

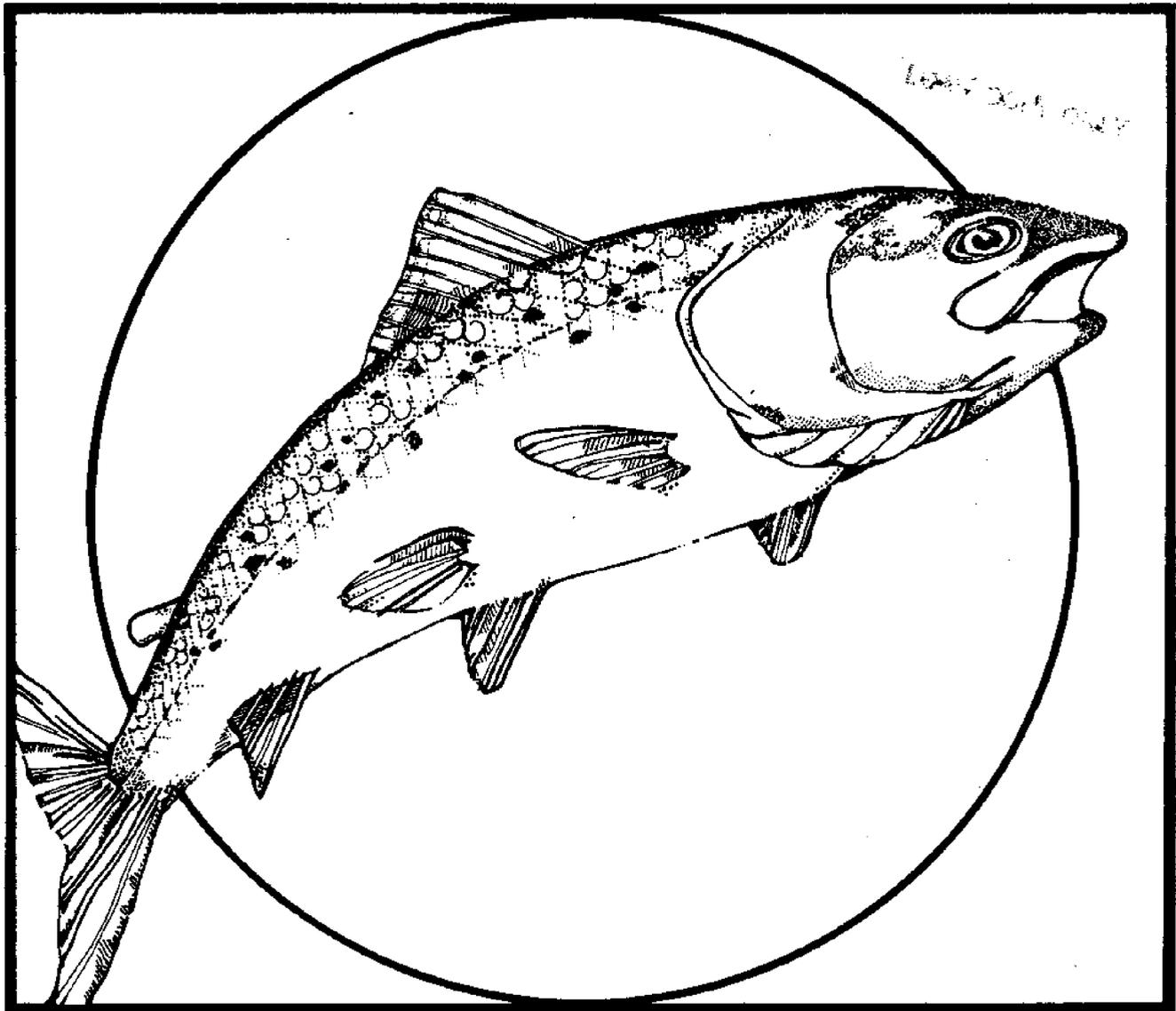
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GETTING THE MOST FROM



YOUR GREAT LAKES SALMON

C.E. JOHNSON, D.A. STUIBER, R.C. LINDSAY

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C.E. Johnson , D.A. Stuiber , R.C. Lindsay

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ABOUT THE AUTHORS . . .

C.E. Johnson is Associate Professor, Department of Food Science, College of Agricultural and Life Sciences, UW-Madison and Extension Food Specialist, UW-Extension.

D.A. Stuibler is Associate Professor, Department of Food Science, College of Agricultural and Life Sciences, UW-Madison and Extension Fisheries Products Specialist, UW-Extension.

R.C. Lindsay is Associate Professor, Department of Food Science, College of Agricultural and Life Sciences, UW-Madison.

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Salmon have become an important part of the Great Lakes sports catch. While these fish closely resemble their saltwater counterparts, their utilization after creeling by Midwest sportsmen creates some problems and confusion because they differ from the familiar lake trout in both seasonal quality and handling characteristics.

Some Great Lakes fishermen are aware of the problems that may be encountered in handling salmon and have learned how to protect the quality of their prize salmon catch. However, a great many occasional fishermen are disappointed with the eating quality of their fish, especially when caught late in the season.

This booklet provides basic information on how to get the most eating enjoyment from Great Lakes salmon. Methods are also detailed on how to avoid high levels of pesticides in fish flesh and how to preserve salmon eggs for future fishing pleasure.



Photo Courtesy of Salmon Unlimited

SALMON IN THE GREAT LAKES

The events leading up to the introduction of salmon in the Great Lakes began over 100 years ago with the construction of the Welland Canal which bypassed Niagara Falls. Prior to that time the four upper lakes were isolated from Lake Ontario and the Atlantic Ocean by that 167-foot natural barrier. The Welland and subsequent navigational canals have had a profound effect on the ecology of the lakes by permitting two saltwater species, the sea lamprey and the alewife, to enter the upper lakes.

The sea lamprey is an eel-like parasite which attaches itself to the host fish with its suction, disk-like mouth. With its rasping tongue the lamprey quickly penetrates the skin and proceeds to extract the host fish's blood and body fluids.

The destructive effect of the lamprey was first noticed in the decline of lake trout. The large, relatively slow-moving lake trout were easy victims as they swam about the lake bottoms. As a result of the declining lake trout population, commercial fishing for trout was stopped in June 1962.

Since the mid fifties the United States and Canadian governments have conducted a determined campaign to eradicate the lamprey. Although fencing and barriers have some effect, the most successful method is destruction of the immature lamprey in the spawning streams by chemical treatment. The program has brought about a reduction in lamprey population and the percentage of lamprey-scarred and wounded fish has declined. The success of this lamprey eradication program is dependent on continued yearly treatment of lamprey spawning streams and areas.

Lamprey wound on a lake trout.



The second invader from the sea, the alewife or river herring, found the lakes nearly devoid of predators and soon took over. By 1967 alewife constituted 70% of the Lake Michigan commercial harvest. Starting in 1967 alewives began dying off in huge numbers and dead fish littered harbors and beaches. The reasons for this massive die-off are still not fully understood.

Under these circumstances the introduction of coho salmon in 1964 and chinook salmon in 1967 was held as a master stroke. Salmon, with their voracious appetites, made excellent predators to help control the alewife. Further, it gave the sportsman a needed replacement for a badly depleted trout population.

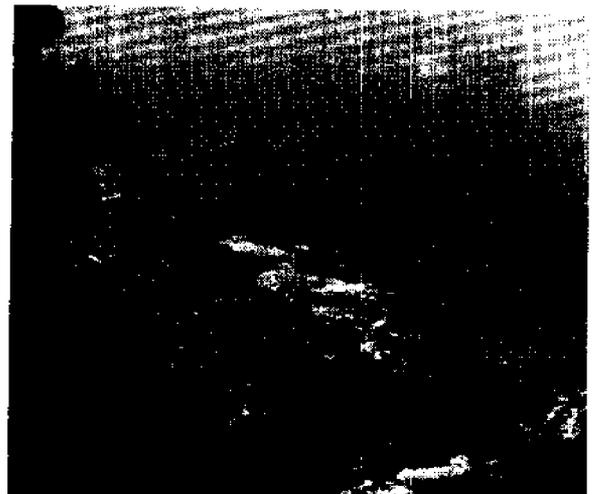
The salmon adjusted without difficulty to their totally freshwater environment. These freshwater-reared salmon exhibit a similar life cycle and characteristics to their saltwater cousins. The only major apparent visual difference in the adult freshwater Lake Michigan salmon is a lack of the typical orange salmon color in the flesh of the prime mature fish. But some strains of salmon in salt water also lack orange salmon color in the flesh.

However, reports of poor eating quality and high pesticide levels indicated the need for a study of the quality of Great Lakes salmon. In 1971 the Department of Food Science at the University of Wisconsin at Madison began studying Lake Michigan salmon to determine whether the criticisms were valid, and, if so, what might be done to improve fish quality.

LIFE CYCLE OF GREAT LAKES SALMON

From eggs initially obtained in Oregon, Washington and Alaska, both Michigan and Wisconsin instituted a salmon hatching and rearing program which supplies chinook and coho for stocking Lakes Michigan and Superior. Since most of the tributaries lack the gravel bottoms and clean, fast-moving water necessary for natural spawning, the future of the Great Lakes salmon population is based solely on hatchery rearing and stocking programs.

Eggs are collected by fisheries biologists from mature, spawning-run Great Lakes salmon in October and November. The fertilized eggs hatch in about 50-60 days. Sac fry are on hand by the first of January. Within a month the young fry have absorbed the egg sac and feeding has begun. The young salmon are held in the hatchery until they smolt, which is a physiological adaptation that occurs in salmon just prior to migration from their hatching streams to the ocean. Chinook smolt in 90-120 days and measure 1.5-2.5 inches long when released about April. Coho, however, must spend about 16 months in the hatchery before they smolt and are planted the following spring as 4 to 10 inch smolts. Smolt size depends on hatchery water temperature. Cold water slows growth.



In smolting the young salmon change in appearance to a more silvery fish and develop strong migratory tendencies. The young salmon are "imprinted" with the chemical environment of their hatchery stream or release sites so that upon maturation they will seek out and return to the same stream or release site for spawning.

The migration patterns of growing salmon in Lake Michigan are not known, although there is some evidence that they migrate in a southerly direction initially and then take a northerly route as they return to spawning or release sites.

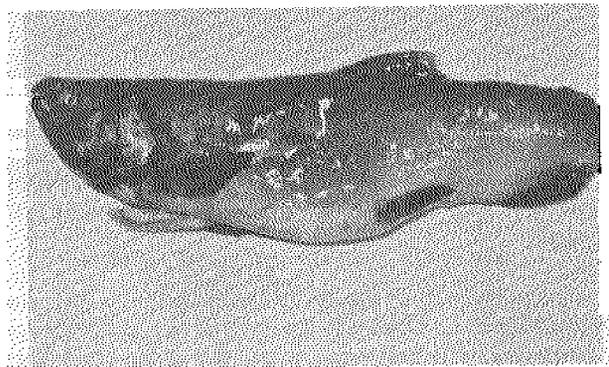
The first sports catch of salmon in Lake Michigan comes during the summer after release when the yearling coho salmon are about 9-12 inches in length. Usually the flesh is pink and they make excellently flavored pan-fried table fare. These yearling fish are taken along with the two-year old salmon during the months of June through August and are not usually caught during the winter months.

The two-year old coho salmon measure 16-22 inches when caught in the period from April through June. These actively feeding immature fish are of the highest quality when handled properly. The fish are bright silver and the scales slip easily. The flesh is firm-textured and usually exhibits a pronounced orange-pink color, rather than a deep orange color. However, flesh color varies among individual fish and some are only light pink colored. The color is attributed to the presence of certain insects and aquatic organisms in the diet of the younger fish. When cooked, the color tends to diminish in intensity, as is the case with ocean-caught fish.

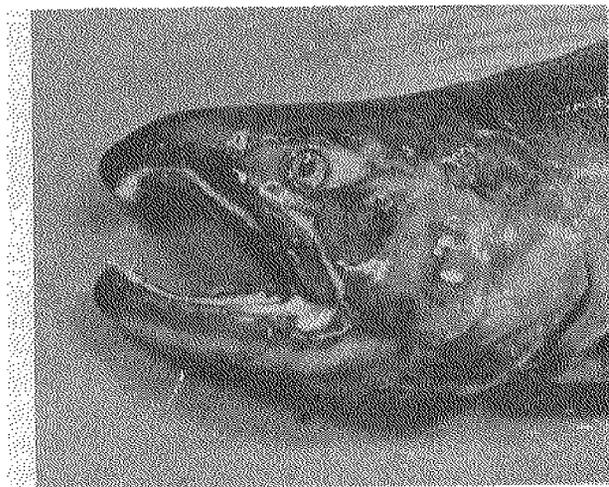
Salmon caught at the beginning of August are usually still immature and do not exhibit noticeable sexual changes. The fish are still bright silver and the scales still slip easily. But the flesh color is a lighter pink, due to the fish's shift to an alewife diet as they enter their most rapid growth period.

Beginning about the middle of August the nearly three-year old coho and nearly four-year old chinook begin to mature sexually. A heavier slime coating begins to develop over the scales, which become tightly set. Hooked noses begin to develop, especially in the males. The flesh becomes softer or watery and is a light pinkish cream to white color.

The salmon move in close to shore, preparing for the return to the spawning streams, and it is from this group that many of the sports-caught fish are taken. Since these salmon are taken from the lake and are still reasonably silvery bright, they are considered by the sportsman to be of prime quality. However, off flavors associated with sexual maturity are developing in these fish and the quality has begun to drop noticeably.



Extremely heavy slime coating on mature female coho salmon at spawning time.



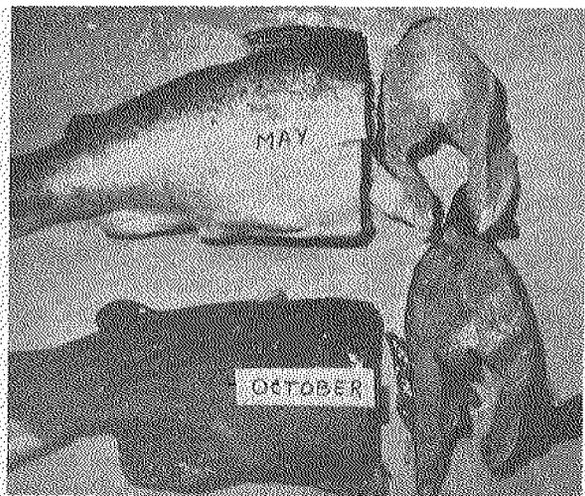
Typical hooked nose of a mature male coho salmon.

Finally, in September through November, sexually mature salmon cease actively feeding and enter the streams. The fish take on an extremely heavy slime coat; their thick skin has darkened and they have lost their silvery bright color. Males exhibit a pronounced hooked nose and the nose and jaws of females usually extend to a lesser degree. Male coho often exhibit typical bright red skin colorations and the females a lesser reddish dark coloration. The flesh has become soft, watery and greyish white, which is similar to that found in ocean-run "spawners." Most of the salmon by now have lost the characteristic prime salmon flavor and many have taken on pronounced off flavors. Prior to the spawning run they have ceased to feed and have begun to convert body fat to energy, eggs and milt, thus causing their watery soft flesh.

Intermingled with the adult spawning-run salmon are significant numbers of "jacks," or sexually mature male cohos at two years of age and chinooks at two and three years of age. Coho jacks average 16-20 inches and two pounds, while chinook jacks run up to 22 inches and four pounds. Jacks may be of better eating quality than fully mature adult salmon.

The off flavors and soft textures found in some mature Lake Michigan salmon pose problems in preparing products with pleasant flavors and chewing characteristics. Although the fish are generally wholesome, they may not be enjoyed because of off flavors and mushy mouth feel. Adding desirable flavors, such as smoke, masks some of the off flavors, and partial drying firms the texture to a more desirable consistency.

The presence of DDT and PCB pesticide and chemical residues in Great Lakes fish is of concern. Although still controversial, it is recommended by health authorities that the frequency and amounts of large Great Lakes fish eaten should be in moderation. Since these chemical residues tend to concentrate in the fatty tissues, it has been recommended that the high fat areas such as the belly flaps and the flesh comprising the dark, lateral line and dorsal lines be removed prior to cooking.

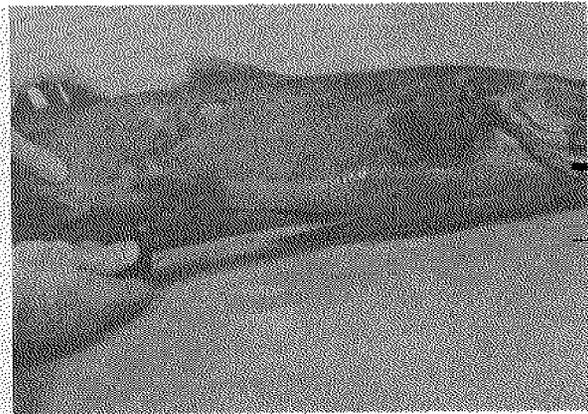


Comparison of a silvery bright May salmon with a dark, slime-coated spawning salmon caught in October.

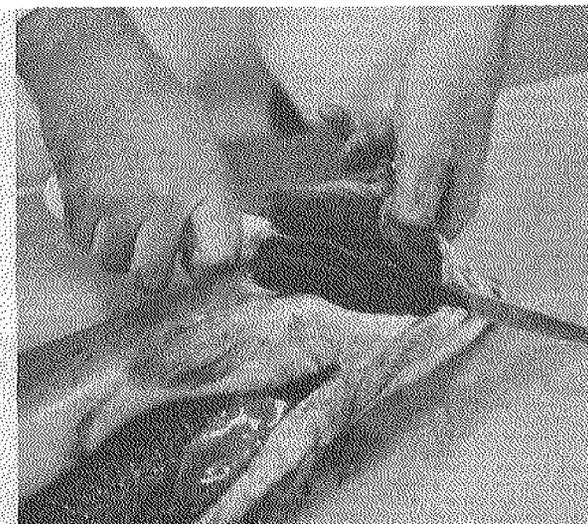
HANDLING AND CLEANING

The flavor and texture of salmon flesh will deteriorate soon after the fish is taken from the water unless proper care is exercised. Deterioration is caused by many factors, but the presence of spoilage bacteria, blood and normal digestive fluids are major contributors. Thorough gutting and cleaning remove these problems, and since deterioration is accelerated by high temperatures, icing is essential. Crushed ice should be packed inside the cavity and about each fish immediately after catching. It is desirable to gut fish prior to icing, but icing whole fish will aid in maintaining quality. Properly iced, fish can be held for four or five days without problems.

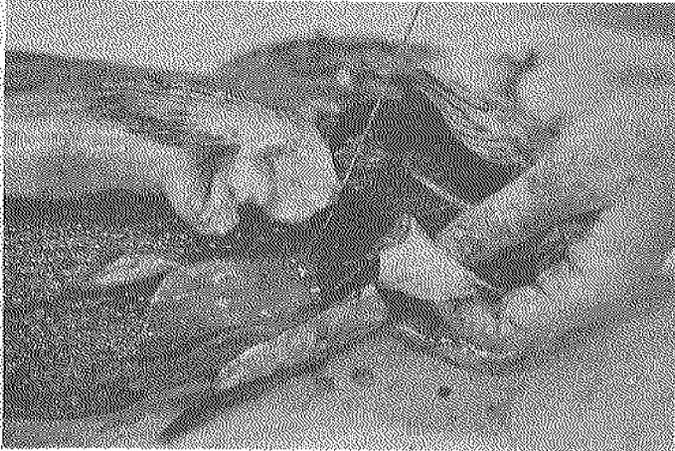
Use the best facilities that are readily available. A sharp knife and clean water are required. Wash all fish to remove surface dirt and excess slime before beginning. Then take the following steps.



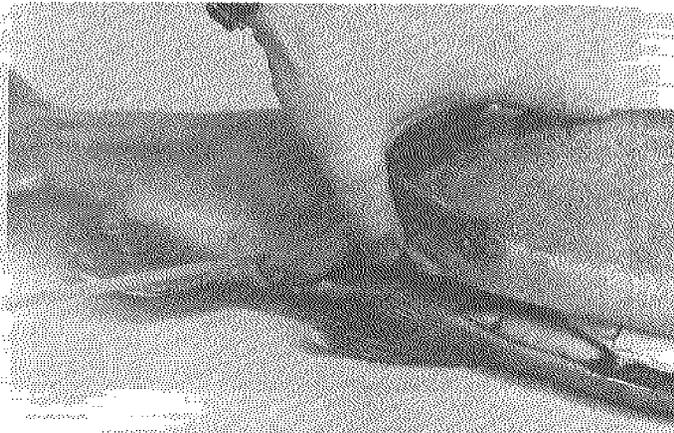
1. Open the body cavity by cutting along the belly from the vent to bony gill collar. Do not puncture the internal organs.



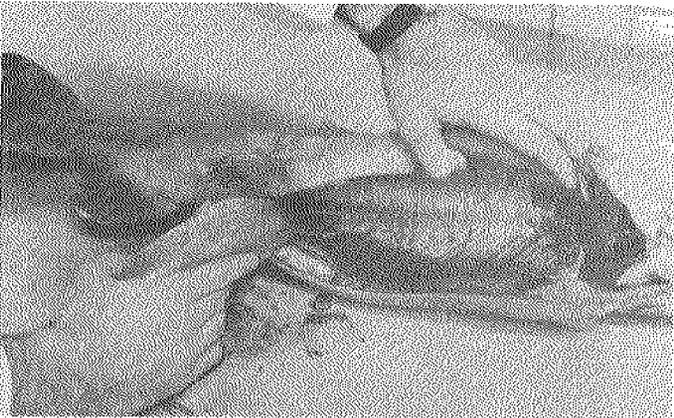
2. Cut gills loose from backbone at base of head.



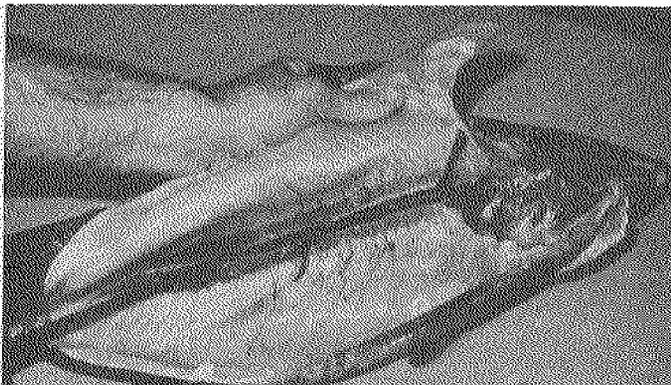
3. Cut gills free from belly next to pectoral fins. Complete removal of gills increases refrigerated storage life.



4. If desired, the lower intestine can be detached by cutting around vent, or simply trimmed free.



5. Grasp gills and pull viscera from cavity.



6. Cut the kidney membrane along backbone and remove blood by scraping with thumbnail or teaspoon. Wash all blood from flesh and pack the cavity with ice.

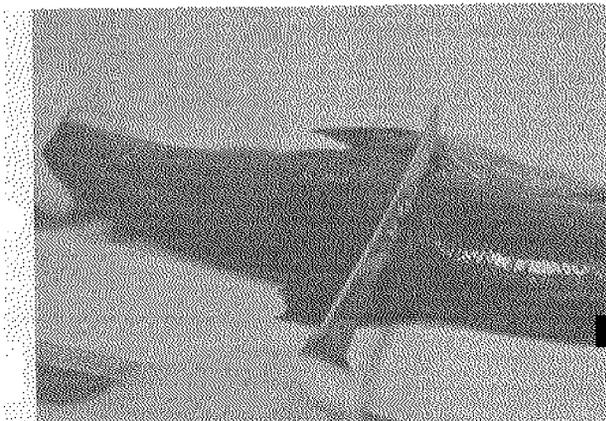
SLIME REMOVAL

As salmon begin their spawning runs a heavy slime layer develops on their skin that normally protects the salmon in their difficult trip up the spawning stream. This slime, however, makes handling during cleaning difficult and tends to harbor spoilage bacteria.

The slime can be removed by washing the surface in water containing chlorine [one tablespoon of liquid household chlorine laundry bleach (hypochlorite) in four gallons of water]. Rinsing the fish in this chlorine solution following gutting will reduce the number of spoilage bacteria on the flesh. The slime can also be coagulated or set for easier removal by washing — momentarily dip the salmon in hot (180°F) water. After removal of the slime the fish should be chilled again in ice to retard deterioration.

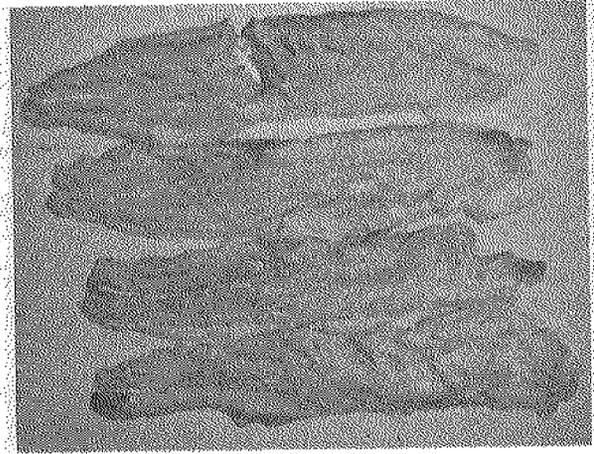
SCALE REMOVAL

The scales of immature salmon are loose, and although edible, can cause cleanup problems in the kitchen sink. They can be removed by a strong water spray or by employing a knife or fish scaler to loosen scales before rinsing them off. Once the salmon reach maturity the scales become set and are nearly impossible to remove.



Remove scales by scraping knife along skin from tail to head in direction of scale set.

IMPROPER HANDLING . . . WHAT HAPPENS



Damaged fillets from prime salmon. Soft, open texture is a result of failure to promptly ice fish.



Blood clots caused by lack of bleeding and prompt gutting. This defect is particularly noticeable in improperly handled late season salmon.

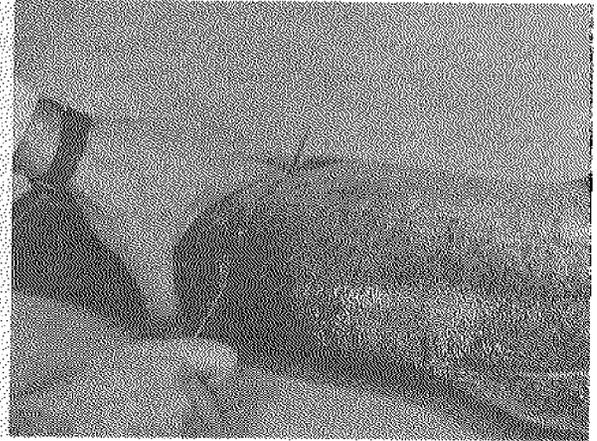


Severe case of flesh deterioration caused by delayed icing and gutting. Note the ribs are separated from the flesh, a condition called "belly-burn."

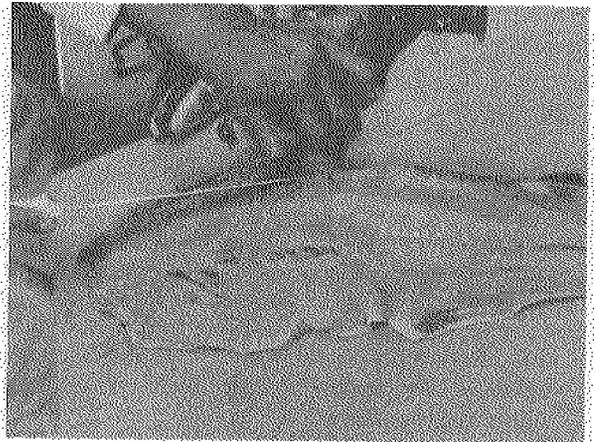
FILLETING

Fillets are sides of the fish, cut lengthwise away from the backbone, and contain no waste or bones. Salmon fillets can be prepared for eating as is or smoked.

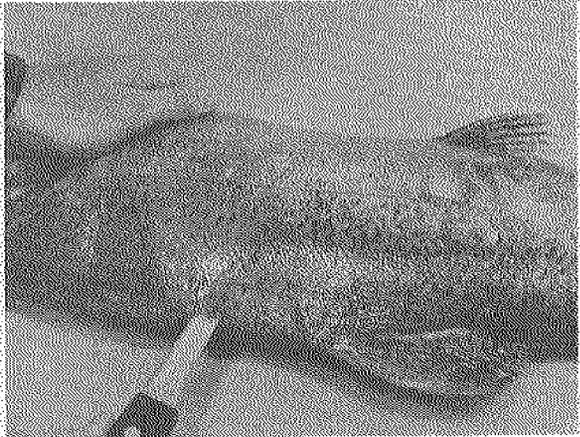
For high quality fillets, be sure to properly clean and handle the catch prior to filleting. A good, sharp knife is a must.



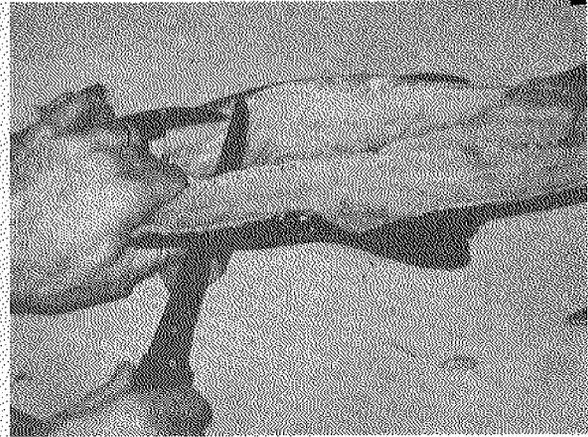
1. Cut down to backbone directly behind the gill covers.



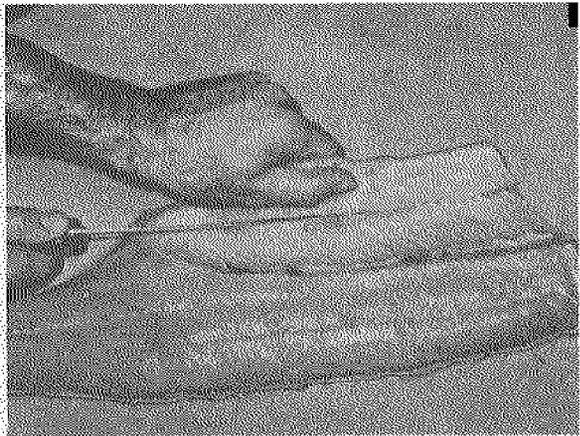
4. Carefully remove fin bones.



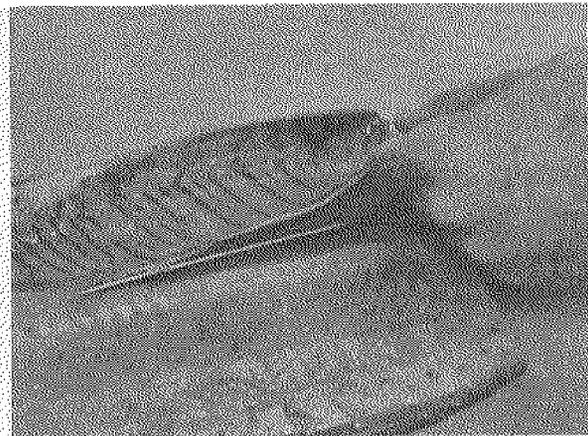
2. Turn knife flat and cut through rib bones along backbone to tail.



3. Cut fillet on opposite side by cutting on other side of backbone.



5. Remove excess belly flap to get rid of high fat portion and fins. This removes potentially high pesticide deposits in fatty tissue.



6. Remove rib bones by carefully cutting between rib bones and flesh. Very little flesh should be removed with the rib bones.

TO PRESERVE QUALITY, KEEP FILLETS PACKED IN ICE UNTIL READY FOR USE OR FURTHER PROCESSING.

SKINNING

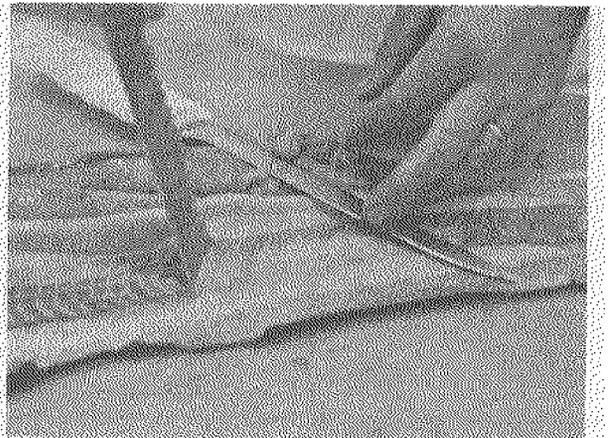
WHOLE FISH

The skin is often removed before cooking, particularly for late season salmon. This permits removal of the dark, lateral line flesh and allows seasonings to better penetrate the fish.

The skin can be easily stripped from an eviscerated whole fish with pliers. First cut the skin around the tail, neck, and along the back. Grip the skin at the tail with pliers and pull toward the head.



- Hold the tail and slowly pull the skin free from body.



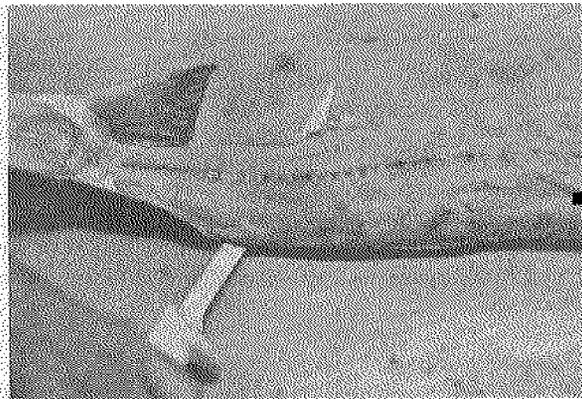
- Note dark, lateral line flesh which has adhered to skin. Discard this portion which has potentially high pesticide levels.

FILLETS

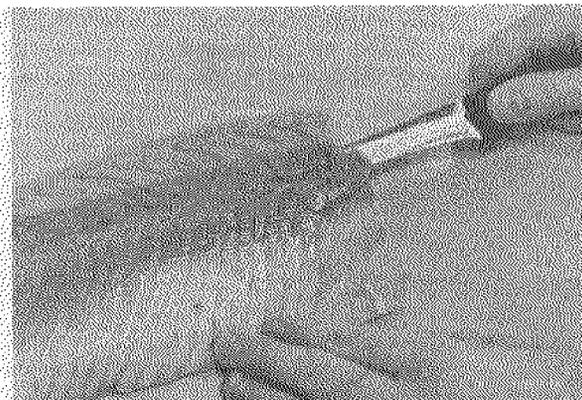
Salmon fillets may be skinned using a long knife.



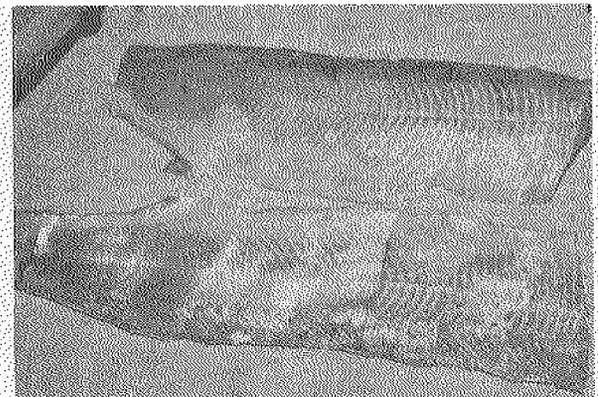
1. After cutting fillet from backbone, remove fin bones and excess belly flap.



2. Place fillet skin side down on work surface and run knife between skin and flesh. A convenient hold is provided by retaining the tail during filleting.



3. Turn fillet skin side up and make a shallow V-cut under dark, lateral line flesh to remove this section. Carefully remove as much dark flesh as possible.



Fillets with dark, lateral line flesh removed, ready for freezing or cooking.

FREEZING

Freezing is an excellent method for home preservation of fish and is recommended over canning. It will not, however, improve the quality of fish which have not been properly cleaned and promptly iced. The storage life of frozen fish is dependent on low storage temperatures and air tight packaging.

Although freezing prevents the growth of microorganisms, it only slows many enzymatic and chemical reactions which cause flavor, color and texture deterioration in frozen foods. As the temperature is lowered, these reactions become slower and frozen foods should be stored at the lowest possible temperature, preferably below 0°F. Although packaged frozen fish may be kept up to a year, temperatures available in the home freezers will not generally result in high quality salmon if stored for more than three months. Fish should be placed in the coldest part of the freezer, as rapid freezing is essential. If pieces take over five hours to freeze, they are too large. Small pieces which are not crowded together freeze fastest. Always store frozen fish at the lowest possible temperature.

Many of the undesirable flavor and color changes in fish are caused by oxidation of the unsaturated fats, oils and color pigments. This is a chemical reaction which occurs even in frozen flesh, and once it begins, it cannot be stopped. Salmon contain unsaturated oils and are therefore highly susceptible to oxidation. Air tight packaging is essential to reducing oxidation.

Evaporation of water from the fish flesh during frozen storage causes dry and tough foods and is known as freezer burn. Various packaging materials and methods can be employed to help provide an oxygen and water vapor barrier.

WRAPPING IT UP

Aluminum foil and polyvinylidene chloride "cling wrap" films provide excellent barriers to both water vapor and oxygen. Since they cling well to surfaces, they exclude undesirable air pockets which contain oxygen and space for moisture to be withdrawn from the flesh.

Polyethylene bags, "plastic noncling," are less expensive and more convenient to use. However, although they provide good vapor barrier protection, they allow oxygen to pass, thus readily permitting the development of oxidized flavors.

Freezer wrap papers provide limited vapor and oxygen barriers. They serve best as an outer protective wrap over an inner wrap, such as ice glazes and cling wraps. Waxed and polyethylene cartons or boxes offer poor vapor and oxygen barriers and are not recommended.

FREEZING METHODS

An excellent way to freeze salmon is to glaze the fish. Glazing is accomplished by dipping frozen fish in ice water, then freezing — this step is repeated several times to build up a thick glaze. Ice glazes tend to evaporate in the freezer and must be renewed about every month. Evaporation can be slowed by wrapping or bagging the glazed fish in a vapor barrier, such as foil, cling wrap or polyethylene bag.



Fish glazed (upper) and unglazed.

Whole Fish: 1. To prepare whole fish for glazing, place gutted fish in plastic bag and freeze. To save freezer space, the head and tail may be removed.

2. Remove the frozen fish from bag and dip fish in ice water. Return to bag and place in freezer.

The plastic bag protects the glaze from evaporation and prevents wet pieces from freezing together or onto the freezer shelves.

3. Repeat operation several times to build up a 1/8-1/4" glaze.

Mark freezing date on tag or directly on the bag. Remove oldest fish from the freezer first.

Individual Fish Pieces:

Small pieces need extra care because their large surface area permits drying and absorption of oxygen. They should be individually glazed or frozen in ice.

A solution of six tablespoons cornstarch per gallon of water which has been cooked and chilled provides a more durable glaze than just ice water, but the starch must be rinsed from the fish before cooking.

- Small steaks and fillets are glazed by dipping the frozen pieces in ice water. Protect glaze by wrapping in plastic film or foil. Return to freezer. Repeat operation several times to build up a 1/8-1/4" glaze.

- Another excellent means of protecting flavor and quality in freezer storage is to freeze salmon in containers of water. Place pieces in protective plastic bag, submerge in water and freeze. Metal, plastic or plastic-paper containers may be used.

- To freeze pieces in blocks of ice, freeze individual pieces or cut frozen whole fish into steaks. Place frozen pieces in shallow pan, cover with ice water and freeze. Remove the frozen blocks and wrap in a protective layer of freezer wrap, plastic or foil.

CANNING

Canning is a popular method for commercially preserving salmon; however, the potential botulism poisoning in improperly canned foods is always present. It takes higher-than-boiling temperatures to destroy *Clostridium botulinum* bacteria spores. Such temperatures are only possible by processing in a pressure cooker. Water pack, boiling water, or oven processing is not sufficient and should *never* be used for processing canned fish.

It is not recommended that fish be home canned in metal containers. To safely perform the closing or seaming operation, special equipment and knowledge is required that is not generally available to the home processor.

Home canning of fish in glass canning jars is possible if properly performed in a pressure cooker. Read the instructions provided by the manufacturer for your pressure cooker. The recommendations described here are for thawed, fresh salmon packed in pint or smaller canning jars. Jars larger than one pint should not be used as they require a much longer cooking time than recommended. Wide mouth jars are best for inserting large pieces. All jars should be thoroughly washed and inspected for cracks or nicks that would prevent sealing. Use new, single service metal dome-type canning lids which indicate whether a proper seal is obtained.

1. Prepare fish for canning.

Remove the entrails and carefully wash to remove all blood and slime. If frozen, completely thaw.

Dress salmon by removing head, tail, fins and excess belly flap. You may remove skin at this point, if desired.

Cut salmon into properly sized pieces that will fit in jar, leaving a head space of 3/4–1-1/4".

2. Filling Jars.

Pack raw fish tightly into jars, skin toward outside of jar.

Use small pieces to fill empty spaces or voids in jar.

Add one teaspoon table salt to each pint.

Adjust lids on glass jars, following manufacturer's instructions.

3. Pressure Cooking

Place jars in pressure cooker containing a minimum of one inch of warm water. Follow manufacturer's instructions.

Place cover on cooker and apply heat. Allow all air to be vented from the cooker before closing petlock or placing weight to let pressure rise. Follow canner instructions for recommended venting time for your model.

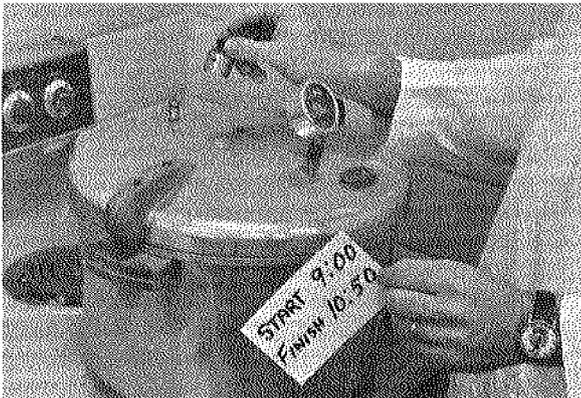
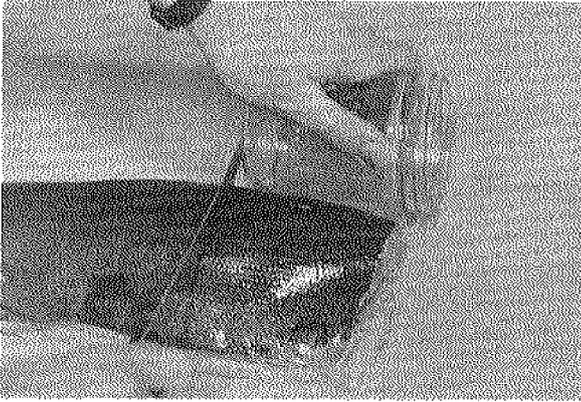
Begin timing process *after* pressure reaches 10 pounds. Process at 10-15 pounds for at least 110 minutes. Write starting time on paper, don't guess.

At the end of cook period, remove from heat and let the pressure drop to zero.

When the pressure reaches zero remove vent weight or open petlock before removing cover.

Remove jars from cooker and permit to air cool. When cool, carefully check each jar for proper sealing.

Store in a cool area.



Moderate over-pressure cooking does not harm canned salmon; therefore, you may use the pressures higher than 10 pounds and longer time without serious damage to the product. If for any reason the pressure drops below 10 pounds at any time during the 110 minutes, you must raise the pressure to 10 pounds and start retiming the 110-minute cooking period. You must have a complete, uninterrupted 110 minutes cook at a minimum pressure of 10 pounds for safety.

If the jars fail to seal, or if for any reason you are doubtful as to whether proper time or temperature was used, reprocess in the canner for the entire time of 110 minutes at 10 pounds. Otherwise, immediately refrigerate the fish and consume within five days, or freeze it.

Remember . . .

Don't guess at anything.

Use a pressure cooker that is in good working condition.

Never can fish using only a boiling water bath or an oven for cooking.

Be sure the pressure gauge on the canner is accurate. Check it for accuracy at least once a year.

Before processing, re-read the instructions that came with the pressure canner.

SMOKING

Smoking is a method which can be used to process salmon and is particularly useful in covering the strong flavor of spawner salmon. Salmon may be prepared by cold smoke or hot smoke (kippering) methods. In cold smoking the temperature in the smoke chamber is near room temperature; therefore, the flesh is not cooked. Preservation is limited to the effects of the smoke, salt and limited drying, thus the storage life of cold smoked salmon is limited to a few days if not frozen and must be refrigerated. Hot smoked salmon has a longer storage life, as the flesh is cooked during the smoking process. Wood smoke has little, if any, preservative effect and is mainly a flavoring and coloring agent.

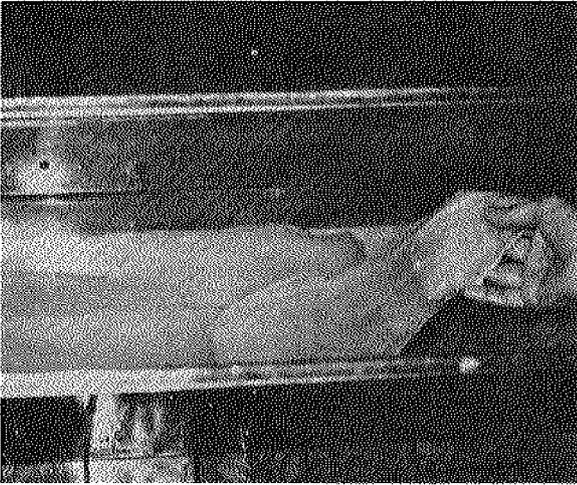
Although whole fish can be smoked as split sides, fillets, chunks or pieces are easier to handle and permit more uniform salt and smoke penetration. Salmon to be smoked can be prepared in the same manner as for freezing. Fillets should not be skinned and bones are generally not removed. Usually carcasses are split and only the backbone is removed.

BRINING

Prior to smoking, salmon are placed in a brine of salt, which aids in preservation and leaches out any residual blood. The amount of salt in smoked salmon depends on the strength of the brine, the length of brining time and the amount of fresh water rinsing following brining. Individual taste preferences determine the amount of salt used. The following recommendations serve as a starting point for developing a salting process that will yield smoked salmon with a suitable amount of saltiness.

Prepare a 30° salometer brine by dissolving one cup of salt to one gallon of water. If a salometer is not available, an egg can be used to check the strength. A large fresh egg will float about one-half inch out of the brine. If it sinks lower add more salt. A glass, plastic or stainless steel container should be used to hold the brine. Prepare one quart for every pound of fish to be brined. Place the fish in the cold brine and hold in a refrigerator at 40°F for 16 hours. Gently stir the brine occasionally to keep the salt content uniform. After brining the fish should be freshened by rinsing in slowly flowing cold water for at least 30 minutes. This removes excess salt and blood and firms the flesh prior to smoking.

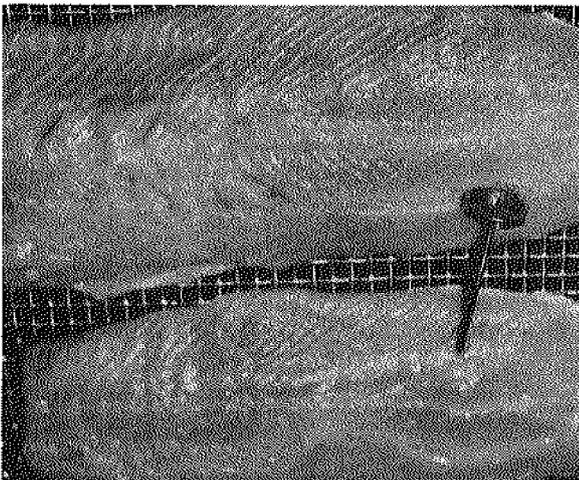
After freshening, drain the excess water and place pieces skin side down on screen racks to dry the surface. In the early stages of smoking, the flesh surface must be dried to form a "skin" or "pellicle." This seals the surface and prevents loss of natural juices during smoking. If a pellicle is not formed prior to smoking, milky-colored juices collect in pools on the surface. A properly formed pellicle gives a shiny dry surface to the flesh. Fish pieces should be dried on screens at 90°F for an hour and should be moved occasionally during the drying period to prevent them from sticking to the screen. Drying time will vary with the humidity and the amount of air circulated over the pieces. The use of a fan will speed up the process.



Filletts in brining solution.



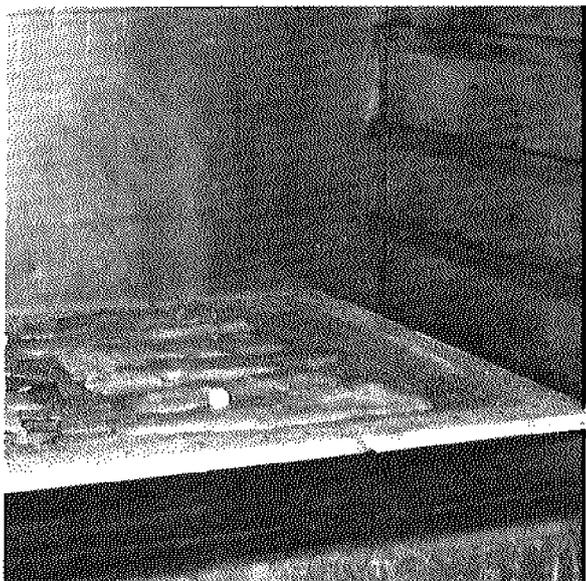
Salmon side slabs placed skin side down on smoking screen to permit drying and formation of pellicle. Open texture is due to delayed icing after catching.



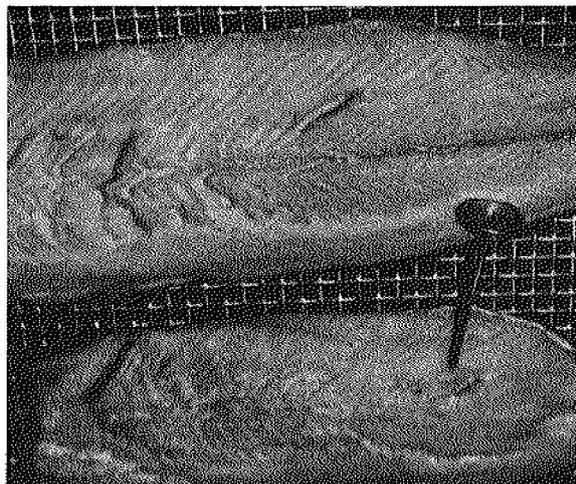
Note the shiny surface appearance due to the formation of proper pellicle. Thermometer is inserted to determine internal temperature during smoking.

HOT SMOKING

Almost any nonresinous hard wood can be used for smoking, and usually hickory, apple or oak chips or sawdust is used. A thermometer should be inserted in the thickest flesh section to determine the internal temperature. During the first two hours cool smoke should be applied while the fish temperature does not exceed 95°F. This completes the pellicle formation and slowly develops brown coloring. After the initial two-hour period the temperature of the smoker should be raised to about 225°F. A final internal flesh temperature of 180°F will be reached in three to four hours after first applying the higher heat. Smoking is usually continued during the heating or cooking, and if a heavier smoke flavor is desired, ample, moist sawdust is added to the fire box throughout the process. Whole fish should be smoked and cooked thoroughly and the cooking time may require up to 12 hours, depending upon the size of the fish. After the desired smoke and internal temperature is reached the racks are removed from the oven to permit the pieces to cool.



Smoking racks placed in smoke oven.



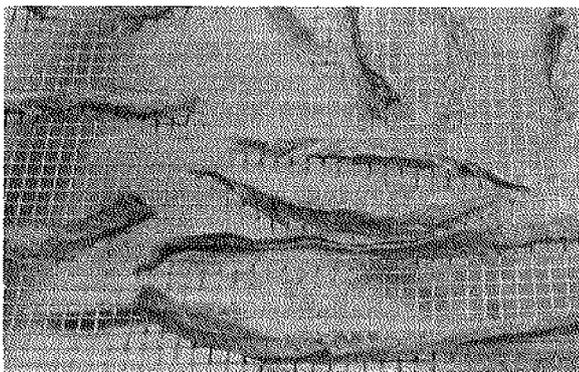
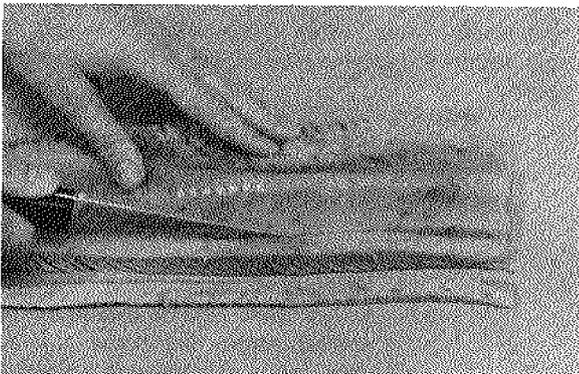
Salmon after the smoking process has been completed. Note pools of juices which formed in pockets where pellicle did not form.

● Storage

Smoked fish is perishable and must be kept under refrigeration. If smoked fish must be stored longer than several days, it should be wrapped in vapor-proof film or placed in an air tight container and frozen. Upon thawing the wrapping should be removed and the product consumed within a few days.

SALMON JERKY

Jerky is an excellent method for preserving salmon, especially late season spawners. The flesh is salted, smoked and dried. The finished product should be firm, dry and tough, yet not dry enough to crumble to the touch. When chewed, there should be some resiliency or rubbery characteristic to the meat.



Jerky strips after drying and smoking.

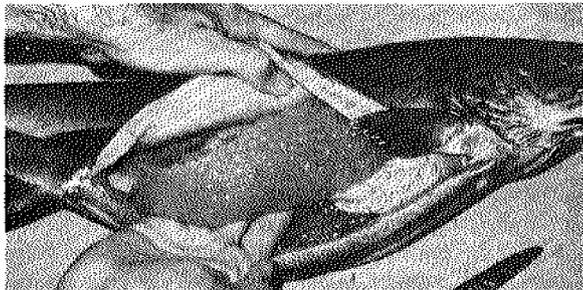
1. Cut boneless, skinned fillets into strips 1/2-3/4 inches wide.
2. Place jerky strips in brine solution (1/2 lb. salt per gallon of water) for 12 hours. Make sure brine completely covers fish flesh. Hold brine temperature at 40°F or less to prevent bacterial spoilage.
3. After brining, freshen the strips by immersing in fresh, cold, running water for 30 minutes to one hour to remove excess salt. Then place the strips on wire screens and allow them to dry on the surface, turning at one hour intervals to keep from sticking to the screening. This process can be done in the smokehouse if it is equipped with a fan, and requires approximately two to three hours.
4. Dry and smoke the strips of fish for approximately 12 hours at 150°F. The time in the smoker will depend a great deal upon the amount of moisture in the flesh at the beginning of the process and the temperature of the smoker. Check at regular intervals and remove the fish before too dry.

● Storage

The finished jerky should be stored in air tight containers, such as sealed glass jars or foil. Jerky keeps for months in this condition if all the fat was removed from the flesh prior to processing.

SALMON EGGS FOR BAIT

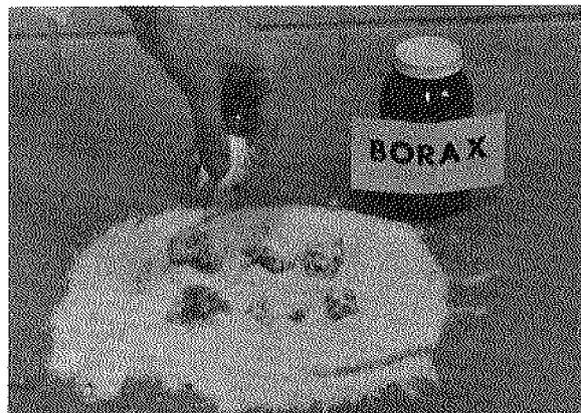
Salmon eggs make good fish bait. Properly processed and packaged eggs may be frozen or preserved for a year or more. Depending on the stage of maturity, the roe may be in "loose" or "tight" skeins when taken from the fish. Eggs in loose skeins have reached the stage where they can be readily separated from the enclosing membrane without special treatment. These are excellent for preserving as single salmon eggs. Eggs in tight skeins can be used in preparing cluster egg baits.



A tight skein of eggs in a coho salmon.

The roe should be carefully removed from the fish at place of catch and put into plastic bags. The bags of eggs should be kept cold to insure high quality. Pack in ice at place of catch before transporting home.

After thawing at room temperature, frozen roe appear to be as satisfactory for making bait as fresh eggs. Fast freezing at -10 to -30°F is important for maintaining original appearance, texture and odor of the eggs. Slow freezing results in the formation of large ice crystals which break down cellular structure and cause eggs to become soft and mushy. To package fresh eggs, double wrap in plastic freezer wrap or locker paper or seal in plastic bags to exclude air. If eggs are exposed to air during frozen storage, dehydration and oxidation will change their color, consistency and odor and eventually make them unfit for bait.



PRESERVING EGG CLUSTERS

The use of powdered borax on salmon eggs is a common practice among West Coast winter steelhead fishermen. It toughens the eggs, preserves their appearance and prevents the growth of bacteria. The tougher clusters stay on the hook longer than fresh ones.

Preparation of boraxed eggs is simple. It takes very little time to prepare soft or medium-soft clusters that readily "milk" while in the water. Being soft, the eggs within the cluster crush easily and give off odors readily.

Spread out a sheet of paper large enough to scatter the egg clusters on and cover it with borax.

Skeins of eggs may either be cut into bait-size pieces with scissors or pulled apart with fingers along the natural connective tissue cleavage lines. Use a sharp pair of scissors to snip off pieces from the dangling end of a skein.

Thoroughly dust clusters with borax and allow to stand in a cool, dry place for 12-36 hours.

After the clusters have obtained the desired firmness (overnight), pack in large-mouth jars with air tight seals for storage. Cluster egg baits may be refrigerated for shorter periods or frozen in the jar for longer storage times.

Soft egg clusters tied in a piece of nylon stocking stay on the hook better and are popular Lake Michigan bait for trout and steelhead. These are easily prepared by simply tying clusters in discarded nylon stockings. They are then refrigerated or frozen in suitable containers.

PRESERVING SINGLE EGGS

Single salmon eggs are used for bait by fishermen in all parts of the country, and the fisherman who is willing to put forth a little time and effort can prepare a suitable bait from salmon roe. The only requirement is a reasonably large egg size and proper care before preparation.

Eggs in tight skeins may be separated from the membrane by immersing in water at a temperature of 115-120°F and hand manipulating the egg mass. The membrane coagulates at this temperature and allows the eggs to be separated easily without damage.

Materials needed to prepare single eggs include:

1. *Preservative bath* consisting of one part commercial (40%) Formalin (available at most drug stores) to 20 parts water at about 90°F
2. *Dye* (if red eggs are desired) consisting of 1/4 teaspoon of powdered Safranin-O (available at many drugstores) dissolved in two quarts of water
3. *Neutralizing and fixing bath* consisting of eight tablespoons of sodium bisulfite (available from photo supply dealers and at some drug stores) dissolved in a gallon of water at 60°F
4. *Glycerine* with six drops 40% formalin added per ounce
5. *Fish-attracting flavors*, such as anise, may be added to glycerine if desired

Immerse single eggs in the preservative bath for 30-45 minutes. Since processing characteristics of eggs will vary, these treatment times are guides. The sportsman should process small batches until the correct treatment for his eggs is obtained. Remove single eggs from the formalin solution while still soft, but with no trace of a liquid center when sliced in half. The fixing and glycerine treatments will have an additional firming effect. Eggs left in the bath too long are rubbery and undesirable for bait.

Eggs may be dyed at this point by dipping in a dye solution for a few minutes. It is thought by some that fish are more readily attracted to brightly-colored eggs. The degree of redness depends on the strength of the dye solution and the time of immersion. When the desired color is obtained, rinse excess dye off the eggs with water.

Immerse eggs in a neutralizing-fixing bath for 20-30 minutes to neutralize any further action of the formalin. This prevents undue hardening during storage.

Drain and place in screw-cap jars for storage. Do not rinse or allow surface of eggs to dry before sealing. Formalin (6 drops/ounce glycerine) and, if desired, anise, is added to the glycerine before it is poured in the jars of eggs.

Pour enough glycerine, with additives, into the jars to moisten the eggs but not cause a noticeable accumulation at bottom of jar. Eggs treated in this way will keep for weeks in a warm room and may be stored for over a year in the refrigerator.

IN THE KITCHEN

If you are lucky enough to catch a prime salmon before the spawning condition develops, you usually will not have any problems preparing a delightful dish. Any traditional manner of preparation including broiling, frying, barbecuing, baking and kippering will yield excellent results.

Occasionally, salmon from certain locations (even in prime condition) will have a "gasoline-like" off flavor, and others will have an "earthy" or "muddy" flavor. The causes of these flavors are not fully known, but certain microscopic organisms in the lakes and possibly environmental contamination of various sorts have been implicated. Fish with these flavors and those spawning salmon (especially males) which have a characteristic "musky" or "musty" off flavor pose problems in proper preparation. The level of off flavors must be reduced to an acceptable point. The soft textures resulting from improper cooling of prime fish and the naturally soft flesh of many spawning salmon (especially females) pose further problems in preparing enjoyable dishes.

In general, recipes using larger amounts of spices, lemon and smoke are best for reducing off flavors. Also, using salmon as an ingredient in full flavored dishes rather than eating it alone as a main entree helps prevent noticeable flavors. The soft texture problem can best be overcome by preparation with a method that tends to dry out the finished fish. Smoking or kippering is one of the better means of preparing problem fish as it adds a strong, pleasant flavor and markedly dries out the flesh.

The following recipes are given as a starting point for using salmon which may have flavor and texture problems. If strongly objectionable flavors still persist, it is best to discard the fish.

Broiled Salmon (Gegrilt Locks)

**4 salmon steaks (approximately 2 lbs.)
1 1/2 t salt
1/4 t white pepper
3 T lemon juice
3 T olive oil
1 large onion, sliced**

Rinse and dry salmon. Season with salt and pepper and sprinkle with lemon juice and olive oil. Spread onion slices over salmon and let stand 1 hour. Discard onion. Arrange in broiling pan. Broil 3" from source of heat, turning once, until browned on both sides.

Baked Salmon With Tomato Sauce

**1 med. - large salmon
1/2 C minced onion
1/8 t garlic powder
1 C tomato sauce
12 oz tomato juice
1/4 t white pepper
1 t salt
1/2 C water
12 slices bacon, crumbled**

Rub fish with cloth dipped in vinegar. Combine tomato juice, sauce, garlic powder, onion, salt, white pepper and water. Cut fish in large pieces to fit loaf pans. Place pieces in pans and sprinkle bacon between fish layers and on top. Pour sauce over all.

Bake in 400° oven about 20 min.

Salmon Casserole

2 salmon steaks	3 stalks celery, chopped
2 t salt	2 T cornstarch
1/4 t pepper	2 C chicken broth made with bouillon
1/4 C flour	1 C canned corn kernels
4 T butter	2 T soy sauce
2 C sliced onions	1 t sugar
1 C chopped green pepper	7 oz. spaghetti noodles, cooked and drained

Cut salmon in 2" cubes discarding bones. Dip cubes in mixture of flour, salt and pepper, coating all sides --- in butter saute the salmon, onions, green pepper and celery 10 minutes. Mix cornstarch and broth until smooth. Add to skillet, stirring constantly until it reaches the boiling point, then cook over low heat 5 min. Taste for seasoning.

Spread spaghetti in buttered casserole and arrange salmon over it. Pour sauce over all. Cover the casserole.

Bake in 350° oven with cover on for 30 min. Remove cover and cook 5 minutes.

Barbecue Sauce for Salmon

1/2 C lemon juice
1 1/2 - 2 t salt
1/2 C salad oil
1/4 t pepper
1 t dry mustard
2 T onion, chopped
2 T brown sugar

Combine all ingredients and pour over fish. Broil 2" from heat. Turn to brown on both sides.

Baked Salmon Rolls with Cheese Sauce

3 T butter	6 fillets salmon steak
3 T flour	1/2 C grated onion
1 1/2 C lt cream	1 T lemon juice
1 C grated cheddar cheese	1/2 t white pepper
1 T sweet sherry	1/4 C melted butter
1 1/2 t salt	

Melt 3 T butter in a skillet. Mix in flour until smooth. Gradually add the cream, stirring until it reaches the boiling point. Cook over low heat 5 min. Add the cheese, sherry and 1/2 t salt; cook until cheese melts. Remove from heat.

Roll up salmon; fasten with toothpicks. Arrange in buttered baking dish. Sprinkle with onions, lemon juice, pepper and remaining salt. Pour the 1/4 C melted butter over top.

Bake in 400° oven for 35 min. Pour the cheese sauce over the fish and brown under broiler.

FOR FURTHER INFORMATION, WRITE . . .

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Corvallis, Oregon 97331

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