Home Canning OF FISHERY PRODUCTS

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HOME-CANNING PROBLEMS

Careful review of publications and related data on home canning has led to the following conclusions: (1) Many "sterilization" processes given for sea foods are insufficient; (2) one or two methods are wrongly supposed to apply equally well to all varieties of sea foods; (3) seldom has distinction been made between methods used in packing in tin and in glass containers; (4) little thought has been given to limitations in size of containers; that is, the limit in size beyond which a sufficient process may not be obtained; (5) data are lacking as to the type of container, especially glass, best adapted to the home canning of sea foods; (6) the importance of workmanship in packing and its effect on the quality of the finished product has not been sufficiently recognized; (7) there has been no discussion of costs of home-canned fishery products; and (8) figures have not been available on production data, such as the percentage of loss in packing different fishery products and the quantity of raw materials required for a given number of containers of specified sizes. The home-canning problem has been studied with these factors in mind, and it is believed that methods that are simple, practical, and safe have been developed for the most important varieties of sea foods that are suitable for canning.

STANDARDS IN HOME CANNING

If home canning is to be recommended as a desirable method of food preservation, it is necessary that home-canned products meet the following conditions: (1) It should be determined whether a product of acceptable quality can be prepared, since some sea foods, because of their composition or structure, are not suitable for canning; (2) the process must be sufficient and it must be possible to control the processing apparatus so that variations that might adversely affect the sufficiency of the process will not occur; (3) there are limitations in size of containers beyond which it has not been found possible to obtain a satisfactory process, regardless of the length of cook or type of apparatus used, and the composition and shape of the container must also be suitable; and (4) workmanship in packing must be uniform. It is sometimes said that this fourth condition is technical and arbitrary, but it was only by adhering to it that our great commercial food-canning industry was enabled to develop. The homemaker will find that lack of uniformity in packing will end, sooner or later, in products not welcomed at the family table. The effect of workmanship in packing is taken up under examination of canned fishery products on page 30.

PRINCIPLES INVOLVED IN CANNING SEA FOODS

RELATION OF MICRO-ORGANISMS TO CANNING

The canning of sea foods in hermetically sealed, heat-sterilized containers is based upon the prevention of spoilage through microbiological action. Fresh, dried, salted, or smoked fishery products may be rendered unfit for use by many causes other than ordinary decomposition, but to protect canned fishery products from spoilage consideration must be given to micro-organisms, which are the cause of putrefaction or spoilage under ordinary circumstances.

Micro-organisms, as the name indicates, are a class of living things too small to be seen except by the aid of a microscope. They are unicellular; that is, each life cell is a separate and complete organism, though they may be joined in chains or masses. Micro-organisms are intermediate between plant and animal life and consist of the yeasts, molds, and bacteria. The home canner is concerned only with that class of micro-organisms generally classed as bacteria. The yeasts and molds are destroyed at temperatures much below those required for sterilization, and their presence in canned sea foods indicates either gross understerilization or defective containers. These organisms are distributed in wide variety almost everywhere in air, soil, and water. They may lodge on a fish that is alive and in the water, or during the period after its removal from the water and before it is packed in a hermetically sealed container.

Micro-organisms require moisture and favorable temperatures for development because they obtain their food only in liquid form, absorbing it through the cell walls. A moisture content below 35 percent has a direct inhibiting effect. Favorable temperatures for ordinary forms range between 70° and 100° F. Live fish are able to resist the growth of micro-organisms, and, too, their body temperatures are not favorable. After death, however, there is no longer any resistance and the body temperatures rise rapidly. The tissues must be liquefied in order that the micro-organisms may absorb the necessary food. The organisms throw out secretions, known as enzymes, which have the property of breaking down, decomposing, and liquefying surrounding tissues. When the liquids have been absorbed by the organism the resulting waste products are excreted, producing characteristic results such as "off" odors and tissue break-down associated with decomposition. This process is known as putrefaction.

The cells in animal tissue also contain enzymes that do not cease their activity upon the death of the animal but may even start a digestion of the cells in which they are contained. This process is known as autolysis, or self-digestion, and is distinct from putrefaction as described in the preceding paragraph. It is especially marked in fish that were feeding when caught. Death prevents completion of the normal cycle of digestion. The large quantities of digestive enzymes produced during the feeding process are prevented from fulfilling their function of preparing the food for absorption and react on the walls of the digestive tract, destroying them with extreme rapidity and passing to the flesh tissue, which is also softened in a short time. This process is normal, and while the fish are not absolutely inedible they are difficult to handle in canning and the resulting product is objectionable in appearance, color, and texture. The best example of this is troll-caught, or "feedy," salmon that must be eviscerated and packed in crushed ice immediately after catching or they will be found unfit for use in very few hours.

The fundamental principle of canning is the application of heat to food in hermetically sealed containers at temperatures and for periods of time sufficient to destroy any yeasts, molds, or enzymes, and to destroy or render inactive any bacterial organisms likely to cause spoilage. Only a brief discussion of the various organisms encountered in the preparation of canned fishery products will

be given. Heat-resistant spore-forming organisms are, of course, the most important type, and the heat treatment, or process, must be sufficient to render them impotent. A short treatment at a high temperature, or a long treatment at a lower temperature may destroy the active, or vegetative organisms, but leave unharmed the spores that may return to activity under favorable conditions.

These spore-formers may be either aerobes, or anaerobes. The first type require oxygen to develop. In this instance, if the can has been properly exhausted, that is, if a sufficient vacuum has been obtained, there is little likelihood of spoilage before the container is opened. The presence of aerobic spore-formers in a properly sealed container indicates insufficient heating but it does

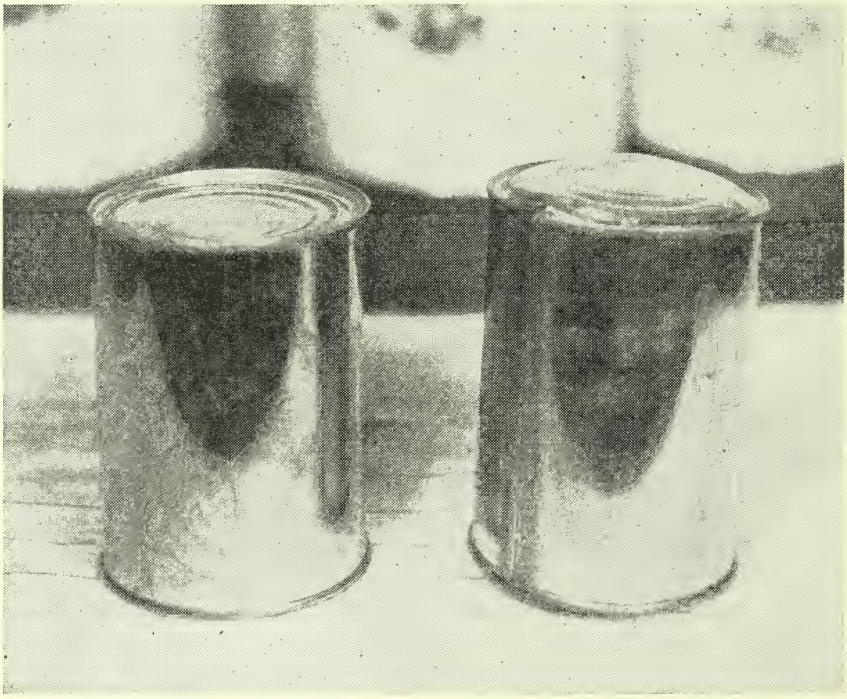

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Figure 1.—**Uninoculated and inoculated cans from experimental pack. The inoculated can on the right is a "swell," while the uninoculated can does not show spoilage.**

not necessarily follow that the product is unfit for consumption, for until recently most of the home-canned products were so infected, and a considerable proportion of such packs is still believed to contain the spores of aerobic bacteria. The anaerobic organisms require the absence of oxygen to develop. If anaerobic bacteria are present, complete seal of the container and sufficient vacuum only make conditions favorable to the development of spores not destroyed by heat. Spoilage from this cause is usually indicated by swelled or bulging can ends (fig. 1), accompanied by an offensive and pervasive odor when the can is opened. Spoilage may occur without gas formation and swelled ends if certain anaerobic organisms are present. Such cans are known as "flat sours."

The first and most important point for study in canning sea foods is the sterilization process, intended to protect these foods against bacterial activity.

STERILIZATION

The heat treatment of foods in home canning usually is called "sterilization," although this is not literally correct. Commercial canners have adopted the term "processing," which is more accurate because by it only those organisms likely to cause spoilage are destroyed.

Theoretically, complete sterilization is possible and desirable, but actually many factors affecting the cooking process in canning work against the attainment of this ideal. Although the primary purpose of processing is the destruction of the organisms that cause spoilage, in certain products it improves the texture, appearance, or flavor. If the processing is done at too high a temperature or for excessive periods of time, however, the product may be seriously damaged by scorching or overcooking. Other detrimental factors might be cited with reference to individual products.

To be effective, a process must not only preserve a product but must operate within certain limits. A temperature sufficient to destroy spoilage organisms establishes the minimum temperature, or lower limit of heating, while quality considerations determine the maximum, or upper limit of processing. Sometimes these limits are close together, leaving little room for variation in procedure, and the packer must stay between them if he is to prepare a product of acceptable quality. For instance, in canning clams the upper and lower limits are close, while in packing salmon they are wide apart.

EXPERIMENTAL PROCEDURE

The canning study was so planned as to include the most important and widely distributed species and also those varieties usually taken by noncommercial fishermen, since the latter are the most important source of raw material for home canning. Packs were divided among six general groups, representing salt-water and fresh-water fishes, shellfishes, smoked products, chowders, and packs made in sauces and other specialty products.

Each type of product was packed both in glass and in tin containers, and two types of glass jars were used in an effort to obtain data on their relative merits. In making each pack, the following information was collected in addition to data concerned strictly with the method used: Source of raw material; weight as packed; percentage of loss; quantity of raw material needed for 12 No. 2 cans, or pint jars; cost of the raw material; and net cost of the finished product. In addition, when the packs were examined bacteriologically an attempt was made to obtain data on the quality of the finished product. The 274 packs made involved 42 different products, representing 38 different species of fish and shellfish.

With few exceptions each individual pack consisted of at least 24 containers, part of which were inoculated before sealing to insure accurate determination bacteriologically of sufficiency of process. The part of each pack not inoculated served as a check sample, or negative control. A culture was chosen of a resistant type and of the group of organisms believed responsible for much of the

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spoilage in canned fishery products. It is only by controlled laboratory tests, similar to those undertaken, that the adequacy of a sterilization process may be exactly determined.

EQUIPMENT REQUIREMENTS

Any discussion of the equipment and utensils necessary for canning fishery products must be general, because requirements vary to some extent with each product. While every utensil listed below may not be needed by each individual packer, all are necessary if all packs herein described are to be prepared. The equipment should be obtained and made ready for use before starting preparation of the product, thus avoiding delays and consequent canning losses.

	Number required
Basket, deep-frying	1
Board, cutting	1
Bowl, earthenware, large	1
Brush, wire	1
Can-closing machine	1
Collander	1
Crocks, stoneware: 5-gallon	2
Crocks, stoneware: 2-gallon	2
Crocks, stoneware: 1-gallon	2
Dipper, 1-pint	1
Dishpans: 30-quart	1
Dishpans: 18-quart	2
Funnel, jar, 12-inch	1
Grinder, meat, large	1
Hangers, smokehouse	4
Kettles, preserving: 16-quart	1
Kettles, preserving: 8-quart	2
Knives: butcher	2
Knives: paring, small	4
Ladle, soup	1
Measure, 1-quart	1
Measuring cup, standard	1
Opener, can	1
Pans, baking, shallow, large	4
Pressure canner, large	1
Scaler, fish	1
Scales, household	1
Screens, draining, 2 by 3 feet	4
Spatulas: medium	1
Spatulas: small	1
Spoons: basting	1
Spoons: measuring sets	1
Spoons: stirring, wood	1
Steamer	1
Strainer, jelly	1
Tablespoons	2
Thermometer	1
Tongs, jar	1

Utensils for peeling, chopping, slicing, or cubing vegetables used in soups or chowders are useful, if not absolutely essential. A salinometer should be used in checking the strength of brines, especially in experimental work.

Pans and kettles in which raw materials are kept, or in which they are precooked or otherwise prepared for canning, should be of a good grade of aluminum or stainless steel. Copper and galvanized-iron kettles and pans are liable to cause discoloration and unpleasant flavors in the finished products.

The cutting board, draining screens, smokehouse hangers, and smokehouse [1] may be home-made. The cutting board should be of oak or similar hardwood. Soft woods, such as pine, are too absorbent and are likely to splinter when much cutting is done. A board about 18 by 36 inches, 1 inch thick, is suggested as a good size. Grooves should be cut in the surface at intervals corresponding to the heights of the various sizes of containers in use, so that they can be used for measuring when cutting fish into container-length pieces. A device built like a carpenter's miter box is better for this purpose, however, as the fish may be cut more speedily and the workmanship is better.

[1] Bureau of Fisheries Economic Circular No. 27, A Practical Small Smokehouse for Fish, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., price 5 cents.

PROCESSING APPARATUS

Methods of processing other types of home-canned products are described at length in Farmers' Bulletin 1762, Home Canning of Fruits, Vegetables, and Meats.[2] For a detailed treatment of this subject the reader is referred to that publication.

PRESSURE CANNER

The home canning of fishery products requires the use of a larger sized steam-pressure canner than is ordinarily necessary for packing other products, as the canner is not only needed for processing but also for precooking or preparing the raw materials, as in packing mackerel tuna-style. The canner should be of at least 30-quart size and be fitted with an accurate pressure gage if a well-prepared and properly processed product is to be obtained (front cover). The smaller sizes are designed for cooking rather than canning and hold so few containers that several batches would have to be processed, thus increasing the cost and work of canning.

Pressure canners are made either of aluminum or iron, but as iron is liable to cause discoloration when packing fishery products, especially shellfish and crustaceans, the aluminum canner is recommended.

GLASS JARS

Jars of 1-quart capacity may be used for canning wet-pack shrimp, although they are not recommended. With this one exception, however, no fishery product should be put up in containers larger than 1 pint. The use of half-pint containers is not economical except for small families or for products that are usually used as components of other dishes, such as salads.

For best results with most fishery products, especially those packed in a few large pieces, a wide-mouthed jar with a short neck should be used (fig. 2), as it is extremely difficult to obtain a good fill in a narrow-mouthed jar or one with a tall neck. The latter style may, however, be used without inconvenience when packing shrimp, clams, or other products that are filled in small pieces and a large part of the contents is liquid. The type of jar sealed by porcelain-lined one-piece zinc screw cap is not recommended, as more trouble is experienced in obtaining a perfect seal with this than with other types because the caps may develop defects not ordinarily noticeable. Both of these factors lead toward spoilage of the product and the possibility of food poisoning. The "lightning-type" mason jar (fig. 2), with a glass top that fits down on a rubber ring and is sealed with a wire clamp, may be used, but more care is required in handling these containers because the glass tops chip and break rather easily. By far the greater part of the breakage occurring in experimental packs of fishery products was the glass tops. Jars of the self- or vacuum-sealing type, fitted with enameled metal tops edged with an inert composition gasket are regarded as preferable to all other types, but have the disadvantage of being somewhat more expensive because the caps are not reusable.

[2] Farmers' Bulletin 1762, of the U. S. Department of Agriculture, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., price 5 cents.

When preparing glass jars for use they should be examined carefully for defects. Jars or glass caps showing even slight nicks or cracks, especially around the rim, should be discarded without question. Wire clamps must be tight and free from rust and dirt. Jars must be thoroughly washed and rinsed and then placed in scalding water for 10 to 15 minutes for sterilization. Jar caps must also be washed and sterilized, and both jars and caps must be kept hot until used.

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Figure 2.—Home-canned fishery products packed in glass jars. Upper: shrimp, packed in "lightning-type" mason jar. Left and right: mackerel and salmon, packed in mason jars fitted with vacuum-sealing tops.

TIN CANS

The so-called tin can is made of sheet steel that is provided with a thin coating of tin. Certain products, especially shellfishes and crustaceans, react with the steel base of the tin plate to form sulphide compounds that discolor the inside of the container and also the product. While this discoloration is harmless, appearance and flavor are unpleasantly affected. This is prevented by the use of a special enamel lining of dull gold color on the inside of the can known as "C" enamel, sea food formula. Enamels used in packing fruits and vegetables are not suitable for fishery products. If "C" enamel cans are used in packing acid products, such as spiced fish, the enamel will peel off. This does not make the product inedible, but it is unsightly. Best results are obtained if such products are packed in glass containers or in plain tin cans.

Tin cans are used extensively for the home canning of fishery products, especially on the Pacific coast. They have certain disadvantages in comparison with

glass jars, but they also have points in their favor. The original cost of glass jars is considerably higher than that of tin cans, but the jars can be used over and over, whereas reuse of tin cans is dangerous and should not be practiced. In continuous service, therefore, the jars will prove the more economical. The advantages of tin cans are that the product is not in danger of being light-struck, as may happen when packing in glass. Cans are much lighter than jars and easier to handle, as there is no danger of breakage. The development of lightweight, high-strength glass containers, however, is expected largely to overcome this disadvantage. Tin cans may be cooled much more rapidly than jars, which is important when over-cooking during cooling would lower the quality of the product. Tin cans also require a much shorter processing time, as the rate of heat penetration is more rapid than in glass. Final choice of the container, however, depends upon the individual. If a large supply of jars is on hand the purchase of tin cans would not be economical, but if containers have not been purchased and the homemaker expects to pack large quantities, the relative merits of the two types of containers should be weighed carefully before making a selection.

The sizes of tin cans recommended for home canning vary from the half-flat to the No. 2. Some can sealers for home use are adjustable to No. 3, No. 5, and No. 10 cans. The large sizes are not only more difficult to process, but require special equipment to avoid paneling and buckling. These containers should be used only by commercial canners provided with the proper equipment. Condensed data on the various sizes of tin cans suitable for home canning of fishery products are given in table 1.

TABLE 1.—*Specifications of and uses for the various sizes of standard cans*

Common designation	Can size	Can-makers' designation	Dimensions (inches)	Capacity (fl. oz.) [1]	Contents (cups)	Recommended use
Half-flat	No. ½	307×202½	3 7/16×2 5/32	9	1	Minced clams and tuna-style packs.
Eastern oyster	No. 1	211×400	2 1/16×4	11	1⅓	Wet-pack shrimp, clams, oysters, crab gumbo, chowder and other soups.
Tall salmon	No. 1 tall	301×411	3 1/16×4 1/16	17	2	Salmon, shad, mackerel, and solid-pack products.
Pint	No. 2	307×409	3 7/16×4 9/16	21	2½	Products for which no other specific recommendation has been made.

[1] The capacity as given indicates the approximate contents in terms of fluid ounces and is not a recommended fill.

CANNING PROCEDURE

Certain general principles must be followed in the canning of all sea foods. The production of any type of canned pack may be divided into a number of definite steps applying equally to all, though details of methods and processes may vary with the individual product. The home canner will gain a better understanding of the methods to be followed by carefully studying the principles involved. Attention to the requirements of each step is necessary in packing each individual product, if the quality is to be good and the food safe.

OBTAINING RAW MATERIAL

Studies by the Fish and Wildlife Service indicate that fish purchased at average wholesale prices make the cost of home-canned products higher than those canned commercially. A saving is made only when the raw material is brought in by members of the family and no outlay of money is involved, or when it is obtained at prices well below wholesale. Surplus catches of noncommercial fishermen are one of the best sources of raw material for the home canner. Fishery products should not be canned, however, if they are not fresh and in good condition, because no canned product can be better in quality than the raw material from which it was prepared.

HANDLING AND TRANSPORTING

Fish should not be left exposed to the full rays of the sun or thrown into the bottom of the boat where they will be stepped upon and bruised. To delay spoilage and improve the color of the flesh, fish should be bled immediately after they are caught. After bleeding, they should be packed in finely crushed ice; or, if crushed ice is not available, they should be thoroughly cleaned, the belly cavities rubbed with fine salt, and placed in a ventilated covered box. A piece of burlap, or gunny sack, frequently wetted with water will make an excellent cover, but it should not rest upon the fish. The box also may be used for transporting the fish home from the fishing area if necessary. Every effort should be made to get the fish home in the best possible condition.

GRADING

Before starting canning operations, the fish should be graded; that is, sorted according to variety, size, and condition. A fisherman's catch may include some varieties that are suitable for canning and others that are not, or they may not all be in suitable condition for canning. The sense of smell is important in judging freshness. If the fish have a "salt water" or "fishy" odor, they have not undergone spoilage. The gills should vary from pink to red in color, and be free from ropy slime. In fresh fish the eyes are bright and clear and the flesh may be torn away from the backbone only with difficulty, leaving many clinging shreds.

DRESSING AND WASHING

Even if the fish were cleaned when caught, they will require further cleaning and washing before canning. At this time the fins must be removed, the fish scraped free from scales and slime, the heads and tails cut off, and any remaining bits of viscera or membranes cleaned from the cavity. After washing in fresh water, the color of the flesh usually can be improved by soaking 15 to 60 minutes in a light brine, made in the proportion of one-half cup of salt to 1 gallon of water. This drains diffused blood out of the flesh.

All water used in canning should be of drinking-water quality. The use of any other, especially when obtained at the edges of ponds or streams, increases

the chances for spoilage. Brines should be made up just before use and should be discarded after being used once or twice.

PREPARATION FOR THE CONTAINER

Salmon, shad, and similar varieties are packed raw with no preparation other than cutting into container-length pieces. Others are precooked for a short time before filling into the containers. Precooking removes excess moisture, thus making the canned product firmer, makes filling easier, helps to create a vacuum in the container, and eliminates the exhausting step. It also shortens the time required for processing, as the product is hot when the container is put into the pressure canner. Precooking may also be used to impart a desired flavor or to remove some undesirable natural flavor. As far as possible, delays at this stage should be avoided. In warm weather a brief delay in handling precooked material is sufficient for spoilage to set in, and there may be appreciable deterioration not visible to the naked eye. Containers should be prepared as directed under the discussion of glass jars and tin cans on pages 7 to 9.

FILLING

Fishery products packed raw should be filled into the containers flush with the rim. The shrinkage occurring during processing will create sufficient head space. If additional provision is made by leaving a head space of one-fourth to one-half inch, this space in the finished product will be excessive and the fill will be slack; that is, the container will be underfilled. This allows the contents to shake about when moved, and results in breakage. Allowance may be made for an average head space of three-sixteenths inch when filling precooked products. Variations will be noted in directions for individual packs.

EXHAUST (VACUUM)

Products packed in glass need not be put through an exhaust process to obtain a vacuum. Exhaust occurs during processing, because the containers are not then completely sealed. Precooked foods filled into tin containers when hot, and sealed immediately, need not be exhausted, because the shrinkage of the product in cooling creates sufficient vacuum. Exhaust before sealing is necessary only for cold-filled, raw-pack, or precooked products in tin containers. If a partial vacuum is not created in tin containers the ends may swell after processing and cooling. The products are not harmed, but to all outward indication they are spoiled and should be discarded.[3]

SEALING

Machines are required for sealing the covers on tin cans after they are exhausted (fig. 3) and before they are put into the pressure canner. The principle of operation is the same in all types of these machines, and the manufacturers' directions

[3] See Farmers' Bulletin 1762, p. 13.

for care and operation should be followed carefully. The filled can with cover is placed on the base plate and raised by a lever until the chuck of the machine fits closely into a countersink, about one-eighth inch deep, in the top of the can lid. The can is then rotated while the first seaming roll folds the cover flange over the can flange. The second seaming roll then presses the folded layers together into a seam that is made airtight by the gasket in the lid. Sealing machines should not be purchased on a price basis; that is, a machine should not be

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Figure 3.—Typical can-closing machine adapted to the home canning of fishery products.

selected because it is cheap. A sealing machine must be strong, durable, as nearly automatic as possible, and simply and easily adjusted. Community canning projects often use batteries of several hand-seaming machines, although a single power-operated semiautomatic machine could be purchased for approximately the same outlay and would assure a smaller number of defectively sealed containers.

PROCESSING

Use of a pressure canner for processing nonacid meats and vegetables is recommended by most State and Federal agricultural experiment stations and extension services. Recently, however, home-canning bulletins have been published by some manufacturers of glass jars, and by certain other agencies, in which processing in hot water or in an oven are recommended as optional methods. These bulletins contribute to the erroneous belief of many home canners that a satisfactory heat treatment of nonacid foods can be obtained by these more or less

makeshift methods. *It cannot be emphasized too strongly that under no circumstances should any fishery product be canned unless a pressure canner is used. It is impossible to obtain a sufficient heat treatment, or process, by any other means.* Moreover, it must be borne in mind that the temperature-pressure-time relationships recommended for processing each product have been accurately worked out and must be adhered to if a safe and satisfactory product is to be obtained.

Manufacturers of pressure canners and cookers provide purchasers with detailed instructions for proper use and maintenance of their equipment. One point not always made clear, however, is that the petcock, or vent, should not be closed until all air in the canner has been displaced by steam. This requires from 7 to 10 minutes after the first steam issues from the vent. If air is imprisoned in the canner it will expand and exert pressure that is additional to that of the steam, and the temperature-pressure relationship shown on the gage will be incorrect.

Irregularities in processing also may occur if the opening leading to the steam gage becomes clogged, in which case the pressure would be higher than that indicated. Irregularities in processing are easier to detect when it is possible to check the accuracy of the pressure gage by a tester, or by comparison with a thermometer. The pressure canner used in making the experimental packs was equipped with a thermometer of the straight industrial type, checked for accuracy before use. It was found that variations occurred with sufficient frequency and were of great enough range to indicate clearly the need for equipping every pressure canner used in home canning with a thermometer in order to check and correct such variations. When the canner is equipped only with a gage, the pressure must be increased 1 pound for each 2,000 feet elevation above sea level in order that pressure-temperature relationships may be maintained. This point should be borne in mind by home canners in the Middle West and Rocky Mountain States.

Directions of manufacturers of pressure canners and instructions in this bulletin on processing in both glass and tin containers must be followed carefully. If properly processed, the product should neither be overcooked nor have a so-called "understerilized" flavor noticeable; and the texture should be reasonably firm, yet not stringy or woody. Wherever a processing time is specified it should be remembered that this does not include the entire period from the time the cans are placed in the canner until they are removed, but only the length of time after the required temperature and pressure have been reached and until steam is released. Time required for bringing the canner up to the processing temperature and for reducing the pressure to atmospheric level are in addition to the processing period. It is important that sufficient time be allowed for each of these steps.

COOLING AND WASHING

All containers must be cooled as rapidly as practicable after processing, otherwise the stored-up heat will continue the cooking and the contents will be overcooked. Tin cans should be plunged into cold running water, although standing water will suffice if changed frequently. When the temperature has been

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reduced to the point where the cans feel only slightly warm they should be removed from the water and wiped clean and dry. The slight remaining heat in the cans will assist in driving off any moisture not removed in wiping.

While the rapid cooling of the contents of glass jars is equally necessary, the glass would break if subjected to cold water. Glass jars must be so stacked that air can pass freely around them, but they should be protected from drafts while cooling. When the jars are practically cool they should be washed and dried.

Inspect all containers carefully for signs of leakage or other defects before storing them. No attempt should be made to reprocess leaky containers of fishery products, even though they are discovered shortly after processing.

All containers, whether of glass or tin, should be labeled for identification. Homemakers packing small lots usually find it sufficient to label with the name of the product and the date of packing. A special pencil for writing on glass may be obtained at stationery stores, or gummed labels may be used. In case the label does not adhere to tin cans properly, rubber cement should be used. Both the label and the place on the can where it is to be attached should receive a thin, even coat of the cement. The outstanding characteristic of rubber cement is that both parts must be absolutely dry before they will adhere. Therefore, after coating both the can and the label with the cement they must both be allowed to dry before the label is put in place. Any cement extending out beyond the edges of the label can be wiped off with a dry cloth.

Most canned fishery products require 2 to 3 months in storage to ripen properly; that is, to allow sufficient time for complete absorption of the salt and other flavoring substances. If goods packed in glass jars are stored in lighted places, however, the products may fade and soften. This action, of course, will require some time, but it is far better to store in a dark, cool place. Damp basements and cellars are to be avoided because dampness promotes the rusting of tin cans and the metal fittings of glass jars, as well as the oxidation of zinc screw caps.

RECOMMENDED CANNING METHODS

The methods herein given are recommended only for the products specifically named. While the processes are believed to be adequate for the sterilization of practically all varieties of fishery products, some species of fish, because of certain physical and chemical properties, are not suited to canning. Therefore, if it is desired to can a species not similar to those listed, it is suggested that a study be made to determine the suitability of that fish for canning. It may be necessary to experiment with more than one method, selecting that which gives best results. For example, firm-fleshed fish that would produce a palatable product if canned by the method given for salmon might be considered much better if packed tuna-style.

The home canner should bear in mind that this bulletin is intended only as a guide, not a series of infallible recipes, and that much depends upon the care with which the general instructions are followed.

RIVER HERRING

1. Thoroughly wash the fish and remove the fins and scales. With a sharp knife cut completely through the fish just behind the head. Continue the cut downward along one side of the fish directly behind the gill to the belly, thence along the belly to the vent. The head may then be removed, and with it the viscera. Wash and scrape the cavity clean and rinse off all traces of blood.

2. Prepare a brine that will float an egg (70° to 80° salinometer) and place the fish in it for approximately 6 hours. If the skin should show signs of wrinkling or changing color within this period the fish must immediately be removed.

3. Cut the fish into pieces equal in length to the containers in which they are to be packed. Wrap each piece tightly in vegetable parchment paper and pack it in the cans or jars (No. 2 cans or pint jars are recommended) in alternate positions; that is, head to tail, so that a uniform pack will be obtained.

4. Prepare a brine in the proportion of 1½ tablespoons of salt to 1 quart of water and pour it into the spaces between the packed fish, completely filling the container.

5. Covers are clinched loosely on tin cans, and jar tops are put on but not completely tightened, and they are exhausted 10 minutes at 212° F. Immediately following the exhaustion period tin cans must be completely sealed. Glass jars are not sealed until after processing.

Process.—Pint jars must be processed 70 minutes and No. 2 cans 60 minutes at 15 pounds pressure (250° F.).

To fill 12 No. 2 cans or pint jars, 25 pounds of herring in the round (not eviscerated) are required.

RIVER HERRING ROE

1. Wash the roe thoroughly in fresh water, picking out all bits of "black skin," or intestine.

2. Spread the roe in a thin layer on a wire-mesh screen and drain for 10 minutes.

3. Fill into No. 1 or No. 2 cans (half-pint or pint glass jars may be used). If scales are available, fill by weight. As the roe swells somewhat in processing, fill 14 ounces into a No. 2 can or pint jar, or 7 ounces into a No. 1 can or half-pint jar. If scales are not available fill by volume, leaving about three-fourths inch head space.

4. Fill the containers to the top with brine made in the proportion of 2 tablespoons of salt to 1 quart of water.

5. If canning in tin, the covers are clinched on loosely and the containers exhausted 8 minutes at 212° F. Tin cans must be completely sealed immediately after exhausting. If canning in glass, seal jars loosely until after process.

Process.—No. 2 cans 60 minutes and pint jars 70 minutes at 15 pounds pressure (250° F.).

To fill 12 No. 2 cans or pint jars, 10 pounds of roe are required.

OTHER FISH ROE

The roe of haddock, cod, hake, "Florida" or jumping mullet, and channel bass makes an excellent canned product. Roe of other salt-water fishes may be used if obtainable in sufficient quantities and if the individual eggs are not large. The roe of some fishes in southern waters is said to cause severe illness, however, and only mullet and channel bass roe can be recommended for canning in the South Atlantic and Gulf regions and on the coast of southern California.

1. Spread the roe on trays with wire-mesh bottoms where it can be sorted and allowed to drain. The roe must be picked free from all bits of intestine, gall bags, or other offal, and if it is dark-colored or bloody it cannot be used. If a gall bag breaks, the area covered by the fluid from the bag must be cut out and discarded immediately.
2. Wash the roe thoroughly in fresh water.
3. Slit the skin covering each lobe, or section of roe, and rub the lobe on a one-eighth-inch mesh screen placed in an inclined position over a pan. The roe will be separated from the membrane and drop into the pan. The separation may be accomplished more rapidly by running the lobes through a meat grinder that is fitted with a plate having one-eighth or one-fourth-inch holes, but the membranes also will pass through the grinder and must be skimmed off afterward.
4. After the roe is separated from the membrane it should be stirred vigorously for 5 minutes in brine made up in the proportion of 2 tablespoons of salt to 1 quart of water and at the rate of 3 pints of brine to 5 pounds of roe.
5. Filling and other details, including process and quantity of raw material, do not differ from the canning of herring roe.

CARP AND SUCKERS

1. Clean the fish and remove the fins, skin, and streak of dark flesh along each side. Split the fish, but do not remove the backbone, and cut into container-length pieces.
2. Wash and soak the pieces in a brine, made up in the proportion of one-fourth cup of salt to 1 gallon water, for 30 minutes. Then remove and drain.
3. Rub the drained fish with dry salt and pack in a stone crock for 2 hours with as much salt as will cling to the flesh.
4. Rinse the fish in fresh water, removing all traces of salt, drain, and pack them in either pint jars or No. 2 cans.
5. Place the lids on the containers loosely and steam for 30 minutes at 3 pounds pressure (220° F.). Then remove and invert the containers on a wire screen to drain for 2 or 3 minutes.
6. Place 1 bay leaf on top of the fish and fill up each container with chopped onion. Seal tin cans immediately. Glass jars must not be completely sealed before they are processed.

Process.—Pint jars 100 minutes and No. 2 cans 90 minutes at 10 pounds pressure (240° F.).

To fill 12 No. 2 cans or pint jars, 34 to 38 pounds of carp or suckers, round weight (as caught), are required.

Experimental packs following this method did not develop the so-called "muddy" or "kerosene" taste if the fish used were taken from clean waters. Off tastes were present in fish taken from badly polluted waters, though somewhat less prominent than when other canning methods were used.

MACKEREL, LAKE TROUT, WHITEFISH, AND FLORIDA MULLET

1. Clean the fish thoroughly, cutting away strips of the thin belly section, wash them in fresh water, and drain for a few minutes.

2. Split the fish, but do not remove the backbone, and cut them into container-length pieces. Soak these in brine, made up in the proportion of one-half pound of salt to 1 gallon water, for 60 minutes.

3. Drain the brined fish and fill into containers, flush with the rim, alternating head and tail ends in order to secure a good fill. If pint glass jars are used, the skin side of the fish should be placed against the glass. Submerge the open jars or cans in brine, made up in the proportion of 4 ounces of salt to 1 gallon of water, and bring to a boil for 15 minutes.

4. Remove the containers and invert them on a wire screen to drain for about 3 minutes. Drained liquid is discarded. Add 1 or 2 bay leaves and 1 or 2 slices of onion to each container. Seal tin cans immediately.

Process.—If packed in pint jars, process for 100 minutes at 10 pounds pressure (240° F.). Release pressure very slowly from the pressure canner, allowing 20 minutes or more, and remove the jars. If the pack is made in tin, process for 90 minutes at 10 pounds pressure (240° F.). Release pressure immediately.

To fill 12 No. 2 cans or pint jars, 35 pounds of fish, round weight, are required.

MACKEREL IN TOMATO SAUCE

Duplicate the method given above through step No. 3; then proceed as follows:

4. Remove the containers and invert them on a screen to drain for about 3 minutes and discard the drained liquid.

5. Pour hot tomato sauce over the fish to within one-half inch of the rim. Seal glass jars immediately and process for 100 minutes at 10 pounds pressure (240° F.), releasing pressure very slowly. Fill No. 2 cans with hot tomato sauce, seal immediately, and process for 90 minutes at 10 pounds pressure (240° F.).

Recipe for Tomato Sauce

1 gallon tomato puree.
6 tablespoons spiced vinegar sauce.
½ ounce ground horseradish.
1 tablespoon minced onion.
1 ounce salt.

Mix the ingredients and concentrate them by boiling to half their original volume.

To fill 12 No. 2 cans or pint jars, 33 pounds of fish, round weight, are required.

MACKEREL, READY-COOKED SALT-MACKEREL STYLE

1. Clean the fish and remove the heads, fins, and all other waste. Split the fish but do not remove the backbone. Trim off the thin belly strips. Wash the fish again and allow them to drain for a few minutes.

2. Soak the fish 60 minutes in a brine made up in the proportion of one-half pound of salt to 1 gallon of water, then drain them for about 10 minutes.

3. Rub the drained fish with fine salt and pack them in a stoneware crock with as much salt as will cling to the flesh. After 3 hours rinse the fish in fresh water, removing all particles of salt.

4. Drain the brined fish and fill into the containers, alternating head and tail ends in order to obtain a good fill.

5. Place the containers in a pressure canner, bring the pressure up to 3 pounds, and steam for 20 minutes.

6. Remove the containers, whether cans or jars, and invert on a wire screen to drain for 3 minutes. Seal tin cans immediately.

Process.—If packed in pint jars, process 100 minutes at 10 pounds pressure (240° F.). Process No. 2 cans 90 minutes at 10 pounds pressure (240° F.).

Mullet also may be packed by this method. Tomato sauce may be added if desired, using 3 tablespoons to each container.

To fill 12 No. 2 cans or pint jars, 28 to 31 pounds of mackerel or mullet are required.

MACKEREL AND MULLET, SMOKED

1. Split the fish along the back and clean the cavity thoroughly. Wash and soak the fish in a saturated brine solution from 1 to 2 hours, depending upon its size and the degree of salt flavor desired. Then rinse the fish in fresh water and allow the surplus moisture to drain off. Hang them on smoke sticks in a current of air to dry for about 2 hours, or until a thin, shiny, dry skin forms on the surface of the flesh. Smoke the fish for 2 hours in a light smoke, then increase the density of the smoke until the surface of the fish is straw yellow in color. This should require an additional 1 or 2 hours. The fish must then be cooled for several hours before they are prepared for canning.

2. Cut the smoked fish into container-length pieces and divide these into fingers, or strips about 2 inches wide. The backbone may or may not be removed, depending upon individual preference. Cutting out the backbone adds about 16 percent to the amount of waste.

3. Pack the strips in containers so as to obtain a solid cylinder of fish. The net weight should be 16 ounces for No. 1 tall cans, and 20 ounces for either No. 2 cans or pint jars.

4. Place the containers in a pressure canner, bring the steam pressure up to 10 pounds (240° F.), and cook the fish for 20 minutes. Then allow the pressure to return to zero and open the canner.

5. Invert the containers on a wire screen and drain for 3 minutes. Then right them and pour 3 tablespoons of hot olive oil (or cottonseed oil) into each. No salt is added.

Process.—Seal the lids on tin cans immediately and process for 90 minutes at 10 pounds pressure (240° F.). Seal pint jars rather loosely and process for 100 minutes at 10 pounds pressure (240° F.). Allow the pressure to return to zero before opening the vent after processing is completed.

To fill 12 No. 2 cans or pint jars, 30 pounds of smoked mackerel (approximately 60 pounds as caught) are required.

SALMON AND SHAD

1. Remove scales, fins, and head, and clean and wash the fish thoroughly. The backbone should not be removed, however, because it contains minerals essential in the diet and becomes edible during processing.

2. Cut the cleaned fish into can-length pieces and soak these for 60 minutes in a brine made up in the proportion of one-half pound of salt to 1 gallon of water. One gallon of brine will treat 25 pounds of cleaned fish. Do not use the brine more than once.

3. Drain the brined fish for several minutes and then fill it into the containers. Pack the containers solidly until the fish is level with the rim, but do not jam or crush the flesh.

Process.—If pint jars are used, seal them loosely and process in the pressure canner for 1 hour and 50 minutes at 10 pounds pressure (240° F.). If the fish is packed in No. 2 cans, crimp the lids loosely on the cans, using only the first operation roll of the double seamer, and steam in the canner for 15 minutes at 212° F. Then remove the cans and complete the seal immediately. Process for 1 hour and 40 minutes at 10 pounds pressure (240° F.). The 15 minutes steaming is not a part of the process.

If glass jars are used, after the processing period shut off the steam and allow the pressure to drop to zero. Then open the vent, remove the jars, and tighten the tops immediately. If tin cans are used, open the vent immediately at the end of the processing period and bring the pressure down quickly.

To fill 12 No. 2 cans or pint jars, 25 pounds of fish, round weight, are required.

SPICED FISH

Salmon, shad, mackerel, trout, or lake trout may be used.

1. Scrape off all scales, remove fins and heads, clean, and wash the fish thoroughly, but do not take out the backbones.

2. Cut the cleaned fish into can-length pieces and soak these in brine, made up in the proportion of one-half pound of salt to 1 gallon of water, for 60 minutes. Drain the fish for about 10 minutes.

3. Fill into pint jars or No 2 cans to a weight averaging 20 ounces, packed rather loosely. Fill up each container with half-strength spiced vinegar sauce. If pint jars are used, put them in cold water up to a level about 2 inches below the rims, bring the water to a boil, and cook for 20 minutes. If tin cans are used, set them in boiling water up to about 2 inches below the rims and boil for 20 minutes.

4. Invert the containers on a wire screen and drain for about 3 minutes. Right the containers and add a slice or two of raw onion, a bay leaf, a few mixed spices, and enough fresh vinegar sauce, full strength, to cover the fish. One tablespoon of olive oil may be added if desired.

Process.—Seal pint jars rather loosely and process for 90 minutes at 10 pounds pressure (240° F.). After processing is completed allow the pressure to return to zero before opening the vent. If No. 2 cans are used clinch the lids rather loosely and steam for 10 minutes in the pressure canner at 212° F. Seal the cans immediately after this exhaust period and process for 80 minutes at 10 pounds pressure (240° F.).

Spiced Vinegar Sauce

2 quarts vinegar (preferably distilled).
1 quart water.
2 ounces sugar.
¼ ounce whole white pepper.
¼ ounce mustard seed.
¼ ounce whole cloves.
⅛ ounce cracked cardamon seed.
⅛ ounce cracked whole ginger.
⅛ ounce bay leaves.

Add sugar and water to the vinegar, put in the spices (tied in a cloth) and allow the mixture to simmer for 1 hour. After straining use the clear liquor.

To fill 12 No. 2 cans or pint jars, 27 to 30 pounds of fish, round weight, are required.

TUNA-STYLE PACK

This method is best suited for albacore or white-meat tuna, tuna, king mackerel, and mackerel. Only large mackerel should be used.

1. Dress the fish and wash them thoroughly. Cut away strips of the thin belly section between one-half and three-fourths inch in width.

2. Place the fish in pans with perforated bottoms and stack these in the pressure canner. Bring the pressure up to 10 pounds and cook for 2 hours.

3. The cooked fish must be cooled for several hours, otherwise a high quality product with a firm texture and good flavor will not be obtained. When the fish is cool scrape away the skin with a knife, lift out the backbone, and cut away the streaks of dark flesh along the sides. Cut the meat into sections about three-fourths inch shorter than the length of the container.

4. Put one-half level teaspoon of salt and 3 tablespoons of olive oil or cottonseed oil in each empty container, either half-flat cans or half-pint jars. Larger-sized containers are not recommended for this style pack. Fill the meat solidly into the containers, using small flakes to fill interspaces.

Process.—Clinch the can lids on loosely and steam for 10 minutes at 212° F. Seal the cans immediately after the exhaust period and process for 70 minutes at 15 pounds pressure. Seal glass jars rather loosely and process for 80 minutes at 15 pounds pressure. Remove the jars and tighten the tops immediately.

To fill 12 half-flat cans or half-pint jars, 25 to 26 pounds of albacore, mackerel, or tuna will be required.

WHITING

1. Scrape off all scales, remove the head and fins, clean, and wash the fish thoroughly. Trim off the narrow strips of thin belly flesh.

2. Cut the cleaned fish into can-length sections and soak these in a saturated brine solution for 90 minutes, then drain for about 10 minutes.

3. Fill into containers, either No. 2 cans or pint jars, head and tail ends alternately to secure a good fill.

4. Put the containers (without lids) into a pressure canner, bring the pressure up to 3 pounds (220° F.), and cook for 30 minutes. Allow the pressure to fall to zero before opening the canner.

5. Invert the containers on a wire screen and drain for about 3 minutes to remove excess moisture. Right the containers and add 3 tablespoons of olive oil or cottonseed oil to each. One bay leaf and a half-dozen whole black peppers also may be placed in each container if desired. Seal cans immediately.

Whiting may be packed by the method given for smoked mackerel, except that in this case the fish are not split or boned. Follow steps 1 and 2 given above, with the exception of the brining period. Brine for 60 minutes and then smoke for 4 hours. Whiting packed in tomato sauce is considered an unsuitable product.

Process.—If packed in pint jars process 100 minutes at 10 pounds pressure (240° F.). Allow the pressure to return to zero before opening the vent after processing is completed. If the pack is made in No. 2 cans process for 90 minutes at 10 pounds pressure. Release pressure immediately.

To fill 12 No. 2 cans or pint jars, 26 to 30 pounds of whiting are required.

WHOLE CLAMS

This method is recommended only for the quahaugs, or hard clams, of the Atlantic coast, and butter, little-neck, razor, and hard clams of the Pacific coast. Experimental packs of other species have not been made.

1. The clams should be scrubbed and placed in a tub of clean salt water. As there is some danger that ocean water may be contaminated, it is always better to make up a 10 percent brine by dissolving salt in fresh water known to be safe. Scatter a few handfuls of cornmeal in the brine and allow the clams to remain in it from 12 to 24 hours.

2. There are two methods of opening clams. The product obtained by the first method is most attractive, but less time is required by the second method: (1) Open the live clams over a pan and save the juice, then open the stomach and scrape out the dark mass. In case of little-neck clams, the dark siphon, or "neck," should be snipped off; (2) put the clams into a steamer with a drip pan below to catch the juice and steam them for 20 minutes, then split open, clean, and snip off the siphons.

3. Wash the meats thoroughly in brine made up in the proportion of 2 ounces of salt to 1 gallon of water.

4. Blanch the clam meats for 1 minute in boiling water in which citric acid crystals have been dissolved in the proportion of one-half teaspoon of crystals to each gallon of water.

5. Pack the meats in No. 2 cans or pint jars to a net weight of 12 ounces. Strain the juice saved in shucking and concentrate it to about two-thirds of the original volume by boiling.

6. Fill the containers to within one-fourth inch of the top with the hot concentrated clam juice.

7. Seal tin containers immediately.

Process.—Pint jars, 70 minutes, and No. 2 cans, 60 minutes, at 10 pounds pressure (240° F.).

To fill 12 No. 2 cans or pint jars, 3 gallons of shucked meats (including juice) are required.

MINCED CLAMS

Quahaugs, butter, little-neck, and razor clams may be used.

Follow steps 1 to 4, inclusive, described in the canning of whole clams.

5. Grind the blanched and drained meats with a grinder, using a plate with one-eighth inch holes.

6. If scales are available, fill containers by weight, as follows: 6 ounces of ground meats into No. ½ flat or No. 1 cans, or half-pint jars, and 12 ounces into No. 2 cans or pint jars. If scales are not available fill three-fourths cup of ground meats into half-pint, and 1½ cups into pint containers.

7. Fill the containers to the top with the hot concentrated clam juice and stir until the meats and juice are well mixed.

8. Seal tin cans immediately.

Process.—Half-flat and No. 1 cans 60 minutes, and No. 2 cans 1 hour and 20 minutes at 8 pounds pressure (236° F.). Half-pint jars 1 hour and 10 minutes, and pint jars 1 hour 30 minutes at 8 pounds pressure (236° F.).

To fill 12 No. 1 or half-flat cans, or half-pint jars, 3 gallons of shucked meats are required.

OYSTERS

1. Wash the oysters carefully in either fresh water or a weak brine solution.

2. Place the washed oysters in metal baskets or pans and steam them in a pressure canner for 5 minutes at 10 pounds pressure (240° F.). An alternate method is to steam the oysters in a steamer for 15 minutes at atmospheric pressure (212° F.).

3. Shuck the oysters in the same manner as fresh oysters immediately after steaming. The meats should be shucked into a 3 percent brine solution because the protective mucous coating of the oyster meat is destroyed in steaming and the meats oxidize rapidly if exposed to air.

4. Wash the shucked meats in fresh water or weak brine of at least three times the volume of the meats until all sand or grit particles sink to the bottom.

5. Drain the washed oyster meats 5 minutes and fill into the containers. Filling should be by weight, as follows: 8 ounces in No. 1 picnic (Eastern oyster) cans or half-pint jars, 12 ounces in No. 1 tall cans, and 16 ounces in No. 2 cans, or pint jars. If scales are not available fill 1 cup, 1½ cups, and 2 cups,

respectively. A small quantity of 3 percent salt brine should be added to each container.

6. If the pack is made in glass, the containers are partially sealed without exhaust. Clinch the covers of tin cans lightly and exhaust for 5 minutes at 212° F., after which sealing is completed.

Process.—No. 1 picnic cans 29 minutes, half-pint glass jars and No. 1 tall cans 35 minutes, No. 2 cans 42 minutes, and pint glass jars 50 minutes, at 10 pounds pressure (240° F.).

The quantity of oysters required for 12 No. 2 cans or pint glass jars will vary with the locality and time of year. In Maryland and Virginia 3 bushels of unshucked oysters is the average requirement.

Olympic or native oysters of the Pacific coast are not usually considered large enough for canning.

CRABS, ATLANTIC AND GULF COAST

Only large-size crabs should be canned, and they must be alive at the beginning of the canning operation. Leather gloves or tongs may be needed for handling the crabs, although dipping in ice water makes them sluggish so there is little danger from pinching. Unless crabs are shelled before cooking it is impossible to control discoloration.

1. Dip the crabs in ice water for 1 or 2 minutes, then grasp the body between the back legs and break off the claws and legs. Claws are saved but legs are discarded as waste. To remove the back shell, insert the fingers in the leg holes and pull the shell apart.

2. Remove the gills or "fingers," crab butter, and other viscera and wash the bodies in a heavy spray of fresh water. The crabs may be washed in tubs if running water is not available, using a vegetable brush to scrub them. The water must be changed frequently and the crabs thoroughly rinsed after washing.

3. Pile bodies and claws in wire-mesh baskets or perforated cantainers that will fit in the pressure canner and steam them for 10 minutes at 8 pounds pressure (236° F.).

4. Pick the meat as soon as possible after steaming, keeping claw and body meat separate. The picker must be careful that bits of shell are not included in the meat, because shell is not softened by processing and it must be removed before the meat is canned.

5. Wash the meat in a brine made up in the proportion of one-half cup of salt to 2 quarts of water. Drain the meat for a few minutes, then dip it into a brine composed of one of the following solutions: (1) One-fourth cup of lemon juice in 2 quarts of water; (2) one level teaspoon of citric acid powder dissolved in 1 quart of water; or (3) one-half cup of vinegar to 2 quarts of water.

6. Press the meat with the hands until all excess moisture from washing and brining is removed.

7. Fill the meat into half-pound flat or No. 1 standard (Eastern oyster) cans, "C"enamel and lined with vegetable parchment paper, or half-pint glass jars. The use of containers of larger sizes is not recommended. Put from three-fourths to seven-eighths cup of meat into each can or jar. If scales are available, fill 6 to 6½ ounces by weight. Pour enough brine, made in the proportion of 1½ tablespoons of salt to 1 quart of water, into each container to cover the meat.

8. Exhaust tin cans 10 minutes at 212° F., then seal. Crab packed in glass is not exhausted, but is partially sealed and processed immediately after the brine is added.

Process.—Half-pound flat or No. 1 Eastern oyster cans 80 minutes and half-pint jars 90 minutes at 5 pounds pressure (228 F.). Glass jars must be completely sealed immediately after processing.

Body and claw meat are canned separately, as the claw meat is coarser in texture and darker in color. Many people prefer the claw meat because of its stronger flavor, and for this reason it is suggested for use in crab gumbo, deviled crab, and crab soup.

If the crabs are of average size, 24 pounds (weight as caught) are required for 12 No. 1 cans or half-pint jars.

CRABS, PACIFIC COAST (DUNGENESS)

1. Shell and wash the crabs as described for Atlantic coast crabs. Claws and legs are used and, in contrast to the blue crab, are considered of higher quality than the body meat.

2. Bring to a boil a large preserving kettle of water to which one-fourth cup of vinegar and 1 cup of salt per gallon have been added. A few whole black peppers and bay leaves may be added for seasoning, depending upon individual preference. Boil the crabs for about 20 minutes, counting from the time when the water again begins to boil after the crabs have been put in it.

3. Pick the meat out of the shells as soon as possible after cooking. In picking, break the claw and leg shells with a small mallet and peel off the broken pieces, taking care not to break the meat unnecessarily. Cut the body in two with a sharp knife, as if slicing a bun, and pound the shell against the pan in which the meat is to be picked. This loosens and releases the meat without breaking it into small pieces. The body and leg meat will be about equal in quantity and should be kept separate.

4. Immerse the picked meat for 1 minute in a brine made up in the proportion of one-half pint of white distilled vinegar and 1 cup of salt to each gallon of water.

5. Press the meat with the hands to remove excess moisture and fill it into the containers. Half-flat, pound tall, or No. 2 "C"enamel lined cans may be used, and the usual practice is to put in a lining of vegetable parchment paper as additional protection. In filling, a layer of leg meat is placed on the bottom, then a layer of body meat, with another layer of leg meat on top.

Glass containers should be of the half-pint or pint size. When canning in glass, place a layer of leg meat on the bottom and around the sides, so as to present an attractive appearance, and fill the center with body meat.

If scales are available fill the containers by weight: 6½ ounces to a half-flat can or half-pint jar, 13 ounces to a pound tall can, and 17 ounces to a No. 2 can or pint jar. One level teaspoon of salt is added to each pint container.

6. Glass jars are partially sealed and processed immediately after filling. If the pack is made in tin cans, the covers are clinched on loosely and the cans are exhausted 10 minutes at 212° F., after which they are sealed immediately.

Process.—Half-flat cans 70 minutes, No. 1 cans 75 minutes, and No. 2 cans 80 minutes at 5 pounds pressure (228° F.). Half-pint jars 80 minutes and pint jars 100 minutes at 5 pounds pressure (228° F.).

It is especially important to water-cool both Atlantic and Pacific canned crabs immediately after processing to completely prevent discoloration. Packs in glass must be air-cooled.

To fill 12 half-flat cans or half-pint jars, 13 to 15 average crabs are required.

DEVILED CRABS

18 cups crab meat.
8 cups water.
2 cups salad oil.
6 level tablespoons salt.
1¼ cups flour.
½ cup Worcestershire sauce.
8 level tablespoons dry mustard.
6 level tablespoons minced onion.

Either Atlantic or Pacific crab may be used. Small broken pieces and coarse or dark-colored meat are better used here than in plain canned crab.

1. Carefully pick and remove all bits of shell and other foreign matter from the crab meat.

2. Mix together the flour, mustard, and salt and then stir in the oil, gradually making a smooth paste. The onion and Worcestershire sauce are added last.

3. Mix the water and crab meat thoroughly and add them to the above, 1 cup at a time, stirring well so that an even mixture will be obtained.

4. Fill into half-flat or No. 1 cans, or half-pint jars.

5. Clinch covers loosely on tin cans and then exhaust 10 minutes at 210° F., following which they must be completely sealed. Glass containers are not exhausted but should be loosely sealed until after processing, when they must be completely sealed.

Process.—Half-flat or No. 1 cans 70 minutes and half-pint glass jars 80 minutes at 10 pounds pressure (240° F.).

This recipe is sufficient to fill 24 half-pint containers.

When canned deviled crab is prepared for the table, add a few tablespoons of toasted bread crumbs and a little cream or evaporated milk and mix well. Then fill into shells or small baking dishes, sprinkle with bread crumbs, and bake in a hot oven until browned.

CRAB GUMBO

8 cups crab meat.
2 cups minced onion.
1¼ cups minced green pepper.
4 cups hot water.
1½ cups olive oil.
4 pints canned tomato.
4 pints canned okra.
1 cup flour.
1½ tablespoons salt.
1 teaspoon white pepper.
¼ teaspoon ground mace.
¼ teaspoon powdered thyme.
1 clove of garlic, minced.

The crab gumbo of New Orleans is well known as one of the most appetizing of sea-food specialties. This recipe brings it to the table with all the flavor and rich quality of creole cookery.

1. Pick over the crab meat carefully for bits of shell. Dice the onions and green peppers and cut the okra into small slices.

2. Heat the oil in a kettle and blend in the flour slowly, stirring until it is cooked. The onion and pepper are then added.

3. When these have cooked until soft, stirring constantly, the tomatoes and seasoning are put in and brought to the boiling point, after which the okra, hot water, and crab meat are added.

4. Heat the gumbo almost to the boiling point and fill into No. 2 cans or pint jars.

5. Tin cans are sealed immediately but glass jars are only partially sealed until after processing.

Process.—No. 2 cans 70 minutes, and pint jars 80 minutes at 10 pounds pressure (240° F.).

Gumbo prepared by this recipe is not in a concentrated form and should not be diluted when served.

This recipe is sufficient to fill 12 No. 2 cans or pint jars.

CRAB SOUP, NORFOLK STYLE

8 cups crab meat.
2 cups diced green pepper.
2 cups diced celery.
2 cups diced onion.
2 pints (No. 2 cans) tomato.
7½ pints water.
½ pound butter.
¼ cup dry rice.
1½ level tablespoons salt.
1 level teaspoon white pepper.

This product is preferred by many who find crab gumbo too highly seasoned.

1. Pick over the crab meat carefully for bits of shell, then wash and drain.

2. Braise the diced celery, pepper, and onion together in one-half of the butter. When these are soft add the tomato.

3. While these ingredients are heating, braise the crab meat in the remainder of the butter in another pan and add it to the above, together with the water.

4. Simmer until the boiling point is reached, add the pepper and rice, stir the mixture vigorously, and fill into containers.

5. Seal the containers immediately while the contents are hot.

Process.—No. 1 cans 45 minutes, No. 2 cans 75 minutes, and pint jars 80 minutes at 10 pounds pressure (240° F.).

LOBSTER

1. Place the live lobsters in boiling water that contains 2 tablespoons of salt to each gallon. Boiling will momentarily cease, but upon resumption the lobsters should be cooked for from 15 to 30 minutes, depending upon their size.

2. Remove the lobsters from the boiling water and immediately chill them in cold water that contains 1 tablespoon of salt per gallon. Do not use sea water for cooling purposes. After the lobsters are cool, pick out the meat in as large pieces as possible.

3. Wash the meat quickly but thoroughly in running water, and pick out any shell fragments that remain. Then drain the meat for from 5 to 10 minutes to remove as much excess water as possible.

4. After draining, dip the meat in a solution made up of one of the three following: (1) One-fourth cup lemon juice in 2 quarts of water; (2) 2 level teaspoons of citric acid powder in 2 quarts of water; or (3) one-half cup vinegar in 2 quarts of water.

5. Press the meat lightly with the hands to remove excess moisture from the washing and brining and fill into No. 1 standard (Eastern oyster) cans, "C" enamel, lined with vegetable parchment paper. Half-pint glass jars may be substituted for the cans. Owing to difficulty in processing, larger containers are not recommended. Pack 6 ounces (three-fourths cup) in the cans or jars as follows: Place tail meat on the bottom, small pieces of arm meat in the center, and claw meat on top, dark side up, alternating ends to secure a good fill.

6. Fill the containers to the top with hot brine made up in the proportion of 3 tablespoons of salt to each gallon, clinch the lids loosely, exhaust for 10 minutes, and complete the seal. Do not exhaust glass jars, but seal them immediately after the hot brine is added.

Process.—No. 1 (Eastern oyster) cans 60 minutes at 10 pounds pressure (240° F.), or 80 minutes at 5 pounds pressure (228° F.). Half-pint glass jars 70 minutes at 10 pounds pressure (240° F.), or 90 minutes at 5 pounds (228° F.).

SHRIMP, WET-PACK METHOD

This product should be packed only near the place where the shrimp are taken, as they spoil quite readily.

1. If the shrimp are taken by the canner's family, they should be headed as soon as removed from the water. If this is done the black streak along the back, the so-called "sand vein," can be removed with the head. After the shrimp are out of the water 30 minutes or more the black streak cannot be removed in this manner. If the shrimp are bought from a fisherman he may be persuaded to head them when caught, if arrangements are made in advance and the catch is fairly light. No practice can do more toward improving the quality of this product.

2. The shrimp should be packed in finely crushed ice as they are headed. This not only retards spoilage but it has been found that the shells can be more easily removed after the shrimp have been in ice for some time.

3. When ready to start canning, wash the shrimp thoroughly and pick out all bits of seaweed or other refuse. Stale shrimp, which may be recognized by their dead flat color, traces of blood, and a strong ammonical odor, must be discarded.

4. Peel the shrimp and wash the meats in fresh water.

5. Place not more than 35 pounds of the meats in a galvanized metal container and cover them with cold brine, made up in the proportion of one-half cup of salt to 1 quart of water, for from 20 to 30 minutes, depending upon their size. Stir the shrimp occasionally so that brining will be uniform.

6. Drain the meats and place them in wire baskets of the type used for deep-fat frying. The basket should be not more than half full. Fill a large preserving kettle with brine made up in the proportions given above. Bring the brine to a boil and lower the basket of shrimp meat into it. Cook for 6 to 8 minutes, counting the time from when the brine again begins to boil after the shrimp have been put in. This step is known to commercial canners as "blanching." The brine can be reused, but it will be necessary to add salt in the proportion of 1 tablespoon to each quart of brine after each batch is blanched. The brine should be discarded entirely and replaced by a fresh lot after each five batches, otherwise the canned shrimp will be ragged and the liquid in which they are canned will be "ropy."

7. Spread the blanched shrimp on a wire-mesh screen, tray, or rack to dry and cool. An electric fan will shorten the time required. Bits of shell and whiskers that were missed in peeling and washing may be removed at this time. The meats must be cool and show no traces of surface moisture before filling into the containers.

8. Fill the meats into the containers by weight, 6 ounces into a No. 1 can or half-pint jar, and 12 ounces into a No. 2 can or pint jar. Fill the containers with scalding brine, made in the proportion of 1½ tablespoons of salt to 1 quart of water and seal immediately. Cans should be of the "C" enamel type, sea food formula, although plain cans are suitable if they are lined with vegetable parchment paper.

9. Containers should be processed immediately after sealing.

Process.—No. 1 cans 20 minutes at 10 pounds pressure (240° F.), or 10 minutes at 15 pounds pressure (250° F.). No. 2 cans 30 minutes at 10 pounds pressure (240° F.), or 15 minutes at 15 pounds pressure (250° F.). Half-pint jars 25 minutes at 10 pounds pressure (240° F.), or 13 minutes at 15 pounds pressure (250° F.). Pint jars 35 minutes at 10 pounds pressure (240° F.), or 20 minutes at 15 pounds pressure (250° F.).

To fill 12 No. 2 cans or pint jars, 18½ pounds of "green" headless shrimp are required.

FISH CHOWDER

5 pounds diced potato.	2 quarts fish broth.
5 pounds cubed fish.	½ cup flour.
¾ pound salt pork.	½ teaspoon white pepper.
¾ pound ground onion.	2 tablespoons salt.

Chowder is made from groundfishes, especially cod and haddock on the New England and North Atlantic coast, channel bass and sea bass in the Middle Atlantic States, grouper and red snapper on the coast of Florida and in the Gulf of Mexico, and gray cod, or rockfish, on the Pacific coast. Fish broth is the liquor obtained by cooking edible scraps of fish in water in the proportion of about 4 pounds of scraps to 1 gallon of water. The mixture is allowed to simmer for 2 hours, after which it is strained and the scraps discarded.

1. Grind the pork and onions and cook them together in a preserving kettle until they are soft but not brown.

2. While the pork and onions are cooking beat flour slowly into the fish broth until a smooth liquid is obtained. Then put the broth into the kettle, add the salt and pepper, and allow to simmer to the boiling point.

3. To prevent discoloration, potatoes should be blanched immediately after dicing or kept in water until needed. Three-fourths cup of diced potato (½-inch cubes) and three-fourths cup of raw fish cut into cubes are filled into each No. 2 can or pint jar. Some canners find it better to steam the fish for 30 minutes in a pressure cooker at 15 pounds pressure and then flake it.

4. Add a scant half cup of hot fish broth to each container and seal immediately.

Process.—No. 2 cans 80 minutes and pint jars 90 minutes at 10 pounds pressure (240° F.).

This is a concentrated chowder and should be diluted with an equal quantity of milk when heated for serving.

This recipe is sufficient to fill 12 No. 2 cans or pint jars, or 24 No. 1 cans.

CLAM CHOWDER, NEW ENGLAND

9 cups diced potato.
9 cups chopped clam meat.
1½ cups ground salt pork.
1½ cups ground onion.
2 quarts clam juice.
½ cup flour.
2 tablespoons salt.
½ teaspoon white pepper.

Soft, hard, or butter clams may be used.

1. Clams should be thoroughly washed before shucking.

2. Clams may be shucked raw or steamed open. In either case the body membrane should be cut off, the siphon snipped off, the body cut open and the dark body mass removed.

3. Thoroughly wash the dressed meats and blanch them for 1 minute in boiling water that contains 2 tablespoons of salt and one-fourth teaspoon of citric acid crystals to each quart. Drain the meats and chop them coarsely.

4. The juice should be saved when shucking raw clams. If the clams are steamed open the juice may be caught in a pan placed beneath them in the steamer. Strain the juice and dilute it with water if the clam flavor is too strong.

5. Mix the pork and onions and cook them together in a kettle until they are soft and yellow. Beat the flour into the clam juice and add these to the pork and

onions, bring to a boil, and add the seasoning. Thyme also may be used as a seasoning if desired.

6. To prevent discoloration, blanch the potatoes immediately after dicing, or cover them with water until needed.

7. Put three-fourths cup of diced potato and three-fourths cup of clam meat into each container, fill to the brim with the hot soup (step 5), and seal immediately.

Process.—No. 2 cans 75 minutes and pint jars 80 minutes at 10 pounds pressure (240° F.).

To prepare for the table add an equal volume of milk to the canned chowder and bring it to a boil.

This recipe is sufficient to fill 12 No. 2 cans or pint jars.

CLAM CHOWDER, MANHATTAN OR CONEY ISLAND

The difference between Manhattan and New England clam chowders is that three-fourths cup of diced celery and 1 quart of tomatoes are added to the soup in making Manhattan chowder.

To prepare Manhattan clam chowder for the table, add an equal volume of water to the chowder and bring it to a boil.

EXAMINATION OF CANNED FISHERY PRODUCTS

When grading the quality of home-canned fishery products, especially competitive exhibits of home demonstration clubs or community groups, ratings should be based upon a score card such as suggested in table 2.

TABLE 2.—*Suggested score card for judging canned fishery products*

Points for consideration	Condition	Grade	Perfect score
External appearance of container	Good	8 to 10	10
	Average	6 to 8	
	Poor	4 to 6	
Amount of head space	Good	4 to 5	5
	Average	3 to 4	
	Excessive	2 to 3	
Fill	Good	16 to 20	20
	Average	12 to 16	
	Poor	8 to 12	
Texture	Firm	4 to 5	5
	Slightly soft	3 to 4	
	Soft	2 to 3	
Color of flesh	Good	8 to 10	10
	Average	6 to 8	
	Discolored	4 to 6	
Cleaning	Good	8 to 10	10
	Average	6 to 8	
	Poor	4 to 6	
Odor	Normal	16 to 20	20
	Stale	8 to 16	
	Tainted	0 to 8	
Flavor	Good	8 to 10	10
	Average	6 to 8	
	Poor	4 to 6	
Quantity of salt	Good	8 to 10	10
	Insufficient	6 to 8	
	Excessive	4 to 6	

The outside of containers should be thoroughly cleaned and neatly labeled, showing the name of the product and date of packing. The pack should not include any substance merely for "show." For example, in packing crab meat the inclusion of a claw, properly placed, would be decorative, but it would not improve the product. When discoloration or loss of color occurs readily during processing, packs for exhibition are sometimes purposely understerilized to minimize the color changes. Such practices should be discounted in grading. The wire clamps of glass-topped jars must be clean, free from rust, and not deformed. Glass tops must not be chipped around the edges. Zinc screw tops must be clean and free from dents. Rubber jar rings (washers) must be resilient, show no signs of cracking, and form a perfect seal between the jar and jar top.

CAUTION

If spoilage is suspected, even in slight degree, do not attempt to verify the fact by tasting the product. One taste of a spoiled canned fishery product may cause serious illness or death. When opening a container observe the contents carefully, and if they seem unduly soft or have a cheesy, sour, or tainted odor it is reasonable to suspect that they are no longer fit for food. In the case of tin cans, bulging ends (fig. 1) must be regarded as a definite indication of spoilage. Spoiled products should be destroyed as quickly and completely as possible—preferably by burning. Clams, shrimp, and other products packed in tin cans may darken the inside of the container and become discolored. The discoloration is harmless but it renders the product unsightly.

CERTAIN FISHERY PRODUCTS UNSUITABLE FOR CANNING

Because of changes that take place during canning, certain sea foods are rendered unpalatable either during processing or subsequent storage. In canning sea trout, for example, a large proportion of the moisture content of the fish is extracted, leaving the product in a fibrous or disintegrated condition and usually accompanied by an unpleasant flavor. The flesh of grayfish contains urea, and in processing the urea is transformed into ammonia that renders the product unsavory. Heat treatment sufficient to sterilize the sea food portion of shrimp or crab cocktails will caramelize the sauce and impart a scorched flavor.

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