



PRESERVATION OF SEAFOODS



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Foreword

Commercial fishing has long been one of the most important industries in Oregon. The salmon of Oregon's rivers has been the species most extensively used. More recently, tuna has become a large and important fishery. Now the rock and bottom fishes are coming into the foreground. Then, too, some other little-known seafoods products have been used for human consumption. As the science of food technology progresses, Oregon will move forward in the field of commercial seafoods processing to make it one of the leading industries in the Northwest.

The purpose of the Seafoods Laboratory is to study means of improving present methods of marine foods preservation and to derive new foodstuffs from such sources. This circular has been written as a result of some of this work and is now revised to include some improved processing techniques. It is being printed because of the economic need of additional protein in the diet.

A handwritten signature in cursive script, reading "Wm. A. Schoenfeld". The signature is written in dark ink and is positioned above the printed name and title.

Dean and Director

Preservation of Seafoods

By Edward W. Harvey

PROCEDURES for the preservation of some seafood products are discussed in this circular. These procedures combine both old and new information.

These methods have been worked on in the Seafoods Laboratory* at Astoria, for varying periods during and since the war. Some methods will necessarily need to be changed to suit certain conditions in the plant or home. The plan or principle of a given procedure, however, must be followed to give satisfactory results.

As with any method of food preservation, seafood products must be of good quality to begin an operation. Inferior quality at the start can mean only an inferior finished product. The wise producer will see to it that he receives his fish or other marine products in good condition, and that his plant operational plan is set up in such a manner as to produce the finished product most efficiently. Straight-line operation and rapidity of handling and processing are important factors in the production of fishery products. To the new processor it is suggested, therefore, that the detail of operation and handling be given consideration before he starts to work.

Clams

(Razor, Steamer)

Canning clams

1. Scrub steamer clams with a brush if necessary and then allow them to stand 2 to 3 hours in fresh salt brine, 3 per cent ($3\frac{3}{4}$ ounces salt per gallon of water) to clean themselves. Razor clams do not need such treatment. They clean readily after being opened when washed thoroughly in plenty of fresh water.
2. Open clams by one of three methods:
 - ▶ Put clams into a steaming container in which a clam liquor-catching pan has been placed. They will steam in 1 to 5 minutes.
 - ▶ Submerge in boiling water until shells open.
 - ▶ Open them raw, shuck, saving the juice or liquor. This method of opening is preferable if time permits, because the appearance and flavor of the clams will be

* A branch of the Food Technology Department, Oregon Agricultural Experiment Station, Corvallis.

better. If clams cannot be canned right away it is possible to store them at 0° F. in the shell for a 3- or 4-week period if they are subjected to live steam for 60 seconds (only) at 200° F. and immediately cooled in water prior to freezing. Glazing with water is advantageous if clams are to be stored for 3 or 4 weeks. As the clams are opened and removed from the shell, the stomach or dark mass should be opened and its contents completely removed.

3. Wash all clam meat thoroughly in fresh water or a weak brine (2½ ounces salt per gallon of water). Clean the neck (or siphon) and the stomach carefully. Slit lengthwise to clean.*
4. Optional: Dipping or immersing the meats in a boiling citric acid bath will improve the pack in color and flavor. Use ½ teaspoonful citric acid crystals (obtained in drugstore or chemical supply house) per gallon of water.
5. Grind clam meats or leave whole as desired.
6. Pack into C-enamel cans or glass jars, leaving ¾ to 1 inch space at the top of container (Table 1).
7. Add ½ to ¾ teaspoonful of salt per container or to suit taste.
8. Cover meat with hot clam liquor and/or hot water to within ¼ to ⅝ inch of the top of container.
9. Seal containers immediately.
10. Process at 240° F. (10 pounds pressure).

Table 1. PROCESSING TIME FOR CLAMS

| | 8 ounce tin | 1 pound tin | ½ pint jar | 1 pint jar |
|--------------------------|-----------------------|-------------|------------|------------|
| Whole clams | 60 minutes | 70 minutes | 70 minutes | 80 minutes |
| † Minced or ground | 70 minutes at 228° | 70 minutes | 70 minutes | 90 minutes |

† Note: 5½ ounces ground clam for 8 ounce can or a ½ pint jar; 12 ounces or 1½ cups ground clam to a pint jar or No. 2 can.

Freezing clams

1. Remove sand or dirt by hosing, holding under a faucet, or brushing. Steamer clams should be allowed to stand in fresh water or a weak 3 per cent brine (3¾ ounces salt per gallon of water) for 2 to 3 hours so they will void themselves of some internal dirt and sand. Razor clams may be flushed free of sand or other foreign material by carefully washing the meats in fresh water.

* Shell fish poisoning in clams and mussels has rarely occurred in Oregon, but a safe rule is: *Do not eat the viscera (dark meat), nor siphons (necks), nor drink the juice from mussels or clams taken from ocean beaches between May 1 and October 31*, unless State health authorities have certified that no poison is present in clams and mussels.

2. Open clams by one of three methods:
 - ▶ Open raw with knife.
 - ▶ Steam open by subjecting to live steam for 2 to 3 minutes.
 - ▶ Dip in hot water for 1 to 3 minutes.
3. Slit open lengthwise the neck (or siphon) and the stomach so that both may be freed of their contents. All dark material in the stomach should be removed. (This step may be done in combination with step 1.) See footnote on page 4.
4. Drain off excess wash water or brine for a few minutes.
5. Pack in cellophane-lined cartons, waxed cartons, wax-impregnated cartons, glass, or slip-top cans.
6. Cover meat with clam liquor, or a 3 per cent brine ($3\frac{1}{2}$ ounces salt per gallon of water), leaving a headspace for expansion $\frac{1}{4}$ to $\frac{1}{2}$ inch.
7. Heat-seal or otherwise close and seal the containers being used, excluding as much air as possible.
8. Freeze at 0° F. and store at 0° F.

Crabs

(*Dungeness*)

Canning crabmeat

The Dungeness crab (*Cancer magister*) is found abundantly in Oregon's coastal waters. The crab season is long-lasting and offers canning material for many months of the year.

There are two major difficulties encountered in canning crab. Both of these difficulties involve discoloration. The first is a natural discoloration caused by a slight chemical change in one of the tissues of the crab. It is a harmless change, usually most evident on the sides of the larger leg muscles. It varies in degree from a light shadowy effect to a slate-gray color. Even though a harmless change, it impairs the appearance of the canned product, and it is desirable to prevent it.

The other discoloration is from a combination of factors—namely, improper treatment of the meat, poor temperature control, and poor range in retort operation. The red pigment on the leg muscles becomes darkened or browned.

An improved method of precooking crabs for canning has been derived, tested, and put into practice commercially. This newer method of precooking is easier, causes less delay in operations, and also produces a far better meat than was obtained when whole or partly cleaned crabs were boiled.

This is the procedure that will minimize discolorations and utilize the precooking method:

1. Use *only* live crabs.
2. While alive, remove carapace (back shell) by pulling from one side. The operator holds the crab, with its mouth down, by grasping its left legs and holding it on the table or against his abdomen. Then with the right hand on the left edge of the carapace, he pulls out or away. Crabs may be cut in half by means of a heavy blade and then cleaned. Iced or chilled crabs will be less active.
3. Eviscerate and wash. The body contents are easily shaken and/or washed out by a small fast stream of water. The gills are removed by hand. Newly forming shell, which is jelly-like and contains some pigment, is best removed; if not removed, this pigment may discolor the body meat. The crabs are now broken in half, ready for the precook.
4. Put the crabs into a suitable perforated container or basket and subject them to a good flow or source of live steam at 212° to 214° F. Place them in a retort or pressure cooker above preheated water. Allow an ample flow of steam to escape from vents (petcock). (A small amount of trapped air will prevent attainment of the desired temperature.) After the air has been driven from the retort and a steady flow of steam has been obtained from the vent, cook the crabs for 12 to 15 minutes.
5. After this cook, remove from retort and, as soon as the pickers can handle the crabs, start the picking. A small amount of cold water may be used to cool a few crabs in order to start the picking, but it is better if the hot meat does not come into contact with water.
6. Grasp the halves by the legs. Crack the body sections (thin white cartilaginous structures) and crush them slightly by hand so as to free the body muscle attachments. Then shake the halves, dropping the loosened body meat into a pan. The picker can strike the body against the rim of the pan to remove some of the meat that may remain within these sections. The legs should be cracked along the outer curved edges just enough to allow shell removal. The segments should be removed from the legs, starting with those farthest from the body and pulling out the cartilaginous sheath to which the muscle of the next segment is attached.

Usually the smaller segments do not contain enough meat to justify their being cracked and opened. Keep leg and body meat separate to facilitate packing and prevent

leaching of red pigment. Work on small batches of crabs so that the remaining heat will aid removal of the meat. Wash meat in clean, fresh water to remove coagulum.

7. Dip the meat, both leg and body, in a 5 per cent salt brine (6.4 ounces salt per gallon of water) containing 1 to 1½ ounces of citric acid per gallon. Subject the leg meat to this dip for 2 minutes and the body meat for 1 minute with enough agitation, usually by hand, to insure complete contact of the acid-brine to all pieces. Allow the meat to drain, and express the excess moisture by hand.
8. Pack the meat closely in C-enamel tins (or in glass jars) with or without parchment. Use 6½ to 7 ounces (¾ cup) meat per 8 ounce can or ½ pint jar.
9. The recommended processing for crabmeat in ½ pound cans:
 - ▶ Time: 60 minutes
 - ▶ Temperature: 240° F.
 - ▶ Pressure: 10 pounds
10. Water-cool cans. Air-cool glass.

Precautions

▶ Do not allow crab meat to come into contact with copper or iron. These metals intensify the slate-gray discoloration. Aluminum, stainless steel, monel, galvanized, and enamelware utensils are satisfactory.

▶ The acid brine used for dipping the meat cannot be used for too long a period. The acid will be taken up gradually by the meat and will not continue to allay discoloration.

▶ Do not use the meat of dead crabs and do not allow meat to stand for long prior to packing. Do not keep acid-brine overnight. Rapidity of handling is important.

Freezing crabmeat

- ▶ Follow steps 1 through 6 as given in the foregoing crab canning procedure.
7. Pack meat closely in suitable container for freezing. Glass, waxed cups, cellophane-lined cups, or cellophane-lined cartons may be used.
8. Cover meat with a 2 per cent brine (2¼ ounces or 3 level tablespoonfuls of salt per gallon of water), leaving head-space for expansion. Cover tightly, heat-seal, or otherwise close the container. (The brine addition may be omitted if the crabmeat is to be used within four months.)
9. Freeze at 10° to 20° F. below zero, if such temperatures are available. If freezing is to be done at 0° F., allow ample spacing of containers for circulation of air until packages are frozen. Store at 0° F. or below.

Oysters

(Pacific)

Freezing oysters

Oysters are more susceptible to various types of spoilage than are some of the other marine foods. Oysters must be handled with care and as rapidly as possible. It is suggested that the operator have well in mind the various steps in handling, and the equipment and supplies needed, before starting to shuck oysters preparatory to freezing them.

1. Use only live oysters.
2. Hose off to remove external debris from the shell.
3. Shuck or open raw in usual manner, saving oyster liquor.
4. Wash thoroughly in 2.6 per cent brine ($3\frac{1}{2}$ to 4 tablespoonfuls of salt per gallon of water). (This is a 10 degree salometer brine.) Do not leave oysters in brine longer than necessary (8 to 10 minutes).
5. Allow excess water or brine to drain from meats.
6. Package in cellophane-lined box or carton, glass jars, heavy waxed containers, or C-enamel cans.
7. Cover surface with oyster liquor or 10 degree brine and prevent exposure to air. Allow for expansion.
8. Seal or close container.
9. Freeze at 10° to 20° F. below zero as soon and as fast as possible.
10. Store at 0° F.

Canning oysters

1. Wash the oysters by hosing to free them of mud, dirt, and other loose material.
2. Shuck by knife, or open by subjecting to steam as follows: Place oysters in baskets or trays and steam them in retort or pressure cooker for 5 to 7 minutes at 240° F. (10 pounds pressure), or until shells open.
3. Shuck meats into water or a brine to prevent the action of air upon the meats. A 2.5 to 3.0 per cent brine is used to protect the meats in this step (3.2 to 3.8 ounces or $3\frac{1}{4}$ to 4 tablespoonfuls of salt per gallon of water).
4. Agitate by stirring and wash meats in this brine. Remove darkened, or otherwise discolored, oysters. Remove by screen, basket, or perforated container.
5. Allow to drain 3 to 5 minutes.
6. Pack as quickly as possible to prevent discoloration. Use C-enamel or plain cans, or glass jars. Care should be exer-

cised in this operation because of the weight change that occurs in oyster meats when retorted. Allow $\frac{1}{2}$ to 1-inch space at top of container (depending on size being used) for this change during processing.

7. Add 3 per cent brine and vacuum seal, or add sufficient hot 3 per cent brine (see step 3 above) to cover meat. Exhaust cans with loosely crimped lids for 8 to 10 minutes at 212° F. Complete seal. If glass jars are used, place covers on loosely and exhaust in same manner.
8. Process at 240° F. (10 pounds pressure) as follows:

| | |
|-------------------------|------------|
| One-half pint jar | 45 minutes |
| No. 1 tall tins | 45 minutes |
| No. 2 tins | 60 minutes |
| 1-pint jars | 60 minutes |
9. If cans are used, release retort pressure, remove, and water-cool the cans. If glass jars are used, remove from heat source and allow pressure to come down naturally. Remove jars, seal, and air cool them well before storing.

Kippering oysters

1. Use live oysters of good quality.
2. Wash shells by hosing to remove mud and other loose materials.
3. Oysters may be shucked or opened raw, but operations may be hastened if they are opened by the following method:
 - ▶ Place washed oysters in basket, metal or wood, and put into pressure cooker or retort.
 - ▶ Steam at 10 pounds pressure for approximately 15 to 20 minutes to open and remove some moisture.
 - ▶ Release pressure gradually.
 - ▶ Remove basket as soon as possible.
 - ▶ Remove meats from shells by knife, taking care to cut adductor muscle or eye from shell.
4. Place meats in an 8 per cent brine (10 $\frac{1}{4}$ ounces salt per gallon of water) solution to wash. Agitate gently to loosen all dirt. Do not leave meats in this washing brine longer than 8 or 9 minutes, because a bitter flavor may develop. Give meats a quick cold water dip or rinse.
5. Place oyster meats separately on oiled metal mesh trays. (Use any suitable bland oil for this purpose.)
6. Allow trays of meats to drain for 3 to 5 minutes and then place them in the smoking chamber, which has been preheated by a moderate fire to 120° to 130° F.

7. Maintain the temperature range of 120° to 140° F. for 3 to 4 hours. If meats are not as brown as desired, the temperature may be raised to 160° to 165° F. for 10 to 15 minutes to achieve the color desired.
8. Remove the trays of meats from the smoking chamber and allow to cool.
9. The oysters may be used as they come from the trays but since they will not keep indefinitely, it is recommended that they be canned as follows:
 - ▶ Pack meats to fill in No. 32 (tuna) enamel cans, or 8-ounce glass jars.
 - ▶ Add 1 to 1½ ounce cottonseed, soya, or other suitable oil, as desired.
 - ▶ Vacuum seal, or exhaust with lids on for 12 minutes at 212° F. Then seal.
 - ▶ Process 8-ounce containers 70 minutes at 240° F. Complete jar seal.
 - ▶ Water-cool tins. Air-cool glass jars.

Smelt

Ground or loaf smelt

A good source of protein foodstuff is found in the early spring runs of smelt. This fish, however, is susceptible to spoilage of one form or another in both fresh and frozen methods of handling and storing. The following is a new procedure of conserving smelt. Carp, sucker, and shad may be handled similarly.

1. Wash whole fish to remove external debris.
2. Remove head in such a manner as to remove heart. Knife, rotating blade, or scissors may be employed.
3. Eviscerate after slitting belly wall.
4. Wash well by spray and/or agitation tank washing.
5. Precook on metal mesh (4 per inch) trays in thin layers at 212° F. for 10 to 15 minutes.
6. Grind through $\frac{3}{8}$ -inch to $\frac{1}{2}$ -inch plate into perforated containers to allow escape of moisture.
7. Fill No. 1 tall (300 x 407) cans to give a net content of not less than 15 ounces.
8. Exhaust 25 minutes at 212° F. or vacuum seal.
9. Process 90 minutes at 250° F.

Tuna

(Albacore)

Canning tuna

Fresh or frozen tuna may be used for canning. If frozen fish is to be used, however, ample time for thawing must be allowed.

1. Clean fish well. Remove viscera or entrails. Wash. Allow blood from the stomach cavity to drain.
2. Place fish, gut cavity down, on metal mesh tray or perforated pan.
3. Place tray with fish in a steaming chamber or preferably a retort (pressure cooker). Do not allow fish to rest on bottom of container.
4. Precook fresh tuna at 216° to 218° F. (2-pounds pressure) for 2¾ to 4 hours, depending on size of fish. Precook thawed tuna at 216° to 218° F. for 2½ to 3½ hours, depending on size of fish. If steam at 212° F. is used, add ½ to 1 hour to foregoing cooking time.
5. Allow to cool to room temperature. Then store overnight, or 12 to 24 hours in a cool room.
6. Remove fish from cool room and peel off skin with knife, lightly scraping surface to remove blood vessels.
7. Separate meat into four quarters. First break apart the two halves from back to belly and remove backbone. Then separate each of these halves into quarters. Pull off and cut out all bones and fin bases.
8. Scrape and cut out all dark brown flesh, leaving four cleaned, all-white meat sections.
9. Cut sections crosswise in lengths suitable for packing in container to be used in canning.
10. Fit cut pieces into cans (tuna enamel or C-enamel) or jars. Press down gently to effect a solid pack. Allow ⅜ to 1¼ inch space at top of can or jars.*
11. Add salt and oil to each container. Cottonseed, soya, or other vegetable oil is to be used. If oil is not available, water may be substituted, or a pack can be made using half oil and half water. When water is added, C-enamel cans or glass jars must be used.
12. Vacuum seal or—
Exhaust or steam containers for 10 to 12 minutes at 212° F. with covers or lids on.

* Allow ⅜ inch space from tuna meat to top of ½ pound cans; ¾ to 1 inch space for ½ pint or larger jars.

13. Seal cans, or partly seal glass, and process. Complete seal on jars after process.
14. Cool before storing.

Table 2. CANNING TUNA

| | Salt | Oil | Water | Oil and water | Process 240° F., 10 pounds pressure |
|------------------------------|----------------------|---------------------------------------|----------------|------------------|--|
| 8 ounce can | $\frac{1}{2}$ tsp. | 1-1 $\frac{1}{2}$ oz. (3 tbsp.) | Same as oil | Same—equal parts | 75 minutes |
| 1 pound can | 1 tsp. | 2-2 $\frac{1}{2}$ oz. (5 tbsp.) | Same as oil | Same—equal parts | 100 minutes |
| $\frac{1}{2}$ pint jar | $\frac{5}{8}$ tsp. | 1 $\frac{1}{2}$ -2 oz. (4 tbsp.) | Same as oil | Same—equal parts | 90 minutes |
| 1 pint jar | 1 $\frac{1}{4}$ tsp. | 2 $\frac{1}{2}$ -3 oz. (5-6 tbsp.) | Same as oil | Same—equal parts | 100 minutes |

Canning of dark-and-light-meat tuna

As the white muscle sections are prepared in the regular tuna canning procedure, considerable dark-and-light-meat tuna is obtained. This meat has not been used in the past except in very few instances, and has been considered a waste or byproduct going into fish meal. This combination of meats can be commercially packed with a good degree of success by the following procedure, thus providing an added source of protein for loaf, sandwich filling, and other food stuff preparations.

- ▶ Pick over the mixture of light and dark meat to remove bones and any other waste material. Pack with oil and salt additions as shown in Table 2, or—
- ▶ Grind the meat through a $\frac{1}{4}$ - or $\frac{3}{8}$ -inch mesh plate.
- ▶ Add to the ground meat 3.0 to 3.5 grams salt ($\frac{1}{2}$ teaspoonful) per half pound of meat, mixing thoroughly to insure an even distribution of salt.
- ▶ Pack firmly 6 $\frac{3}{4}$ to 7 ounces of ground meat per 7 ounce flat tuna enameled can.
- ▶ Add 5 to 7 cubic centimeters of cottonseed, soya, or other bland vegetable oil per can. The oil addition may be omitted, or increased.
- ▶ Vacuum seal.
- ▶ Process 80 minutes at 240° F. (10 pounds pressure).

Salmon

Kippering salmon

1. Dress and clean fish well.
2. Fillet.

3. Cutting the fillets into 2- to 4-inch pieces is advantageous at this stage for later storage purposes, and salt penetration.
4. Allow pieces of fish to stand in a brine (10½ ounces of salt per gallon of water) overnight or 16 to 18 hours.
5. Rinse well in fresh cold water for 5 to 10 minutes.
6. Place pieces on wire mesh trays, skin down, leaving space between pieces. Allow moisture to drain and flesh surface to partially dry. Place trays in smoking chamber.
7. Smoke with barkless alder for 40 to 48 hours at 70° to 80° F. Never use more heat than 80° F.
8. Raise heat by building up fire to 165° to 170° F. for 45 to 50 minutes to cook fish and obtain appetizing brown color. Never raise temperature to more than 175° F.
9. Open doors to smoking room to release heat and remove trays to cool fish. Kippered fish thus prepared must be kept under refrigeration, or canned. If kept under refrigeration it will store for a period of 3 to 5 weeks. If it is to be canned, follow this procedure:
 - a. Cut into pieces suitable to the containers being used. Pack.
 - b. Exhaust or heat with lids or covers on containers for 12 minutes at 212° F.
 - c. Seal containers immediately, *or*—
 - d. Vacuum seal (instead of *b* or *c*).
 - e. Process as follows:
 - 8-ounce plain or enamelled tin—60 minutes at 240° F. (10 pounds pressure) if no bones are present.
 - ½ pint jar—60 minutes at 240° F. if no bones are present.

To cook bone, process 90 minutes at 240° F.

Smoking salmon

1. Dress and clean fish well.
2. Fillet (remove backbone lengthwise).
3. Puncture skin along middle of side or fat line, and place on layer of salt in wooden tub or keg, crock, or other suitable container. Cover fillets with dry salt and allow to stand in cold room overnight.
4. Remove excess dry salt. Cover with a strong salt solution (28 ounces salt per gallon of water).
5. Allow to stand in cold room (refrigerator) for 10 to 14 days or in a cool storage room for 4 to 6 days.
6. Remove from brine and soak in fresh running water for 20 to 30 minutes.

7. Place fillets, skin down, on trays in smokehouse 10 or more feet above fire.
8. Smoke with crab apple, vine maple, or alder at temperatures below 80° F. The sawdust of these woods is recommended as an aid in obtaining a good smoke and as an aid in keeping this temperature. This smoking should be continued for 5 to 10 days, or until such time as the operator attains the degree of smoke desired and knows that enough moisture has been withdrawn from the flesh to provide good keeping quality.

Kipperer salmon cheeks

1. Remove cheeks from salmon heads.
2. Allow to stand covered in a 3 per cent brine (4 ounces salt per gallon of water) overnight in a cool room.
3. Remove from brine and soak in fresh cold water for 20 minutes. Remove and drain.
4. Place salmon cheeks on oiled (vegetable oil) screen trays ($\frac{1}{4}$ to $\frac{1}{2}$ inch mesh).
5. Place trays in preheated smoking chamber.
6. Smoke with vine maple, crab apple, or alder by one of these two methods:
 - ▶ One hour at 160° to 170° F., *or*—
 - ▶ Six hours at 70° to 80° F. with a hot fire (170° F.) for 30 to 40 minutes to brown the cheeks. The latter method is preferred.
7. Remove trays to cool.
8. The salmon cheeks are then ready for use. If it is desired to store some of them for a period of several months, they must be canned according to the method given under the procedure for kippered salmon.

Soup-fin Shark

Canned kippered soup-fin shark

Soup-fin shark (and other elasmobranch) flesh is more susceptible to spoilage than the flesh of other species of fish. Careful and rapid handling is therefore of considerable importance in any method of preservation of this group.

As soup-fin shark flesh has been used in large quantities in the fresh and frozen fish markets, other methods of preservation of this

fish flesh have been considered. A kippered soup-fin shark procedure is as follows:

1. Dress and clean fish in usual manner, cutting away the belly wall (soft portion).
2. Fillet the fish by removing skin and backbone (cartilaginous-bony structure).
3. Cut across fillets to make pieces that will fit the containers to be used.
4. Put pieces of flesh into an acid brine that has been prepared in advance. The brine is composed of 2.5 per cent salt solution (3.2 ounces salt per gallon of water) containing 0.2 per cent citric acid (0.25 ounce citric acid crystals per gallon water). The salt and acid concentrations may be varied to suit individual tastes. The salt may vary between 1.5 and 3.5 per cent. The acid may vary between 0.1 and 0.3 per cent; the recommended concentrations, however, have been found to be more suitable. Allow the fish to stand in the acid-brine for 14 to 16 hours (overnight) in a cool room.
5. Remove meat from acid-brine. Soak briefly in fresh water 10 to 15 minutes. Drain off free-run water.
6. Place pieces of meat on oiled trays and put the trays into the kippering or smoking chamber. Cold-smoke at temperatures of 75° to 80° F. for a day (8 to 10 hours). Raise heat to 165° to 170° F. to brown the flesh for about three-quarters of an hour. Release heat and smoke from the chamber and remove trays.
7. Choosing pieces to fit, fill containers to be used (8 ounce plain or enamelled (tuna) tins, or $\frac{1}{2}$ pint glass jars).
8. A bland vegetable oil (cottonseed, soya, other suitable oil) is added to each container in amounts varying from $\frac{1}{2}$ to 1 ounce (2 to 4 teaspoonfuls). A dry pack may be made omitting the oil addition. Added oil, however, improves flavor, texture, and color of product.
9. Vacuum-seal, or exhaust and seal container. Do not seal glass jars.
10. Process at 240°F.

| | |
|---------------------------------|------------|
| 8-ounce containers (tin) | 70 minutes |
| $\frac{1}{2}$ -pint glass | 85 minutes |
11. Water-cool tins. Seal and air-cool glass.

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