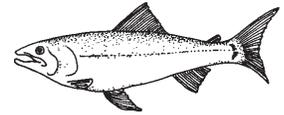


# Smoking Fish At Home



FNH-00325

## Note:

If you are planning to can the smoked fish, please refer to FNH-00223, *Home Canning Smoked Fish and Home Smoking Fish For Canning* for recommendations for smoking fish for canning and for directions for canning smoked fish.

## Introduction

Producing a high quality home-smoked fish is a popular recreational activity and a point of pride for many Alaskans. In earlier times, smoking was a form of food preservation; large amounts of salt and long smoking times were used to help preserve the fish. Now fish is smoked more for flavor and appearance. Today's lightly salted and smoked fish is not a preserved product; the amounts of salt and smoke used are NOT sufficient to prevent bacterial spoilage. Most food poisoning bacteria can and will grow under the conditions normally found in preparation and storage of smoked fish. Clostridium botulinum, the bacteria that may cause botulism, is the most harmful of these bacteria.

A safe home-smoked product requires a good understanding of the procedures and precautions needed to prevent food poisoning. This bulletin explains why certain procedures must be followed and precautions taken to prepare safe high quality smoked fish.

## The Smoking Process

Smoking fish usually requires five steps. These are:

- PRODUCT PREPARATION
- SALTING OR BRINING
- EQUILIBRATION AND DRYING
- SMOKING AND COOLING  
(hot or cold smoke)
- PRODUCT PACKAGING and STORAGE

Each step is critical to producing a good quality and safe product. It is important to follow the steps outlined to minimize the potential for bacterial spoilage and food poisoning.

## Product Preparation

Almost any fish can be smoked. Fatty fish, such as salmon and black cod, can be brined and smoked much easier than lean fish. Low fat fish, such as grayling and halibut, are more difficult to smoke because these fish absorb salt quickly, and it is easy to get the flesh too salty.

Only high quality fresh or frozen fish should be used for smoking. Using poor quality, freezer burned fish will produce a poor smoked product. Smoking will not hide poor quality; it will call attention to the problem.

When preparing fish for smoking, it is important to keep the preparation area clean and sanitary. Keeping the work area, cutting boards, knives and hands clean will help prevent bacterial contamination. Do not, under any circumstances, handle raw fish where the finished smoked product is kept. This could result in cross-contamination; spoilage bacteria could transfer from the raw to the finished product.

Clean all fish carefully to remove slime, blood and harmful bacteria. Then fillet or split the fish, leaving the skin on the fillet. Cut the fillet into uniform pieces so that no parts will get oversalted. Pieces should not be more than one inch thick. Larger pieces of fish may spoil during the smoking process.

During preparation the fish should be kept as cool as possible. This will help keep down bacterial growth and spoilage. The ideal temperature for holding fish during this stage of the process is below 38° F. Home refrigerators are often 40° F or higher. Check the refrigerator temperature with an appliance thermometer and adjust controls as needed.



Another common problem is parasites. Many fish contain tapeworms and nematodes that can survive some low salt brining and temperature smoking methods and can cause serious health problems. These parasites can be destroyed by freezing the raw product at a temperature of 0° F for two weeks or longer, **before** salting and smoking. When freezing the product in a home freezer, it may take several days to reach 0° F throughout the entire fish; *the more food you put in the freezer at one time, and the thicker the pieces of food are, the longer it will take to freeze the food.*

(If you have several fish to freeze at one time, it would be a good idea to borrow or rent additional freezer space to be sure the fish will freeze within a reasonable time.)

For hot smoked product (see section on smoking) the internal temperature of the fish is raised to at least 160° F for bacterial reduction, which exceeds the 150° F required to kill parasites. Therefore, only fish intended for a cold smoke process must be frozen prior to processing.

### **Salting**

The second step in the smoking process is salting the fish. Salting was once the preservation step in smoking. High levels of salt inhibited bacterial growth and made the product safe. But, with today's concern over salt in the diet, it is used only as a flavoring agent, not as a preservative.

Salting can be accomplished using either a strong salt solution (brine) or dry salt. For most recipes, brining gives a more uniform salting and is easier to prepare and use. Dry salting requires considerable experience before consistent results are obtained.

Brines can be prepared by dissolving salt in fresh water. Use only kosher salt, vacuum dried salt, dairy salt, pickling and canning salt, or flake salt for brines. These are pure salts. Avoid rock salt, sea salt and iodized salt because these contain impurities and additives that can cause bitterness and off flavors. Curing salts should also be avoided since they contain nitrites. It is difficult to get an even distribution of nitrite throughout the fish under home conditions.

Any strength brine may be prepared. The brine used in our experiments is made by dissolving 1½ pounds of salt per gallon of water. Once the brine is made it should be chilled to 38° F or lower before

use. This helps reduce bacterial growth and increases salt uptake into the fish. Place the fish in the brine for 20 minutes to 3 hours depending on the desired taste. Weaker brines (using less than 1½ pounds of salt per gallon) can be used with correspondingly longer soak times.

After keeping fish in brine for long periods of time (1 hour or longer), the fish should be “freshened” by soaking in fresh water to remove the excess brine. This usually takes 30 to 60 minutes for most products. For a lightly salted product (brining times less than 1 hour), a fresh water rinse is sufficient to remove excess brine.

The brine-to-fish ratio should be 3 parts brine to 1 part fish. For example, 10 pounds of fish will require 30 pounds of brine (approximately 4 gallons; 1 gallon of brine weighs about 8 pounds).

### **Drying**

Once the fish has been brined, it is usually dried before smoking. Drying accomplishes two things. It allows the salt to penetrate and to become evenly distributed throughout the flesh of the fish (equilibration). Secondly, the surface of the fish dries to form a “pellicle” or tough shiny coat. The pellicle seals in moisture and makes the appearance of the finished product much better.

Refrigerate the fish while waiting for salt penetration and to start surface drying. Keep temperatures below 38° F. Equilibration may require anywhere from 2 to 24 hours depending on fish thickness (6 to 8 hours for a 1-inch thick fillet).

Forming a pellicle requires warmer temperatures and is usually done in the smoker just prior to smoking. It may take 30 minutes to 3 hours to form a good pellicle. This depends on the smoker temperature and humidity. If possible, avoid the longer times because the potential for bacterial spoilage becomes greater.

### **Smoking**

The fourth step of the process is smoking. There are many recipes for smoking using different times and temperatures, but only two basic methods:

1. “Hot” smoke: the internal product temperature reaches 160° F and higher. A cooked, smoked product such as kippers is produced.

2. "Cold" smoke: the internal product temperature is below 90° F. The resulting product is a raw, smoked fish such as lox or Nova Scotia style salmon.

For most people, hot smoking is the most popular form and easiest to produce in home smokers.

Also, the temperatures recommended for hot smoking are high enough to kill most bacteria. Cold smoke temperatures are not hot enough to kill bacteria and actually may promote growth of bacteria.

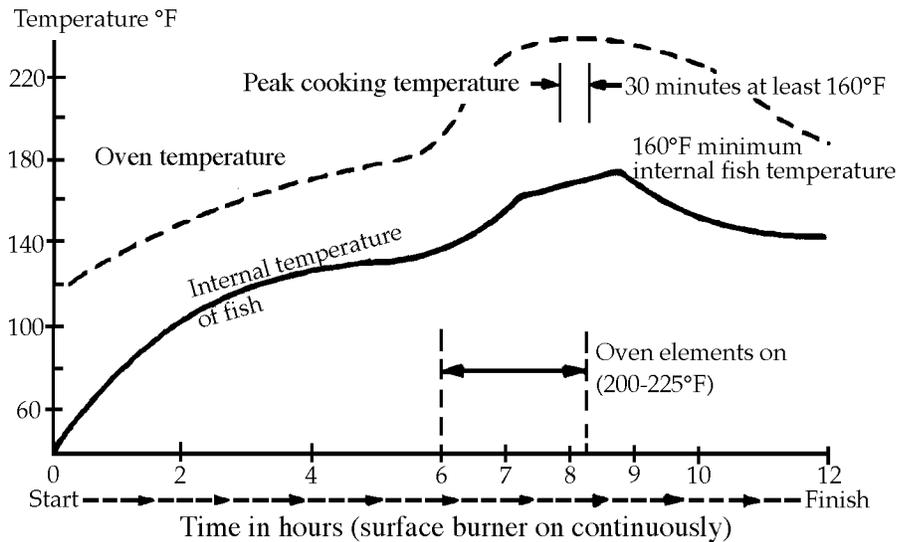
Recommendations for each smoking method:

#### Hot Smoking —

- Cook the fish to 160° F **internal** temperature (use a thermometer) for at least 30 minutes at some time during the smoking cycle, preferably toward the end. This temperature will kill most food spoilage bacteria and combined with proper refrigeration will ensure a safe product. A typical fish smoking cycle (figure 1) should bring the internal temperature of the fish to 160° F within 6 to 8 hours after placing it in the smoker.

Use a standard meat thermometer to monitor internal temperature. Insert the thermometer into the thickest part of the fish.

- It is best to wait 3 to 5 hours before raising the fish internal temperature to 160° F. This will prevent curd formation and "exploded" pieces that occur when the temperatures are elevated too quickly.
- If the smoker does not heat hot enough to produce an internal temperature of 160° F in the fish, the smoked fish can be transferred to a home oven set at 300° F for a final heat treatment. Bring internal fish temperature to 160° F and bake for at least 30 minutes. Adjust the oven temperature as needed throughout this baking period to maintain the 160° F internal temperature. Be sure that hands, utensils and work surfaces are clean when transferring fish from smoker to oven to avoid cross-contamination.



**Figure 1.**  
Typical internal fish temperature during smoking cycle.

Source: Kenneth S. Hilderbrand, Jr., *Smoking Fish at Home Safely*, Pacific Northwest Extension publication PNW 238. Reprinted September 1996

- Depending on the desired finished product, smoking should take anywhere from 6 to 15 hours. Shorter cooking times will result in more moist finished products.

#### Cold Smoking —

*If cold-smoked fish will not be cooked prior to eating, the freezing step (page 2) is necessary to destroy harmful parasites that may be present in uncooked fish.*

- Temperature control is very critical. Never allow the internal product temperature to exceed 90° F. At 95° F, the fish will start to cook.
- It is difficult to cold smoke in areas of high humidity. When relative humidity cannot be reduced below 75 percent at air temperatures below 85° F, then cold smoking is not possible.
- Depending on the desired finished product, smoking will take anywhere from 16 hours to 7 days.

**CAUTION:** *The entire cold smoking process takes place in the temperature "danger zone" (40° F to 140° F). Therefore, this product could spoil or become unsafe to eat before it is fully smoked.*

## SMOKING FISH AT HOME

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### Product Storage

The final and most important step in producing smoked fish is product storage. Most smoked products have had no preservation step. There is not enough salt, smoke or heat to preserve the product. The potential for bacterial spoilage and botulism exists.

After the fish has been smoked, allow it to cool to room temperature (this will prevent condensation) and then do one of the following:

1. Wrap and refrigerate below 38° F until consumed. Use a good plastic wrap and/or aluminum foil. Lightly salted and smoked product can last as long as 10 to 14 days in the refrigerator. (Again, make sure that your refrigerator can maintain proper temperatures.)
2. Wrap and freeze. Use a good freezer wrap and aluminum foil to protect the product. Properly protected smoked salmon will last for 2 to 3 months.

You **MUST** handle the finished product using one of these options in order to keep the smoked fish **SAFE**. Another popular method for storing smoked fish is sealing the products in vacuum packages. Home style vacuum packages make it easy to protect smoked fish. **BUT**, vacuum packaged smoked fish

**MUST** be kept under refrigerated or frozen storage. **NEVER** leave smoked fish at room temperatures. Please refer to FNH-00221, *Storing and Mailing Vacuum Packaged Fish*.

### Brine Recipes

Heavy Salt Brine: 2½ pounds (4½ cups) of salt per gallon of water.

Medium Salt Brine: 1½ pounds (2½ cups) of salt per gallon of water.

Slowly pour salt into water stirring constantly. Chill before using. Sugars and pickling spices can also be added to give extra flavors to the finished product. Vary the ingredients and proportions to suit your taste:

- Heavy salt brine, add 1½ cups white or brown sugar per gallon of water.
- Medium salt brine, add 1 cup white or brown sugar per gallon of water.

Spices - amounts per gallon of water

Bay Leaf-----	50 leaves, crushed
Pepper -----	8 teaspoons
Mace -----	2 tablespoons
Allspice -----	7 teaspoons
Cloves -----	2 tablespoons
Juniper berries -----	2 tablespoons, crushed

**Smoked fish also may be canned. Please refer to FNH-00223, *Home Canning Smoked Fish & Home Smoking Fish For Canning* for directions.**

*Written by Chuck Crapo, Seafood Quality Specialist, Marine Advisory Program, University of Alaska Fairbanks. Revised June 1993 by Barbara Greene, EFNEP/Nutrition Coordinator. Revised in 1998 by Bret Luick, EFNEP Coordinator.*

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*For more information contact Kristy Long, Extension Foods Specialist at 907-474-7974 or [ffkal@uaf.edu](mailto:ffkal@uaf.edu).*

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