because of the necessity of separating the fish from the ice before they are hoisted to the pier for weighing. The time element is important because employees of filleting plants are waiting for sufficient fish to be brought to them in order to begin operations. Likewise, the packing houses have orders to be filled which often require large quantities of fish to be shipped out quickly. Therefore, the boats must be unloaded rapidly in order to supply the demand for fish. It is common practice to unload from 100,000 to 200,000 pounds of fish from a single large trawler within 4 to 6 hours.

One of the principal methods in use at present for unloading and weighing fish requires the use of forks in removing the fish from the weighing box. This not only causes further damage to the fish but also accounts for piercing and splintering of the wood of the weighing box, resulting in a surface that accumulates fish scales that are difficult to remove. An improvement over this method of weighing, which eliminates forking, was found to be in use at some ports. A platform (Figure 5) several feet in height and of sufficient size to hold a weighing scale and 2 or 3 workmen, is used. The fish are hoisted in the usual manner to the scales, weighed in the canvas basket used for unloading, and then dumped into a short chute which carries them to boxes or carts for transportation to the packing houses.

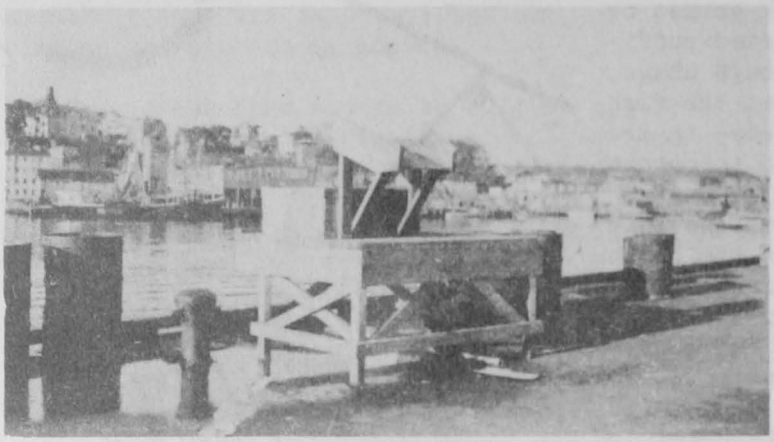

FIGURE 5 - ONE TYPE OF PLATFORM FOR USE IN DISCHARGING WEIGHED FISH INTO BOXES OR CARTS.

Objections to the use of this method are that too many weighings and too much time is required for handling the separate and comparatively small quantities of fish that are contained in the canvas baskets. An improvement over this method was suggested by Puncochar and Pottinger (1939) and Firth (1947) and was used for a short period at one of the principal ports (Figure 6). After weighing, the box is tilted, the end is opened, and the fish slide into the cart. The box should be lined with corrosion-resistant metal, having round inside corners with all seams soldered to prevent water and gurry from seeping beneath the lining.

FIGURE 6 - A WEIGHING PLATFORM AND BOX WITH HINGED END FOR DISCHARGING FISH INTO CARTS.

SUGGESTED IMPROVEMENTS ON THE DOCK AND IN THE PACKING HOUSES

As previously mentioned, it is common practice to place the fish in carts or boxes after being weighed. These containers are of wooden construction and when new, are ordinarily painted on all surfaces. A bakelite varnish is sometimes used on the inside surfaces, providing a tough coating which is more readily cleaned than painted surfaces. Since the carts and boxes are constructed of wood, inside surfaces are frequently found to be roughened and covered with an accumulation of fish scales and gurry. Fish scales and gurry, when once dried, are difficult to remove. Consequently, boxes and carts should be cleaned thoroughly with a

stiff brush and running water at the end of the day. Where live steam is available, it should be used in preference to the brush method for cleaning.

Corrosion-resistant metal linings would be more satisfactory than paint or varnish for carts and boxes. By having the metal overlap the edges of the wood, soldering all seams and nail heads, and rounding the inside corners and joints, a lining would be provided which would be impervious to water and gurry. The metal could be more readily cleaned than wood and would provide a more sanitary surface. The use of forks for transferring the fish from the carts to the filleting table can be eliminated through the use of shallow dip nets. The dumping of fish from the carts to the floor is not good practice. Bacterial contamination from this source will hasten deterioration.

MISCELLANEOUS CONSIDERATIONS

During a number of trips that were made on the vessels, several faulty practices other than those already mentioned were found in use which have a bearing on the ultimate keeping quality of the fish.

A practice often seen was that of leaving the "trash" fish on deck, after taking out the commercially important varieties. This "trash" was only partially removed at times and it was often allowed to remain on deck long enough to become quite putrid. Bacterial contamination of fresh fish that are dumped on deck may result from this source. Consequently, all "trash" fish should be removed after each haul and the deck and "checkers" washed down thoroughly to keep contamination at a minimum.

The water in the wash-boxes becomes bloody and contains much extraneous matter after a small quantity of fish are washed. Wash-boxes were frequently found to be only partially drained before the next lot of fish was placed in them. As a result, subsequent lots of fish are not washed as well as they might be if clean water were used. Therefore, the wash water should be drained completely after each lot of fish is washed.

Some attempt should be made to improve the surface treatment of the "pen boards" that are used for making up pens. These boards are often used without being painted, and even when painted, the coating is usually worn off to the bare wood in a short time. In this condition, they quickly become water-soaked and rough, making cleaning difficult and thus producing a medium for the growth of bacteria. The boards should be thoroughly dried and coated at frequent intervals, with consideration of the use of the newly-developed water-resistant plastic resins.

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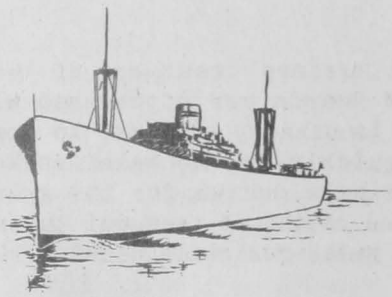
HOW TO LABEL GOODS FOR SHIPMENT ABROAD

A comprehensive booklet containing detailed descriptions of how to mark and label goods or their containers for export to foreign countries has just been issued by the Office of International Trade.



Entitled Foreign Marks-of-Origin Regulations, the booklet tells exporters about the customs regulations prescribed by the various foreign countries as a condition of entry and sale to avoid goods being subject to possible customs fines or delays in or even refusal of admission.

Marking is usually routine in foreign trading. However, it should be done, in full compliance with regulations, at the time the goods are being manufactured or packed. It is often difficult or expensive to attempt to affix the proper markings later on when the goods are about to be exported or after the shipment has arrived at the foreign port. Where special markings of origin are necessary for specified products or under special conditions, such requirements are given in detail.

The booklet is available from the U.S. Department of Commerce, Special Business Service Desk, Room 6066, Washington 25, D. C., for 35 cents per copy.