

# Home Smoking of Fish

UPDATED BY SUZANNE DRIESSEN, FOOD SAFETY EDUCATOR, UNIVERSITY OF MINNESOTA EXTENSION

EDITED BY ELIZABETH WHITE, UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE



STU SPIVAK / CREATIVE COMMONS

Historians say that as far back as the Stone Age, people were using heat and smoke—smoking—as a means of preserving fish and other flesh foods. The technique apparently evolved as Stone Age people began to use fire instead of the sun to dry fish for long-term storage.

Today, fish are smoked more for the flavor and aroma that smoking imparts than for preservation. While smoking does produce a safe, fully cooked product, it is important to remember that smoking does not make fish immune to spoilage. The smoking methods presented here have been scientifically tested both for their safety in preserving fish and for the appetizing flavor and savory aromas they produce.

## Safety and Quality Guidelines

The safety and quality of smoked fish depend on the skill, experience and knowledge of the person doing the smoking. Research and experience have shown that fish can be safely smoked when the following guidelines are observed. You may have to modify them somewhat to fit your particular situation. But keep these facts in mind.

- Though smoking can mask a wide range of off-flavors and defects in the raw fish, these defects will still be present in the final product. Be aware that if bad fish goes into the smokehouse, bad fish will come out. Use only high-quality fish.
- Problems may be encountered when you try to get uniform salt levels in the fish from batch to batch. The condition of the fish, its size, its fat content, whether it's been frozen or is fresh, and the time of year the fish was caught all influence the rate at which salt will be taken up. Unless you smoke fish every day or generally smoke

only one species of fish caught about the same time every year, you need to develop some way to determine the right level of salt for your taste. One way is to take a small piece of the brined fish and cook and taste it—keeping in mind that smoking will later remove a lot of water and fat, which will concentrate the salt. It's best to err on the low side—what may taste just right when the raw brined fish is tasted may be too salty after smoking.

- The internal temperature of the fish must reach 160 degrees F and be maintained at this temperature for at least 30 minutes. If your smoker cannot heat the fish sufficiently, you will need to cook the fish in your kitchen oven within 2 hours of smoking.
- Smoking does not prevent fish from spoiling. After fish is smoked, it must be kept refrigerated and eaten within four weeks, or immediately frozen for future use.

## Choosing the Fish

Any fish can be smoked, but some species taste better and have a higher quality when smoked than others.

In Wisconsin, the favorite fish for smoking include salmon, trout, whitefish, chubs, carp, suckers, buffalo and catfish. In general, fatty fishes like these will come out juicier than lean fish species like perch and walleye, which have a drier and firmer character when smoked.

In the final analysis, your personal preference for dry or moist smoked fish will determine which type of fish you will want to smoke.



## Brining the Fish

Proper brining is essential to successfully smoking fish because salt reduces the moisture content of the flesh, which preserves it. However, you can't rely on brining alone to preserve fish because it is impossible to tell how much salt a fish has absorbed without chemical analysis.

The key factors in brining are:

- Salt concentrations
- Brine-to-fish ratio (the amount of brine for the amount of fish)
- Brining temperature (40 degrees F)
- Fish that are about the same size and of similar kind (fat or lean)

### PREPARING FISH FOR BRINING

Decide how the fish are to be smoked—split, as fillets, in chunks, dressed with the head on or head off, with the backbone removed or left in.

**Freshly Caught Fish:** Clean (gut and gill) each fish. Make sure you remove the kidney from the belly cavity and rinse all exposed surfaces of the fish with fresh water to remove blood and foreign matter.

**Frozen Fish:** Thaw and wash them in fresh water.

### BRINING

When preparing the brine, be sure to use a container made of plastic, glass or some other material not affected by salt. Don't use metal containers—salt is corrosive and reacts with various metals.

The brine solution should be 1 part table salt (not iodized salt or salt with any anticaking agent) to 7 parts water by volume. One batch (1 cup of salt to 7 cups of water) will brine 2-3 pounds of fish. Double the amounts for larger amounts of fish, but be sure to use the 1:7 ratio.

Brining should be done at refrigerator temperatures (40 degrees F or lower). Large pieces of fish and oily fish require longer brining times; skinned and lower-fat fish require shorter times. A one-hour brining time works well in many cases. You can also start with 15 minutes of brining for each half-inch of fish. Do not allow fish pieces to overlap during the brining process.

Recipes that call for longer brine times with lower salt concentrations increase the opportunity for bacterial growth and possible spoilage later and are not recommended.

After brining, rinse the fish surface, and prepare for smoking.

## Smoking the Fish

### PREPARING THE FISH FOR SMOKING

Place the fish skin-side down on a wire mesh screen or suspend them on hooks or wooden dowels. For more uniform smoking, prop the belly flap open on hanging fish; on a rack, make sure the fish lie flat.

After racking, dry the fish by using a fan to blow air over them. This will dry the surface of the fish and cause a firm, smooth, shiny skin called a pellicle to form on the outer surface of the fish. On days of low humidity, this process normally takes one to two hours.

It is recommended that fish placed directly on screens or racks be turned occasionally during drying so they will not stick to the rack or screen. The reason for drying the fish is to provide a smooth, even surface for the condensation of smoke particles and to remove surface moisture from the fish before it goes into the smoker.

At this point insert a short-stem meat thermometer into the middle of the thickest portion of the largest fish. This will enable you to know the minimum internal temperature of all the fish during smoking, which is essential to ensuring that they will be safe to eat. Make sure that the thermometer is firmly in place so it won't fall out or give inaccurate temperature readings. Through a hole in the cover of the side of the smoker, insert another thermometer capable of measuring temperatures from 50 to 250 degrees F to use as a guide for monitoring the temperature of the air inside the smoker.

### KEY FACTORS IN SMOKING FISH

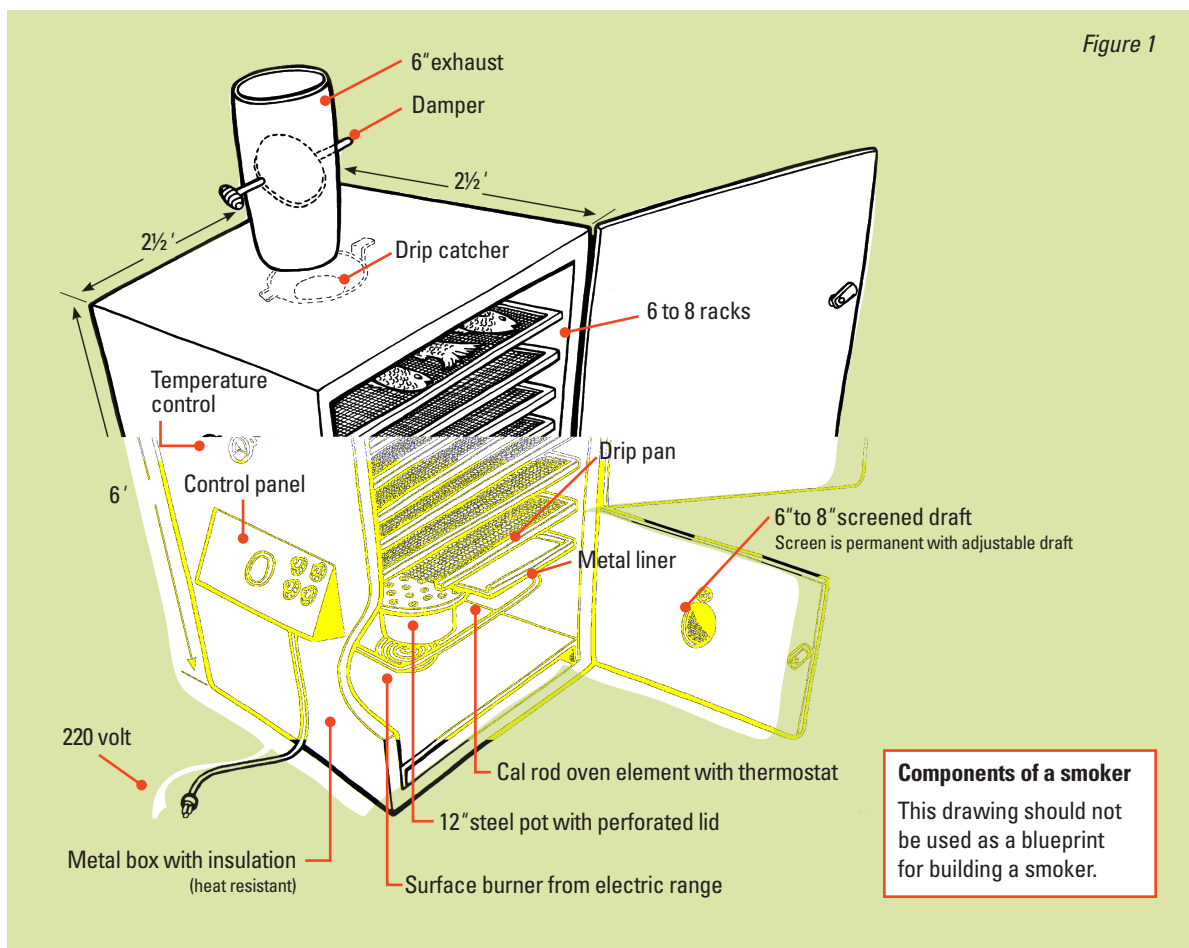
There are three key factors to keep in mind when smoking fish:

1. The uniformity of the temperature of all fish in the smoking chamber.
2. The rate of temperature increase in the fish flesh during smoking.
3. Maintaining the desired temperatures (no less than 160 degrees F for at least 30 minutes) in the flesh during the total smoking time for all fish in the smoker.

### Smoking Equipment

There are a number of small home smokers now on the market. These smokers will do a reasonably good job of smoking fish and other food products on a small scale.

But there are times when you can run into difficulty using small smokers. For example, it may be difficult to get the smoker hot enough to adequately cook the fish when outside temperatures are near or below freezing. Your smoker needs to be able to reach air temperatures of 200-225 degrees F. If the internal temperature of the fish does not reach 160



degrees F for at least 30 minutes, remove the fish from the smoker and finish the cooking process in the kitchen oven. Whether you use a large or small smoker, cooking the fish in an oven is one way of making sure the fish get adequate heat treatment.

### Making Your Own Smoker

Construct a large wooden box that is open on the bottom, with one side hinged so it opens outward as a door. Be sure to cut a draft hole in the top with a sliding cover so you can adjust the size of the hole and control the draft in the smoker. Nail wooden strips inside the box on the two sides of the box adjoining the door for the ends of the smoking racks to rest on. These strips should be far enough apart that the racks of fish won't touch.

Set the bottom end of the smoker over a hole in the ground. The firepit, no more than a foot away from the smoker, should have an ample, adjustable airway to make sure enough air gets in to keep the fire smoldering. You might do this by inserting a piece of drain pipe with an elbow into the ground just next to the hole, and then use a plate to partly cover the above-ground end to control air flow through the pipe.

The next step depends on whether the fish will be hung or racked for smoking. To hang the fish, suspend rods made either of iron or wood dowling on the top strips inside the box. Space the rods far enough apart so the fish do not touch while being smoked. Make S-shaped hooks from 8- or 10-gauge steel wire about 14 inches long, or from clothes hanger wires. Leave the bent loops in the wire large enough to slip over the rods. Be sure the wire is strong enough to support the weight of the fish being smoked and that the fish will not slip off the hook. Place a wire mesh tray on the bottom to catch any fish that may fall off during smoking.

Fish also may be smoked by laying them on wire mesh screens or racks. A coarse wire mesh rack made from hardware cloth may be used for this purpose. If fish are to be smoked in this fashion, sticks or short pieces of wire should be inserted into the flesh along the edges of the belly cavity to make sure that the inside of the belly receives a similar smoke treatment to that of the outer surface of the fish.

The wooden portion of the smoker will not catch fire if the ventilation is controlled properly and the fire is smothered to form smoke rather than flames. Keep the door and top draft hole closed during smoking. Allow just enough air to enter and leave the box to keep the fire smoldering.



## Heat Sources

Both heat and smoke are important in smoking fish. Heat cooks, dries and renders the fish, while smoke imparts flavor and color to the product. The source of heat must be adequate to raise the internal temperature of the fish flesh to 160 degrees F, hold that temperature for at least 30 minutes and not burn the fish in the process.

If you are not using a commercially made smoker, you can generate heat and smoke by a variety of methods. One method is to use an electric hot plate and an old iron skillet, or some other heavy metal container that will hold heat and not burn through. Put them in the smoker, turn on the hot plate and let the skillet get hot. Place damp sawdust or wood chips in the hot skillet and allow them to smolder and smoke. After the wood has begun to smoke, the temperature in the smoker can be controlled by adjusting the hot plate's temperature dial. As the combustible material is consumed, more sawdust or wood chips must be added to the smudge.

Another method is to make a wood chip or sawdust smudge. This is done by placing charcoal briquettes in a pail or other suitable container, igniting and allowing them to burn to a light-gray color, then placing wood chips or damp sawdust on the hot briquettes to burn and smoke.

Damp sawdust burns slowly and makes a good, dense smoke. The sawdust should be mixed with water in a pail or tub until it is damp to the touch. Don't get it too wet or it might put out your slow-burning fire, which once extinguished will be difficult to get started again. It may be necessary to create a forced draft to keep the sawdust burning—an electric hair dryer might be a handy item to blow air through one of the vents in the bottom of the smoker.

If wood chips or split wood are used, a normal draft hole in the fire pot door usually supplies enough air to keep the fire going.

## Suitable Types of Wood

Wood from oak, hickory, maple, alder, beech, apple, white birch or ash trees produce good smoke-flavored products. Don't use pine or other woods that contain high amounts of pitch.

The wood can be chipped or cut into pieces about 8 inches long and 1 inch in diameter. If sawdust is used, make sure

that it comes from one of the recommended woods. Don't use sawdust from a woodworking shop unless you know what's in it—sawdust from fiberboard or plywood contains glue and adhesive residues that, besides creating off-flavors in the smoked product, may be toxic as well.

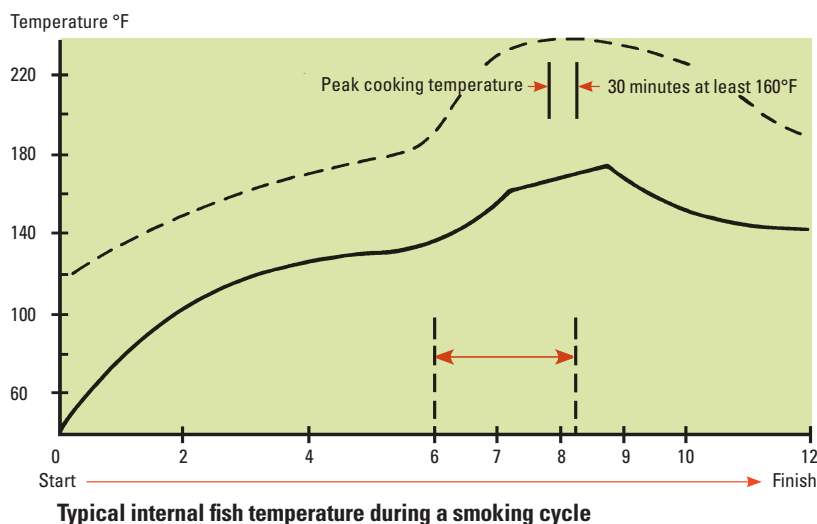
After the fire is kindled and has heated the air in the smoker to about 100 degrees F, put the fish in the smoker.

## The Importance of Temperature Control

The key part of smoking is controlling the temperature in the smoker. Fish flesh is considered to be adequately cooked if the internal flesh temperature reaches 160 degrees F and is held at the temperature for at least 30 minutes. This is called the "hot smoke" process.

During smoking, the temperature inside the smoker will keep rising, so care must be taken to control the rate of temperature rise and the temperature level in the smoker. On dry (low humidity) days, the fire will burn faster than on

Figure 2



days when the humidity is high and the air heavy. To control temperature, regulate the draft vents, which allow more or less air to reach the burning wood or sawdust, and increase or decrease the heat from the fire pot.

Having an idea of the relationship between air temperature in the smoker and the internal flesh temperature is essential to knowing if the fish will be overcooked or undercooked. If the air temperature in the smoker is raised to 200-220 degrees F, the temperature of the fish flesh will be approximately 160 degrees F. Holding this temperature for 30 minutes is essential to ensuring that the fish flesh is properly cooked. It is absolutely necessary to measure the temperature of the fish flesh as well because air circulation varies inside smokers, and air temperature is not a guarantee of flesh temperature.



After the fish has been cooked, the internal temperature can be lowered to about 125 F and the smoking process continued until the desired level of smoked flavor is achieved.

Smoking may take up to 12 hours—or longer if a very heavy smoked flavor is desired—but the minimum time required before fish acquires a delicate light-smoked flavor is about 8 hours in the smoker with smoke being generated the entire time. Longer periods of smoking will produce a progressively stronger smoke flavor.

### Care and Storage

When the smoking is completed, immediately remove the racked fish from the smoker and allow them to cool at room temperature for about an hour. When first removed from the smoker, the warm cooked fish flesh will be very soft and hard to handle. By allowing the fish to cool, the flesh becomes firmer and easier to handle without damaging it.

After the fish have cooled, they should be wrapped in butcher paper or covered, and then refrigerated. Smoked fish must be stored at refrigerator temperatures (40 degrees F or lower) and kept no longer than a month, or it may be frozen and kept up to four months.

---

### Related Sea Grant Publications

“Home Canning of Fish” by David Stuibler and Mary E. Mennes. Wisconsin Sea Grant publication. Madison: University of Wisconsin, updated 2014 by Suzanne Driessen.

“Home Freezing of Fish” by David A. Stuibler. Wisconsin Sea Grant publication. Madison: University of Wisconsin, updated 2014 by Suzanne Driessen.

“Home Pickling of Fish” by David Stuibler and Mary E. Mennes. Wisconsin Sea Grant publication. Madison: University of Wisconsin, updated 2014 by Suzanne Driessen.

### Source

“Smoking Fish at Home—Safely,” Pacific Northwest Extension Publication, 2009. [cru.cahe.wsu.edu/cepublishations/pnw238/pnw238.pdf](http://cru.cahe.wsu.edu/cepublishations/pnw238/pnw238.pdf)