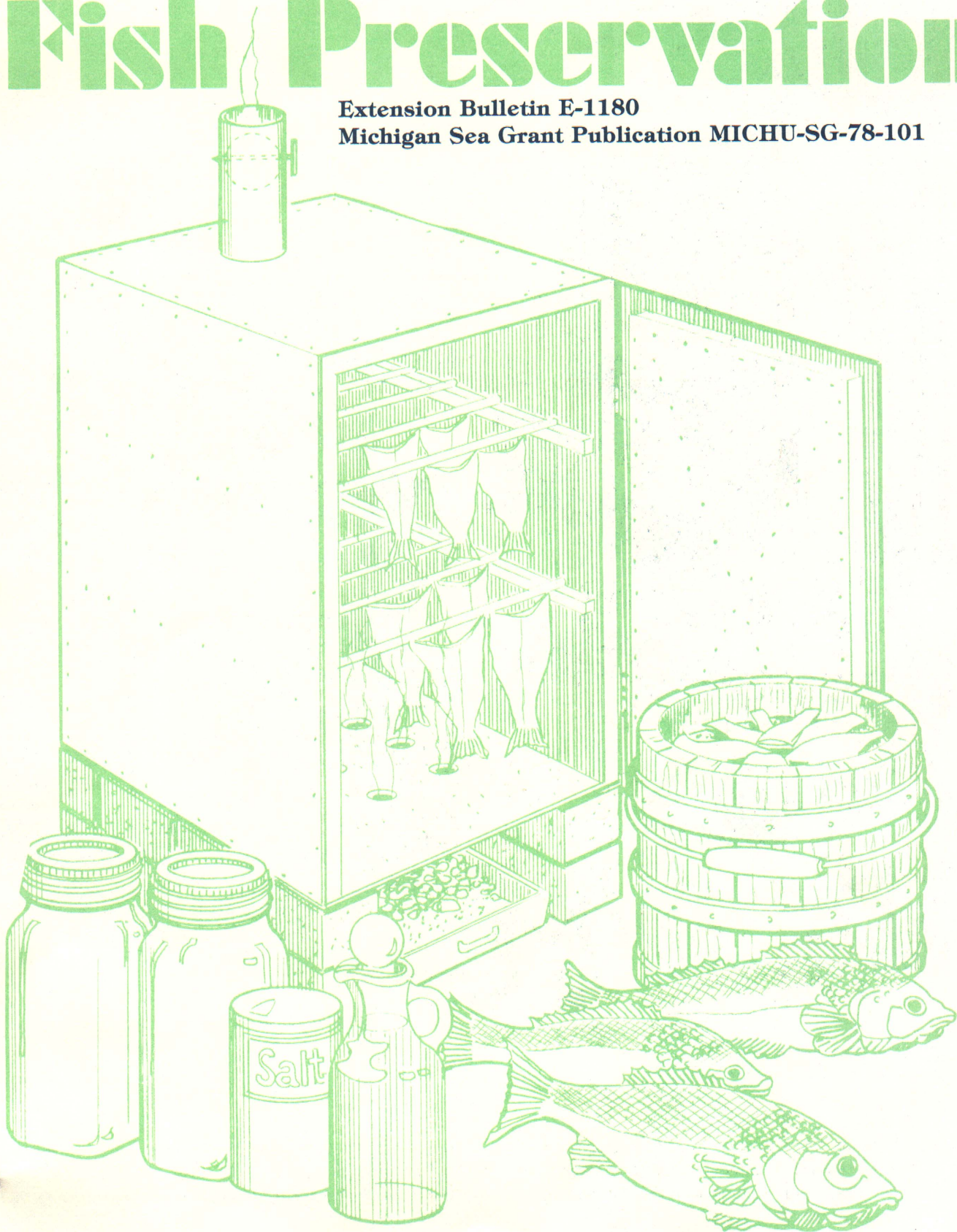


# Freshwater Fish Preservation

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COOPERATIVE EXTENSION SERVICE

MICHIGAN STATE UNIVERSITY



*Special thanks are expressed to Mrs. Ingrid C. Bartelli, Consumer Marketing Information Agent, Michigan State University Cooperative Extension Service, retired, for use of materials on fish preservation which inspired this publication. It is out of her dedication to the development of the natural resources of Michigan's Upper Peninsula that this bulletin evolved.*



by

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## Freshwater Fish Preservation

THE YEAR-ROUND AVAILABILITY of many kinds of fish in the Great Lakes area has prompted many people to harvest quantities of fish they like. Keeping these fish flavorful and safe to eat requires proper preservation. Methods of preserving fish are diverse and many times incorrect, leading to spoilage of this high-quality protein source, or, worse, to food poisoning. This bulletin outlines the basic principles and techniques for preserving fish for home use. A number of recipes are included to show the variety of products possible from these fish species and to serve as a guide for home processing and preparation. Successful preservation depends on careful attention to proper procedures and sanitation throughout the processes.

### Preservation and Quality

Preservation will not improve the quality of the fish. The preserved product will be no better than the raw fish. But home-preserved products may be better than commercial products because the fish can be rushed straight from catch to table, freezer, can or other process.

**FREEZING** is the most convenient and most highly recommended method for preserving fish. It keeps fish safe from spoilage for long storage, and it is easy and requires very little time.

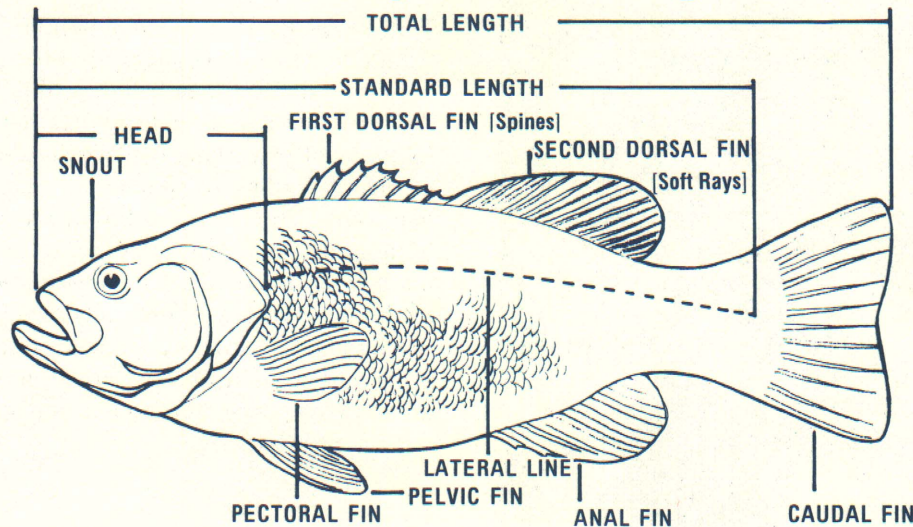
**CANNING** is more time-consuming than freezing but the product can be stored on the shelf for many months. Fish **MUST** be **pressure** canned for safety. A temperature of at least 240°F is needed to kill the spores of *Clostridium botulinum*. This organism grows in improperly processed food, and produces a deadly toxin. Only pressure processing will reach the necessary 240°F.

**SMOKING** is not preservation in the same sense as freezing and canning. In Indian fish camps, hundreds of pounds of fish were smoked for winter food, but that sort of smoking was accompanied by drying, and it required around-the-clock smoking for weeks at a time. As discussed in this booklet, smoking is actually cooking. It adds flavor and appeal to the fish. Smoked fish require refrigerated storage.

**SALTING** removes water and preserves fish by increasing the salt content to such an extent that many bacteria will not grow. Salting is usually used with other processing. Salted fish require freshening before use.

**PICKLING** produces a very flavorful fish product which will keep for several weeks in the refrigerator. Pickled fish can be eaten without further preparation.

# Handling and Cleaning



The quality of the preserved fish begins with the handling of the fish when it is caught. Handle fish carefully; they bruise easily. Keep them out of the sun. Clean, dress and wash fish immediately; then pack them in ice, or refrigerate them as soon as possible to prevent deterioration. Use within 1 to 2 days.

Follow these basic steps for cleaning, dressing and steaking fish.\*

1. Wash fish. Use clean, drinking-quality water.

2. Scale or skin as required. Remove scales by scraping with dull edge of a knife from the tail to the head. If you skin the fish, it is not necessary to scale it. To skin, split the skin down the back, and loosen around the fins. Use pliers to remove the skin, pulling from head to tail.

3. Cut entire length of belly from vent to head. Remove viscera and gills if the head is not to be removed.

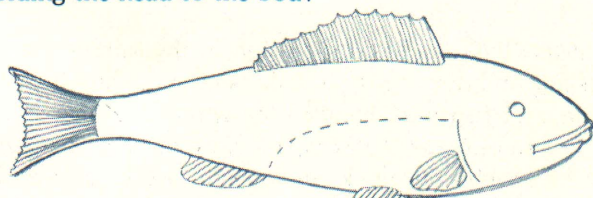
4. To remove the head (if desired) cut to the backbone above the collarbone. Break the backbone over edge of a table or cutting board, then cut any tissue holding the head to the body

5. Remove dorsal (large back) fin by cutting along each side and pulling the fin and attached bones out. Never trim off fins because the bones at the base of the fins will be left in the fish.

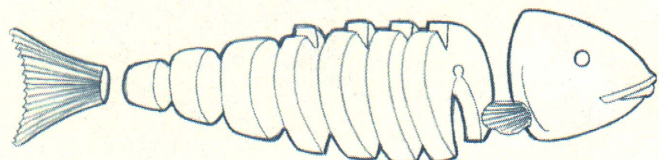
6. Wash fish thoroughly in cold running water.

7. Large fish may be steaked. Cut fish crosswise into portions about 1 inch thick.

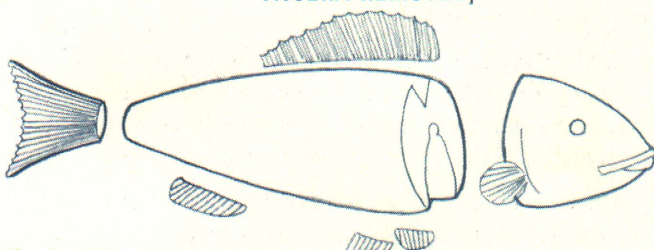
Fish may be filleted without first removing the viscera. With a sharp knife, cut down the back of the fish from the tail to the head. Then cut down to the backbone. Angle the knife to cut away the flesh from the backbone, allowing the knife to run over the rib bones. Lift off the side piece, freeing the fillet at the tail. Turn the fish over, and cut the fillet from the other side. If you wish to skin the fillet, lay it skin-side down on a cutting board. Hold the tail end with your fingers, and cut through the flesh to the skin. Flatten the knife on the skin, and cut the flesh away from it by running the knife forward while holding the free end of the skin firmly between your fingers.



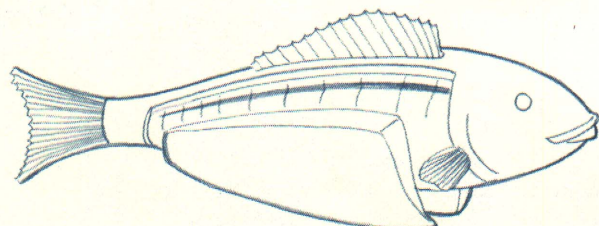
ROUND OR WHOLE [DRAWN-INDICATING VISCERA REMOVED]



STEAKED



DRESSED



FILLETED

\*See also: MSU Extension Bulletin E-1179, Great Lakes Fish Preparation.

# Freezing

Freezing is the easiest and most convenient way to preserve the quality and nutritive value of fish. All kinds of fish can be frozen. Successful freezing depends on low storage temperatures and airtight, vapor-proof packaging.

Freeze fish quickly. To quick freeze, set the freezer dial at  $-10^{\circ}\text{F}$ , if your freezer will go that low. Store fish at  $0^{\circ}\text{F}$  or below. Large, thick pieces take longer to freeze, allowing quality to deteriorate during the freezing process. Package fish in small or flat packages.

Moisture loss from frozen fish causes dehydration called "freezer burn." Off-flavors and poor quality result. To prevent dehydration and to lock-in fresh fish flavor, package fish in airtight, vapor-proof packages. The following fill the bill: aluminum foil, plastic freezer boxes with airtight lids, thick plastic freezer bags, thin plastic freezer bags in paperboard boxes, freezer papers and ice coatings at least  $\frac{1}{8}$  inch thick. The best protection, however, is aluminum foil, cling freezer wraps or ice coatings.

## Freezing Fish In Protective Wraps

1. Use fresh fish, cleaned and dressed.
2. Cut fish into appropriate serving pieces. Fish can be frozen whole or as portions. The most economical way to freeze fish is in meal-size packages of steaks or fillets. To be able to separate one frozen fillet or steak from another, insert a double layer of wax paper between fish portions when they are packaged for freezing.
3. Dip fish in one of the following solutions to help preserve quality. For lean fish (almost all Great Lakes fish): Add  $\frac{1}{2}$  cup salt to each quart very cold, almost frozen water. For fat fish (salmon, lake trout, whitefish): Add 2 tablespoons ascorbic acid powder to each quart water. Place fish in solution for one minute; drain on paper towel; dip again.
4. Wrap or place fish in airtight, vapor-proof package. To wrap fish, pull the wrap tightly around the fish, squeezing out any air pockets. Seal (see illustration). In containers or bags, pack fish tightly, excluding as much air as possible. Never use large containers or freeze fish in cartons. It may take three days before the center of the pack freezes. In the meantime, quality will deteriorate. This is because packages freeze from the outside toward the center, and the food expands when frozen. This pressure may turn the fish in the center of the pack to mush.
5. Store in freezer at  $0^{\circ}\text{F}$  or below. Fat fish are best used within a few months.

## STORAGE TIMES AT $0^{\circ}\text{F}$

Kind of fish	Max. Quality (like fresh)	Max. Storage
FAT—(salmon, lake trout, rainbow, chubs, whitefish)	3 months	9 months
LEAN—(most Great Lakes fish)	6 months	12 months
SMOKED	---	2 months

## Individually Quick Frozen Fish

Spread a single layer of fish or portions on a flat pan, such as a cookie sheet. Cover with a protective wrapping, and place in freezer. When fish are thoroughly frozen, remove and package in heavy plastic freezer bags or freezer containers. This method allows you to take out only as many fish as you need for a single meal.

## Freezing Fish In Water

Water is the most effective airtight package. Three good ways to seal fish in water are glazing, ice blocks without prior freezing and ice blocks with prior freezing.

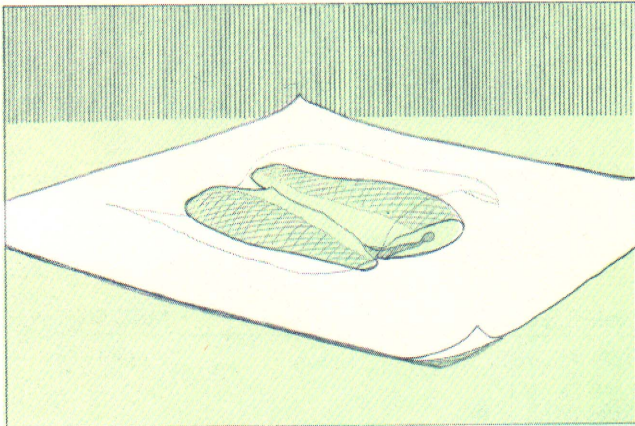
**Glazing**—This method works especially well for whole fish, but other portions can be frozen this way also. Freeze the fish in a protective plastic bag. Have ready a pan of very cold, almost frozen water. Remove frozen fish from plastic bag, dip in the very cold water and return to freezer. Repeat dipping and freezing until the ice glaze is  $\frac{1}{8}$  to  $\frac{1}{4}$  inch thick. Fish can be stored without further wrapping, but the ice glaze will gradually evaporate. To improve keeping quality, wrap glazed fish in freezer wrap, date and store.

**Ice Block 1**—Place a single layer of fish in shallow pan, such as a cake pan. Cover with water and freeze solid. Remove block from pan, wrap in freezer wrap, date the package and return to freezer.

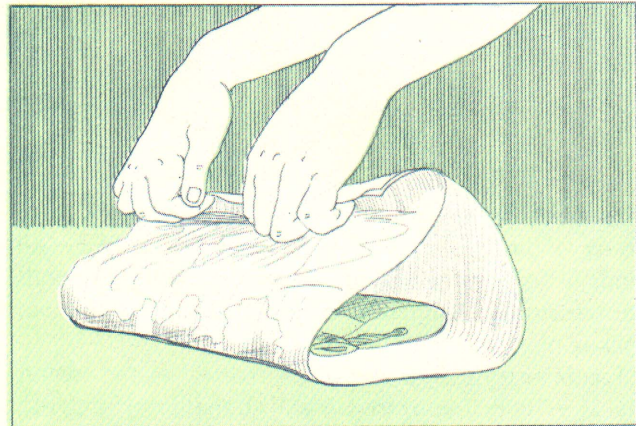
**Ice Block 2**—This method creates the least amount of pressure on tender fish flesh. Place a single layer of fish in a shallow container. Place pan in freezer overnight to freeze fish solidly. The next morning, cover the frozen fish with water, and freeze. Remove frozen block from pan, wrap and store.

## Freezing Fish In Sauce

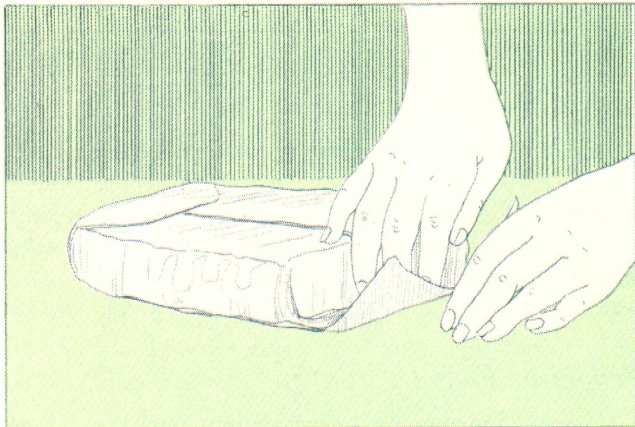
Fish can be frozen in boil-in-a-bag pouches or suitable containers with sauce included. (Good sauces include



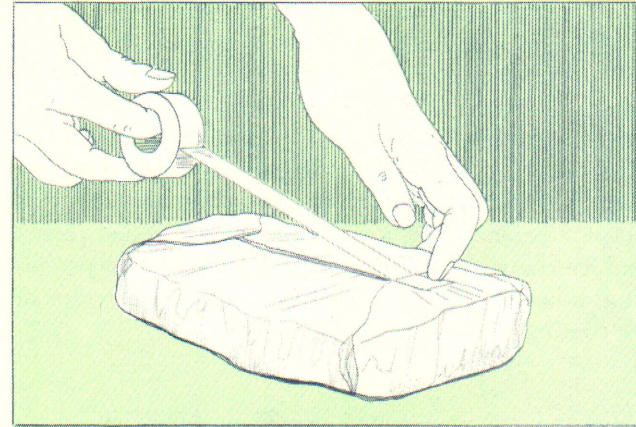
Place fish on freezer paper so as to exclude air pockets.



Pull the wrap tightly around the fish.



Fold ends to exclude air pockets.



Tape to secure ends, label and store.

tomato sauce and mushroom sauce.) Place fish in package with sauce, seal and freeze. Boil-in-a-bag pouches need only be simmered in boiling water and served. This method leaves no fish cooking odors or messy pans to clean up. To serve fish frozen with sauce in other containers, partially thaw in refrigerator before heating in a saucepan.

#### TOMATO SAUCE

2 c. stewed tomatoes	¼ t. black pepper
1 small onion, chopped fine	2 T. melted butter or margarine
1 t. salt	2 T. flour

Simmer tomatoes, onion, salt and pepper together for 10 minutes. Combine melted butter with flour. Gradually add tomato mixture to flour and butter. Cook until thick, stirring constantly. Cool before adding to fish. Makes 2 cups.

#### MUSHROOM SAUCE

½ c. diced onion	1 c. milk
2 T. vegetable oil	1 t. red pepper
1 T. chopped green pepper	½ t. salt
1 can undiluted cream of mushroom soup	

Saute onion in oil until yellow. Add green pepper. Cook 3 minutes. Gradually stir in soup and milk. Add seasonings and heat, stirring constantly. Cool before adding to fish. Makes 2 cups.

### Thawing Frozen Fish

You can cook fish successfully without thawing them first. Just allow additional cooking time for the frozen fish—about double the time in the recipe. However, recipes which call for breading, stuffing or broiling work better if the fish is thawed first.

Thaw fish in its original wrappings in the refrigerator or under cold running water. Never allow fish to thaw at room temperature. Thaw fish only until it has just become pliable. It may still have some ice crystals in it.

Free fish frozen in ice blocks by running cold water over the block. When the fish is free of ice, remove it and wipe dry. Cook at once.

If thawed fish is required, remove fish when freed of ice and let stand in clean, cold water until just thawed. Drain, wipe dry and cook at once. To avoid the leaching effect of the water, remove the fish when free of ice and cover with aluminum foil or food wrap and finish thawing in the refrigerator. Cook at once.

Thawing times vary with the size and shape of the package and with temperature. **A rule of thumb is:** Each packaged or solid pound requires 6 to 8 hours to thaw in the refrigerator or 1 to 2 hours to thaw under cold water.

# Canning

Although freezing is the easiest way to preserve fish, canning does offer some advantages. Canned fish may be stored on a shelf. Canning produces a moist, flaky product. Canning also eliminates the bone problem. Mullet (suckers) and other bony fish are often canned in the Great Lakes area for this reason. The bones soften and become edible with the meat.

Use only half-pint or pint jars for canning fish; do not use quart jars. Jars must be thoroughly clean. It is not necessary to sterilize them, however. Just wash them in hot, soapy water; rinse well.

Close jars with two-piece canning lids. Wipe jar rim clean. Put lid on, with sealing compound next to glass. Screw band down firmly, so that it is hand tight. Some lids with sealing compound require boiling or holding in boiling water for a few minutes before use. Follow the manufacturer's directions.

**The only safe way to process fish is in a pressure canner.** To prevent any risk of botulism food poisoning, the pressure canner must be in perfect order and canning directions must be followed exactly. Unless you are absolutely sure of your pressure gauge and canning methods, boil home-canned fish for 15 minutes in a covered pan before tasting or using. Boiling will destroy botulism toxin.

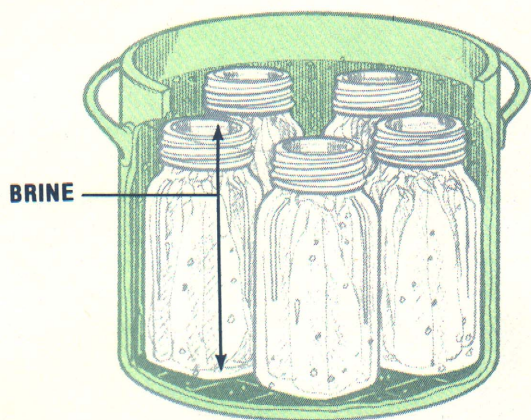
Fish that has been frozen may be safely canned. Thaw the fish in the refrigerator. As soon as it has thawed, brine it and process it according to the directions given below. Processing the fish promptly after thawing is essential for a safe product.

## Preparation

It takes 25 to 35 pounds of fresh fish to fill about a dozen pint jars.

1. Clean and wash fish thoroughly. Remove the en-

### OPEN JARS



Boil submerged jars in brine for 15 minutes to reduce water content of fish.

tails, heads, fins and tails. The skin and dark flesh along the lateral line may be removed if desired.

2. Cut into desired size pieces—usually the size of the jar.

3. Soak pieces in brine made of 1 cup salt per gallon of cold water. Pieces  $\frac{1}{2}$  inch thick require 10 to 15 minutes, while pieces the size of a pint jar require an hour in the brine. Brining removes blood and water from the fish flesh and firms the flesh to produce a more desirable canned product.

## Canning Methods

Brined fish may be packed into jars without liquid, or it may be packed in tomato sauce, tomato juice or oil. Smoked fish is usually packed in oil.

### Raw Pack

This is a good method for canning salmon or trout.

1. Drain the brined fish. Pack solidly into clean, hot half-pint or pint jars, but do not jam or crush the flesh. Leave  $\frac{1}{2}$  to  $\frac{3}{4}$  inch head space.
2. Wipe jar rims. Adjust lids.
3. Process half pints or pints in a pressure canner at 10 pounds pressure for 110 minutes.

### Hot Pack

This method is suggested for canning most freshwater fish including alewife, carp, smelt and whitefish.

1. Drain the brined fish. Pack solidly into clean, hot half-pint or pint jars, but do not jam or crush the flesh. Leave  $\frac{1}{2}$  to  $\frac{3}{4}$  inch head space.
2. Set the open jars packed with fish on a rack in a large pan filled with fresh brine made of  $\frac{1}{2}$  cup salt per gallon of water. The open jars should be submerged in brine (see illustration). Bring the brine to a boil and boil for 15 minutes.
3. Using a jar lifter, remove jars from the brine and invert them on a rack or screen to drain for about 3 minutes. Discard the drained liquid.
4. Add a slice of onion and a bay leaf to each jar if desired. Or add 3 tablespoons vegetable oil to each pint jar if desired. Smoked oil, such as Red Arrow oil, may be added for flavor with the vegetable oil.
5. Wipe jar rims. Adjust lids.
6. Process half pints or pints in a pressure canner at 10 pounds pressure for 100 minutes.

### Tomato Sauce

Alewife or smelt may be packed in tomato sauce.

1. Follow steps 1 through 3 in hot pack method above.
2. In a pan, combine  $\frac{1}{2}$  gallon tomato puree,  $\frac{1}{4}$  cup

vinegar, ½ ounce ground horseradish and 1 tablespoon minced onion. Heat to boiling.

3. Pour boiling sauce over packed fish, leaving ½ to ¾ inch head space.
4. Wipe jar rims. Adjust lids.
5. Process half pints or pints in a pressure canner at 10 pounds pressure for 100 minutes.

### Mullet in Tomato Juice

1. Drain the brined mullet (suckers). Pack solidly into clean, hot half-pint or pint jars, but do not jam or crush the flesh. Leave ½ to ¾ inch head space.
2. To each pint jar, add 1½ teaspoons vinegar and 1½ teaspoons prepared mustard. Cover with boiling tomato juice, leaving ½ to ¾ inch head space.
3. Wipe jar rims. Adjust lids.
4. Process half pints or pints in a pressure canner at 10 pounds pressure for 110 minutes.

### Smoked Fish

Smoked fish should be canned soon after smoking.

1. Break or cut smoked fish into strips 1 to 2 inches wide, removing bones and skin if desired.
2. Pack flaked fish and pieces firmly into clean, hot half-pint or pint jars.
3. Add vegetable oil to within 1 inch of top.
4. Wipe jar rims. Adjust lids.
5. Process half pints or pints in a pressure canner at 10 pounds pressure for 100 minutes.

### Using a Pressure Canner

Follow the manufacturer's directions for the canner you are using. Here are a few pointers for using any pressure canner:

1. Put 2 or 3 inches of boiling water in the bottom of the canner.
2. Set jars on rack in canner. If two layers of jars are put in canner, use a rack between them. Stagger the second layer.
3. Fasten canner cover securely so that no steam can escape except through vent (pressure regulator or weighted gauge opening).
4. Watch until steam pours steadily from vent. Let it escape for 10 minutes to drive all air from the canner. Then put on the pressure regulator or weighted gauge.
5. Let pressure rise to 10 pounds (240° F). As soon as this pressure is reached, start counting processing time. Keep pressure constant by regulating heat under the canner.
6. When processing time is up, turn off the burner. Let canner stand until pressure drops to zero by itself. Then remove the pressure regulator or weighted gauge. Unfasten canner cover, tilting it away from your face.
7. Place the hot jars on a board, towel or folded newspapers to cool. Keep them out of drafts.

### After Canning

When jars are cool (12 to 24 hours after processing), check the seals. If the lid is depressed or concave and will not move when pressed, it is sealed.

Label sealed jars with species and date. Store in a cool, dry, dark place. For best eating quality, try to use canned fish within a year. Use oil-packed fish within 6 to 9 months.

If you find a jar that did not seal, either refrigerate the fish and use it within 5 days, freeze it, or can it again. Begin the second canning by emptying the contents of the jars into a pan and heating them through. Then repack the hot fish and liquid into clean, hot jars, put on new lids, and reprocess in a pressure canner for the full time.

## Smoking

Wood smoke has little, if any, preservative action. Smoking merely adds flavor and color and removes some water. Smoked fish are almost as perishable as fresh fish. Home processors would do well to heed the Michigan state law that applies to commercial smokers. Smoked fish should be kept at temperatures under 36°F and used within 14 days. If smoked fish is to be kept longer than 14 days, it should be frozen or canned immediately after smoking. Canning or freezing old fish only further reduces the quality of an already deteriorating product.

The four basic steps in smoking fish are cleaning, curing, drying and smoking.

### Cleaning

Clean fish as soon as possible after taking them from the water. Scale fish and remove viscera, including the kidney, which is the dark streak along the backbone. The head may also be removed from larger fish, but the collarbone should remain to provide shape. Fillet or steak large fish.

### Curing

Cure the fish in salt, either dry or in a brine. If dry curing fish, follow the procedure for salting (see next section). Dry salted fish will have a high salt concentration and will need to be freshened before smoking.

The goal of brining is to produce a thoroughly and uniformly salted product. A basic brine consists of 1 cup salt to each gallon of cold water (30° salimeter). Sugar, spices, and saltpeter are often added to the brine.

Here is one recommended sugar spice brine:

1 gal. cold water	Cloves*
1 c. salt	Bay Leaves*
½ c. sugar	Pickling spices*
1 t. saltpeter (optional)	Sage*

\*Optional and to taste



Use a mixture of spices at the rate of 1 tablespoon per gallon of water.

Another spice formula is 1 tablespoon whole cloves and 1 teaspoon bay leaves per gallon of water.

Saltpeter may or may not be added, according to personal preference, but it does provide a margin of safety against botulism.

Place fish in a large nonmetal container so they lie flat. Cover with brine. Use one gallon for each 4 to 5 pounds of fish. Use a plate or cover to weight down fish enough to submerge them without packing them together. Allow fish to cure in a cold place (34° to 38°F) for the appropriate time (see table).

There is no one time which is right for all fish under all conditions. Brining times vary because brine concentration and amount, and fish condition and size affect how quickly and how much salt will be absorbed.

**Concentration**—The stronger or more concentrated the brine, the shorter the brining time required. However, short brining times will not salt fish as uniformly as slow times. A brine concentration of 30° to 40° salimeter is recommended. This is about 1 or 1¼ cups salt for each gallon cold water.

**Amount of brine to fish**—The amount of brine to the amount of fish affects how uniformly and thoroughly the fish will be salted. A good ratio is 2 parts brine to 1 part fish. One gallon of brine weighs about 9 pounds. This means you would need 20 pounds or about 2 gallons brine for each 10 pounds of fish.

**Fresh, refrigerated or thawed**—The muscle fibers of freshly caught fish are still intact. This slows the rate of salt absorption. Freshly caught fish will require about 18 to 24 hours of brining. Fish held in the refrigerator for 24 hours will absorb salt faster. About 16 hours is required. Thawed fish absorb salt still faster. Thawed fish will be thoroughly brined in 12 to 14 hours. These times are for the concentration and ratio of brine outlined above.

**Size**—Brining times are affected by the thickness of the fish pieces. Fresh pieces ½ to 1 inch thick require 14 to 16 hours of brining. A large, whole, fresh fish, like a salmon, would require 48 to 72 hours of brining. For such large fish, the concentration of the brine should not exceed 30° salimeter.

#### TABLE OF BRINING TIMES

(for a brine of 30° salimeter, 2 parts brine to 1 part fish)

Size	Condition		
	Fresh hours	Refrigerated hours	Thawed hours
½ to 1 inch thick, fillets or split fish	18 to 24	16	12 to 14
Large whole fish 10 lbs. or larger	48 to 72	36 to 60	24 to 48

## Drying

When fish are cured, remove from brine and rinse thoroughly. Fish may be dried in the smokehouse or in a protected area with heat and air circulation. Place on smokehouse hangers (see illustration) or racks wiped with vegetable oil, and allow surface to dry. A shiny skin-like pellicle will form on the fish surface. The pellicle seals the surface and prevents loss of natural juices during smoking.

Fish require approximately ½ hour of drying at 70° to 80°F before smoking. Air circulation and humidity will affect the time. A fan will speed the process.

## Smoking

A number of simple serviceable smokehouses can be built at home (see next section) but smoking procedures are about the same for all. Follow the manufacturer's instructions for commercially built smokers.

Place fish in the smokehouse. Clear all combustible material from around and under the smoking area. Form a small bed of coals on the hot plate for a small fire. Take care to keep it from flaring up. Cover the coals with dry hardwood chips. Use only hardwoods, because softwoods, moss and leaves may leave unpleasant tastes on the fish. Chips may be dampened to prevent them from flaming. Add chips as needed to keep the smoke dense throughout the process. Regulate the draft by the vents or by raising or lowering the lid or side of the chamber.

Cold smoke (90° to 100°F) for 2 to 3 hours. Then gradually add hot coals to the smoker to raise the temperature of the smokehouse to 225°F. Maintain this temperature until the internal temperature of the fish reaches 180°F, which should take 3 or 4 hours. Hold the fish at the 180°F flesh temperature for 30 minutes. Insert a thermometer into the thickest part of the fish to be sure all the flesh reaches this temperature. Whole fish also need to be smoked and cooked thoroughly. The total time required may be as much as 12 hours for whole fish.

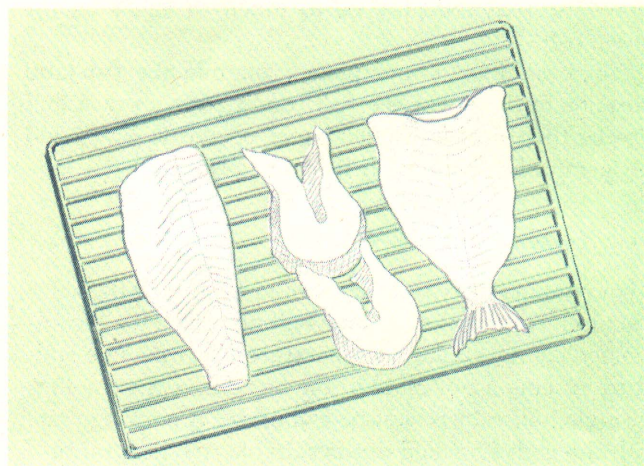
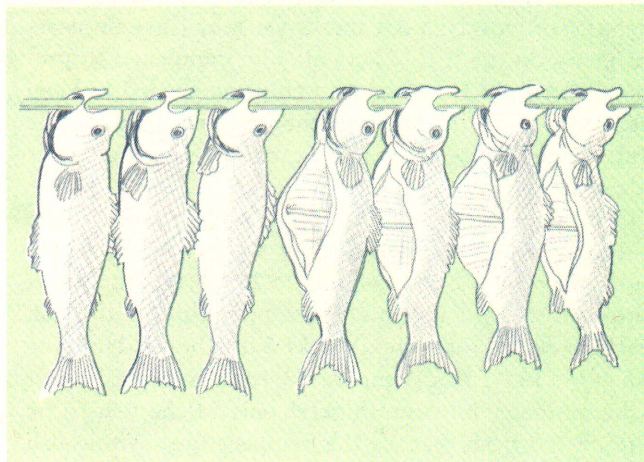
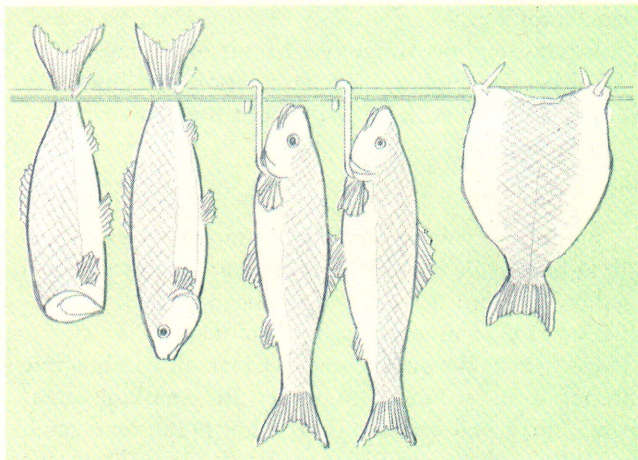
When smoking is completed, remove the fish and allow them to cool. Keep fish protected from dust and insects; then wrap in waxed paper or plastic wrap, and refrigerate. Use smoked fish within 14 days.

## Smokehouses

For commercially built smokehouses, follow the manufacturer's instructions. Some will not reach the recommended smoke cooking temperature. Heat may be added by placing a hot plate in the bottom of the smoker.

Smokehouses need not be elaborate. A packing crate with the ends knocked out is suitable (see illustration). Old refrigerators are popular homemade smokehouses (illustration). You can even smoke fish on a charcoal

grill with a hood or dome cover. Build a small charcoal fire in the bottom of the grill (about half the size of a regular broiling fire) and add damp hardwood chips and then additional coals for cooking, following the times and temperatures already discussed.



Fish may be hung on rods, or placed on racks for smoking.

## Salting

Salting is an ancient procedure for preserving fish. It was introduced to the Great Lakes area by northern European immigrants. Salted fish was commonly used for food when traveling and during the summer.

Salt preserves fish by removing water from the flesh and tying up the remaining water so that spoilage organisms cannot use it for growth. If enough salt is used, the fish may keep for as long as a year in a cool, dry place. Salting is one way to store fish until you are ready to smoke or pickle them.

If you are salting less than 50 pounds of fish, you will need no special equipment, just a sharp knife and a 2- to 4-gallon nonmetal container—a stone crock, wooden or food-grade plastic tub with a lid.

Salt should be pure and clean. Iodized table salt is not satisfactory. Use a high-purity pickling or canning salt. Pickling salt is available at many grocery stores.

Salt brine penetrates lean fish better than oily fish, and lean fish become rancid less easily. However, oily fish can be excellent when salted.

The salting method is the same for all fish.

### Preparation

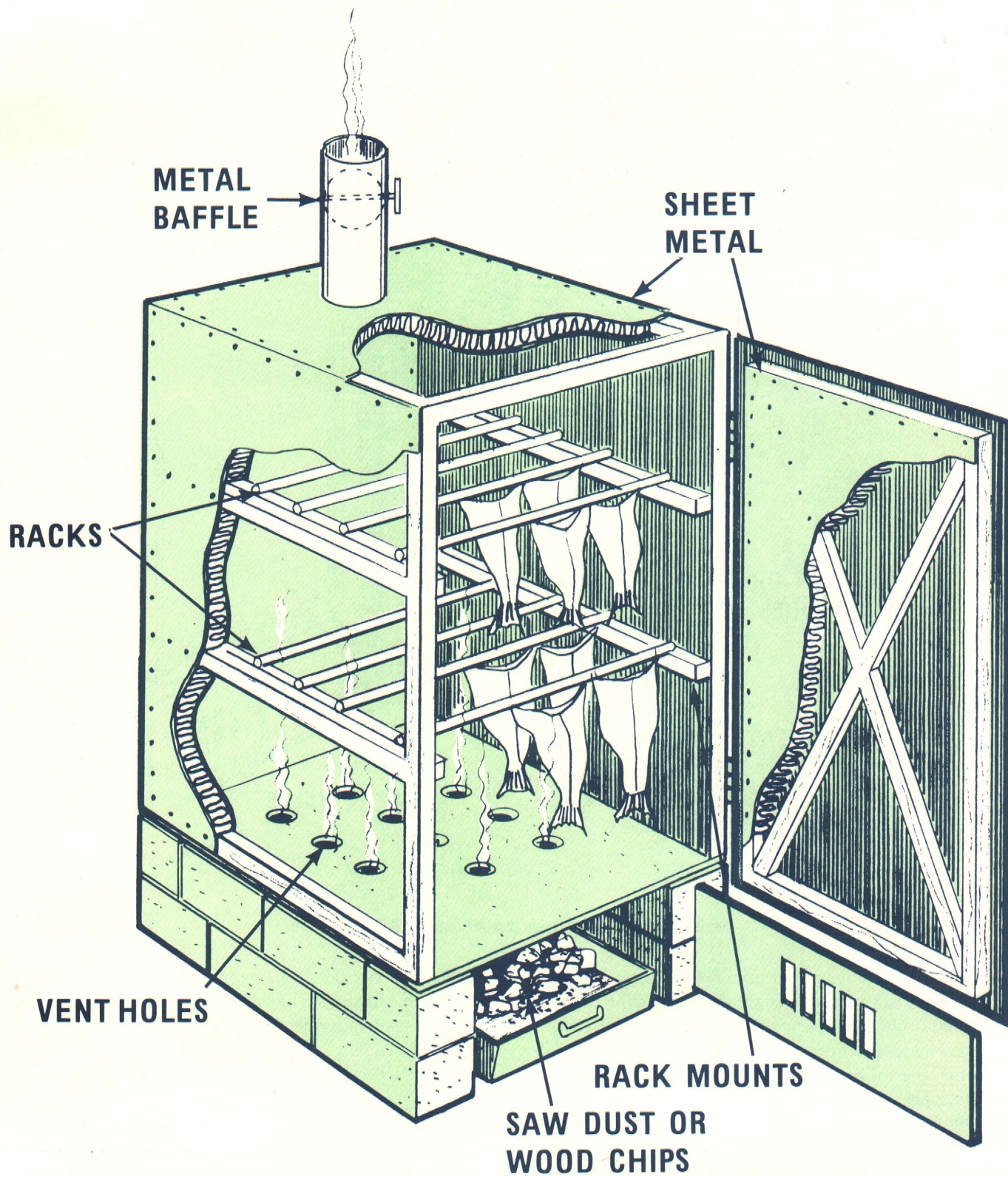
Split small dressed fish down the back so that they lie flat. Cut large fish into two fillets, removing the backbone. Always remove the gills but not the collarbone just behind the gills. The collarbone supports the weight of the fish and is especially useful when the brined fish is to be smoked. Without it, the fish will fall off smokehouse hangers. The pieces should be small enough to lie flat in the crock. For good salt penetration, score the flesh of the thickest pieces lengthwise, about  $\frac{1}{2}$  inch deep and 1 to 2 inches apart. Do not pierce the skin. Soak the fish  $\frac{1}{2}$  hour in brine ( $\frac{1}{2}$  cup salt to 1 gallon cold water) to draw off blood. Then drain the pieces while you prepare the salt.

### Dry Salting

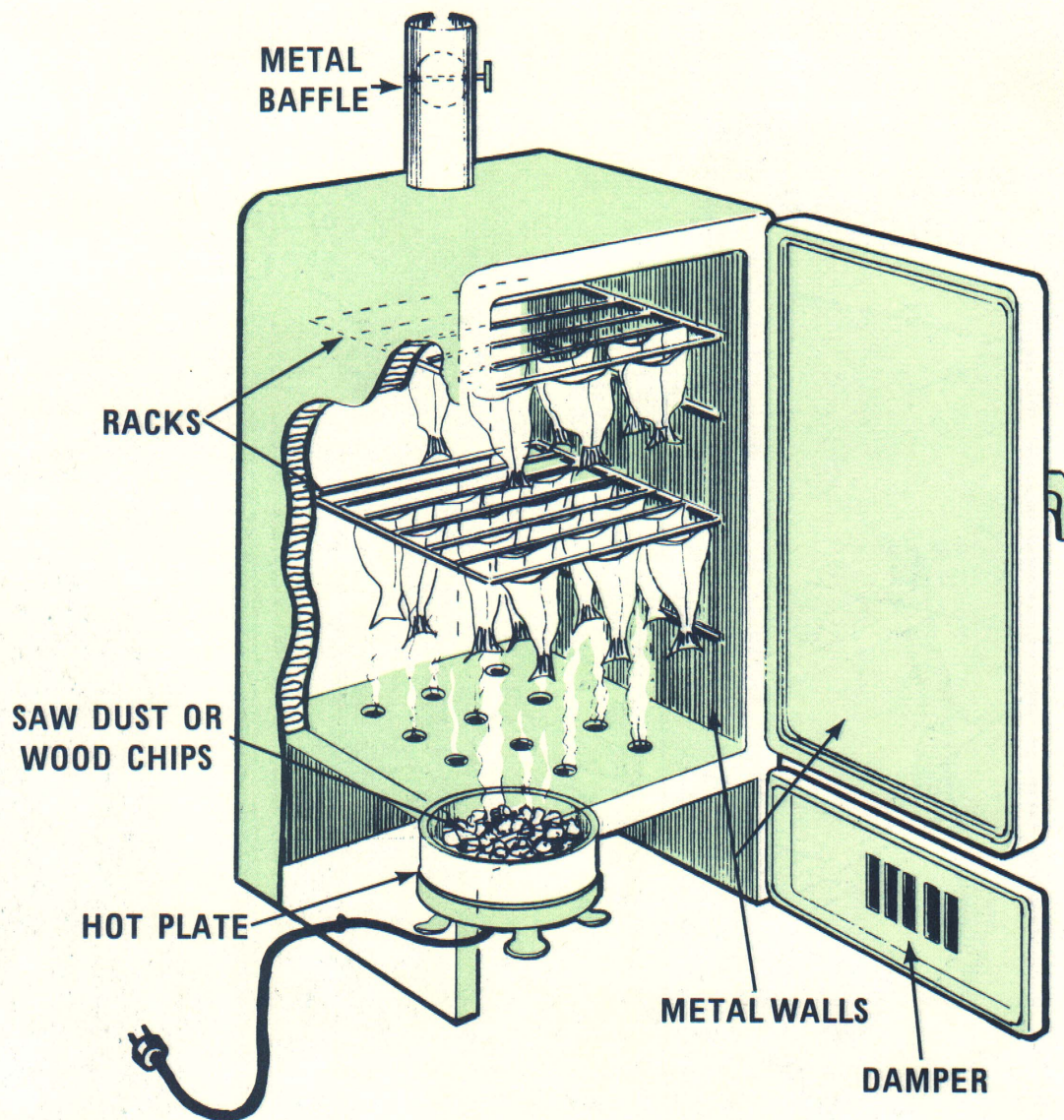
Fill a dish pan or shallow box with dry salt. Sprinkle a thin layer of salt on the bottom of the brining container. Dredge each piece of fish in salt in the dish pan, then place skin-side down in the container. Arrange pieces to make even layers. Place large pieces with the backbone next to the container wall. An extra piece may be placed in the middle to level each layer. Overlap pieces as little as possible.

Pack small fish in a ring with tips of heads touching container walls. You may need to put one or two fish across the center to keep the layer level. Stagger successive layers so that each fish rests on two fish in the layer below.

Scatter a thin coat of salt between each layer. Pack the top layer of fish, both large and small pieces, skin-



Smokehouse built from available materials.



Smokehouse made from converted refrigerator. Note metal walls.

side up. The amount of salt used depends on the season of the year, fish size, and length of preservation desired. A general rule is to use one part salt to three parts fish.

Place a loosely fitting wooden cover or china plate on the top layer of fish. Weight the cover with a nonmetal weight. The fish will form its own brine. Small fish will be completely brined in 48 hours. Thicker and fatter fish will require a week or 10 days.

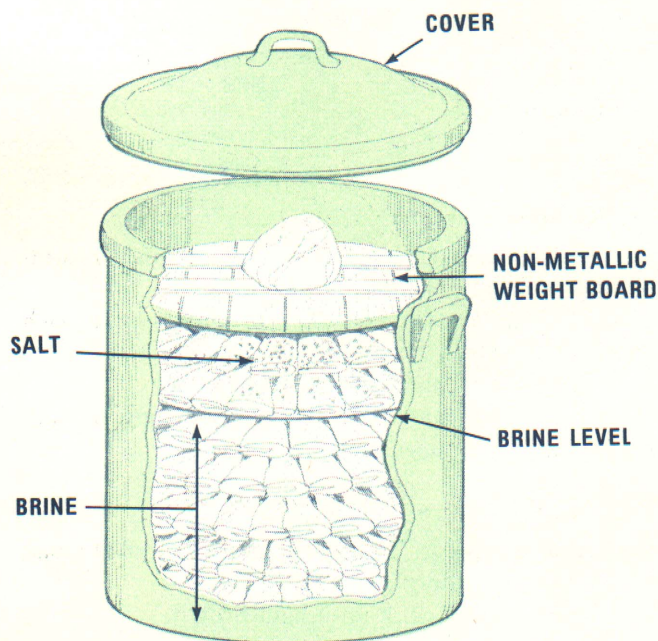
When the fish are thoroughly brined, remove them and scrub in saturated brine (4 cups salt to 1 gallon cold water) using a stiff brush.

Repack them, scattering a thin layer of salt between layers. Fill the crock or container with fresh, saturated salt brine, and store in a cool, dark place until used.

After three months or at the first sign of fermentation, change the brine. (The brine will become cloudy if bacteria start to ferment the fish.)

### *Freshening*

Salted fish can be smoked, pickled or used in a variety of recipes, but they need to be freshened in cold water first. Soaking in several changes of cold water for 8 to 48 hours, according to taste, should be sufficient. Should further freshening be desired, put fish in cold water to cover and just bring to a boil; then simmer. Cookery methods suitable for salt fish include broiling, frying, baking in milk or cream, simmering and creaming.



Dry salting fish in a crock.

### SALTED FISH CAKES

1 salted fish	½ t. white pepper
6 medium-sized potatoes, diced	½ c. bread crumbs
1 t. Worcestershire sauce	1 egg
1 T. butter	

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 and crumbs. Add well-beaten egg and shape into cakes. Saute or fry in deep fat, 390°F. Drain and serve hot with or without sauce.

### CREAMED SALTED FLAKES

1½ c. freshened fish, cooked and flaked	½ t. curry powder
4 T. fat	½ t. Worcestershire sauce
4 T. flour	¼ t. black pepper
2 c. whole milk	

Make a white sauce of the fat, flour and milk. 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.

## Pickling and Smoking

To pickle or smoke salted fish, follow the procedures in those sections.

## Pickling

Pickling entails the use of vinegar, salt and optional spices for preservation. Pickling preserves fish for shorter periods than freezing, salting or canning.

Vinegar slows the growth of spoilage bacteria, gives flavor and softens bones. Vinegar, however, is only a temporary preservative, because enzymes continue to act, softening and spoiling the product.

The acetic acid content of the vinegar is important. Use ordinary vinegar containing 5 percent acetic acid. The final pickling solution should contain at least 2½ percent acetic acid, no less than one part vinegar for each part water. If the taste of vinegar in the pickling solution is too strong, offset it with more sugar rather than dilute it with water.

Pickled fish must be refrigerated. When properly preserved, they should keep for 4 to 6 weeks at 40° F.

## Ingredients

To pickle fish, you will need:

**Fish**—Use only good quality fresh or salted fish.

**Soft water**—Hard water has too much iron, magnesium or calcium. Soften or filter hard water.

**Vinegar**—It should be clear without foreign flavors or odors and have a guaranteed 5% acetic acid content. Distilled white vinegar is recommended. Cider and other fruit vinegars containing 5% acetic acid may be used, but the fruit compounds may give the fish off-flavors.

**Salt**—Use finely ground canning and pickling salt. Table salt contains iodine, calcium and magnesium compounds which may give the fish a bitter flavor.

**Sugar**—Regular table sugar is suitable.

**Spices**—Use only fresh, whole spices.

## Basic Brining Procedure

1. Clean fish thoroughly.
2. Soak fish in weak brine made of 1 cup salt to each gallon cold water for 1 hour. Drain.
3. Make saturated brine of 4 cups salt to each gallon cold water. Soak fish in saturated brine for 12 hours at refrigerator temperature (approximately 40° F). Soak small fish like smelt for 4 hours.
4. Rinse fish in fresh water.
5. Cut fish into serving size pieces.

Dry salted fish are also suitable for pickling. Freshen salted fish for several hours in cold water. Then follow the recipes below for cooking and packing.

### BASIC PICKLING RECIPE

Prepare fish as in Basic Brining Procedure.

10 lbs. fish (brined and cut)	1 clove garlic, crushed (optional)
5 c. water	1 oz. white pepper (optional)
2 qts. vinegar	Crushed red pepper
½ lb. sliced onions	(optional and to taste)
2 oz. mixed pickling spices	

#### To pack in jars:

Bay leaves  
Lemon slices  
Onion slices

1. In a large kettle, bring to boil water, vinegar, onions and spices.
2. Add fish and simmer for 10 minutes or until fish is easily pierced with a fork.

3. Remove fish from liquid and spread in single layer in shallow pan. Refrigerate for rapid cooling.
4. Pack cold fish loosely in clean glass jars.
5. Add onion slices, lemon and bay leaves if desired.
6. Strain the vinegar solution, bring to a boil, and pour into jars to cover the fish.
7. Seal immediately.
8. Store in the refrigerator. Use within 6 weeks.

This recipe makes 6 to 8 quarts of pickled fish. It is suitable for all kinds of freshwater fish, especially carp, herring, smelt and mullet (sucker).

### GREAT LAKES PICKLED SMELT

Prepare smelt as in Basic Brining Procedure.

10 lbs. smelt (brined and cut)	8 bay leaves
1½ qts. white vinegar	10 whole cloves
3½ c. sugar	2 t. mustard seed
	2 t. whole peppercorns

#### To pack in jars:

Lemon slices  
Onion slices

1. Place smelt in a bowl and cover with white vinegar. Let stand 24 hours in refrigerator.
2. In a pan, combine 1½ quarts white vinegar, sugar and spices. Bring to a boil.
3. Drain fish. Add to boiling pickling solution and simmer for 10 minutes or until fish is easily pierced with a fork.
4. Remove fish from pickling solution and spread in single layer in shallow pan. Refrigerate for rapid cooling.
5. Pack cold fish loosely in clean jars.
6. Add lemon slices and onion slices if desired.
7. Bring pickling solution back to a boil and pour over fish. Seal.
8. Store in refrigerator.



### ESCABECHE

10 lbs. fish	1 c. onions, chopped
1 clove garlic, crushed	1 T. black pepper
2 T. bay leaves	1½ t. cumin seed
1 T. crushed red pepper	1½ t. marjoram
2 c. vegetable oil	1 qt. vinegar

#### Preparation

1. Cut 10 pounds firm-fleshed, cleaned fish into individual serving portions.
2. Place in a saturated brine (4 cups salt to each gallon cold water).
3. Brine for ½ hour; drain and wipe dry.
4. Salted fish may be used by freshening in cold water and wiping dry.

#### Pickling Procedure

1. In a frying pan, heat garlic and some of the bay leaves and red pepper in oil.
2. Add fish and cook until light brown.
3. Remove fish and cool in refrigerator.
4. Add onions, black pepper, cumin seed, marjoram and vinegar to frying pan. Cook slowly 15 to 30 minutes. Cool.
5. When fish are cold, pack loosely in clean jars with the rest of the red pepper and bay leaves.
6. Fill jars with sauce. Seal.
7. Refrigerate.

### CURED HERRING OR ALEWIVES

(for use in Cut Spiced Herring or Rollmops)

1. Cut off head and thin belly flesh to the vent. Clean thoroughly. Wash in fresh water and drain.
2. Pack drained fish loosely in a crock. Cover with a brine made of 2½ cups salt, 2 quarts white vinegar and 2 quarts water.
3. Leave fish in brine until the salt has "struck through," but remove before fish skin wrinkles or loses color. The length of the cure depends on the judgment of the pickler and varies with temperature and size of the fish. The average time is 5 days, but can vary from 3 to 7 days.
4. When you judge the fish sufficiently cured, drain off the brine.
5. Repack the fish more tightly, scattering a bit of dry salt among them. Cover with a brine made of 1¼ cups salt, 2 quarts vinegar and 2 quarts water.
6. Store the crock in refrigerator. At this point the fish will keep 2 to 3 weeks.
7. To use fish, freshen in cold water for 8 hours. Some cooks use the fish at this stage.
8. Others prefer to soak the fish one last time in vinegar and salt. Use 2 quarts vinegar, 2 quarts water and ¾ cup salt. Let fish soak 48 hours; then drain and use in Cut Spiced Herring or Rollmops.

### CUT SPICED HERRING (Raw Pack)

10 lbs. cured herring	5 T. whole red chili peppers
½ lb. onions, sliced	3 T. whole white pepper
½ c. bay leaves	3 T. whole black pepper
5 T. whole allspice	1 qt. vinegar
5 T. mustard seed	1 pt. water
5 T. whole cloves	2 T. sugar

Cut 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, water and sugar solution. Allow to stand in refrigerator for 24 hours. The cut, spiced herring may be repacked in pint or quart glass jars. It will keep 1 to 3 months refrigerated.

#### VARIATION: Herring In Sour Cream Sauce

Remove herring from spiced pickling sauce. Toss with sour cream, a squeeze of lemon and some grated onion. Add salt and pepper to taste. Dill and cucumber are also good seasonings. Chill several hours before serving.

### ROLLMOPS (Raw Pack)

10 lbs. cured herring	¼ c. bay leaves
Prepared mustard	2½ T. mustard seed
Dill pickles, one piece for each fillet	2½ T. whole cloves
1 qt. vinegar	3 T. whole black pepper
½ lb. onions, sliced	3 T. cracked ginger
2 T. sugar	3 T. cracked cinnamon

Cut cured herring into two fillets, removing the backbone. Spread each fillet with mustard. Roll each fillet around a dill pickle and fasten with a toothpick. Pack the rolls on end in a crock.

Mix together vinegar, sliced onions, sugar and spices. Simmer, do not boil, sauce for 45 minutes. Strain out the spices and onions to pack among the layers of rollmops. Cool the sauce and pour over fish to cover. Allow to stand 2 to 3 days in refrigerator before using. Rollmops should keep for several months refrigerated.

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