

Fishery Leaflet 18

Washington 25, D. C.

*

Re-issued April 1945

HOME PRESERVATION OF FISHERY PRODUCTS

Salting, Smoking, and Other Methods of Curing Fish at Home

By Norman D. Jarvis, Technologist, Branch of Commercial Fisheries

Illustrations by Katherine L. Howe

Contents

	Page :		Page
Introduction	1	Smoking—Continued	15
Preservative action in curing fish	1	Fillets	15
Corning, or temporary preservation		Salmon	15
while fishing	2	Catfish	16
Brine salting	2	Smoking method for sportsmen	16
Herring	4	Pickled fish	17
Dry salting	5	Herring	17
Barracuda	7	Cut spiced herring	18
Drum or channel bass	7	Rollmops	18
Mullet	8	Russian sardines	18
Shark	8	Potted herring	19
Fish roe	9	Pickled carp	19
Drying	9	Pickled pike or pickerel	19
Rackling	10	Pickled eels	19
Dried shrimp	10	Pickled salmon	20
Smoking	10	Escabeche	20
Hot smoking	13	Pickled clams, oysters, mussels	20
Cold smoking	14	Pickled shrimp	21

INTRODUCTION

Fish may be corned, brine-cured, dried, dry salted, smoked, or pickled (vinegar cured). These methods have several advantages over canning: they are simpler, do not require much equipment, are less expensive, and permit utilization of varieties not canned successfully. One disadvantage, however, must be kept in mind: unlike canning, these methods do not preserve indefinitely; in fact, for certain fish and methods, preservation is limited to a comparatively brief period. This single disadvantage, though important, does not outweigh the many advantages of fish-curing (a general term for all these methods of preservation). Moreover, even when containers and canning equipment are readily available, fish curing is often preferable to canning.

PRESERVATIVE ACTION IN CURING FISH

Food preservation is essentially the prevention of spoilage. The most important cause of spoilage is through micro-biological action. Fresh, dried, salted, or smoked fishery products may be rendered unfit for use by a wide variety of causes other than ordinary decomposition. Micro-organisms, however, are the cause of putrefaction, which is the ordinary form of spoilage. They require moisture and warmth for development, and the most favorable temperatures for the development of spoilage organisms are from 70° to 100° F. Therefore, removal of a large part of the moisture from a given product, and its storage at temperatures unfavorable for bacterial development have a direct effect. Cured fishery products should be held at temperatures below 70° if the maximum length of preservation is to be obtained.

For the maximum length of preservation, moisture should be reduced to about 20 percent. This usually requires a long curing period and some special equipment. Under ordinary home conditions, cured products with a moisture content of 40 percent are about all that can be expected.

The chemical cause of spoilage most common in cured fishery products is oxidation, or rusting. If the surface of the flesh is exposed to the air or the action of sunlight, it turns yellow to brown and acquires an unpleasant, rancid flavor. An increase of 18° F. in temperature during storage doubles the speed with which this will occur. The most important physical cause of spoilage results from damage by insects, and rodents such as rats or mice.

To best protect home-cured fishery products against these chemical and physical spoilages, they should be placed in tightly-closed containers and kept in a cool, dry place, preferably dark. Brine-cured products should be weighted down so that they will be kept below the surface of the brine. Smoked products should be covered with a thin coating of paraffin or dusted with fine salt, wrapped in oiled or parchment paper, and packed in tightly closed boxes.

CORNING, OR TEMPORARY PRESERVATION WHILE FISHING

Sport fishermen, and the casual angler, frequently bring in catches in poor condition. Sometimes the fish must be discarded. The latter is especially true when the weather is warm, and the fisherman is a considerable distance from home, or is unaware of a method by which fish may be properly handled when refrigeration is not available.

Such waste is avoidable if the proper procedure is followed. Bleed the fish as soon as caught by pulling out the gills completely, leaving no remnants. Clean the fish as soon as possible, scraping out all traces of blood and intestinal material. Wash the body cavity thoroughly. Thorough cleaning delays spoilage; if the body cavity is not thoroughly cleaned, spoilage begins sooner than if the fish were not cleaned at all.

Rub the belly cavity well with fine table salt containing one tablespoon pepper per cup. Rub salt into the flesh at a ratio of about one tablespoon to 3/4-pound of fish, dusting a small amount on the skin side.

Place the fish in a basket or box. A loose packing of green leaves around the fish has been found useful in inland regions. Cover the container with several thicknesses of burlap. The burlap must not rest on the fish since there should be an air space above them. Keep the cloth well moistened with water, since evaporation of moisture lowers the temperature in the container.

Treated in this manner, fish should remain in good condition for at least 24 hours when ice is not available. When rinsed thoroughly, the fish so treated are ready at once for cooking in any way desired. If rolled in salt and packed away with as much of it as will cling to them, they will keep for about 10 days. These fish should be freshened for about ten hours in one or two changes of fresh water.

BRINE SALTING

Brine salting of fish at home requires a set of 1- to 5-gallon stoneware crocks with tight-fitting covers; 1 or 2 tubs or cut down barrels for washing or preliminary brining; and, at least, 2 sharp knives, one large and one small. The family storing less than 50 pounds of salt fish, however, needs only a sharp knife and two 2-gallon stoneware crocks. Stoneware crocks are advised because there is little danger of leakage, foreign flavors are not absorbed by the container walls, and the crocks may be used later for other purposes.

The salt used should be pure and clean, free from dirt and moisture. It should be of a fairly small grain, "three-quarters" ground or "dairy fine." Many commercial salters prefer a coarsely ground salt, but a finely-ground salt is preferable in home salting as it forms into brine and penetrates the flesh more rapidly. Chemical impurities, especially carbonates and magnesium salts, should be present in less than 1 percent quantity by chemical analysis. These chemicals delay the brine penetration and give the product an acrid, salty flavor, whereas the pure salt imparts a much milder flavor.

It is usually better to allow the brine to form by packing fish and salt in layers. Even a saturated brine may be weakened sufficiently for incipient spoilage during salting. The danger is that too much or too little salt may be used. Too much salt may "burn" the fish, while too little may permit fermentation and spoilage during curing.

The number of species salted commercially is quite limited, but almost any variety may be salted at home. As a rule, the so-called "lean" species are salted more readily; salt brine does not penetrate as rapidly in "fat" fish. With the latter, oxidation and rancidity occur more readily, and they need extra care both in salting and storing. When cured successfully, however, they make a salt fish of the finest quality.

Fresh-water fishes usually salted are lake trout, whitefish, lake herring, blue pike, yellow pike, catfish, perch, and pickerel. Others that may be salted at home are sheephead, carp, suckers, buffalofish, river herring (alewife), eels - in fact, almost any fish of satisfactory size.

Salt-water fishes commonly salted at home are cod, hake, cusk, pollock, bluefish, sea trout (or squeteague), channel bass, rock or striped bass, salmon, shad, sea bass, rockfish (rock cod), mackerel, sea herring, and Florida mullet. Others that are salted, but not to such an extent, are croaker, hogfish, scup, barracuda, butterfish, spots, whiting, grouper, halibut, sablefish, and robalo (snook).

The method of pickling, in general, is the same for all varieties. Smaller fish are split down the back so as to lie out flat in one piece with the belly not cut through. A cut is made just under the backbone, and the flesh is scored with the point of a knife at intervals about one-inch apart. All traces of blood or membrane are cleared away, and the gills removed from the split head.

Large fish are split into two fillets, removing the backbone. The collarbone just below the gills is not cut away. The fish are damaged more in handling if this is done; and, if it is intended to smoke the brined fish, the pieces will often drop from the smokehouse hangers, since the skin and flesh cannot support the weight unless the collarbone is present. The flesh of the large pieces or fillets is scored longitudinally to a depth of about 1/2-inch at intervals, 1 or 2 inches apart. The cuts should not penetrate to the skin. Cut the pieces just long enough to lie flat on the bottom of the crock or tub.

Thick-skinned, spiny-finned fishes with large scales, such as carp, suckers, buffalo, black bass, channel bass, and catfish should be skinned and the fins removed. This is best done by making a deep cut along each side of the fin, which is then pulled away by hand. This method is much more rapid than the usual system of clipping, and removes the small bones in the flesh at the base of the fins.

The fish, whether large or small, are washed thoroughly in fresh water, after which they are soaked for 30 minutes to one hour in a brine made in the proportion of 1/2 cup salt to one gallon water to remove diffused blood from the flesh and to cut away slime from the skin. The fish are drained for 5 to 10 minutes after brining.

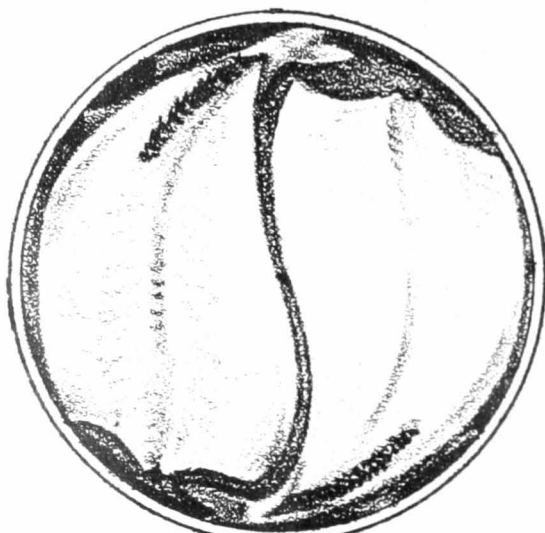
Make a shallow box about 2 feet square with sides 6 inches high. Fill this with dry salt. Scatter a thin layer of salt on the bottom of the crock or keg in which the fish are to be salted. Dredge each piece of fish with salt, and rub salt into the places where the flesh is scored. Pick up the fish with as much salt as will cling to it and pack in the container, skin side down. Arrange the pieces so that an even layer will result.

With large fishes, this is best done if the thick side, usually the one with the backbone, is placed next to the wall of the container. An extra piece may be placed in the middle, if needed. Pieces should overlap each other as little as possible. Scatter a thin layer of salt over the layer of fish, and arrange the next layer of fish in place at right angles to the preceding layer.

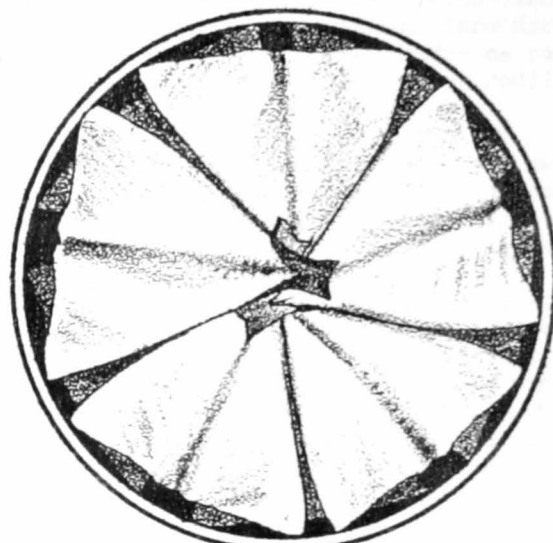
Small fish such as spots, butterfish, or croakers are packed in a ring with the tip of the head touching the walls of the container. It will be necessary to lay one or two fish across the center to keep the layer level. Stagger successive layers so that each fish rests on two fish of the layer below. Scatter salt between each layer. The top layer of fish, both large and small, should be packed skin side up.

The amount of salt used depends on the purity and grain of the salt (less is required, for example, if the salt is of high purity and small grain), the season of the year (more salt is required in warm weather), size and fatness (large, thick, or fat fish require more salt), and probable length of preservation. The proportion of salt used runs from 1/4 to 1/3 of the total weight. A general rule is to use one part salt to three parts fish. In salting, be careful not to exceed the proper proportion - an excess will "burn" the fish, lowering the quality.

Place a loosely-fitting wooden cover on the top layer of fish, and weight the cover down. Fair-sized rocks or bricks, previously well-washed, make good weights. The fish will form its own brine. Small fish like spots or croakers may be "struck through," or completely brined in 48 hours, thicker, larger, fatter fish will require a week or 10 days. At the end of this time, with the exception of a few varieties, the fish are removed, scrubbed in fresh-saturated brine with a stiff bristle brush, then repacked with a very light scattering of salt between layers. Layers must be well-pressed down. Fill the crock or keg with a fresh-saturated salt brine and store the container in a cool, dark place. After three months, or at the first sign of fermentation - especially if the weather is warm - change the brine again. Brine-cured fish generally have kept longer, but should not be expected to remain in good condition for more than nine months.



Method of Packing Large Fish in Container for Brine-salting



Method of Packing Small Fish in Container for Brine-salting

Herring

Since herring are more easily obtainable than other fish by people living at or near the sea shore in the North Atlantic and Pacific regions, they are one of the most important fish for home curing. Brine-curing them requires a separate discussion, however, as methods of cleaning, packing, and curing differ in certain procedures.

Herring intended for brine salting must be strictly fresh, in good condition, and thin or small-sized fish should not be used. They must be free from "feed" or other materials causing enzymic spoilage; and should not be bruised or crushed. Ice must not be used if a salted product of good quality is desired; instead the fish should be cured immediately on landing.

The herring may be brined whole (without cleaning), or they may be "gibbed" - that is, cut through at the throat, removing part of the viscera without cutting the belly. In gibbing, one takes hold of the herring by the middle with the left hand, thumb on one side of the head and fingers on the other, leaving the throat clear. A small, short-bladed paring knife is stuck through the gills, just under the gill cover and with the edge of the blade toward the gibber, and gives a sharp twist upward and outward. If the herring are fresh and the operation performed properly, the throat and pectoral fins together with the main gut and gills are taken out in a single motion. Before the knack is acquired, more than one motion may be required.

The herring are then well washed in sea water or salt brine, preferably the latter, stirring the fish about. This operation removes scales and leaches the blood from the flesh. After washing, the fish are drained for about ten minutes, or until all excess moisture is removed, thrown into a shallow box of fine salt, and stirred about until all the salt possible clings to them.

Scatter a very thin layer of salt on the bottom of a large crock or keg which must be tight and free from leaks. Take up a herring with as much salt as will cling to it, but no more. Place it straight against the side of the container, back down. Place two others in front of the first, their heads touching the side walls of the container, one to the right the other to the left, straight on their backs, belly up, and packed as tightly as possible. Place a fourth herring in the middle between the two; and, two others, heads to the side walls as before. The head-end of the middle herring should be alternated. Continue to pack in this fashion until the layer is completed. The rows must not be irregular, and the fish must not be packed on a slant or they will not be salted evenly. The space at the sides of the container where the heads touch must be filled. Two herring are placed here with their heads pointing in opposite directions. This leaves an even surface for succeeding layers. Enough salt should be scattered on top so that the layer is just covered.

Begin another layer. Pack each layer at right angles to the one preceding. The top layer should be packed with backs up and salted a little more heavily than the others. Fill the container with fresh 100 percent brine, and close tightly. Store in a cool, dry place. The brine should be changed at 2-month intervals if the fish have not all been used. Fairly fat herring will require a total of 35 pounds of salt per 100 pounds of fish.

DRY SALTING

Dry salting is the method of fish curing best adapted to warm climates, but is widely used by non-commercial fish curers in northern areas as well. Nearly all fish may be used, although fatty fish are much more difficult to cure, and they keep a shorter period of time. As a rule, properly dry-salted fish keep for a longer period than when brine-salted. This depends, however, on temperature, atmospheric humidity, percentage of moisture remaining, and on the care used in preparation and storage.

The method used in salting is generally the same, but there are many local modifications. The method given here is especially descriptive of the home-curing of cod, haddock, cusk, hake, and pollock, but is applicable to most large non-fatty fish. Variations necessitated by differences in species or by local conditions are discussed elsewhere in this report.

The fish are bled by cutting the throat and pulling out the gills as soon as caught. This results in a much lighter-colored flesh in the finished product.

When the fish reach shore they must be thoroughly washed. Then the head is cut off, but the "lugs" (hard, bony collar plates) must remain. If not, the fish will shred apart during curing or afterward in handling. Cut down the left side of the backbone, with the knife edge at a slight downward slant, so that it scrapes the backbone. If the knife blade is held level, much flesh is left on the backbone. Continue the cut down to the tail so that the upper side is removed in one piece. Then, insert the edge of the knife blade just below the end of the backbone at a slight upward angle, and cut down to the tail. The fish is now separated into two sides of fillets. If the cutting is well done, the sides are perfectly smooth, with practically no flesh left on the backbone.

Another method, especially adapted to smaller fish (from 2 to 5 pounds) is to cut down the middle of the belly to the vent (anal opening). Lay the fish on the edge of the table so that the head overhangs. Grasp the head and give a quick downward jerk, which removes the head more quickly and easily than by cutting. With the fish lying on its side, cut above the backbone from neck to tail holding the knife horizontal and working from the belly side. This cut must not be too deep. It must not go through the back skin. Next, cut the backbone below the vent (leaving about one-fifth of tail section as a hinge). Cut forward just below the backbone to the head, thus, removing it. Make another cut below the remaining section of backbone in the tail section, so that salt may penetrate. The fish should now lie open in one piece.

After the fish is split, scrub the inside of the belly cavity with a piece of coarse sacking to remove the black skin and to clean away blood, membranes, and bits of viscera. Place the fish in a tub of water; wash, and brush thoroughly with a stiff bristle brush. Only pure, fresh-drinking water should be used. Brine made in the proportion of 1 cup salt to 1 gallon water is often preferable to plain water. Afterward, drain the fish to remove surplus moisture.

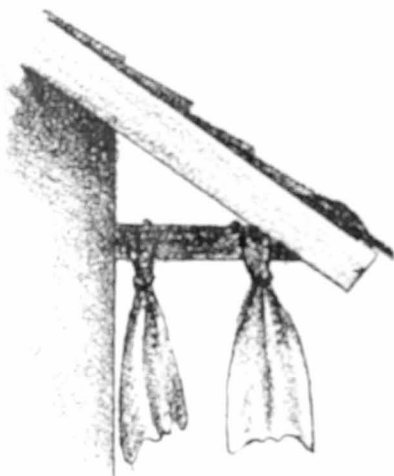
Dredge the fish in a box of salt as in brine salting. Stack the fish in rows on the floor, choosing a place where the brine formed will run away to a drain. First, scatter a

thin layer of salt on the place where the fish are to be stacked, and arrange them in place by alternating heads and tails. Scatter a little salt between the layers of fish. Fish are piled flesh side up, except for the last layer which is piled skin side up. The average amount of salt used is 1 pound to each 4 pounds of fish.

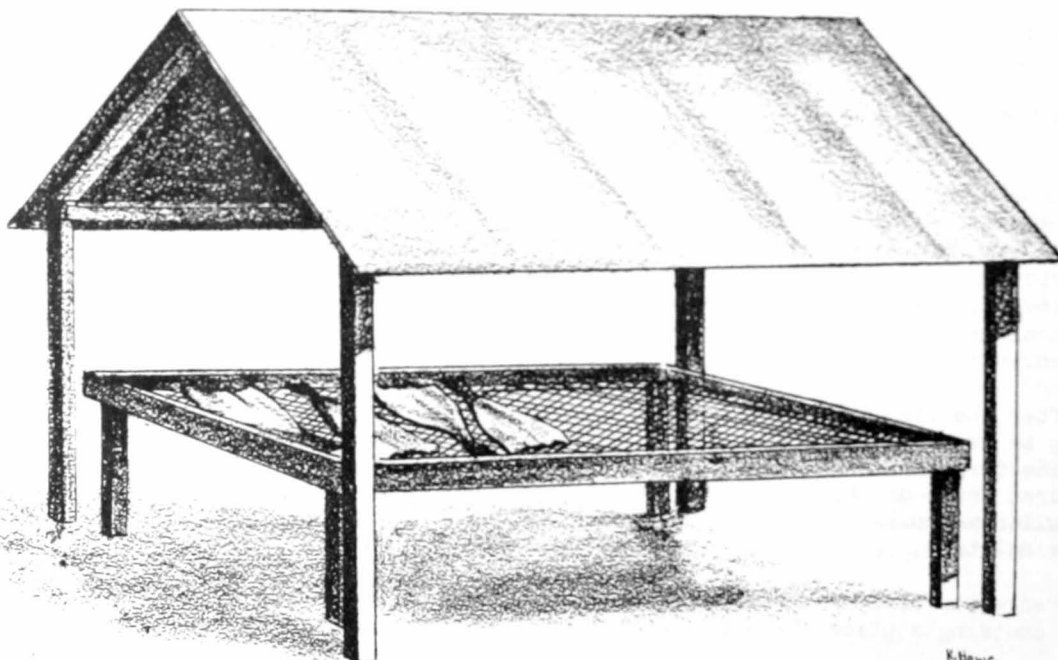
The fish are taken out of salt after 48 hours to one week, depending upon the size of the fish and weather. In damp or stormy weather, they are allowed to remain in the salt, as it is useless to attempt drying. Less time is required for salting in warm weather.

When the fish are ready for drying, they should be scrubbed in brine to remove all excess salt and dirt. No traces of salt should be visible on the surface. After draining 15 to 20 minutes, the fish are ready for the drying racks. These are frames of wood covered with chicken wire and standing on legs about 4 feet high. A slat top of thin poles or laths may be substituted for wire mesh, if a two-inch space is left between laths. The drying racks must be placed on dry ground, preferably covered with gravel.

Oxidation, or rusting of the fish, occurs most readily if they are dried in direct sunlight. If the fish are kept shaded in a breezy location, they will dry well with a clear color. For this reason, drying is best done in the shade under an open-walled shed ventilated by air currents. If only a few fish are being dried, they may be hung under overhanging eaves, or from the rafters of a shed or barn where there is good cross-ventilation.



Drying a Few Fish under
Overhanging Eaves



Drying Shed and Rack for Dry-salting Fish

K. Howe

If placed on racks, the fish are laid skin-side down, but should be turned three or four times the first day. They should be gathered up and stored each night, for they sour and mold if left spread out in the open. The fish are stacked in rows, alternating heads and tails, flesh side up except for the top layer. No stack should be more than two feet high, and there should be a rack at the bottom to prevent contact with the floor. Each stack is weighted down evenly, the weights at least equaling that of the fish in the stack. Additional moisture is pressed out of the flesh. If the fish cannot be taken out to dry the next day because of unfavorable weather, they must be repiled at the close of the day, placing the top layers of fish at the bottom. If the weather continues to be unfavorable for drying, the fish are left in the stacks, but are repiled every other day with a small amount of fine salt (about 1 pound to 10 pounds of fish) scattered between layers.

A smoke smudge under the drying racks may be necessary, for the first day at least, to prevent the flies from "blowing" the fish. The smudge should be made of green wood, or a wood fire smothered by green branches. Resinous woods such as pine or fir must not be used. The time required for drying depends upon weather conditions, the size of the fish, and the length of preservation desired. Fairly large cod, haddock, hake, or pollock must receive 60 hours of air drying - about six good days of drying. The usual test to determine sufficiency of drying is to press the thick part of the flesh between thumb and forefinger; if no impression can be made, the fish are sufficiently dried.

The cured fish are wrapped in waxed paper, packed in a thin wooden box, tightly covered, and stored in a cool, dry place. At the first signs of rust, mold, or reddening, scrub the fish off in a salt brine and dry in the air for a day or two.

Barracuda

Remove the head, leaving the collarbones, slit down the middle of the belly to the vent, and clean the body cavity thoroughly. Make a cut just above the backbone on the abdominal side, cutting along a line where the rib bones join the backbone, and continuing the cut to the tail. Hold the edge of the blade at a downward angle so that no flesh is left on the backbone. A similar cut is made just below the backbone. A sweep of the knife through the cut section of rib bones still adhering to the flesh removes the backbone which is broken off near the tail. These cuts must not reach through to the skin. When splitting is completed, the barracuda should lie flat in a single piece. After splitting, the fish is washed thoroughly in salt brine and soaked 30 minutes to remove all traces of blood. The flesh is scored almost to the skin, the cuts running longitudinally from collarbone to tail.

Fine salt should be rubbed well into the flesh and the fish packed flesh-side up in tubs. Scatter sufficient salt between the layers to cover any exposed surface. Place a loose-fitting cover on top of the fish with sufficient weights to keep all fish under the surface after the brine has formed.

After 48 hours, remove the fish, scrub well in brine and dry for one day as described previously. At the end of the day, the fish should be packed in layers between thick layers of clean sacking, alternating layers of fish and sacking until the stack is completed. Weight down the stack as heavily as possible. The next morning, dry the fish for a second day. After about 40 hours or 5 days of air drying, the fish should be sufficiently dry.

Drum or Channel Bass

Split the fish in two sides, removing the backbone. Each side should be scored through the flesh longitudinally (from neck to tail), the cuts penetrating almost to the skin and about 2 inches apart. Wash the sides thoroughly in a salt brine to remove all traces of blood or other waste, and drain for about 20 minutes.

Dredge the sides about in a box of fine salt, rubbing salt well into the flesh and especially into the cuts. Pack in even layers in tubs, flesh side up. Scatter a little more salt between each layer, and weight down the top. Fill the tub with a saturated salt-brine. The fish are allowed to remain in the tub about two weeks. Take out, and scrub the fish thoroughly to remove any blood spots, black skin, or excess salt. Stack the sides in a row, like cordwood, but not more than 1 foot high. The bottom row should be laid skin-side down, but the other layers should be placed skin-side up. Cover the top with boards and weight down by rocks.

The second day the fish are restacked, reversing the layers. The third or fourth day, depending upon the weather, the sides are placed on racks in the shade for about 8 hours of

air drying. The flesh, during the first day's drying, should not be exposed to direct sunlight since a crust is formed that would prevent the removal of moisture from the inner flesh. At the end of the day, the fish are again stacked as before and heavily weighted down. They remain in the stack for two days, after which they are given a day of drying. Then they are repiled, and given two days of pressing. The process of one day of drying followed by two days of pressing is continued until the fish have received about 10 days of drying. The fish are cured thoroughly when the pressure of a thumb in the thick part of the back makes no impression.

Mullet

While small mullet are suitable for brine curing, only the larger fish weighing one pound or more, make a good, dry-salted product. The heads are first removed, leaving the collarbone as usual. They are split mackerel-style, along the back just above the backbone. When the knife is drawn toward the tail it must not go clear through the skin so that the lower half is cut in two. A cut is made under the backbone and the flesh is scored longitudinally on both sides. Intestines, "black skin," and blood must be cleaned out. Scrubbing with a piece of coarse sacking or canvas is the most effective means of removing black skin and blood from the flesh.

The cleaned fish are washed thoroughly, and dropped in a tub of salt brine made in the proportion of 1 pound of salt to 1 gallon of water. They should be allowed to soak in the brine for 30 minutes to remove all traces of blood from the cut flesh. After brining, the mullet are drained for at least 20 minutes to remove surplus moisture. A shallow box, about 2 feet square, is filled with salt, usually a dairy-fine grade. The drained fish are dredged in this salt, and salt is rubbed into the slashes in the flesh. A thin layer of salt is scattered over the bottom of a tub. The fish are then picked up with as much salt as will cling to the body and packed in even layers in the tub, flesh-side up, each layer at right angles to the preceding one. A small amount of salt is scattered between each layer. A loose-fitting cover is placed on top and weighted down sufficiently so that the fish will be covered by the brine formed. In warm weather, a saturated brine may be added immediately, instead of allowing it to form gradually by extracting moisture from the flesh. The amount of salt used should not be more than 3 pounds per 10 pounds of fish.

The mullet should be sufficiently salted in about 36 hours, after which they should be removed from the brine. Scrub thoroughly to remove any traces of excess salt, and place in layers, flesh-side up (except for the top layer), on a low rack. The stack should be weighted down to press moisture out of the flesh, and the next morning the mullet hung in a shady spot where there is a good breeze, or should be dried on racks as described previously. At night, they are restacked and weighted down, and set out again to dry the next morning. A small amount of salt is sometimes scattered between the layers in stacking, but any excess salt must be brushed off before the fish are taken out to dry.

In good drying weather the mullet will be sufficiently cured after 4 days; in unfavorable weather, and for the largest fish, more time may be required. When dried, each fish is wrapped in waxed paper, packed in a tightly covered wooden box, and stored in a cool, dry place.

Shark

Curing must begin within the shortest possible time after catching, as spoilage occurs more rapidly with this than with many other species. The shark is gutted, and skinned, after which the carcass is split into two sides, removing the backbone. The large streak of dark meat along the middle of each side must be cut away, dividing each side into two fillets of light-colored flesh. The individual fillets may be further divided into two or more pieces if the shark is very large. The individual fillet, or piece, should not weigh more than 5 pounds. Each piece is then scored lengthwise with a knife on both sides. The pieces are dropped into a tank of saturated salt brine to soak for about one hour.

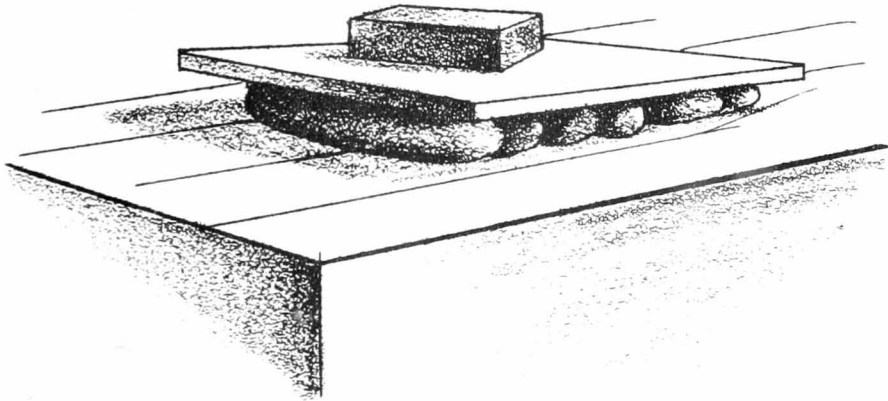
The fillets are drained of excess moisture, rolled around in a box of fine salt, and the salt rubbed well into the slashes in the flesh. They are packed in layers at right angles to each other in a tub, with a scattering of salt between each layer of fish. The top is weighted down to keep the flesh below the surface of the brine which is formed. They remain in salt from 5 to 10 days, depending on size (larger pieces requiring more time), and weather. The fillets are kept longer in salt during unfavorable weather.

When the meat has been sufficiently salted, the pieces are scrubbed thoroughly in fresh brine, and laid in small heaps to drain for 2 or 3 hours. They are hung out to dry in a shady location having a good breeze, or are laid out on racks. Drying under the direct rays of the sun is apt to discolor the flesh, especially during the first days of the drying period.

At the end of the day's drying, shark fillets are piled up in small heaps with weights on top equivalent to about half the weight of the fish. The next day the fish are again dried and in the evening stacked under weights with the amount of pressure somewhat increased. The pressure is increased until it is about three times the original weight of the fillets, and curing is complete. This requires about 10 days. The fish are hung in a light smoke (the temperature should not exceed 80 F.) for one day (about 10 hours). The last step is often eliminated in good drying weather. Shark fillets are wrapped in waxed paper with a scattering of fine salt, and packed in tightly covered boxes.

Fish Roe

A very good home-substitute for caviar may be made from the roe of several types of fish, especially mullet, herring, shad, drum (or channel bass) and striped bass (or rock). The roe must be fresh, and the skin of the roe-sac must not be broken. The lobes of roe are first freed from blood, gall bags, and bits of intestine or black skin. After washing, the roe is allowed to drain for about 30 minutes, and rolled in fine salt. Two pounds of salt to 10 pounds of roe should be sufficient. Too much salt must not be used as it will break the egg sacs.



Pressing Mullet Roe during Drying Process

The roe is taken out of salt after 12 hours and brushed to remove any excess. The pieces are laid in direct sunlight, usually on a shed roof. During the first day of drying, the roe is turned every hour. At the end of the day, it is stored indoors. Any moisture falling on the roe after drying has started will spoil, or at least damage, the product. Boards and weights are placed on the roe for the first night or two so as to slightly compress them. Drying requires about one week under good drying conditions. The drying is completed if the roes feel hard when pressed between thumb and forefinger, and when yellow to red-brown in color. The dried roes are dipped in melted beeswax. After cooling about 15 minutes they are wrapped in waxed paper, packed in a wooden or tin box, and stored in a dry, cool place. The roe is sliced thin, like sausage, and eaten without further preparation as an appetizer or relish.

DRYING

The curing of fish solely by drying in the open is not practiced extensively in this country. This is because the weather is not suitable in many localities, and because the flesh of many species available to the non-commercial fisherman has a fat content of 5 percent or more and, therefore, is difficult to preserve by air drying alone. Another reason is that a combination of salting and drying requires much less time and skill than air-drying alone. In the north Pacific and Atlantic States (and for shrimp drying, in the Gulf of Mexico area) air-drying offers some possibilities for those desiring to preserve fish at home.

Rackling

This is a product introduced to this country by Scandinavian fishermen who prepare it for home use. Large flounder, halibut, pollock, cusk, hake, rock cod, or similar fish with a fat content of about 2 percent are suitable. The fish are headed leaving the collarbone, and split into two sides, removing the backbone. The sides are cut in long, narrow strips about an inch in width, left joined together at the collarbone. They are washed thoroughly, (all traces of blood must be removed) and soaked in a saturated salt brine for one hour. They are hung out to dry, preferable in a shady place where they will not be exposed to direct sunlight. Drying requires from one to two weeks. When wanted for use, the rackling may be soaked for a few hours, and steamed and made into fish cakes, fish loaf, or creamed fish. It is most often eaten like jerked meat, however, without any preliminary preparation.

Dried Shrimp

Small shrimp not suitable for the commercial market, or large catches which cannot be used fresh, may be dried at home. The shrimp are first washed thoroughly, picking out all bits of seaweed and other waste, and allowed to drain.

Prepare salt brine, in the proportions of 1/2 cup of salt to one quart of water. Bring to a boil, put in the whole, washed shrimp. Allow them to boil for about 10 minutes, counting the time from the moment when the brine begins to boil after the shrimp have been added. When the meat has separated from the shell it is cooked, which may be determined by breaking open a shrimp.

Spread the boiled shrimp in a thin layer to dry in the sun. A slanting shed roof makes an excellent drying platform. The layer of shrimp must not be more than one inch thick. Turn them at half hour intervals during the first day of drying, so that all parts of the layer will be equally dried. The shrimp are gathered at night and stored in a dry, well-ventilated place. This must also be done at the first sign of rain. Do not place a covering directly on the shrimp or they will start to heat and sour.

Drying requires about three days if the weather is good, longer if drying conditions are unfavorable. When the shrimp are thoroughly dry and hard, place them in a sack. Beat the sack with a piece of board. This separates the shells from the meats. Then, take a wooden-frame, wire-mesh screen with 1/4-inch mesh, and set it up at an angle. Shovel the mixture of meats and shells against the screen as in sifting sand. The bits of shell and waste fall through, while the meats roll down to the bottom of the screen. From 100 pounds of green shrimp, 12 or 13 pounds of dry shrimp should be obtained, together with an equal amount of shell. The dried shrimp meat may be soaked in water for a few hours, wiped dry, rolled in butter or oil and fried. They are also excellent in curries, gumbos, and jambalayas. When the dried meats are ground and mixed with butter and spices they make an excellent sandwich spread. The dried meats are also used with beverages as appetizers.

SMOKING

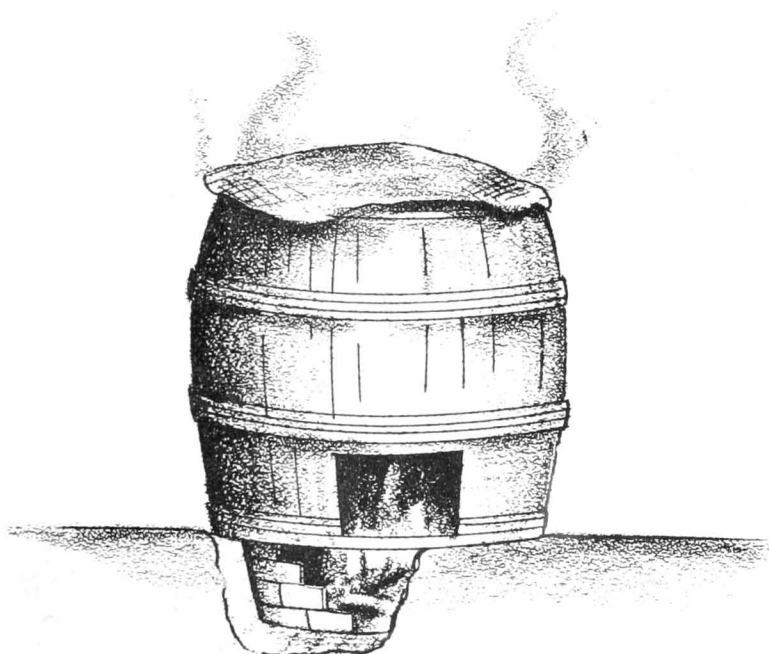
Smoking is a method which should be used much more extensively in home food preservation of fishery products. When the curing is properly done, it is inexpensive and the product is of high quality, attractive in appearance and taste. Although preservation by smoking usually lasts for a shorter time than by salting, the product is more appetizing. If smoked fish spoils quickly and is poor in quality it is because the smoking is improperly done. If proper attention is given to materials and methods little difficulty should be experienced.

The efficiency of smoking depends on the drying action of the smoldering fire. Wood smoke has little if any preservative action; it is only a flavoring and coloring agent. According to the species, fish may be smoked either in the round, gutted, split and beheaded, or cut into pieces with or without the skin removed.

There are two general methods of smoking fish: hot smoking or barbecuing, and cold smoking. In hot smoking, the fish are hung near the fire, usually not more than 3 or 4 feet distant, and smoked at temperatures from 150° to 200° F., so that they are partially or wholly cooked. Therefore, while hot smoked fish is very appetizing, and requires no preparation, it will keep for only a short time. In cold smoking, the fish are hung at some distance from a low smoldering fire and cured at temperatures usually lower than 90° F. (A temperature of 90° F. may be used occasionally). Degree of preservation depends on the length of time the fishes are smoked; fish cold-smoked a few hours, for example, will keep only a short time. If an extended period of preservation is desired, fish must be cold-smoked from a few

days to a week or more. The same general principles governing the smoking, handling, and storing of cured meats should be followed with fish.

A smokehouse for preparing small lots of fish is easily made by knocking the ends out of a large barrel; setting it over a hole in the ground about 2 feet deep and a little narrower in width than the diameter of the barrel, and nailing wooden strips inside the barrel on two sides, a few inches below the top. The ends of the smoke-sticks rest on these strips. Place a loosely fitting cover on top. Dig a hole adjacent to the bottom of the barrel connected with the pit, and fit it with a cover. The fire is fed through this hole which also serves as a draft when the lid is partly raised. A smokehouse so constructed is best for hot smoking, but it may be used for cold smoking if operated carefully. If the fire is permitted to flare up, however, the fish may be scorched. It is best to dig the fire pit about 12 feet away from the smokehouse pit and connect them by a covered trench which acts as a pipe. Always place the fire pit on the side from which the prevailing winds come.



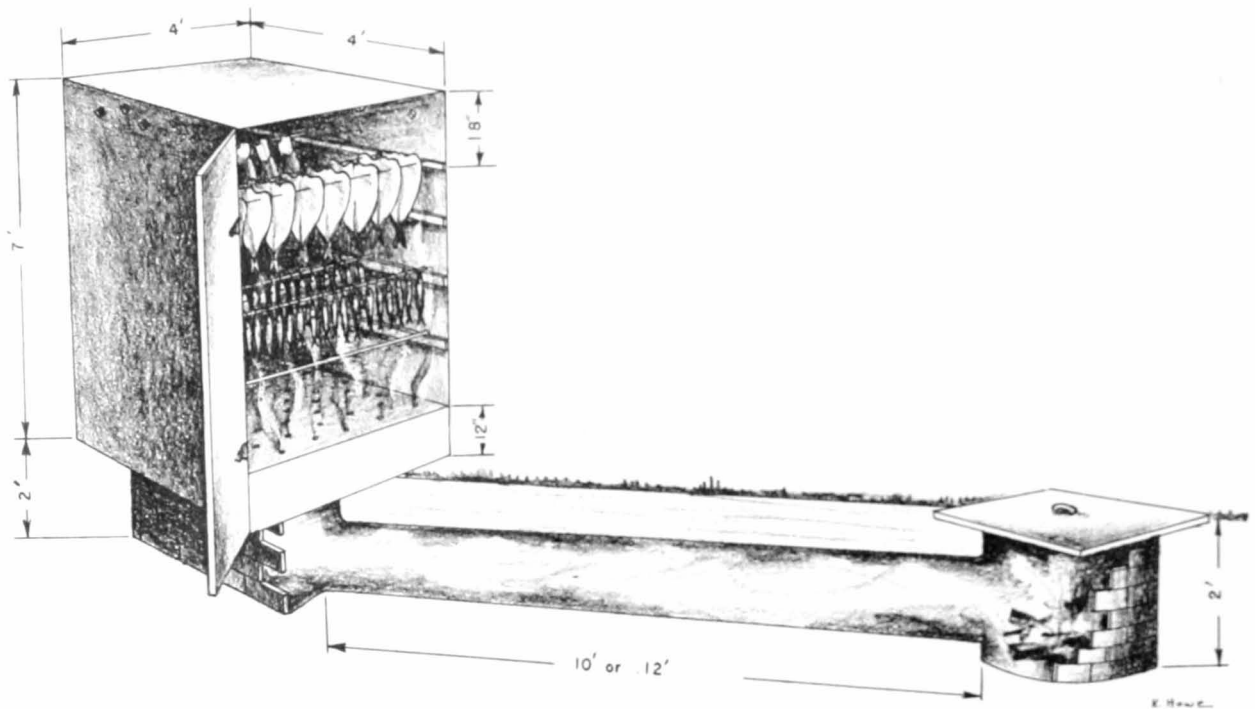
Barrel Smokehouse with Fire Pit below for Hot Smoking



Barrel Smokehouse with Fire Pit at a distance for Hot or Cold Smoking

K. Howe

If a more permanent smokehouse is desired, and one that will handle a larger amount of fish, make a little shed, 7 feet high and 4 feet square, inside measurement. About 12 inches above the ground, place a false bottom with $\frac{3}{4}$ or 1-inch auger holes at 2-inch intervals. On the two sides, wooden battens are nailed at 1 foot intervals, the first about 18 inches below the top. The ends of the smoke-sticks on which the fish are hung rest on these battens. The whole front of the house is hinged for a door. Three or four holes about 2 inches square are cut on the two sides a few inches below the roof, with slides to cover, for use as drafts or ventilators. The pit below the smokehouse and the fire pit may be lined with brick. A teracotta drain-pipe may be placed in the trench connecting the two pits to act as a chimney.



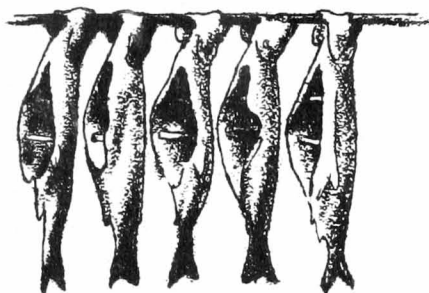
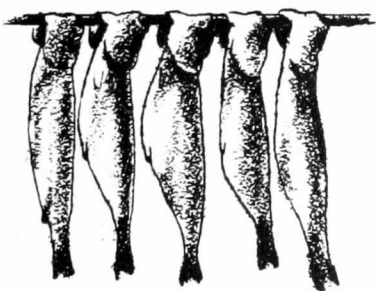
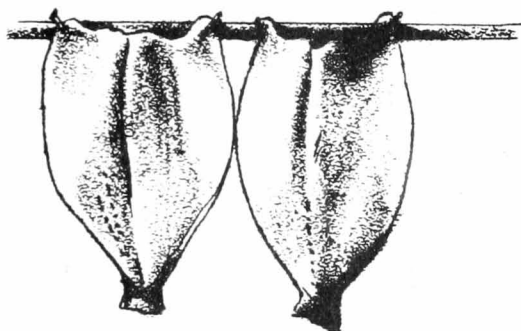
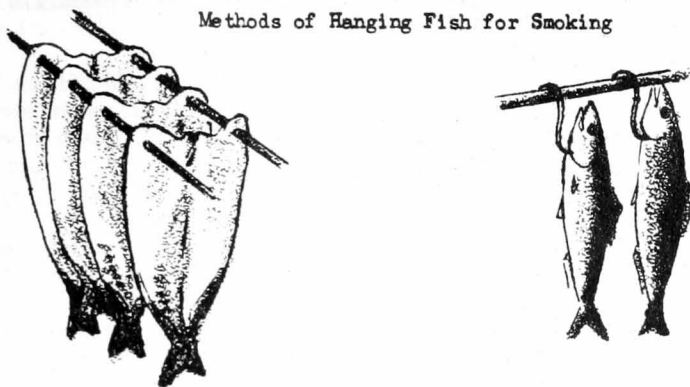
Smokehouse (Shed Type) for a Larger Number of Fish

Almost any non-resinous wood may be used as fuel in smoking. Oak, hickory, and beech are preferred in the north, but on the seacoast old driftwood is most commonly used. Alder is a favorite fuel on the north Pacific coast, manzanita roots in California. Some of the woods that may be used in the southern States are scrub oak, live oak, hickory, sweet bay, river mangrove, palmetto roots, and buttonwood. Dry corncobs make a good fuel, but the fire must be watched carefully or it will flare-up and become too hot. This applies also, to coconut husks, in tropical or sub-tropical fisheries. Dry, fruit-tree wood makes an excellent fuel when obtainable, giving an especially desirable color and flavor to the fish. Hard-wood sawdust and chips are better than larger pieces of wood as they make more smoke, and smolder more slowly. Sawdust or chips of pine or similar resinous woods are very undesirable.

The fish may be hung on one or more S-shaped iron hooks, which are in turn hung over sticks running from one side of the smokehouse to the other. If whole, they may be hung on

round wooden sticks inserted under the gill flap and through the mouth. When these sticks have been hung with fish they are suspended from one side to the other of the smokehouse. If the fish are split, the smoke-sticks may be 2-inch square sticks. Nails are driven through two sides at a 45 degree angle at intervals, depending on the average size of the fish smoked. The sides of the fish are hung on adjacent nail-points, just below the bony neck-plate, thus holding the fish open so that all of the flesh surface will be smoked. Another method is to run 1/4-inch iron rods through the fish just under the hard bony plate at the neck, one rod on each side. Thus, each fish hangs from two rods. Twelve or more fish may be hung on a set of two rods 4 feet long. Fillets may be hung over three-sided sticks of wood which in turn rest upon the sticks at each side of the smokehouse.

Methods of Hanging Fish for Smoking



Hot Smoking

General method:- This process, which differs from some of the usual ones described, may be used with almost any species; with mullet, for example, shad, Spanish mackerel, mackerel, alewives or river herring, herring, lake herring, whitefish, and king mackerel. The method is recommended if it is desired to prepare a fish that can be used immediately without cooking. By it, hot-smoked fish may be kept longer without molding or souring, but even so, it will preserve for only a short time.

Split the fish along the back, just above the backbone so that it will be open in one piece, leaving the belly solid. Scrape out all viscera, blood, and membrane. Make an additional cut under the backbone for the smaller fish. For the larger fish, cut out the forward three-fifths of the backbone. Wash thoroughly and soak in a 70° salt brine ($\frac{1}{2}$ cup salt

to 1 quart water) for 30 minutes to leach blood out of the flesh. Then, prepare a brine using the following ingredients: 2 lbs. salt, 1 lb. sugar, 1 oz. saltpeter, 1 oz. crushed black peppers, 1 oz. crushed bay leaves. This is made up into a 90° brine (saturated salt solution). The amounts of ingredients are increased in proportion to the amount of brine to be made. The spices used may be increased both in variety and quantity.

The fish are held in this brine for periods varying from 2 to 4 hours, depending upon their size and thickness, amount of fat, and the desire for a light or heavily cured fish. Weather conditions also make a difference; the exact length of time must be determined by experiment. Rinse off the fish in fresh water and hang outside in a cool, shady and breezy place to dry for about 3 hours before hanging in the smokehouse, or until a thin shiny "skin" or pellicle has formed on the surface.

For the first 8 hours that the fish are in the smokehouse, the fire is low and smoldering. The temperature should not be higher than 90° F. A dense smoke should then be built up. After 4 hours of heavy smoking, the fire is increased until the temperature is between 130° and 150° F. The fish are cured at this temperature for 2 to 3 hours, or until they have a glossy, brown surface. This partially cooks, or hot-smokes, the fish.

When smoking is finished, the fish must be cooled for two or three hours. They may be brushed over lightly with vegetable oil (usually cottonseed) while warm. This is sometimes done just after finishing the cold-smoking part of the process. The oil forms a light protective coating, but the chief value of this treatment is to make the appearance more attractive. Another method is to dip the fish in melted paraffin; thus, a more effective protective coating is formed, but the fish must be handled carefully as the coating is brittle. The paraffin must be peeled off when preparing the fish for the table. Each fish should be wrapped in waxed paper and stored in a cool dry place. Spoilage occurs more rapidly if the fish are stored in a warm place or under damp and cold conditions.

Cold Smoking

Small fish, such as sea herring, alewives (river herring), spots, or butterfish may be cold-smoked in the round (without cleaning), but they should be gibbed. Gibbing consists of making a small cut just below the gills and pulling out the gills, heart, and liver while leaving the belly uncut. Fish larger than 1 pound should be split along the back to lay flat in a single piece, leaving the belly portion uncut. All traces of blood, black skin, and viscera must be removed, paying special attention to the area just under the backbone. The head does not need to be removed. If the head is cut off, the hard bony plate just below the gills is allowed to remain, as it will be needed to carry the weight when the fish are in the smokehouse.

The next step is to wash the fish thoroughly, whether gibbed or split, and place them in a brine made in the proportion of 1 cup of salt to one gallon of water. They should be left in the brine at least 30 minutes to soak out blood diffused through the flesh. At the end of this time, rinse in fresh water to remove surplus moisture, and drain for a few minutes.

Each fish is dropped singly in a shallow box of fine salt and dredged thoroughly. The fish are picked up with as much salt as will cling to the body, and packed in even layers in a box or tub. A small amount of salt may be scattered between each layer. The fish are left in salt from 1 to 12 hours depending upon the weather, size of fish, fatness, length of time for which preservation is desired, and whether the fish are round or split.

When the fish are taken out of the salt, they should be rinsed thoroughly. All visible particles of salt or other waste should be scrubbed off. They are hung to dry in the shade as described in the dry-salting (p. 4) of fish. An electric fan may be used if there is not much breeze. The chicken-wire drying-racks used in dry-salting may be utilized if they are not exposed to direct sunlight. The fish will dry on both sides but the impression of the chicken-wire detracts from its appearance. The fish is dried until a thin skin, or pellicle, is formed on the surface. This should take about 3 hours under average conditions. If smoking is begun while the fish are still moist, the time required is longer, the color will not be as desirable, the fish will not have as good a surface, and will steam and soften in smoking.

A low, smoldering fire is started an hour or two before the fish are hung in the smokehouse. The fire must not give off too much smoke during the first 8 to 12 hours if the total cure is 24 hours, or for the first 24 hours if the cure is longer. The temperature in the smokehouse should not be higher than 90° F. in California or the southern States, or 70° F.

in the northern States. If available, a thermometer should be used in controlling smoke-house temperature, if not, a rule-of-thumb test is to insert a hand in the smokehouse, and if the air feels distinctly warm, the temperature is too high.

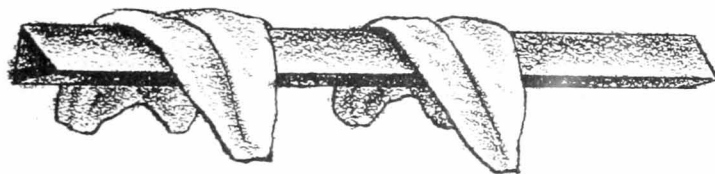
When the first part of the smoking process is ended, a dense smoke may be built up and maintained for the balance of the cure. If the fish are to be kept for about 2 weeks, they should be smoked for 24 hours, if for a longer time, smoking may require 5 days or even more. Hard-smoked or red herring may require 3 or 4 weeks.

A few general rules must be followed in tending the fire: it must be kept low and steady; where hard wood sawdust is not available, chips and bark do almost as well. The fire must not be allowed to die out at night, or should it be built up before leaving, as this will create too much heat. It must be tended regularly during the night.

The general method of cold smoking may be used with most fish if the proper consideration is given to size, climate, humidity, salting, and other limiting factors. A few products requiring varying preparations from the general method are discussed separately.

Fillets

Any white-fleshed, "lean" fish which will produce fillets weighing more than 1 pound may be used. Cut the fish into fillets, removing the backbone and skin. Cover with a 90° brine (saturated salt solution) and hold for two hours. Remove and drain for 10 to 15 minutes and air dry for two hours. Hang across a three-sided smoke-stick, each side about 3 inches in width. Cure over a fire with a fairly light smoke for 4 hours at a temperature not higher than 90° F. Turn the fillets so that the side resting on the smoke-stick is uppermost and smoke 4 hours longer. Smother the fire so that a dense cloud of smoke is obtained, and smoke until the fillets are a deep straw yellow, turning the fillets once or twice so that both sides will be evenly colored. This operation should take about 6 hours. Cool the



Hanging Fillets for Smoking

fillets and wrap each separately in vegetable parchment or waxed paper. Store in a cool, dry place. They will keep about 10 days.

Salmon

All species of Pacific salmon, but especially chinook or king, the Atlantic salmon, and steelhead, and lake trout may be smoked. The general cold-smoking method is most commonly used; but the following method, though it may be more complicated, gives a more appetizing product.

The heads should be cut off and the fish gutted. They must be split into two sides, and the backbone removed. To do this, the shoulder of the salmon is forced down on a sharp-pointed nail protruding from the cleaning table to prevent slipping. Short incisions are made under the anal fin, just above and below the backbone. With the upper lug or shoulder tip of the fish held by the left hand, enter the knife at the shoulder above the backbone, holding the blade steady, with the edge at a slight downward angle touching the bone. Take the whole side off with one sweep of the knife. If the work has been well done, little flesh will be left on the backbone and the side will be smooth. A thin line of backbone edge should run down the center of the side. To remove the second side, a cut is made at the shoulder just under the backbone. With the edge of the knife blade resting against the backbone at a slight upward angle, give one sweep of the knife down to the root of the tail. This separates the backbone from the flesh without removing the fish from the nail. The two sides should be similar.

The sides are washed thoroughly and trimmed of ragged edges and blood clots. Blood remaining in the veins along the belly cavity should be removed by pressing it toward the back either with the fingers or the blade of a knife. If the blood is not removed, it will harden

and discolor the flesh. The sides are placed in a tub of 90° salinometer brine (a saturated salt solution) and chilled with ice. This removes diffused blood, makes the sides a little firmer, and stops oil from oozing out of the flesh. The fish should remain in the brine for 60 to 90 minutes.

The sides should be drained for 15 or 20 minutes. A shallow box is filled with a salting mixture made in the following proportions: 2 lbs. salt; 1 lb. brown sugar; 1 oz. salt-peter; 1 oz. white pepper; 1 oz. crushed bay leaves; 1 oz. crushed allspice; 1 oz. crushed cloves; and 1 oz. crushed mace. This amount should be enough for about 20 pounds of fish. The salmon is placed in the box, one side at a time, and dredged in the mixture which is rubbed lightly into the flesh. The sides are packed in a tub or other suitable container, with as much of the curing mixture as will cling to the flesh. A loose-fitting cover is placed on top and weighted down.

The fish are left for 8 to 12 hours, then rinsed and scrubbed to remove all traces of the salting mixture. The sides are fixed on hangers and dried in the air for about 6 hours. If air drying conditions are unfavorable, fans may be used. Hang the fish in the smokehouse and smoke in a gentle heat (not more than 100° F.) for 8 hours. Build up a dense smoke and continue the cure for 16 to 24 hours at temperatures not higher than 70° F. To obtain a product having the maximum of preservation, the second part of the smoking period should be 48 hours. The fish should be allowed to cool for several hours before handling, then brushed with vegetable oil, and stored in a cool, dry place.

Catfish

The catfish are gutted, skinned, and the backbone is removed. The sides are cut into pieces weighing about 1½ pounds each, and placed in a crock or tub, and held in a 90° brine (saturated salt solution) for 6 hours. Small catfish (less than 3 pounds) are headed, gutted, skinned, and brined whole for 3 to 6 hours, depending upon preference.

The brined catfish are rinsed and scrubbed to remove slime or dirt, and placed on wire bottom trays of ¼-inch mesh. The trays should be well rubbed with lard or vegetable oil before using. The pieces should not touch each other. Some smokers do not skin large catfish when smoking in pieces. The small catfish are strung on iron rods which should go through the backbone near the tail. They are air dried until a thin, shiny skin forms on the surface.

The fish are placed in the smokehouse where they are smoked lightly and partially dried over a medium fire (temperature should be about 80° F.), for from 7 to 12 hours, depending upon the size of the fish and the degree of smoke desired. The fire is built and the fish is hot smoked, or barbecued. If overheated, the fish will be softened and spoiled. The fire must be carefully regulated to keep the temperature even. The usual hot smoking is 1 hour at 170 to 180° F. Some prefer 30 minutes at about 250° F.

The fish must be cooled thoroughly before wrapping in waxed or parchment paper. It may be eaten without cooking, but has a short period of preservation. Molding and souring take place in about 10 days.

SMOKING METHOD FOR SPORTSMEN

This method has been used successfully by fishermen who wished to preserve a portion of their catch immediately. It is suggested, especially for trout, pike, and pickerel, but may be applied to almost any other fresh or salt-water fish of medium size.

The heads should be cut off and the fish gutted. A cut is made above the backbone almost to the tail. Another cut is made under the backbone which is broken off, leaving not more than one-fifth of the tail section uncut. The fish should lie flat in one piece. The flesh is scored longitudinally from head to tail, with the cuts about 1/4-inch deep and 1 inch apart. After washing thoroughly, and wiping dry, the fish are rubbed inside and out with a mixture of 1 oz. pepper to 1 lb. salt.

The fish are stored in a cool place over night, and next morning are rinsed thoroughly. The next step is to fasten two or three thin, flat wooden sticks across the back to keep the fish spread open. The sticks are roughly pointed and the ends pass through the skin. The fish are hung in a breezy place until the surface moisture has dried and a thin skin formed on the surface.

A shallow fire pit is dug, about 3 feet in diameter, and a fire is started while the fish are drying so that a good bed of red coals will be ready. Hardwood, such as oak or

hickory, is preferred as fuel, but any wood such as maple, beech, birch, or alder may be used. When the fish have dried sufficiently, which should be in about 3 hours under average conditions, each fish is fastened to the forked end of a stick about 4 to 5 feet in length. The other end of the stick is thrust into the ground so that it hangs over the bed of coals at an angle. The sticks should be placed far enough apart so that the fish will not touch each other.

Another method is to fasten two or three fish across a stick so that they will not touch each other. The sticks are then thrust into the ground as in the first method, but must not be placed as close to the fire.

A tripod of poles is then erected above the smoke-sticks, and on this is laid a thick thatching of green boughs and grass. A hole may be left in the thatching near the ground. Green wood is placed on the coals, building up a dense smoke, and the hole covered. It will be necessary to place additional green wood on the fire from time to time. The fish are allowed to smoke from 6 to 18 hours, depending on size and degree of smoke-cure desired. After cooling, the smoked fish are wrapped and stored in a cool, dry place. They should remain in good condition from 2 weeks to a month.

PICKLED FISH

While the term pickled fish is sometimes used to include fish cured in brine, it should be applied only to those products in which vinegar is used. Only a few types of fish are preserved commercially by pickling, but almost any species may be prepared for home use.

Herring is the most important fish for pickling, both sea and river herring being used. Other popular species are haddock, mackerel, mullet, catfish, salmon, carp, buffalofish, eels, lake herring, lake trout, pike, pickerel, and shellfishes especially shrimp, oysters, clams, and mussels. Practically all other food fishes, both fresh and salt-water, are pickled by non-commercial, or home, methods to some extent.

Preservation by this method usually holds for shorter periods than by salting or drying. This difference may be due partly to local weather conditions, but depends on the species of fish (certain fish do not remain fresh as long as others), and the method of pickling. The acetic acid content of the vinegar is also a factor. To stop bacterial growth, an acetic acid content of 15 percent is required. The ordinary commercial vinegar contains 5 to 6 percent, and even this may be too strong for the average palate. Pickling solutions containing as little as 3 percent acetic acid, however, will retard spoilage for a week or more, and the product may even be preserved for months if stored in a cool place at a temperature of about 50° F.

Distilled vinegar is preferred for pickling since it has a standardized acetic acid content. Cider or other fruit vinegars are usually considered unsuitable since the acetic acid content is extremely variable, and the fruit residues in the vinegar may give the fish an "off" taste. Spices used in pickling should be fresh. Best results are secured by buying fresh, whole spices, and making up the mixture, by recipe, at the time it is to be used rather than by the use of prepared mixtures.

Herring

Ordinary salt herring may be pickled in vinegar, but herring not especially cured for spicing have a shorter period of preservation, are darker in color, lack flavor, are tougher and more fibrous in texture.

The first step in curing herring for pickling is to cut off the head, and trim off the thin belly-flesh to the vent. The cut herring are cleaned thoroughly, paying special attention to removal of the kidney which is the dark streak along the backbone. The fish are washed thoroughly in fresh water and drained. Pack the drained fish loosely in a crock, and cover with a brine testing 80° salinometer (5/8 cup salt to 1 quart water) and containing sufficient vinegar to give it an acidity of 2.5 percent. This requires about equal quantities of water and distilled vinegar.

The fish are left in this brine until the salt has "struck through," but must be removed before the skin starts to wrinkle or lose color. Length of cure therefore depends upon the judgment of the pickler, and varies with the temperature, freshness, and size of the fish. The average time is about 5 days, but may vary from 3 to 7 days.

When the herring are judged sufficiently cured, they are repacked more tightly, a very little dry salt is scattered among them, and they are covered with a salt vinegar brine one-half the strength of that just stated. The crock is stored in a cool place. At this stage, the fish can not be kept for more than 2 or 3 weeks.

Final processes in the manufacture of spiced herring include the soaking of the herring in a tub of cold water for 8 hours. Remove the fish, drain, and place in a solution of vinegar, salt, and water for 48 hours. This solution is made up in the proportions of 1 gallon of 6 percent distilled vinegar, 1 gallon of water, and 1 pound of salt. Some prefer to eliminate this last step, utilizing the herring immediately after they have been freshened in cold water.

Cut Spiced Herring. - Cut the vinegar-salt-cured herring across the body in pieces 1 to 1½ inches long. Pack in layers in a crock with sliced onions, bay leaves, and spices. Cover with vinegar diluted with water in which the sugar is dissolved. Allow to stand in a cool place at least 24 hours before using. The cut, spiced herring may be repacked in pint or quart glass jars. If packed in jars, the herring may be stored in a refrigerator where they will remain in good condition for as long as 6 months. Add to each jar a few fresh spices, a bay leaf or two, and a slice of lemon at the side of the jar to give an attractive appearance. Rubber jar rings should not be used, since the vinegar causes them to deteriorate.

The quantities given in the formula below are sufficient for 10 pounds of cleaned herring. Whole spices are used in all recipes, unless otherwise specified.

Vinegar	1 quart	Red peppers	1 oz.
Water	1 pint	White peppers	1 oz.
Allspice	3 oz.	Sugar	1 oz.
Bay leaves	2 oz.	Cloves	$\frac{1}{2}$ oz.
Mustard seed	2 oz.	Sliced onions	$\frac{1}{2}$ oz.
Black peppers	1 oz.		

Rollmops. - The vinegar-salt-cured herring are cut into two fillets, and the backbone removed. Each fillet is then rolled around a small piece of dill pickle and fastened with a wooden toothpick. The rolls are packed on end in a crock. Sliced onions, bay leaves, and the spices used in the following sauce formula are scattered on the bottom and between layers:

Cook slowly 1 qt. vinegar, $\frac{1}{2}$ lb. sliced onions and 1 oz. sugar until the onions are soft. Add the following:

Mustard seed	1 oz.	Cracked whole ginger	1 oz.
Black peppers	1 oz.	Bay leaves	1 oz.
Cracked stick cinnamon	1 oz.	Cloves	$\frac{1}{2}$ oz.

This quantity is sufficient for 10 pounds of cut herring. The sauce is simmered, not boiled, for 45 minutes. The spices are strained out to pack with the rollmops. The sauce is cooled, and poured over fish until the fish are covered. Allow to stand for 2 or 3 days before using.

Rollmops will remain in good condition for about 2 weeks in summer, and from 6 weeks to 2 months in winter, at ordinary storage temperatures. This product may be kept much longer if held in a refrigerator.

Russian Sardines. - Wash and scale 10 pounds of small herring (from 7 to 10 inches), remove the gills and as much of the intestines as possible by pulling them out through the gill flap without tearing the throat or belly. Rinse again, drain, and pack in a crock. Cover with 3 parts of distilled vinegar, and 1 part water. Allow to stand for 12 hours.

Make up a mixture of the following ingredients:

Fine salt	2 lbs.	bay leaves	$\frac{1}{2}$ oz.
Powdered sugar	1 lbs.	Cloves	$\frac{1}{2}$ oz.
Allspice	1 oz.	Ginger	$\frac{1}{2}$ oz.
Pepper	1 oz.	Hops	$\frac{1}{2}$ oz.
Saltpeter	$\frac{1}{2}$ oz.	Nutmeg	$\frac{1}{2}$ oz.

The spices should be finely ground and thoroughly blended.

After the fish have drained, dredge them in the mixture, and pack in a crock, belly up. A small additional amount of the mixture may be scattered between each layer. The layers should be packed at right angles to each other, with the top one packed backs up. Scatter the balance of the spice-curing mixture over the top layer, and weight it down so that the fish will be entirely covered when the brine forms. Some people also scatter diced onions, ground or sliced horseradish and capers between each layer. The amount required for 10 pounds of small herring is $\frac{1}{2}$ lb. onions, $\frac{1}{2}$ lb. horseradish, and a small bottle of capers (about $2\frac{1}{2}$ oz.). The fish are allowed to cure for 10 days to two weeks before using. Under proper storage conditions they should keep from several months to a year.

Potted Herring. - Remove heads, clean, wash thoroughly, and drain. Wipe dry, and rub belly cavity with fine salt and ground black pepper. Place in layers in an earthenware baking dish, with a few bay leaves, whole cloves, and peppers, or allspice. Half cover the fish with vinegar and bake in a slow oven. (The potted herring may be eaten as soon as they have cooled.) They will keep about two weeks.

Pickled Carp

Clean the carp carefully, skin, and cut into fillets, removing the backbone. Cut the fillets in pieces about two inches square. Wash well in fresh water and soak for 60 minutes in a brine made in the proportion of 1 cup of salt to 1 gallon of water, to remove diffused blood. Drain fish, pack in a crock, and cover with a 90° brine (saturated salt solution). Brine for 12 hours, rinse in fresh water, and pack in an earthenware crock. Scatter a few spices on the bottom. Pack in a layer of fish, follow with a thin layer of sliced onion and spices, repeating until all the fish are packed. Cover with two parts of vinegar and 1 part water, adding a small piece of alum. Boil slowly until the fish may be pierced easily with a fork. Cool, and pack in pint or quart glass jars, adding a few fresh spices, a bay leaf or two, and a slice of lemon around the side of the jar. A few slices of onion may be packed with the fish. Strain the vinegar sauce and pour over the fish in the jars.

The amounts given in the following formula should be sufficient for 10 pounds of fish, ready for pickling:

Distilled vinegar	2 quarts	All spice	1 oz.
Water	$2\frac{1}{2}$ pints	Mustard seed	1 oz.
White peppers	1 oz.	Bay leaves	$\frac{1}{2}$ oz.
Red peppers	1 oz.	Sliced onions	$\frac{1}{2}$ lb.

The same recipe may be used for catfish or other fresh water fish.

Pickled Pike or Pickerel

Clean and wash the fish thoroughly. Cut into fillets, and remove the backbone. Divide the fillets into 1 - to 2-inch lengths and dredge the pieces in fine salt. Pick them up with as much salt as will cling to the flesh, and pack in a crock or pan. Leave in the salt 12 hours, rinse off the salt, and soak for $\frac{1}{2}$ hour in fresh water. Cook the vinegar, water, sugar, garlic, and spices or 10 minutes, add the fish and cook for 10 minutes longer. Pack the cooked fish in sterilized jars, adding some chopped onions, a few spices, and a slice of lemon to each jar. Strain the spice-vinegar sauce, and bring the sauce to a boil. Fill the jars immediately and seal tight. The mixture recommended is:

Distilled vinegar	$1\frac{1}{2}$ pints	Allspice	1 tablespoon
Water	$1\frac{1}{2}$ pints	Mustard seed	1 tablespoon
Chopped onion	2 cups	Bay leaves	1 tablespoon
Chopped garlic	1 clove	Black peppers	1 teaspoon
		Cloves	1 teaspoon

This amount should be enough for at least 5 pounds of fish, cleaned and prepared.

Pickled Eels

Clean and skin the eels and cut into pieces about $\frac{5}{8}$ -inch thick. Wash, drain, dredge in fine salt, and allow to stand for 1 hour. Rinse off the salt, wipe the pieces dry, and rub with a cut clove of garlic. Brush with melted butter or salad oil, and broil until the surface is a light brown. Place pieces of cooked eel on absorbent paper. When cool, pack them in layers in a crock with a scattering of sliced onion, allspice, bay leaves, mustard seed, whole cloves, peppers, and mace between the layers of fish. Weight the mixture down

to keep it compressed. Store for 24 hours. Add 6 percent acid-distilled vinegar in proportion of 3 parts vinegar to 1 part water sufficient to cover the pieces. Cover the crock tightly and allow to stand 48 hours before using. For 10 pounds of eels the ingredients are as follows:

Distilled vinegar	1 quart	Mustard seed	1/2 oz.
Water	1 pint	Cloves	1/2 oz.
Allspice	1 oz.	Black peppers	1/2 oz.
Bay leaves	1 oz.	Mace	1/2 oz.

Pickled Salmon

Cut 10 pounds of salmon into individual serving portions. Wash well in cold water, drain, and dredge in fine salt. After $\frac{1}{2}$ hour rinse off the salt, and simmer the salmon slowly until done. Place the warm fish in an earthenware crock, and cover with a vinegar spice sauce made as follows:

Distilled vinegar	1 quart	White peppers	1 tablespoon
Water	1 quart	Mustard seed	1 tablespoon
Olive oil	$\frac{1}{2}$ cup	Cloves	$\frac{1}{2}$ tablespoon
Sliced onions	1 cup	Black peppers	$\frac{1}{2}$ tablespoon
		Bay leaves	$\frac{1}{2}$ tablespoon

Cook the onions in the olive oil slowly until they are yellow and soft. Add the rest of the ingredients and simmer gently for 45 minutes. Allow the sauce to cool, and pour over the fish, making sure that all pieces are covered. Allow to stand for 24 hours before using. This method may be used for mackerel, shad, and other large fish.

Escabeche

This recipe is of Spanish origin, and comes down to us from the Romans. It is probably the most popular Spanish method of preserving fish. Though there are many local variations, all are founded on the basic recipe. Mackerel, king mackerel (kingfish), tuna, and corvina are the fishes most used for escabeche. Almost any fish may be used, although soft-fleshed varieties do not make as good a product. For 10 pounds fish use:

Vinegar	1 quart	Red peppers	1 tablespoon
Bay leaves	2 tablespoons	Cumin seed	$\frac{1}{2}$ tablespoon
Black pepper	1 tablespoons	Marjoram	$\frac{1}{2}$ tablespoon
		Olive oil*	1 pint

Cut the fish in small individual serving portions. Wash thoroughly, drain, and place in a 90° brine (saturated salt solution) for $\frac{1}{2}$ hour. Wipe dry. Pour the olive oil into a frying pan together with a clove of minced garlic, half a dozen bay leaves and a few red peppers. Cook the fish until a light brown in color, and lay aside to cool.

Add the onions to the oil and cook until yellow. Add whole black peppers, cumin seed, marjoram, and vinegar. Cook slowly for 15 to 30 minutes and cool. When the fish are cold, add the rest of the bay leaves and red peppers and pack into sterilized jars. Fill with the sauce and close tightly. This preparation may be used the next day, but is said to improve with storage. It will keep about 3 weeks in summer, but much longer if stored in a cool place.

Pickled Clams, Oyster, and Mussels

Scrub the shells well, and steam just enough to open the shells. Save the liquor, or nectar. Remove the meats from the shells: cool meats and nectar separately. When cool, pack the meats in sterilized jars with a few bay leaves, and whole cloves. Add a slice or two of lemon in each jar.

Strain the liquor obtained in steaming. To each quart of liquor add one-half pint distilled vinegar, one-half tablespoon each of cloves, allspice, and red peppers, with a teaspoon of cracked, whole mace. Simmer for 45 minutes. When cool, pour into the jars and seal. Store in a cool, dark place. Pickled oysters and mussels become easily "light struck" and turn dark if exposed to the light.

*Peanut or cottonseed oil may be used.

Pickled Shrimp

Peel green shrimp and wash well. Make a brine of 1 gallon water, $\frac{1}{2}$ cup salt, 1 pint distilled vinegar, 1 tablespoon red peppers, 1 tablespoon white peppers, $\frac{1}{2}$ tablespoon cloves, $\frac{1}{2}$ tablespoon allspice, $\frac{1}{2}$ tablespoon mustard seed and 6 bay leaves. Simmer slowly for $\frac{1}{2}$ hour, then bring to boiling point and add the shrimp. When the shrimp have cooked for 5 minutes (counting from the time when the brine again begins to boil after the shrimp are added), they should be removed and allowed to cool. Pack in sterilized jars with a few fresh spices and a slice of lemon in each jar. Fill the jars with a solution made in the proportions of 2 pints water, 1 pint of 6-percent acid, white, distilled vinegar, and 1 tablespoon sugar. Seal jars tightly and keep in a cool, dark place.

RECIPES

Salted Fish

If the fish have not been too heavily salted, freshening in several cold waters overnight or from 8 to 48 hours, according to the taste, should be sufficient. But should further freshening be needed, par-boil, that is, put on in cold water to cover, and just bring to the boil. Then simmer, as boiling tends to toughen the flesh. The process may be completed by any method of cookery suitable for salt fish, such as broiling, frying, baking in milk or cream, simmering, or creaming, etc. Usually the fish need more freshening for the first two cookery methods named above than for methods requiring milk or other combinations which tend to cover up the excess salty flavor.

By laying the fish flesh side down on a rack, the freshening will take place faster than on a flat surface. Running water will also hasten the process and save the necessity of changing the water.

Creamed Salted Flakes

$1\frac{1}{2}$ cups cooked cold fish flakes	$\frac{1}{2}$ teaspoon curry powder
2 cups whole milk	$\frac{1}{2}$ teaspoon Worcestershire sauce
4 tablespoons fat	Pepper
4 tablespoons flour	

Make a cream sauce of the fat, flour, and liquid. When smooth, add the seasoning and blend. Add fish flakes. Heat through. Serve on toast, waffles, or in ramekins. Strips of pimento make a nice garnish.

Salted Fish Cakes

1 salted fish	1 tablespoon butter
6 medium sized potatoes diced	White pepper
1 egg	Bread crumbs
1 teaspoon Worcestershire sauce	

Skin and bone the freshened fish, cut in strips and cook until tender. Cook the potatoes. When the potatoes are tender, drain and mash fish and potatoes, add butter and seasonings. Add well beaten egg and shape into cakes. Saute or fry in deep fat, 390° F. Drain and serve hot with or without sauce.

Scalloped Salted Fish with Rice

2 cups cold flaked fish	3 eggs well beaten
2 cups cooked rice	Pepper, paprika and pimento
3 tablespoons butter	strips
1 cup milk	

Lightly, but thoroughly, mix the fish flakes and rice. Place in greased baking dish. Combine the seasonings, milk and well beaten eggs and pour over the mixture. Lay strips of pimento across the top for garnish. Serve with relish or pickle.

Smoked Fish

For variety, there is nothing better than smoked fish, which lends itself to a number of ways of preparation, according to the method used in smoking. It is delicious as an appetizer in creoles, salads, sandwiches, or cooked by any good finnan haddie recipe to be served hot. The left-overs offer many possibilities to tempt the appetite.

Broiled Smoked Fish

Wash, clean, and freshen the smoked fish in cold water for one hour, or longer if necessary. Drain, dry, and sprinkle well with butter or cooking oil. The broiler should be preheated to 350° F. Place on the rack, flesh side up. Broil 3 minutes, then turn and finish broiling 4 minutes. Serve with lemon butter, or if preferred, the melted butter and pepper. Larger fish would need several more minutes of broiling.

Baked Smoked Fish

Freshen the smoked fish for 1 hour or more before cooking. Remove any foreign particles, and dry. Place in a greased baking pan, flesh side up. Sprinkle well with any good cooking oil. Sprinkle with finely diced onion and carrot. Cover with milk. Bake from 20 minutes to 1 hour according to thickness of flesh and length of time fish have been smoked. Baste from time to time as milk evaporates. Remove to platter. Garnish with parsley. Serve hot.

Creamed Smoked Fish

1½ cups cooked flaked fish	4 tablespoons fat or oil
1 cup milk	1 teaspoon Worcestershire sauce
1 cup fish stock	Salt, pepper
4 tablespoons flour	

Make a medium white sauce of flour, fat, salt, pepper, liquid, and stir smooth. Add fish flakes and heat through. Variations of this may be had by adding eggs, carrots, and peas, parsley, etc.

Related Publications

Home Canning of Fishery Products, by Norman D. Jarvis and Joseph F. Puncochar. Conservation Bulletin 28. Fish and Wildlife Service. (May be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., for the price of 10 cents).

How to Cook Fish. Fishery Leaflet 106. Fish and Wildlife Service, Department of the Interior, Washington 25, D. C.

Fish Cookery in the Open, by W. T. Conn. Fishery Leaflet 35. Fish and Wildlife Service, Department of the Interior, Washington 25, D. C.

Available Publications on Fisheries, Fishery Leaflet 9. Fish and Wildlife Service, Dept. of the Interior, Wash. 25, D.C. (Many of the publications listed in this leaflet are available for free distribution by the Fish and Wildlife Service, while others may be purchased only from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)