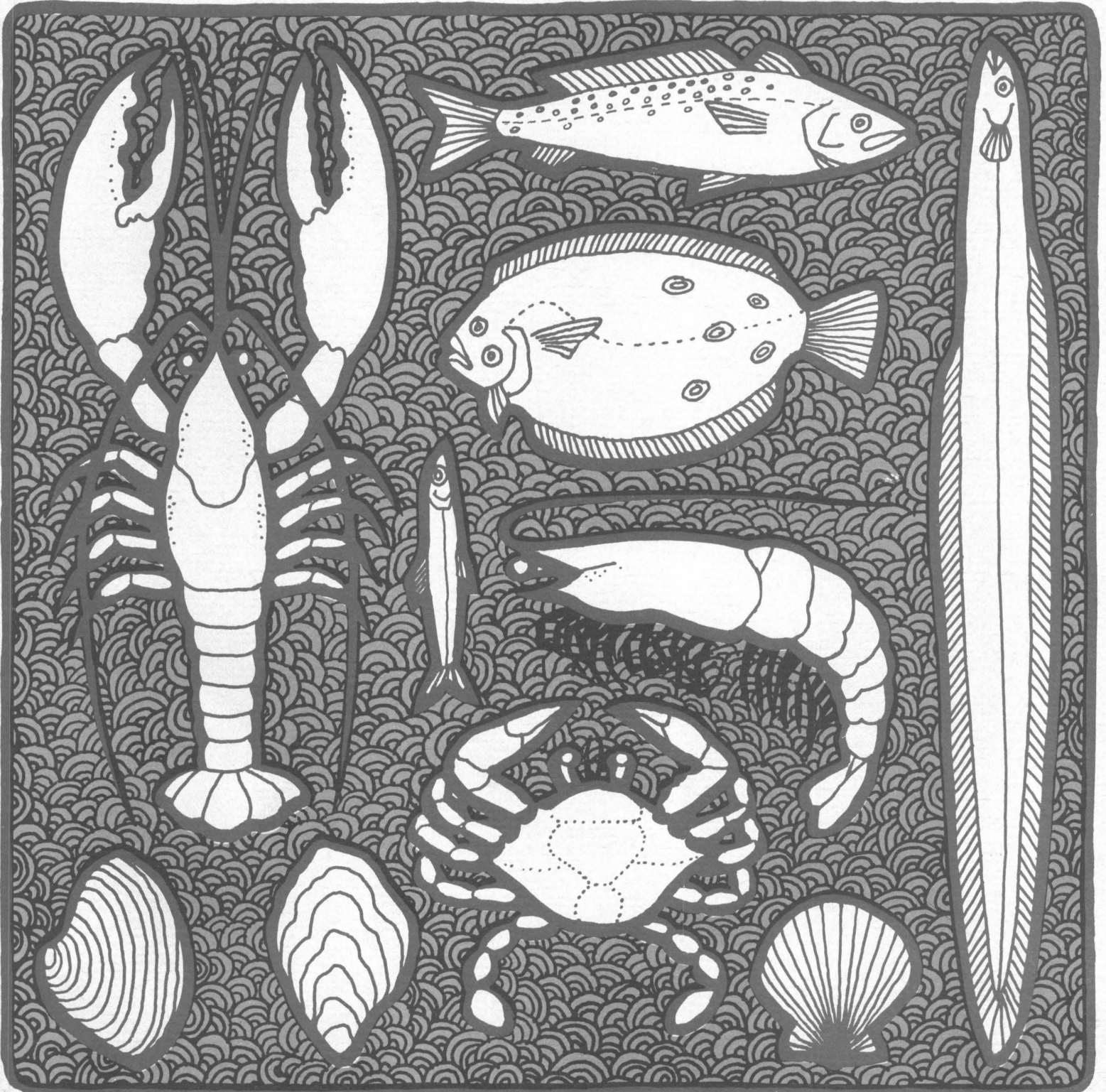


Seafood Products

Course Lecture Guide



Sea Grant
Extension Division
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia 24061



SEAFOOD PRODUCTS COURSE

LECTURE GUIDE

Written and Edited

by

George J. Flick
Donn R. Ward
Joy C. Compton

Food Science and Technology Dept.
Seafood Processing Research and Extension Unit
P.O. Box 369
Hampton, Virginia 23669

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Sea Grant

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Blacksburg, Virginia 24061

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INTRODUCTION

A need has been expressed for consumer education programs on seafood products. This publication is intended to serve as a Seafood Products Program and Teaching Guide for extension agents and home demonstration club leaders. The information contained in the manual should be sufficient for a discussion leader or lecturer to present lectures 1, 2, and 3 of the suggested program as described on page 1. A demonstration on the sucking, picking, and filleting of oysters, crabs, and fish (flat and round species) would require the assistance of a qualified individual.

The Extension Division's Sea Grant Program has developed an 8 minute, 16 mm color film with narration on the correct method for picking the blue crab. Instruction is given on removing the backfin (lump), flake, and claw meat for both right and left handed individuals. The film could be used as a training aid during or prior to the demonstration and practice portion of the program.*

For film loan information call or write: Film Librarian, Learning Resources, Patton Hall, Blacksburg, Va. 24061. Telephone (703) 951-6718. When writing for a film loan, please give a minimum of 30 days notice.

For film purchase information call or write: Extension Division, Sea Grant Program, Food Science and Technology, Blacksburg, Va. 24061. Phone (703) 951-6965. Present cost (June 1976) is approximately \$60.00. Price is subject to change without an advance notice.

The following form may be used when ordering a film for loan.

Send to: Film Librarian, Learning Resources, Patton Hall, VPI & SU, Blacksburg, Va. 24061.		
Please send the film "Picking the Blue Crab" on the indicated dates(s).		
Name _____		
Address _____		

City _____	State _____	Zip _____
Telephone Number _____		
Preferred dates _____ (and, or) _____		
Future dates _____ (and, or) _____ (If possible)		
The film is loaned by VPI & SU for a one to three day period.		

*Other films are presently being developed that will demonstrate the necessary skills for the processing of other fish and shellfish species.

SUGGESTED PROGRAM
FOR
SEAFOOD PRODUCTS COURSE

Seafood Products Course for Extension Homemaker Club Leaders

1. Lecture 1

a. How and what to purchase

Quality characteristics, marketing forms, standards of identity, grades, and cost of seafood and seafood products.

2. Lecture 2

a. How to preserve and store seafood

Packaging materials, freezing methods, and proper storage conditions.

3. Lecture 3

a. Nutritional characteristics of seafood

The chemical and nutritive values of finfish and shellfish species with respect to composition and nutrition.

4. Demonstration

Demonstration and practice on processing seafood in the home. This includes the shucking, picking, and filleting of fresh seafood.

CRABS

Crabs are available in the market forms: Live, cooked in the shell; cooked and frozen; fresh cooked meat; and canned meat. Live hard-shell crabs are generally sold within comparatively short distances from the point of capture, as it is difficult to ship them long distances. Live, soft-shell crabs are shipped hundreds of miles, but they require special care. (Soft-shell crabs are molting blue crabs taken just after they have shed their hard shells and before the new shells have formed. State laws prohibit the marketing of soft-shell Dungeness crabs.) Fresh hard-shell and soft-shell crabs should be alive at the time of cooking. Cooked hard-shell crabs must be kept refrigerated, iced, or frozen from the time they are cooked until they are used.

Canned crab meat from the Blue, Dungeness, King, and Rock Crab is usually available in 5, 6 1/2, 12, 13, and 16 ounce cans.

The fresh cooked meat of crabs is the most common market form. Picked from hard-shell crabs, packed, chilled, and sold by the pound, it can be bought in the following styles:

Blue Crabs

Blue crabs, like other crabs, possess five pairs of legs with the first pair always equipped with pincers. Crabs have hard shells of exoskeletons. Periodically, in order to grow, they shed this external armor or shell. This process is called molting. Before the molt starts, a new, soft exoskeleton forms inside and the crab backs out of the old shell as it loosens. The new shell is soft and elastic allowing the crab to grow. It is particularly vulnerable to attack during the soft-shell stage and seeks refuge in a secluded spot until the new shell hardens. Crabs also lose one or more legs during their lifetimes and are able to grow new ones through a regeneration process.

Blue crabs, when fully grown, average 5 to 7 inches across the back of the shell. The shell is brownish green or dark green and is drawn out on each side into a long spine. The underside of the body and the legs are white, while the tops of the claws in both male and female show varying amounts of blue. The tips of the claws in the female blue crab are bright red.

The common market forms of blue crab meat are:

- a. Lump (back fin) - the highest quality crab meat and includes all meat from the body portion adjacent to the back fin appendage and which substantially remains in sizeable lumps.
- b. Flake (regular or white) - all meat from the body portion except the lump.
- c. Claw - all meat from the claw appendages.

- d. Mixed white (special) - all meat from the body part of the crab in normal proportions (consists of all the lump and flake meat).
- e. Deluxe - there is no official market standard for this product. Consequently, the type of parts and quality may vary greatly among wholesaler and retailer. The term is usually employed to define a variable mixture of lump and flake.

The canned meat should have a good flavor, odor, texture, and color characteristic of the species and free from any foreign or off flavors and odors. The texture of the meat should be firm, but not stringy. The meat should be practically free of blueing and free from any other discoloration. The meat should be practically free from particles of shell and cartilage, and free from extraneous material.

Dungeness Crabs

Fresh cooked meat is picked from both body and claws and packed as one grade. It has a pinkish tinge.

King Crabs

Fresh cooked meat, either frozen or packed, is taken mostly from the legs.

Rock Crabs

Fresh cooked meat (Cancer irroratus) is picked from both body and claws and is marketed as one grade. It is brownish in color. This crab is not fished extensively although it is exceedingly abundant, contains more meat than the blue crab, and is equal to the latter in flavor. Rock crabs are caught to some extent in all the New England states.

The Jonah Crab

The Jonah crab (Cancer borealis) resembles the rock crab, but it has a rougher shell with scalloped edges and is usually slightly larger. It ranges in size up to about 6 inches across the shell. Its flavor is excellent, but it has never been an important article of commerce because of its limited distribution.

The Stone Crab

The stone crab (Menippe mercenarius) ranges from North Carolina to Texas. It compares favorably in flavor with the blue crab and also grows to a much larger size than the blue crab. The principal fisheries are in Charleston, South Carolina, and Key West, Florida, but are not extensive because of the scarcity of this crustacean.

The meat from all kinds of crabs can be used interchangeably in these recipes. Thus, the kind selected will depend largely on the kind available and the cost.

Red Crabs

Red crabs (Geryon quinquedens) occur at depths from 100 to 1000 fathoms in the Atlantic ocean from Nova Scotia to Cuba. The crab is relatively larger and may have a width of 7 inches and weigh more than 2.5 pounds. The crab may yield as much as 23% meat which is approximately twice that of the blue crab. At the present time, red crab meat is being commercially produced in Rhode Island and seafood provisions in other states have expressed interest in the new seafood resource.

Soft Crabs

The crab houses which handle soft crabs and peelers are known by the trade as "shanties," "shedding houses," and "soft-crab houses." Soft crabs are produced by placing them in crab boxes (floats) near shore and holding them until shedding is accomplished. Green peelers which will not shed for several days are placed in certain floats; crabs in the more advanced stages are put in others; and "rank" peelers or crabs actually shedding or about to do so are placed in shedding floats. A "buster" is a crab in which the back shell has cracked loose from the apron and will complete the process of shedding within an hour or so. The crabs are not fed during their confinement in the floats. Many of them die, the proportion depending upon the weather. A sudden change in the temperature of the water often kills as many as one-third.

A freshly molted crab is very soft and dies very quickly if shipped; therefore, the crabs are allowed to remain in the floats for a few hours after shedding before being removed for packing. The soft crabs are "fished out" of the float about 3 times each day by means of a small shallow hand net. If they are not removed for 48 hours after molting, a tough leathery shell will have formed and the shell will have become too hard for commercial use as soft crab. Such crabs are called "buckrams" or "paper-shell" and are sometimes sold; however, they are of little value for culinary purposes as their tissues are watery and contain little meat.

Soft crabs are always shipped alive. Before shipping they are sorted into 4 grades or sizes. The smallest of these are culls, which average about 3 1/2 inches in width. Medium crabs vary from 4 to 4.5 inches in width; prime crabs range from 5 to 6 inches; and jumbos exceed 6 inches. The primes are the most valuable grade. These sizes are not fixed, but vary somewhat depending upon the packer, the quantity of the catch, and the state of the market. In shipping to some markets, the large crabs are not graded as jumbos, but are included with the primes.

Hard Crabs

Some hard crabs are shipped alive in barrels with ice. The large male crabs, called "Jimmies," are usually selected especially for these shipments. A few steamed crabs are shipped whole on ice, but the great bulk of the hard-crab catch is steamed, the meat picked out and shipped on ice or canned.

Picking The Meat From Blue Crabs

With the left hand, grasp the body of the crab with the large claws to the right. Break off the large claws. Pull off the top shell with the right hand. Cut or break off the legs. Scrape off the gills and remove the digestive and other organs located in the center part of the body. Slice off the top of the right side of the inner skeleton beginning near the front. Remove any meat on this slice, then starting with the right back fin pocket, remove the meat from the lower part with a U-shaped motion of the knife. Remove the meat from the other pockets by inserting the knife underneath and prying upward. Cut off the top from the left side of the inner skeleton and remove the meat in the same manner as for the right side.

Cost

The grades are listed in decreasing price: lump, special, flake and claw.

Pasteurized Crab Meat

Pasteurized crab meat is available in some areas. The product is produced by heating canned meat to an internal temperature of approximately 185°F. Since the meat is not given a full heat treatment it will quickly spoil unless stored under refrigeration between 32-36°F. When properly refrigerated, a shelf-life of 6 months is usually expected. Sometimes the pasteurized meat may have a bluish or blue-gray color. This is caused when a processing temperature over 190°F. is used. The over processed product is safe to consume and does not contain off-flavor or odors.

OYSTERS

Description

More than a hundred living species in this large family have been described, but only a few are of economic importance. True oysters are distinguished by having dissimilar lower and upper shells and these shells or valves are hinged together by a complex elastic ligament. The upper valve of the shell is normally flat, while the lower is concave, providing space for the body of the oyster. The two valves fit together making a water-tight seal when the oyster closes, providing the shell has not been damaged or broken. Near the center of the oyster's body is an adductor muscle, attached to both valves, which controls the opening and closing of the shell. There are three important species of oysters which are enjoyed in the United States. They are:

The Eastern or Atlantic oyster (Crassostrea virginica) is found along the Gulf Coast and up the Atlantic Coast to Cape Cod. The Eastern oyster represents approximately 85 percent of the total production.

The Pacific oyster (Crassostrea gigas) recently called Pacific king oyster, is grown in coastal waters from Alaska to Northern California. The biggest production area is centered in the Puget Sound, Gray's Harbor, and Willapa Harbor areas of Washington State. This oyster is grown from seed imported from Japan. The Pacific oyster comprises about 15 percent of the production.

The rare Western oyster (Ostrea lurida) also known as Olympia oyster, is native to the Pacific Coast. The yield of this species has declined because of predators, water pollution, and increased cost of production. Some Olympias are still available and it is hoped that, through conservation methods, the cultivation of this species can be increased.

Shell Oysters

Oysters in the shell are generally sold by the dozen and must be alive when purchased. When alive, they have a tightly closed shell. Gaping shells that do not close when handled, indicate that the oysters are dead and therefore, no longer useable. If shell oysters are held in the refrigerator at about 40°F., they will remain good for quite a while.

Shucked Oysters

There are oysters which have been removed from the shell and are generally sold by the pint or quart. Shucked oysters should be plump, and have a natural creamy color, with clear liquor and free from shell particles. Fresh shucked oysters are packed in metal containers or waxed cartons which should be refrigerated or surrounded by ice. When properly handled, they will remain fresh for a week or ten days.

The Eastern oysters are generally packed in the following commercial grades:

GRADE	OYSTERS PER GALLON
Counts or extra large	Not more than 160
Extra selects or large	Not more than 161 to 210
Selects or medium	Not more than 211 to 300
Standards or small	Not more than 301 to 500
Standards or very small	Over 500

In recent years, shucked oysters have also been quick frozen, a process which makes them available all of the year. Frozen oysters should not be thawed until ready to use. Once thawed, they should never be re-frozen.

Fresh Oysters

Fresh oysters may be purchased at retail stores in the following size containers: 8 ounce, 12 ounce, and 16 ounce.

The "R" Rule

Common belief that oysters should not be eaten in the months whose names do not contain the letter "r" is not based on fact. Oysters can be eaten, and are being eaten, at any time of the year. Being highly perishable, their transportation and storage during the warm season present difficulties and require additional care. Furthermore, summer is the time when in many places oysters spawn. After the discharge of their sex products they become watery, and contain but little solid meat. As a rule, at this time they lack flavor and consistency, which develop with the onset of cold weather. There are, however, several localities in various states where oysters of fairly good quality are available throughout the year.

Physical Characteristics

When a consumer inspects a can or package of oysters several physical characteristics may be observed.

- a. Green Gills - The gills or outer region of the oyster may be green. This is caused by the deposition of chlorophyll obtained from the plant life consumed by the oyster for food.
- b. Green Oysters - Many oysters will concentrate copper in their bodies giving them a green color.
- c. Red Oyster -
 - I. Pink Yeasts - In some instances, oysters and their liquor will have a pink color. This is caused by yeast growth resulting from unsanitary conditions being practiced in the processing plant or on the boat that harvested them.

- II. Serratia marcescens - This bacterium contains a red pigment and if allowed to multiply in large numbers, will cause a red discoloration. However, this is usually rarely observed.
 - III. Pea Crab - A small crab called the pea crab will grow inside many Virginia oysters. The ovaries of the crab have a red pigment which is water soluble. This pigment will leak out at times causing a pink discoloration.
 - IV. Dinoflagellate - Within the last few years, oysters have been consuming a dinoflagellate which contains a water soluble red pigment. If the oyster is cut during shucking or damaged during freezing and thawing, the color will leak out and discolor the oyster liquor. This pigment is heat liable and can be destroyed by heating to 120°F for several minutes. This is the factor most responsible for red colored oysters and oyster liquor. It's important to note that the red color is not related to the toxic red tide that is responsible for the paralytic shellfish poisoning (PSP) reported in the northern and southern Atlantic states. There has never been a reported incidence of PSP in middle Atlantic shellfish. The Food and Drug Administration (FDA) and the U.S. Quartermaster Corps. have issued releases stating that the red oysters are a seasonal effect and should not be considered a potential health hazard. In order to insure consumer confidence in red oysters, several oyster processors and dealers attach a label to the oyster stating that red pigmented oysters are safe for consumption.
- d. Brown Spots - Southern oysters will develop brown spots due to a biochemical reaction. This reaction is normal function for these oysters.
 - e. Pea Crab - The pea crab is found in oysters, mussels, scallops and other bivalves in the middle Atlantic waters. The crabs that are observed in shell oysters are usually females since the males have a short life and are much smaller in size. The crabs enter the mantle cavity of the oyster or small larval usually during the late summer. The crab will grow in size with that of the oyster, however, the crab does not have an adverse effect on the oyster meat. In many of the oyster shucking houses the crabs are considered a delicacy and are eaten now or prepared.

Uses of Oysters

Oyster meats are an excellent source of high quality protein, minerals, and vitamins, and they are easily digested. Because of the high mineral content, oysters are often recommended by doctors for patients with anemia. Oysters can be used in a wide variety of cooking methods and have special appeal because they are easily and quickly prepared. To retain the oyster's delicate flavor, never overcook. Oysters should be cooked just long enough to heat through and remain plump and tender.

Cost

The following grades are listed in decreasing price: counts, extra, selects, standards (small), and standards (very small).

SCALLOPS

Scallops are among the most highly prized and sought after of the inhabitants of the briny deep. Only the excellently flavored muscle, sometimes called the eye, which closes the shell, is the only part of the scallop eaten by Americans; Europeans, on the other hand, eat the entire scallop.

There are two varieties of scallops, the large sea scallop and the smaller bay scallop. The sea scallop shell is saucer shaped and sometimes grows as large as 8 inches in diameter. The adductor muscle, or eye, of the sea scallop may be as large as 2 inches in diameter. The sea scallop is taken from the deep waters off the Northern and Middle Atlantic States with the old whaling port of New Bedford, Mass., taking honors for the vast majority of the catch of this delicious shellfish.

Scallop meat is marketed as fresh or frozen meat. Scallops are chiefly served fried or in a sauce. If fried, one pint or one pound will be required for 3 to 4 servings. One pound will serve six persons if served in a sauce. See specific recipes for preparation of scallops.

The shell of the bay scallop is much smaller than that of the sea scallop, attaining a maximum of about 4 inches in width. Its shape resembles that of the sea scallop except that the shell is grooved and has serrated or scalloped edges. The adductor muscle or eye of the bay scallop is about 1/2 inch across. The bay scallop is taken from inshore bays and estuaries from New England to the Gulf of Mexico.

Scallops are marketed throughout the year. Fresh scallops are a light cream color, sometimes varying to a delicate pink. Scallops are available fresh or frozen, but only in the form of dressed meat, as the scallops are opened, packed, and iced at sea. Fresh scallops and frozen scallops when thawed, should have a sweetish odor. When bought in packages, they should be practically free of liquid.

Scallops are nearly always soaked in water before they are marketed; this makes the eyes swell and become plump, thereby causing about a 40 per cent increase in volume. This plumping process makes scallops very difficult to preserve, and since plumped scallops spoil very easily, it prevents their shipment to distant markets. Yet, because nearly all consumers demand the large plump "eyes", the practice will probably be continued indefinitely. The scallops are sometimes swelled by placing about 4.5 gallons of "eyes" in a 7-gallon keg and filling it with fresh water; after standing overnight more water is added and the scallops are shipped to market. Upon arrival at the market, the scallops have increased to the full amount of 7 gallons. Because of the limited time which plumped scallops may be kept fresh, few are shipped to inland cities.

SHRIMP

Description

Shrimp are among the most popular of our shellfish, are tender and white meated, with a distinct flavor.

The various kinds of shrimp marketed in the United States are the common or "white" shrimp, which is a greenish gray when caught; the brown or Brazilian shrimp, which is brownish red in its raw state; the pink or coral-colored shrimp; and the Alaska and California varieties, which vary in color and are relatively small. Although shrimp range in color from greenish gray to brownish red when raw, they differ little in appearance and flavor when cooked. Raw shrimp are often called "green shrimp" in the retail stores.

Shrimp are customarily sold according to size or grade. This is based on the number of headsoff shrimp to the pound. The count or number designation may also be described by such general terms as jumbo, large, medium, and small. The largest size or grade runs 15 or fewer shrimp to the pound; the smallest size runs 60 or more to the pound. Since all species may be used interchangeably in cooking, the size of the shrimp assumes more importance if the cost and time required to prepare a recipe are taken into consideration. Jumbo or large shrimp generally cost the most but take less time to peel and devein; small shrimp cost less but take longer to prepare. They have the same fine flavor and food value.

The usual grades of shrimp are: jumbo, extra large, large, medium and small. Today, however, most shrimp are sold by count ranges of 5 to the pound rather than grade. For example 16-20, 21-25, and 26-30. The packages usually contain the count for consumer's information.

Jumbo shrimp cost the most per pound while the small grade is the least expensive.

Uses of Shrimp

Shrimp are an excellent source of high-quality protein, vitamins, and minerals. They are low in fat and calorie content and are easily digested. The edible part of the shrimp is the tail section. Although raw shrimp vary in color, the cooked product is pink-white and the flavor and nutritional values are the same. Shrimp are available in most areas of the United States either raw or cooked, peeled or unpeeled, and fresh or frozen. Peeled meats of shrimp, individually quick frozen, may be bought in polybags or rigid plastic containers in a variety of sizes and weights. Shrimp may also be bought by the pound or in convenient, shelf-ready cans. Regardless of size and variety, all shrimp may be used interchangeably in most recipes.

Breaded Shrimp

Frozen raw breaded shrimp are made from whole, clean, headless shrimp which have been peeled and deveined. The shrimp are coated with a whole-

some batter and/or breading. Shrimp are termed "whole" if they consist of five or more segments of shrimp flesh.

Breaded shrimp are prepared and frozen in accordance with good commercial practice. The frozen product is maintained at temperatures which preserve its quality. Many consumers are unaware that frozen raw breaded shrimp are available with different amounts of breading material.

Two styles of frozen raw breaded shrimp are commonly available. "Regular Breaded" are frozen raw breaded shrimp containing a minimum of 50 percent of shrimp material. "Lightly Breaded" contain a minimum of 65 percent of shrimp material.

Two types of breaded shrimp are marketed: "Breaded Fantail Shrimp" and "Breaded Round Shrimp." Both types are available in three forms which vary in the amount of tail fin and shell segments retained.

Breaded shrimp are highly suitable for inspection and grading, but not all these products on the market are inspected or graded.

Inspected breaded shrimp products may be labeled "Packed Under Federal Inspection," either as a mark or a statement. The official mark or statement signifies that the product is clean, wholesome, and safe; and that it has been produced under the supervision of Federal inspectors.

Breaded shrimp may also bear "U.S. Grade" marks which signify that the product is:

- Safe, clean, and wholesome
- The quality of the grade shown
- Processed under supervision by Federal Food Inspectors
- Packed by sanitary food handlers
- Truthfully and accurately labeled as to name, ingredients, and quantity.

Breaded shrimp are graded on a number of factors that affect the quality of the product. The standards are set by the National Marine Fisheries Service, taking into account consumer needs and industry capabilities. In the frozen breaded state, the product is checked for uniformity, condition of coating, damaged breaded shrimp, and extraneous material. Cooked samples are rated for flavor and odor.

"U.S. Grade A" - The frozen product scores at least 85 points, based on a numerical scoring system of 100 for a perfect product. When cooked, the product has a good flavor and odor.

"U.S." Grade B" - The frozen breaded shrimp score at least 70 points, based on the assigned scoring system. Frozen raw breaded shrimp that fail to meet the requirements of "U.S. Grade B" are graded "substandard."

By following these suggestions at the point of purchase, consumers can be sure of enjoying breaded shrimp of top quality, particularly if the fishery products are inspected and graded.

- a. Check carefully to see that the container is intact.
- b. Avoid packages which have been stacked above the frost line or load line of the store's display freezer.
- c. Take only packages which are solidly frozen.
- d. Avoid packages with "drip" or ice on the package, an indication that the contents have been thawed and refrozen.
- e. Check cello-wrap packages for discoloration, a sign of freezer burn.
- f. If products of questionable quality are purchased inadvertently, return them to the store at once.

Cooking of "Green Shrimps"

Uncooked shrimp are referred to as "green shrimp." On cooking, they turn the distinctive shrimp pink color. To cook shrimp-in-the-shell, follow this procedure:

- a. Cover the shrimp with boiling salted water.
- b. Allow 1 quart of water to 1 1/2 lbs. of shrimp, and 1/4 cup of salt for each quart of water.
- c. Simmer shrimp for 5 minutes.
- d. Drain, cook, peel off shell and remove gritty sand vein running through the body, down the back.
- e. Chill and serve with desired sauce.

Deep fried shrimp is a most appealing and popular dish. The shrimp may be peeled raw, the vein removed, and the shrimp breaded or dipped in batter and fried in deep fat at 375^oF. They are then served piping hot with specific garnishes and sauces.

LOBSTERS

Description

The American lobster is not found on the coast of Europe. The true European lobster closely resembles the American lobster, but is distinguished by the narrower spine on its forehead and by having teeth only on its upper margin.

Florida and California waters contain another crustacean that has been locally referred to as a lobster. The animal is actually a sea crawfish but it is related to the true lobster, there are several distinct, easily recognized differences: It does not have the large heavy claws, which are one of the distinguishing characteristics of the true lobster; it is covered with spines on both body and legs, which accounts for its name; and it has long slender antennae.

When the lobster is taken from the water its shell is dark bluish-green. Lobsters color can normally range from a light green to a deep dark blue. However, this color changes rapidly to "lobster red" during cooking. Lobsters must be alive and active at time of cooking; also, the tail should curl under the body and not hang down when the live lobster is picked up.

Live lobsters - usually they weigh from one pound to three pounds - are graded in four sizes: Chickens, 3/4 to 1 pound; quarters, 1 1/4 pounds; large, 1 1/2 to 2 1/4 pounds; and jumbos, over 2 1/2 pounds.

Whole lobsters cooked in the shell are also available. They should be bright red in color and have a fresh "seashore" odor. The tail of a cooked lobster should spring back quickly after it has been straightened out.

The cooked meat of the lobster, picked from the shell, is marketed fresh, frozen, canned. Frozen lobster meat can be purchased in 6, 14, and 16 ounce cans. The 14 ounce can is the most popular size.

Frozen lobster - both boiled and raw lobsters are frozen for the market. The meat is often picked from the boiled lobsters and packed in tin cans with a tight cover, or in waxed cardboard cartons for freezing. The whole lobsters are sometimes frozen and packed in individual waxed cartons. It has been reported that frozen raw lobsters retain the quality better than those which have been boiled. The deterioration of the meat which has been cooked results in a toughening and loss of flavor on long storage. There is often considerable breakage of lobsters which are frozen whole.

When frozen they are very brittle and the legs snap off easily unless they are handled with considerable care. In order to reduce breakage the lobsters are usually packed in cartons before they are frozen.

Lobster in the Shell

Lobster in the shell varies in weight between 3/4 lb. to 3 lbs. A one-pound live lobster will yield 2/3 cup of flaked, cooked meat.

Retail Market Names

Pistols - Lobsters that are alive but are missing one claw.

Culls - Live lobsters missing two claws.

Cooking Live Lobster

Live lobster must be kept alive until the moment of cooking. In the live state, they vary in color from greenish blue to brownish olive. During cooking, they turn a bright red. Boiling is a basic method of cooking lobster given as follows:

- a. Heat enough water to cover the lobster completely.
- b. Add 1 tsp. salt to each quart of water.
- c. Grasp the lobster behind the head and drop it head first into the boiling water.
- d. Cover and simmer approximately 20 minutes.
- e. When cooked, plunge the lobster into cold water, then drain.

Serving Lobster

Lobster may be served in the shell without removing the meat. If large, the lobster should be cut in half lengthwise, using kitchen shears or a sharp knife cutting through both bottom and top shells. It is preferable however, to remove the meat discarding the small sac which lies at the back of the head and the dark intestinal vein running down the back. The rest of the lobster is edible, including the green tomali and the bright red roe known as coral, if present.

The lobster meat should then be piled back into the shell. It may be chilled and served with mayonnaise or heated under a broiler and served piping hot with melted butter.

The flaked lobster meat may be used in preparing many lobster dishes.

CLAMS

Description

Several species of clams are widely used for food (these commercially important species are but a few of the hundreds of species known). The market varieties of the east coast are different from those of the west.

Along the Atlantic coast the four species which rank highest in commercial importance are the surf clam, the hard clam, and the soft clam.

- a. The hard clams (Venus mercenaria) or hardshell clam, are commonly called quahog in New England, where "clam" generally means the soft-shell variety. In the Middle Atlantic States and southward, "clam" is the usual name for the hard clam.
- b. The surf clams (Spisula solidissima) are also known as skimmer, beach, giant, sea hen, or bar clams. This species makes up the largest volume caught along Atlantic shores, but is not as valuable as the hard or soft-shell clams. Canned clams are practically all surf clams.
- c. The soft-shell clams (Mya arenaria) are known in the Chesapeake Bay area as "manninose", "long clam", "long neck", "squirt clam", "sandgaper", and "old maid." These popular clams, unlike the hard and surf clams, have elongated shells that are very thin and brittle. The soft-shell clams cannot close tightly because their long necks extend beyond the shells. The southern limit of these clams is Maryland and in some areas of northern Virginia.
- d. The ocean quahogs (Arctica islandica) are also called "mahogany clams", "mahogany quahogs", and "black quahogs." The clams are 3 1/2 to 4 inches long and average 1/2 pound each. The clam has a hard shell and is extremely difficult to open with a knife. Steaming the clam produces unpleasant effects on the meats. At present, this clam is under investigation to serve as a new resource of what remains of a once seemingly inexhaustible supply of clam. It is unfortunately apparent that the surf clam is diminishing as a readily available commercial shellfish resource. It is interpreted that the ocean quahog will take its place.

On the Pacific coast the geoduck clam (Panope generosa) is being utilized as a commercial resource. The geoduck is mostly neck. Even the mantle bulges out of the shell, which is always far too small to contain the entire clam. Geoducks are the most impressive clams in U.S. waters, and are believed to be second in size only to the giant clam found in the East Indies, the world's largest. The largest geoduck ever found weighed 13 pounds. The average clam weighs 3 pounds, and yields 1 1/2 pounds of meat. Although scientists disagree, latest opinion is that it takes approximately four years for a geoduck to reach maturity.

These clams are sold in numerous market forms including frozen breast and neck steaks, frozen and canned minced meat, frozen and canned chunks, and canned smoked chunks. They are also available fresh upon request. The steaks can be served panfried or grilled, the minced clam in a dip or chowder, and the canned chunks and smoked canned chunks as party snacks.

Hard Clams

The hard clams or quahog are marketed in Virginia in 3 to 6 size grades, however, most dealers use the following four grade system:

littlenecks	1.5 to 2.25 inches
cherry stones	2.25 to 3 inches
sharps	3 to 3.75 inches
chowders	3.75 inches and larger

Sometimes you will hear the terms New York Nick or Philadelphia Nicks applied to hard clams. New York Nicks are those clams 2 inches or larger whereas, Philadelphia Nicks are less than 2 inches in size.

Clams may be bought in three forms: In the shell, shucked, and canned.

Shell Clams

Clams in the shell are generally sold by the dozen or by the pound. They should be alive when bought. With hard clams, gaping shells that do not close when handled mean that the clams are dead and therefore no longer useable. With other varieties, there will be some constriction of siphon or neck when the clam is touched. If fresh shell clams are held in the refrigerator at about 40°F, they will remain alive for several days.

Shucking Hard Clams

Wash the shell clams thoroughly, discarding any broken-shell or dead clams. To open a hard clam, hold it in the palm of one hand with the shell's hinge against the palm. Insert a slender, strong, sharp knife between the halves of the shell and cut around the clam twisting the knife slightly to pry open the shell. Cut both muscles free from the two halves of the shell. If to be served on the half shell, remove only one-half of the shell. If to be used in one of the other recipes, remove and rinse the meat.

Since soft clams and surf clams do not have tight-fitting shells, they are easier to open.

An alternate method is to place the shell clams, after washing, in a small quantity of boiling water. Cover and steam them 5 to 10 minutes, or until they are partially open. Drain, remove, and wash the meat from the shells. Another method is to first freeze the clam and then wash them under tap water for several minutes. This removes the sand and causes the shells to open sufficiently wide to permit shucking. This method is probably the easiest to use and the most accepted procedure.

Shucked Clams

Shucked clams are the clam meats that have been removed from the shells; they are generally sold by the pint or quart. Shucked clams should be plump, with clear liquor, and free from shell particles. Fresh shucked clams are packed in metal containers or waxed cartons, which should be refrigerated or surrounded by ice. When properly handled, they will stay fresh for a week to 10 days.

In recent years, shucked clams have been packaged and quick-frozen, a process that makes them available all of the year. Frozen clams should not be thawed until ready to use. Once thawed, they should not be re-frozen.

Canned Clams

Hard, soft, razor, surf, and pismo clams are canned whole, or minced, or as chowder, and are packed in various sizes of cans from 3 1/2 ounces to 4 pounds. Clam juice, broth, and nectar are also available canned or bottled.

How Much To Buy

The quantity of clams to buy depends to a great extent on how the clams are to be served. To serve six persons, a safe rule is to buy three dozen shell clams, or one quart of shucked clams, or two 7-ounce cans.

If you decide to obtain the clams from the sea shore yourself, it is important that the clams be handled properly.

First, wash off all surface sand with sea water. Cover clams with clean sea water or 2 percent brine (1/3 cup salt to 1 gallon tap water) and let stand for 15 to 20 minutes to allow the clams to cleanse themselves of sand. (Salt is necessary if the clams are to open and discharge sand.) The sand will settle to the bottom of the container. Change the water and let stand a little while two or three times. This step is important if the clams are to be steamed or eaten from the shell. The clams are then shucked according to the previous discussed procedure.

Cost

The following grades are listed in decreasing price: littleneck, cherry stones, sharps, and chowders.

Conversion Factor

Little Necks	-	450-650 per bushel
Cherry Stones	-	300-325 per bushel
Medium	-	180 per bushel
Chowder	-	125 per bushel

GENERAL INFORMATION PERTAINING TO SHELLFISH

- a. With the exception of scallops, shellfish prices are usually lower in winter than summer.
- b. If you harvest oysters and clams yourself, be sure the water you obtain the shellfish from is certified by the State Health Department. Shellfish harvested and consumed from closed areas may result in someone contacting a case of infectious hepatitis.
- c. Crabs are dredged in the middle Atlantic states from December 1 to March 31 each year. This season is also noted for the poorest quality crab meat since sand is usually carried into the final product making it gritty.
- d. Usually, oysters obtained in the spring of the year are superior to those obtained in the fall.
- e. The larger the shrimp, oyster and scallop, the higher the price. The smaller the clam, the higher the cost.
- f. Oysters, clams, and scallops may be packed in their own liquid in jar, but must be completely covered by the fluid to prevent darkening.
- g. Lobsters, crabs and shrimps can be frozen but tend to become tough with storage.

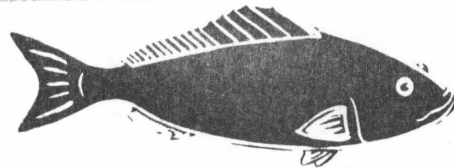
FISH

Market Forms of Fresh and Frozen Fish

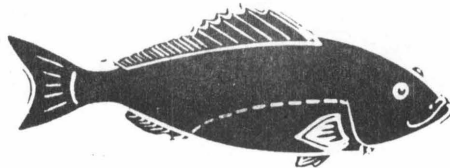
Fresh and frozen fish are marketed in various forms or cuts. Knowing these forms and their special uses is important in buying fish. The following are the best known market forms:

Whole

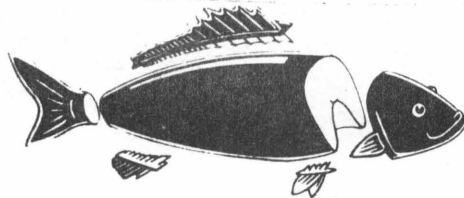
Fish as they come from the water. Before cooking, the fish must be scaled and eviscerated--usually the head, tail, and fin are removed.

Drawn

Whole fish with insides removed. Generally scaled before cooking, and usually the head, tail, and fins removed. Ask your dealer to do this.

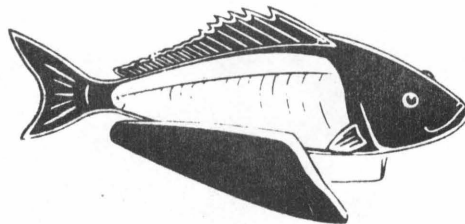
Dressed

Fish with scales and entrails removed and usually the head, tail, and fins are removed. The fish may then be cooked, filleted, or cut into steaks or chunks. The smaller fish are called pandressed and are ready to cook as purchased.

Fillets

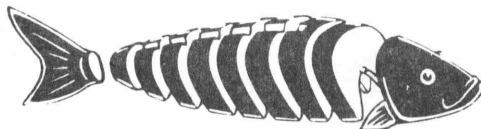
Fillets are the sides of the fish cut length-wise away from the backbone. They are ready to cook as purchased. A fillet cut from one side of a fish is called a single fillet. This is the type most generally available on the market. The fillets may or may not be skinless.

The two sides of the fish cut lengthwise away from the backbone and held together by the uncut flesh and skin of the belly are called butterfly fillets.



Steaks

Steaks are cross section slices from large dressed fish cut 5/8 to 1 inch thick. A cross section of the backbone is the only bone in a steak. They are ready to cook as purchased.



Chunks

Chunks are cross sections of large dressed fish. A cross section of the backbone is the only bone in a chunk. They are ready to cook as purchased.

Raw Breaded Fish Portions

Portions are cut from frozen fish blocks, coated with a batter, breaded, packaged, and frozen. Raw breaded fish portions weigh more than 1 1/2 ounces, are at least 3/8 inch thick, and must contain not less than 75 percent fish. They are ready to cook as purchased.

Fried Fish Portions and Sticks

Within the last decade an entirely new line of frozen food products has entered the consumer market. The success of these products has been tremendous. Today's homemaker has a selection of food in easy-to-prepare forms that were unknown 10 years ago. Along with many others, frozen convenience seafoods have become popular throughout the nation, with fish portions and sticks leading the field.

As an example of how fish portions and sticks have caught on in the United States, statistics compiled by the Bureau of Commercial Fisheries show that from a beginning in the mid'50s, the combined production of fish portions and sticks in 1968 rose to over 270 million pounds. This figure continues to grow as additional drive-ins, restaurants, schools, institutions, and homemakers are introduced to these convenience seafoods.

Fish portions and sticks are generally made of cod, haddock, or pollock and come in frozen, raw, or partially-cooked forms. Fish portions can be obtained either breaded or unbreaded. They come in a variety of sizes and shapes to meet the requirements of different blocks of fish fillets. The cut pieces are dipped into a batter and coated with breading. Most fish sticks and some portions are then partially cooked. Partially-cooked fish portions and sticks take only minutes to prepare. Uncooked portions and sticks take slightly longer. For best results, follow the directions on the package for cooking time and temperature.

Fish portions range in size from 1 1/2 to more than 5 ounces and come in square, round, and rectangular shapes. Generally speaking, one 8 or 10 ounce package of fish portions will serve two. Raw breaded fish portions are at least 3/8 inch thick and contain not less than 75 per-

cent fish. Partially cooked fish portions are at least 3/8 inch thick and contain not less than 65 percent fish.

Fried fish sticks are 3 to 4 inches long and weigh up to 1 1/2 ounces. They are at least 3/8 inch thick and contain at least 60 percent fish. An 8-ounce package will usually serve two persons.

Inspection, Standards, and Grade Marks

Frozen fish portions and sticks lend themselves to the advantages of inspection and grading. However, not all these products on the market are inspected and graded.

Inspected products may be labeled "Packed Under Federal Inspection," either as a mark or statement. The official mark or statement signifies that the product is clean, wholesome, and safe; it has also been produced under the supervision of Federal inspectors.

Fish portions and sticks may also bear "U.S. Grade" marks which signify that the product is:

- a. Safe, clean and wholesome
- b. The quality of the grade shown
- c. Processed under supervision by Federal food inspectors
- d. Packed by sanitary food handlers
- e. Truthfully and accurately labeled as to name, ingredients, and quantity.

Grades For Portions and Sticks

Portions and sticks are graded on a number of factors that affect the quality of the products. The standards are set by the National Marine Fisheries Service, taking into account consumer needs and industry capabilities. In the frozen state, the portions and sticks are checked for condition of package, ease of separation, broken or damaged pieces, and uniformity of weight and size. Cooked samples are checked for color, coating, defects, blemishes, flavor, and odor. For both fish portions and fish sticks:

"U.S. Grade A" indicates frozen fish portions or fish sticks that possess good flavor and odor for the species and rate a score of at least 85 points, based on a numerical scoring system of 100 for a perfect product.

"U.S. Grade B" indicates frozen fish portions or fish sticks that rate a score of at least 70 points on the assigned scoring system. Portions and sticks failing to meet the requirements of Grade B are graded "Substandard."

Buying Fish

How much to buy. The amount of fish to buy per serving varies with the recipe to be used, the size of the serving, and the amount of bone in the fish. Count about 3 ounces of cooked, boneless fish as a serving, a little less for small children and a little more for adolescent boys and men.

The following table can help you decide how much fish to buy per serving:

Whole	3/4 pound
Dressed or pan-dressed	1/2 pound
Fillets or steaks	1/3 pound
Portions	1/3 pound
Sticks	1/4 pound
Canned	1/6 pound

Fish may be purchased fresh, frozen, and canned.

	<u>FRESH</u>	<u>REJECT</u>
a. General Appearance: (lustre and bleaching)	Bright, with metallic lustre, very little, if any, bleaching.	Bloom completely gone. Color faded or bleached.
b. Eyes	Bright, translucent, usually full but in some cases may be slightly sunken and somewhat dull.	Dull and sunken. May be cloudy, dull, white or opaque.
c. Gills: a. Color	Bright red to slightly pinkish red.	Brownish red to brown or gray. Frequent covered with thick, bacterial mucous.
b. Odor	Fresh odor characteristic of species to faint sour odor.	Medium to strong sour odor.
d. Odor: a. Poke End	Fresh to very faint sour odor.	Medium to strong sour odor.
b. At Neck When Breaking.	No odor to very slight odor.	Sour or putrid.
e. Consistency of Fish:	Firm and elastic to the touch. Occasionally may be slightly soft.	Generally soft and flabby.

f. Belly Cavity:	Flesh adheres firmly to rib bones.	Rib bones free or almost free from flesh.
g. Vent:	Normal in shape and color.	Protruding and may be discolored.

Buying Frozen Fish

Frozen fish must be handled properly if it is to reach the consumer in good condition. It will not deteriorate during the deep freezing. It is the change in temperatures during the transporting or handling that results in an inferior product.

A check on the following points will help ensure the product has been correctly handled.

- a. Flesh should be solidly frozen when received.
- b. The flesh should have a firm, glossy appearance with no evidence of drying-out, i.e. no white spots, papery corners or edges, no dark spots, discoloration or fading of red or pink flesh.
- c. If wrapped cut fish shows signs of frost inside the transparent wrap the fish has been stored for a long time or the contents may have thawed and been refrozen.
- d. For wrapped and sealed cartons of fish products it is advisable to open one periodically to check on the condition, otherwise you would simply be relying on the established reputation of the supplier.
- e. Check carefully to see that the container is intact.
- f. Avoid packages which have been stacked above the load line or frost line of the store's display freezer.
- g. Check cello-wrap packages for discoloration.
- h. If products of questionable quality are purchased inadvertently, return them to the store at once.

Care and Handling Suggestion for Fish

- a. Fish should be gutted and washed as soon as possible after being caught.
- b. Freshly caught fish may be frozen and stored in the freezer.
- c. Fish may be packed whole, in steaks or in fillets. Prior to packing the product should be rinsed in a solution of salt water to retard rancidity in the fat.

- d. To prevent drying out the fish should be wrapped in cellophane or laminated freezer paper. Heavy foil or pliofilm make ideal wrapping material.
- e. A very low temperature is required to maintain the delicate flavor of fish. This low degree is hard to maintain with domestic freezers, therefore, it is advisable to store no longer than two months at any one time.
- f. Once fish has been thawed it must be used promptly. It is not advisable to re-freeze fish as it tends to deteriorate extremely fast and if refrozen will be deficient in flavor owing to the drainage during the thawing period.
- g. The recommended cooking method:

Remove from the freezer and cook while frozen, or allow to thaw in the cooler section.

Vitamin and Mineral Content of Fish - Shellfish

Vitamin A and D	Calcium
Niacin and Ribflavin	Iron
Phosphorous	Fluorine
Iodine	Copper

For information for menu suggestions as an aid to combination sales, i.e. vegetables, sauces and garnishes, consult a good cook book.

Fat Content of Fish

Salmon, Halibut, Herring and Eulachons are relatively fatty but vary during their spawning periods. Fish fat is easily digested.

Alaska cod has such a high fat content that it is rarely sold fresh and will usually be retailed as a smoked product.

Classification Of Fish

Breeds of Salmon

Pink - is the smallest, weighing an average of four pounds. It has a good red flesh and a delicate flavor. It may be sold fresh or canned. There is an abundance of pink salmon during the months of July, August, and September.

Sockeye - is the next largest, weighing approximately seven pounds. The flesh is deep red and is usually unobtainable fresh.

Coho - is generally classified as the next largest, weighing approximately nine pounds. The flesh is medium red. May be processed fresh, frozen and canned. There is an abundance of Coho during July, August, September, October, and November.

Spring, Red or White - is the largest of all the salmon. It is accepted as the best eating of the salmon and usually commands the highest prices. It is obtainable fresh in the early spring or summer, but is available the year round in smoked or frozen form.

Methods of Cooking Fish

The best methods of cooking fish are - baking, steaming, sauteing and deep-fat frying. Cooking fish in water is not desirable since more juice is extracted by this method.

Cooking Temperatures

The recommended temperature for baking fish is between 450^o and 500^oF. The length of cooking time will depend on the thickness of the fish. Generally speaking, 10 minutes should be allowed for each inch of thickness for frozen fish.

When deep fat frying fish, cook at 375^oF. A higher temperature will brown the outside before the inside is cooked, and a lower temperature will result in a grease-soaked, unappetizing product.

How to Tell When Fish is Cooked

Overcooking of fish will cause it to toughen, shrink and dry out. Cook only until the signs given below show that it is done:

- a. When cooked, the flesh loses its translucent appearance and takes on a whitish tint.
- b. The juices are milky.
- c. The flesh is easily pierced and separates into flakes.

Seasoning and Serving

To be most acceptable, fish must be carefully seasoned, garnished, and served immediately after cooking. The appearance of the fish will be more appetizing, if the surface is nicely browned and if it is served with a sauce of contrasting color.

When serving large numbers, cook fish in relays and serve as soon as cooked.

In order to introduce variety, vary the methods of preparation and the type of sauce and garnish served with the fish.

CANNED TUNA

Tuna purchased from supermarkets is the food consisting of processed flesh of fish of the following class: Bluefin tuna, Albacore, Blackfin tuna, Big-eyed tuna, Yellowfin tuna, Skipjack, Oriental tuna, and Little tuna. Canned tuna is prepared in one of the following forms of packs:

- a. Solid or solid packs consists of loins to which no free pieces are added. A piece may be added if necessary to fill a can.
- b. Chunk, chunks, chunk style consists of a mixture of pieces of tuna in which the original muscle structure is refined. The pieces may vary in size but not less than 50 percent (by weight) shall be retained on a 1/2 inch-mesh screen.
- c. Flake or flakes consist of a mixture of pieces of tuna in which more than 50 percent of the weight of the pressed contents of the container will pass through a 1/2 inch-mesh screen, but in which the muscular structure of the flesh is retained.
- d. Grated consists of a mixture of particles of tuna that have been reduced to uniform size, that will pass through a 1/2 inch-mesh screen, and in which the particles are discrete and do not comprise a paste.

Any of the above forms of canned tuna may be smoked.

All canned tuna falls within one of the following color designations:

- a. White - This color designation is limited to the Albacore species.
- b. Light - The color designation includes any tuna not darker than Munsell value 5.3.
- c. Dark - This color designation includes all tuna darker than Munsell value 5.3.
- d. Blended - This color designation may be applied only to tuna flakes and consisting of a mixture of tuna flakes of which not less than 20 percent by weight meet the color standard for either white tuna or light tuna and the remainder of which fall within the color standard for dark tuna.

Canned tuna is packed in one of the following optional media.

- a. any edible vegetable oil
- b. olive oil
- c. water

Canned tuna may be seasoned or flavored with one or more of the following:

- a. salt
- b. purified monosodium glutamate
- c. Hydrolyzed Protein
- d. Spices or spice oils or spice extracts
- e. Vegetable broth (not to exceed 5 percent of the volume capacity of the container). The broth can be made from beans, cabbage, carrots, celery, garlic, onions, parsley, peas, potatoes, green bell peppers, red bell peppers, spinach, and tomatoes.
- f. garlic

When solid pack tuna is packed in olive oil, the designation "Tonno" may also appear.

OUTDOOR COOKERY

Thousands of people agree that food rarely tastes better than when properly cooked out-of-doors. The reason? Probably because the open air, the relaxed, congenial atmosphere, and the tantalizing aroma of outdoor cookery all combine to whet the appetite and sharpen the taste.

Fish and shellfish are no exception to this happy rule, and almost all varieties adapt readily to outdoor cooking and eating. Whether your equipment is a simple charcoal grill, or an elaborate electric or gas grill, or a primitive campfire, the results can be equally successful. Important aspects of outdoor seafood cookery are:

- a. Care in selecting and preparing the fish and shellfish;
- b. Cooking the seafood until just flaky when tested with a fork. Overcooking of tender, succulent fish and shellfish is apt to toughen and dry them;
- c. Controlling the heat; and
- d. Marinating, basting, or coating the fishery products to keep the juices in and dryness out.

Operating A Gas Grill

To light the grill, raise the hood or uncover. Remove grid, if manufacturer recommends. Strike long style match or light a soda straw. Turn gas valve to "high"--follow manufacturer's instructions if grill has pilot light. Hold match at ignition point.

Leave valve on "high" to preheat, but do not lower hood. If burner is below food, preheat for 10 to 15 minutes. If burner is above food, preheat for one minute.

Before placing food on grid or rotisserie, adjust valve to proper setting. Experience and personal preference will help you learn best setting. With outdoor grills, allow for climate conditions.

Follow manufacturer's directions for cooking on grid and rotisserie and for grill cleaning.

Operating A Charcoal Grill

Line the bottom of the fire bowl with heavy-duty aluminum foil for easier cleaning later. To prevent the grill from burning out, line the bottom of the firebox with a layer of small pebbles or vermiculite. This permits the fire to breathe, giving more heat from the coals. Make charcoal layer slightly wider all around than the food to be cooked on the grill.

Start the fire sufficiently in advance so you will have a good bed of coals when you start barbecuing. One method used, which takes about 45 minutes, is to stack briquets in pyramid, and soak lightly with any re-

commended charcoal lighting fluid. Let stand 1 minute, then light. Many commercial forms of lighter fluid, easily ignited mats, and other lighting aids are available. **WARNING: AT ALL TIMES TAKE NECESSARY PRECAUTIONS WHEN LIGHTING THE FIRE. NEVER USE GASOLINE!** When the surface is covered with a gray ash, spread the coals evenly and the fire is ready.

For smoke flavor use wood chips from apple, oak, maple, hickory, and cherry to give smoke flavor to fish. Soak chips in water at least an hour before using, so they will give maximum smoke and not burn too rapidly. On a charcoal grill, add a few chips at a time to the charcoal while cooking. If chips flame up, add more wet chips. For a gas grill, scatter wet chips directly on the ceramic briquets for added flavor, or for a more subtle flavor -- wrap them in perforated foil before placing them on the briquets.

Remember, never overcook fish. Cook only until they flake easily when tested.

SARDINES

Description

Maine sardines are the immature young of the Atlantic herring which has an elongated body and are greenish blue in color with a silvery cast on the sides and belly. The tail of the herring is deeply forked and has a single dorsal fin which is directly over the small ventral fin. Scales of herring are large and loosely attached. Herring reach about four inches in length by the end of a year.

Definition

What is a sardine? The word sardine is not the name of just one species of fish but rather a collective name that represents a variety of tiny, soft-boned fish. The name sardine probably comes from the fact that similar, tiny fish, called French sardines, were first found and caught in great abundance around the island of Sardinia in the Mediterranean. The Maine sardine is a member of the Atlantic herring family. Caught and enjoyed by Atlantic coastal Indians long before the first settlers arrived, these tasty little fish are still being caught in the same coves and inlets used by the Indians of long ago.

Uses of Sardines

Sardines are a valuable source of high quality protein which is needed for building and repairing body tissues. They contain iron needed for healthy, red blood. Sardines provide useful amounts of thiamine, niacin, and riboflavin. Maine sardines are packed in various types of oil as well as mustard and tomato sauces. Packed in flat 4-ounce cans, they are ready to eat at the zip of a can opener, a pull tab, or a key.

EELS

Eels traditionally have not been a part of the seafood diets of Americans, however, Europeans have long considered them a delicacy. The American eel (*Anguilla rostrata*) is found in abundance from Greenland to the Gulf of Mexico. These eels can be found living in estuarine waters as well as the fresh waters of our major rivers and their tributaries.

Preparation

Live eels must be killed, cleaned and cooked. One method used in killing eels and also removing the slime layer is to sprinkle them with salt and add just enough water to cover them. Let them soak in this solution for two to three hours before removing and then wash them thoroughly with clean water. Soak them again, however, this time for a half hour only and in fresh cold water. Following this soak, scrub them with a steel brush to remove last traces of salt and slime. Following this procedure the eels should be skinned and gutted. The best method to skin the eel is to drive a nail through the eel's head into a wooden post or board. Using a sharp knife, cut through the skin three inches behind the head all the way around. Care should be exercised to avoid the gall bladder which is located behind the head. Fold the skin back and peel it off with pliers.

The next step is the gutting process. Using a knife, insert it into the vent and cut along the belly line toward the head, stopping at the gills. Cut toward the tail two inches past the vent. Remove the kidneys and if possible pull out the large vein along the backbone. Wash the gut cavity, making sure to remove all traces of blood.

Freezing

Eels can be frozen, however, they do not keep well in home freezers due to their high fat content. If you do attempt to freeze eels, package them well. This will protect other foods in the freezer against off odors and flavors which could develop in eels stored inadequately or stored for too long a period.

Cooking

Fried

Cut in three inch length. Roll in crumbs dip in slightly beaten egg diluted with two tablespoons of water, roll again in crumbs. Fry in deep fat at 375°F for three to five minutes.

Baked

2 pounds of eel in two inch lengths
 ¼ cup olive oil
 1 clove garlic, coarsley chopped
 a pinch of thyme leaves
 juice of ½ lemon
 Sprinkle blended salt and pepper over pieces of eel.

Heat the olive oil in a baking dish. Add garlic and thyme. Place the eel in this hot mixture, squeeze a little lemon juice over it, and bake in a moderate oven (375°) for 25 to 30 minutes.

U.S. GRADE STANDARDS FOR FISHERY PRODUCTS

Bringing the harvest of the seasons to consumers is a complex operation. By nature, fish vary in their characteristics and quality. Processing and distribution involve many steps. The wide variety of packaged and prepared fishery products further complicates the task of bringing fish to our tables.

U.S. Grade Standards are an important aid to orderly and efficient fish marketing. As a part of Voluntary Federal Inspection grading provides useful standardized information for trade transaction in fishery products.

Grade standards identify the relative value, utility, and quality of each unit of fishery product; a product marked "Grade A", for example, is recognized as having higher qualities than "Grade B" or "Grade C" products.

Fishermen, wholesalers, processors, distributors - all who are involved in production of fishery products - use grade standards to buy and sell products of known and accepted quality. Consumers may rely on grading as a guide to products of assured quality.

The National Marine Fisheries Service assigns U.S. Grade Standards for many high-volume fishery products for mass feeding and direct consumer markets. These standards cover such products as frozen fish fillets and fillet blocks; frozen raw fish portions and fish steaks; frozen raw breaded and precooked fish portions and fish sticks; frozen raw headless shrimp and raw breaded shrimp; and frozen raw and precooked breaded scallops.

What Grade Standards Do

- a. Reflect different quality levels of product
- b. Form a basis for sales and purchases
- c. Provide guidelines for in-plant quality control
- d. Establish a basis for official inspection.

What Different Grade Standards Mean

Grade A means top or best quality. Grade A products are uniform in size, practically free of blemishes and defects, in excellent condition, and possess good flavor for the species.

Grade B means good quality. Grade B products may not be as uniform in size or as free from blemishes or defects as Grade A products. Grade B may be termed a general commercial grade, quite suitable for most purposes.

Grade C means fairly good quality. Grade C products are just as wholesome and are generally as nutritious as higher grades. Grade C products

have a definite value as a thrifty buy for use where appearance is not an important factor. Consumers today will not find products labeled Grade B or Grade C in the marketplace because products of Grade B and Grade C quality usually are marketed without any grade designation.

Inspection Reinforces Grading

Product grading is more valid when done by a neutral unbiased party. The National Marine Fisheries Service provides voluntary Federal inspection on a fee-for-service basis, paid for by the plant under inspection. Officially graded and certified products of such plants are eligible to carry the inspection mark and/or the prefix "U.S." on their grade marks, "U.S. Grade A" for example. Products which bear only the inspection mark are at least Grade B, and most are Grade A. Consequently, knowledgeable consumers consider inspection to be an added service by concerned processors on behalf of consumers.

FEDERAL INSPECTION MARKS FOR FISHERY PRODUCTS

Federal inspection marks are official marks approved by the Secretary of Commerce and authorized for use on brand labels of fishery products. When displayed on product labels, these marks signify that Federal inspectors of the Department of Commerce inspected, graded and certified the products as having met all the requirements of the inspection regulations, and have been produced in accordance with official U.S. grade standards or approved specifications.

What Do The Inspection Marks Mean?

The distinctive inspection marks are symbols which signify two distinct but related functions in guiding the consumer to safe, wholesome products produced in a sanitary environment, and packed in accordance with uniform quality standards under the supervision of the U.S. Department of Commerce's voluntary inspection service. The functions symbolized by each mark follow:

"U.S. Grade" Mark

The "U.S. Grade" mark signifies that:

- a. The product is clean, safe and wholesome.
- b. The product is of a specified quality, identified by the appropriate U.S. Grade designation, as determined by a Federal inspector in accordance with established requirements in U.S. Grade standards.
- c. The product was produced in an acceptable establishment, with proper equipment and in an appropriate processing environment as required by food control authorities.
- d. The product was processed under supervision by Federal food inspectors and packed by sanitary food handlers in accordance with specific Good Manufacturing Practice requirements.
- e. The product is truthfully and accurately labeled as to common or usual name, optional ingredients and quantity.

PACKED UNDER
FEDERAL
INSPECTION
U.S. DEPARTMENT
OF COMMERCE

"Packed Under Federal Inspection" Mark

"Packed Under Federal Inspection" may be displayed as an official mark or as an official statement on the product label. The mark or statement signifies that the properly labeled product is clean, safe and wholesome and has been produced in an acceptable establishment with appropriate equipment under the supervision of Federal inspectors. The product has not been graded as to a specific quality level, rather, it is an acceptable commercial quality as determined by Federal inspectors in accordance with approved standards or specifications.

What Fishery Products Bear Federal Inspection Marks?

Many brand-name fishery products carry either one or both inspection marks on their labels. The following is a list of fish and shellfish products made from a variety of species of fish, which presently bear inspection marks.

- a. Frozen Raw Fish Fillets, Portions, and Sticks
- b. Frozen Fried Fish Fillets, Portions, and Sticks
- c. Fresh or Frozen Whole or Dressed Fish
- d. Frozen Raw Breaded Shrimp
- e. Frozen Whole Cooked Crabs and Crabmeat
- f. Fried Fish Seafood Cakes
- g. Raw and Fried Fish Dinners
- h. Fried Clams and Clam Cake Dinners
- i. Fried Scallops and Fried Scallop Dinners
- j. Raw and Raw Breaded Scallops
- k. Frozen Fish Steaks
- l. Raw Peeled and Deveined Shrimp
- m. Cooked Crabmeat, Legs, and Claws
- n. Fish and Shellfish in Sauce Dinners

PACKAGING AND PACKAGING MATERIAL

Packaging of Fish to be Frozen

The object of packaging is to protect fish from dehydration, oxidation, and contamination. A good package is:

- a. moisture proof
- b. low in permeability to air
- c. tight fitting
- d. strong
- e. relatively inexpensive and easy to apply

Unfortunately, it is difficult to find packages which have all five properties, particularly for commercial use. An examination of the properties of the available packaging and wrapping materials will assist in choosing the proper package for individual application. Refer to the chart at the end of this section.

Permeability

Permeability refers to the rate at which the packaging material permits vapors and gases to pass between the product and the surrounding atmosphere. There are large differences in the permeability of packaging materials and films (table 1). Waxed paper and cartons, cellophane and polyethylene (the common plastic bag) offer little protection to seafood products. Bread wrappers - a kind of polyethylene bag - are widely used as a home freezer wrap. However, they should never be used as a home freezer wrap because they are such a poor barrier to water vapor and air.

Aluminum foil is a wrap that one should use with caution. The foil itself is impermeable to gases, however, it is difficult to properly seal this allowing for easy passage of water vapor and air. Additionally, aluminum foil is **not** a tightly fitting wrap and is easily punctured.

Of the plastic films, polyester, polyvinylidene chloride (saran) and polyvinyl chloride (P.V.C.) are all very good barriers to oxygen, and also rank high in most other desirable characteristics of an ideal package.

Tightness of Fit

A tight fitting package is essential to prevent moisture loss inside the freezer package. Inside a loose fitting package, moisture evaporates from the fish and condenses as ice crystals on the inside surface of the package. An ice glaze provides the ideal fit, but glazing is too much trouble for the housewife. Both saran and P.V.C. will adhere to fresh fish and provide a good fit, if you are careful to crowd out remaining air

bubbles. Polyester bags and sleeves are widely used for commercial packaging, but are not practical for home freezing, because it is necessary to evacuate the air from polyester bags either by a vacuum pump or heat shrinking.

Although waxed cartons overwrapped with waxed paper are widely used commercially, this type of packaging is not to be recommended. Waxed cartons fit loosely and are poor barriers to moisture and air.

Other Considerations in Packaging

For storing fish in the home freezer, saran and P.V.C. are good choices. However, saran is not strong at very low temperatures. It is a good idea to overwrap saran packages with a protective paper.

Ice glazing is not easily done in the home, and glaze will not stand up under continued handling. In commercial cold storage, most whole fish are glazed because with proper equipment, glazing is the least expensive method of packaging fish.

Some home freezer users do a form of glazing by packing fish in suitable containers and flooding the containers with water. Waxed cartons, such as milk cartons, should not be used for this purpose.¹ If fish touch the sides of the cartons - as invariably happens - rancidity and "freezer burn" result. A good container for this purpose is a tin can such as a 2- pound coffee can. When using such a container be sure to have at least one-half inch of water over the fish. There are some disadvantages to using this method; it is wasteful of space and electricity, both of which are important considerations in today's economy.

Polyester bags and sleeves are being used more and more in commercial freezing of fish products, both for whole fish and fish portions.

Polyester is most suited for expensive, difficult to hold items such as cooked shrimp, salmon and crab, where the high value of the product offsets the relatively costly package.

One other important consideration in packaging is the size of the pieces. Fish to be stored for periods greater than three months should be left whole or in quite large pieces. There is less dehydration per pound when frozen in this manner.

Storage Time

Suitability of different species for cold storage varies considerably. If conditions are less than the best, maximum storage life will be lowered. Fish may be separated into fat and lean categories. Fish containing more than 5% fat are considered fatty.

Fish oils differ considerably from other animal and plant oils. Normally, fish of high oil content are more susceptible to oxidation

¹See Home Freezing of Seafood, by Melvin E. Waters in the Next section.

and therefore, rancidity. There are, however, exceptions to this rule. King salmon have a fat content of about 15% and pink salmon contain 6% fat or less. Even though the pink salmon have much less fat than king salmon have, they develop a rancid odor and flavor much more quickly than the king salmon.

There are species of fish that are extremely difficult to preserve in the frozen form in a home freezer. Herring is a fat fish which is particularly susceptible to rancidity; it should be held at -20°F. or lower. Smelt are another group difficult to store for extended periods.

The length of time fish are held on ice or chilled storage greatly affects the storage time of the frozen product. Experiments have shown several species of lean fish held two days on ice have a frozen storage life of twelve months whereas the same fish held for seven days on ice have a frozen storage life of only two months. The need for rapid handling of fresh fish cannot be overemphasized.

Storage Temperatures

The most important factors controlling the quality of frozen seafood are storage temperatures and length of storage time. As storage temperature increases, the rate of quality loss also increases. You can safely assume that it is not possible to store fish at too low a temperature.

Cold storage research shows that fish stored at 15°F. for as little as two weeks show a significant loss of quality. Most home freezers are designed to hold temperatures between 4°F. and -4°F. Most of the older cold storage equipment operated at 0°F. to -4°F. Cold storage facilities for fisheries products are now being designed to hold temperatures from -10°F. to -20°F.

Check the temperature of your freezer. Set it to hold at -4°F. If it won't hold that temperature it is time to have it repaired or replaced. A difference of 8 to 10 degrees means a great deal in terms of the storage of your food.

Try not to overload your freezer by putting in large loads at one time. It takes several days to freeze a hundred pounds of fish and pull it down to storage temperature. Large loads will raise the temperature of the food which has been previously frozen. Such temperature fluctuations shorten the storage life of foods. Also, place the fish to be frozen directly on freezer coils, no on other previously frozen packages.

CHARACTERISTICS OF FREEZER PACKAGING MATERIALS

Material	Permeability		Tightness of fit	Strength	Cost
	Water	Air			
Polyvinylidene Chloride (saran)	Low	Very Low	Very Good	Medium Low	Low
Polyvinyl Chloride P.V.C.	Low	Very Low	Very Good	Medium	Low
Polyester Bags and Sleeves	Very Low	Low	Good	Very High	Low
Ice Glace	Low	Low	Excellent	Very Low	Low
Polyethylene Wrap and Bags	Medium	High	Poor	High	Low
Aluminum Foil	Low	Low	Fair	Very Low	High
Cellophane	Very High	Medium	Fair	Low	Low
Waxed Paper and Cartons	Very High	High	Poor	Adequate	Low

HOME FREEZING OF SEAFOODS

Home freezing is an excellent method for preserving seafoods and will be an added economy since fresh seafoods may be purchased in season when prices are generally lower.

Because some fresh seafoods are seasonal, it is important to learn the availability of seafoods during certain times of the year. The local fish dealer can provide this information and indicate which varieties are the most economical. Fresh fish may be purchased by the pound in any of the following forms; whole, drawn, dressed and drawn, steaks, fillets, and chunks.

The selection of seafoods to put in a freezer is one of the most important phases of freezing food for the family. When purchasing seafoods for home freezing, be sure that they have not been previously frozen. Consult the fish dealer to be absolutely certain. When transporting seafoods to the home, they must be kept as cold as possible. A few hours at room temperature or in the trunk of a car on a warm day can completely spoil many types of seafood.

When buying fresh fish, look for the following characteristics:

- a. The flesh of whole fish should be firm and not separating from the bones.
- b. If the head is attached, the eyes should be bright, clear, and full. As the fish become stale, the eyes become cloudy and often turn pink.
- c. The gills should be red and free from slime.
- d. The skin should be shiny with an unfaded color.
- e. The odor of fillets and steaks should be fresh and mild.
- f. Crabs and crab meat should have little fishy odor and no disagreeable ammonia-like taste or odor.
- g. Crab shells should not be slippery.
- h. Oysters and clams in the shell should be alive and the shells should close when handled.
- i. The liquor of shucked oysters should be clear and there should be no sour smell or odor.
- j. Fresh shrimp should have no disagreeable odor and their meat or shells should not be slippery.

Whenever in doubt as to the freshness of seafood, do not freeze it. If serious doubt is present, discard the seafood. Poor handling of fish prior to freezing will make it impossible to obtain good results. Freezing

can only protect the quality of the fish as it was when frozen; freezing does not improve the quality. Frozen foods can be no better than the material one starts with. Do not purchase more seafood than can be frozen and stored in the available freezer space or more than your family will eat within 3-6 months.

Seafood Preparation For The Freezer

When preparing seafoods for the freezer it is important that all inedible material and debris be eliminated. For example, fish should be scaled and the entrails and heads removed. Shrimp should be deheaded and peeled. This will allow additional space in the freezer and eliminate work prior to serving the dish for a meal. It is important that the seafood be packaged in just that amount which will accommodate or serve the family at one meal.

A technique we would recommend for preserving the quality is to dip raw seafood in a precooked and cooled solution of 5 percent starch. This will help exclude air from individual pieces. This can be done by using about 6 tablespoonsful of corn starch per gallon of water. The starch must, however, be rinsed away after the item is thawed and before cooking.

Packaging Seafood For The Freezer

Choosing the right packaging material is a very important step in the process of freezing in the home. Most of the undesirable flavor and color changes in seafood are caused by oxidation. Loss of water during frozen storage, that is, freezer burn, not only dries and toughens foods but promotes oxidation. Freezer burn and oxidation are always accompanied by an off-flavor, off-odor, and off-color. The housewife should select packaging material that is impermeable to oxygen and water vapor and should exclude as much air as possible during packaging. Cling-type wrapping materials are an excellent barrier to both water vapor and oxygen, cling well to surfaces, and are available in most grocery stores. Metal cans with seal-on lids and glass jars designed for freezing are good oxygen and water vapor barriers and are very useful for most seafoods.

Questions often asked are, "Is it a good practice to freeze fish and shrimp in ice cream cartons and milk cartons?" and, "Is it a good practice to freeze fish in pans of water?" (a common practice in the home freezer). The answers are, "Yes." Freezing fish and shrimp in ice cream or milk cartons is a good practice provided that the seafood is completely covered with an ice glaze and the cartons are tightly sealed to prevent the transfer of moisture and oxygen into and out of the package. These cartons are generally coated with wax or a plastic material and are excellent oxygen and water vapor barriers.

The importance of excluding as much air as possible from the package cannot be overemphasized. Besides preventing oxidation, air will act as an insulator and slow the freezing process. Any pocket of air between the package wall and the contents will promote the formation of ice crystals. When the package is cooled and frozen, moisture will move from the seafood to the inside wall of the package. If the product is warmed slightly during defrosting or each time the freezer door is opened, the moisture may move from the package surface back to the food surface. When the pack-

age cools again, the cycle is repeated. This may continue until a large quantity of water is removed from the food and it is severely dehydrated.

A warning is in order about thawing smoked or kippered fish. Never leave smoked or kippered fish in a tightly wrapped package after it has thawed. Some smoking methods do not ensure complete destruction of (Clostridium botulinum) spores, which may be harmful when smoked fish is stored unfrozen over a few weeks in an airtight container.

While it is advisable to package seafoods under vacuum, most housewives do not have access to this equipment. The next best thing is to wrap the seafood to exclude as much oxygen as possible. The drug store wrap is suggested. This is done by placing the item on the sheet of wrapping paper and bringing the ends together at the top and "roll the fold" until it is snug against the food. The ends should be folded in a similar manner while pressing out as much air as possible. The wrapping material should be secured with tape to prevent unfolding.

Freezing and Storing Seafoods In The Freezer

The homemaker can save time, avoid losses, and make freezing seafood a pleasure by planning ahead. Check the freezer to see that it is functioning properly. To maintain the quality, adjust the thermostat to the coldest setting about 2 hours prior to anticipated use. Do not guess; check the temperature with a thermometer. Consider the size of the freezer. Generally, about 2 or 3 pounds of seafood for each cubic foot of freezer space will freeze in from 10 to 12 hours. It is important that packages be placed in the freezer as soon as they are ready. Usually, the faster the food is frozen, the better the quality and the longer the storage life. This is partly due to less cell destruction by freezing. Slow freezing may actually allow bacterial and enzymatic spoilage to take place while the food is still in a semifrozen state. To obtain the fastest freeze, place the packages in direct contact with the freezer floor or walls or coils until they are frozen. If the packages take more than 5 or 6 hours to freeze, they are probably too large. Packages should be stored at 0°F or colder where the temperature does not fluctuate. Generally, the farther away from the freezer door, the more stable the temperature.

Temperature fluctuation can be harmful to frozen seafood. Arrange packages in the freezer so that there is adequate space between them to allow good air circulation. Unfrozen packages surrounded by several other packages may not freeze for 3 or 4 days. If this happens, freshness will be lost and spoilage may occur. Never place unfrozen packages near frozen food. It may cause the frozen food to thaw. Leave the thermostat at the coldest setting until all of the packages have been frozen. Then maintain the temperature at 0°F or colder.

Although commercial packaging may allow over a year of good shelf life, freezing methods available in the home generally will not permit seafood to be stored that long and still maintain its flavor and texture. Most home-frozen seafood should not be stored over 6 months and not more than 3 months for salmon, crab, and shrimp. A good rule for a continuous supply of high quality frozen food is "first in, first out." Two to 3

months storage for all seafood is ideal. Seafood is very delicate in flavor and deserves to be eaten at the peak of quality.

Trying to guess the age and contents of a frozen package of seafood can be frustrating and wasteful. Many times food is discarded because the storage age is unknown. Although it is unlikely that properly frozen and stored food can become harmful at any age, top quality demands that extended storage be avoided. Label each package with the date, type of seafood, weight, and number of servings or pieces. A crayon or a grease pencil is ideal for this purpose. A record attached near the freezer will also be helpful and should carry the same information included on the packages as well as the location of each package in the freezer, the package size, and a current record of the number of packages put into or removed from the freezer. This prevents unnecessary searching for a particular package and the harmful warming of the contents while the freezer door is open.

Proper Use Of The Frozen Product

The method of thawing seafood is almost as important as proper freezing. Usually the quicker a product is thawed the better, but never in hot water. Surface spoilage can take place quickly when thawing at room temperature or in warm water if the surface of the package remains at that temperature for several hours. Schedule thawing so that seafood will be cooked soon after it is thawed. Thawed fish may be held safely for a day in the refrigerator before cooking. Place the package of frozen seafood in the refrigerator to thaw. Allow from 18 to 24 hours for thawing a 1-pound package. If quicker thawing is desired, place the packages of frozen seafood under cold running water. Allow 2 hours for thawing a 1-pound package. Thawed seafoods should not be refrozen.

Some frozen seafood may be cooked without thawing. Breaded frozen fish should be cooked this way. In addition, frozen fillets may be cooked without thawing if additional cooking time is allowed. If the fillets are to be breaded or stuffed, they should be thawed before cooking.

General Information on Quality of The Frozen Product

A general knowledge of the causes of spoilage characteristics of seafoods would help the housewife better serve her family and help her to better appreciate the meticulous care seafood must receive.

There are three major causes of spoilage in foods which are minimized or inhibited by the freezing process - protein degradation, oxidative rancidity, and brown discoloration (Maillard reaction). Protein degradation is caused mainly by autolytic and bacterial enzymes which are quite active about 40°F. This spoilage is characterized by ammonia and amine-like odors often experienced in spoiled meats and seafoods. These enzymes are protein in nature and mobilization or activity decreases as the temperature is reduced. Some enzymes remain active (activity is low), however, even at 0°F. A prime example of this is freezing corn on the cob without first blanching; heating inactivates the enzymes. In fishery products there is very little or no enzymatic degradation at 0 to -10°F and these products may remain palatable for many months, all other factors being equal.

The big problem in spoilage of frozen fishery products is rancidity. The uptake of oxygen and the onset of rancidity seems to be related to the unsaturation of the fat. Long ago, farm women learned to store their lard in crocks with as small a surface as possible exposed to the air and in a dark, cool place. Heat, light, oxygen, and the presence of heavy metal ions, such as copper and iron, enhance the development of rancidity. The oil in fish is long chain fatty acids containing many double bonds and consequently, it becomes very susceptible to oxidation. It is at these double bonds that atmospheric oxygen combines with the oil molecule to produce a variety of compounds such as ketones, aldehydes, acids, and many others that have not been identified.

Fish may be classified into three categories according to their oil content:

- a. Those of low (less than 5 percent) oil content such as halibut, cod, flounder, and red snapper.
- b. Those of moderate (5-10 percent) such as mullet, croaker, and salmon.
- c. Those of high (more than 10 percent) oil content such as herring, mackerel, and lake trout.

Fish processing a high oil content will become rancid in three months in a freezer unless precautions are taken. Moderately oily fish become rancid in from 9 to 12 months. Freezing alone will not prevent rancidity but will slow down the reaction considerably.

Treating fish with an antioxidant coupled with vacuum packaging will increase the shelf life. Antioxidants we have experimented with, and which display excellent results, are butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA), ethylenediaminetetraacetic acid (EDTA), 3', 3'-thiodipropionic acid (TDP), and propyl gallate. Other good antioxidants (which can be purchased at the grocery store) are ascorbic acid and citric acid. We recommend that ascorbic acid be used to soak the fish prior to freezing. The fish should be soaked in a 0.1 percent solution for about 1 to 2 minutes, frozen, and then glazed with this solution. A second glazing is advisable. The fish may then be wrapped as previously described.

The third type of spoilage encountered in frozen fishery products is the browning reaction. This reaction is particularly prevalent when white-fleshed fish are steaked or filleted. Extensive research has shown that this is a non-enzymatic reaction caused by a combining of certain amino acids with reducing sugars. The work showed further that the pentoses (5 carbon sugars) react readily with amino acids which contain sulfur, those amino acids being methionine, cysteine, and cystine. Lysine is also involved. The reaction is characterized by the presence of a brown color much like that of brown wrapping paper. The reaction is inhibited by treatment with antioxidants such as ascorbic acid and TDP.

Seafood is very tasty, nutritious, easy to prepare, economically priced, and commands high priority on a list of preference for any family meal. Consequently, these delicacies of the sea deserve to be served at their peak of quality. We say to the commercial processor, "keep the product clean keep it moving, keep it cold, and keep it stored at a temperature sufficient for proper preservation of the product." This is good advice to the homemaker freezing seafood for her family in the home.

COMPOSITION OF SEAFOOD

Table 1 - Proximate composition, calcium, and phosphorus content of the edible portions of raw finfish.

Fresh finfish	Proximates				Minerals	
	Moisture g%	Crude protein g%	Ash g%	Ether fat g%	Ca mg%	P mg%
Calfish (Cultured) <i>Ictalurus punctatus</i>	77.4 ± 0.1 274.5—80.7 ² 10 ³	20.5 ± 0.7 17.0—23.9 10	1.53 ± 0.09 1.10—1.94 10	0.65 ± 0.32 0.09—2.31 8	64 ± 8 20—90 9	228 ± 14 130—240 9
Calfish (Wild) <i>Ictalurus punctatus</i>	79.4 ± 0.2 77.9—80.0 10	18.2 ± 0.3 16.3—19.7 10	1.19 ± 0.02 1.09—1.25 10	0.96 ± 0.11 0.51—1.51 9	27 ± 2 19—37 9	214 ± 8 158—298 15
Cod (Icelandic) <i>Gadus morhua</i>	81.4 ± 0.2 79.0—83.1 22	18.1 ± 0.2 16.7—19.6 20	1.20 ± 0.02 1.01—1.36 20	0.10 ± 0.02 0.01—0.26 20	22 ± 1 18—30 16	192 ± 7 150—240 15
Cod (Inshore-Domestic) <i>Gadus morhua</i>	80.1 ± 0.3 76.8—83.3 23	19.6 ± 0.3 16.3—21.8 24	1.26 ± 0.04 0.96—1.84 20	0.12 ± 0.02 0.00—0.30 20	42 ± 5 19—80 16	222 ± 6 180—270 18
Flounder, Yellowtail <i>Limanda ferruginea</i>	76.5 ± 0.3 74.1—78.7 20	22.3 ± 0.4 18.8—25.5 20	1.21 ± 0.04 1.05—1.76 20	0.37 ± 0.06 0.05—1.16 19	27 ± 2 20—40 14	203 ± 12 170—300 12
Haddock (Inshore) <i>Melanogrammus aeglefinus</i>	79.0 ± 0.2 78.0—80.7 20	20.4 ± 0.3 16.7—22.6 20	1.50 ± 0.05 1.12—1.87 21	0.11 ± 0.01 0.03—0.23 20	62 ± 7 20—90 11	211 ± 13 150—310 20
Hake, Pacific <i>Merluccius productus</i>	80.1 ± 0.2 78.7—81.1 18	18.4 ± 0.4 16.2—22.4 18	1.25 ± 0.04 1.00—1.59 18	0.69 ± 0.10 0.20—1.50 17	28 ± 3 20—50 17	176 ± 5 150—200 15
Hålbut, Pacific <i>Hippoglossus stenolepis</i>	77.5 ± 0.4 76.6—80.9 23	20.1 ± 0.3 18.1—22.9 21	1.27 ± 0.02 1.14—1.49 21	1.22 ± 0.23 0.43—3.90 19	47 ± 6 20—78 13	221 ± 8 160—260 16
Perch, Ocean <i>Sebastes marinus</i>	77.3 ± 0.3 75.8—80.2 21	21.7 ± 0.3 19.6—24.8 19	1.45 ± 0.03 1.18—1.71 22	0.81 ± 0.11 0.10—1.44 17	141 ± 7 80—190 21	223 ± 6 160—270 23
Pollock <i>Pollachius virens</i>	77.7 ± 0.2 75.8—80.6 22	20.9 ± 0.2 19.2—22.5 23	1.47 ± 0.06 1.12—2.01 20	0.15 ± 0.03 0.0—0.51 20	87 ± 12 30—150 11	228 ± 10 160—300 16
Rockfish, Pacific <i>Sebastes</i> sp.	79.7 ± 0.2 78.0—81.3 22	19.8 ± 0.3 18.0—22.6 22	1.26 ± 0.03 1.07—1.42 20	0.53 ± 0.10 0.03—1.58 19	39 ± 5 20—90 9	214 ± 7 160—250 12
Snapper, Red <i>Lutjanus blackfordii</i>	76.0 ± 0.2 73.8—77.7 24	22.4 ± 0.1 20.9—23.6 23	1.31 ± 0.02 1.16—1.55 20	0.41 ± 0.08 0.09—1.36 21	28 ± 4 20—50 15	210 ± 8 160—240 19
Whiting <i>Merluccius bilinearis</i>	78.7 ± 0.4 75.6—80.9 22	17.8 ± 0.2 16.3—19.5 25	1.26 ± 0.03 1.00—1.53 21	2.43 ± 0.22 0.78—4.76 20	72 ± 6 50—100 11	222 ± 11 150—290 13

¹ Mean and standard error of the mean.² Range.³ Number of analyses.

Table 2 - Proximate composition, calcium, and phosphorus content of the edible portions of canned finfish.

Canned finfish	Proximates				Minerals	
	Moisture g%	Crude protein g%	Ash g%	Ether fat g%	Ca mg%	P mg%
Salmon, Sockeye <i>Oncorhynchus nerka</i>	171.3 ± 0.2 269.3—72.5 316	21.0 ± 0.2 19.3—22.1 20	2.35 ± 0.11 1.55—3.03 17	6.04 ± 0.13 5.20—7.08 16	22 ± 1 19—28 9	273 ± 10 180—340 17
Tuna, Yellowfin (canned in oil) <i>Thunnus albacares</i>	59.9 ± 0.4 57.9—62.2 14	22.9 ± 0.5 19.3—24.3 12	1.91 ± 0.05 1.51—2.11 12	15.2 ± 0.4 13.0—17.7 11	37 ± 7 20—67 7	224 ± 5 190—260 15
Tuna, Yellowfin (canned in brine) <i>Thunnus albacares</i>	74.8 ± 0.4 73.1—76.5 8	24.0 ± 0.2 23.3—24.8 8	1.48 ± 0.12 1.14—1.92 8	0.81 ± 0.08 0.43—1.04 8	33 ± 9 20—50 3	195 ± 12 180—230 4

¹ Mean and standard error of the mean.

² Range.

³ Number of analyses.

Table 3 - Proximate composition, calcium, and phosphorus content of the edible portion of raw crustaceans.

Crustaceans	Proximates				Minerals	
	Moisture g%	Crude protein g%	Ash g%	Ether fat g%	Ca mg%	P mg%
Crab, Blue <i>Callinectes sapidus</i>	177.4 ± 0.3 275.2—80.6 322	19.8 ± 0.1 18.4—21.0 22	2.06 ± 0.04 1.81—2.46 22	1.02 ± 0.07 0.55—1.58 20	102 ± 12 22—180 13	272 ± 10 200—370 16
Crab, King (body) <i>Paralithodes camtschatica</i>	79.2 ± 0.3 76.7—81.4 16	18.3 ± 0.2 17.0—19.5 16	1.60 ± 0.05 1.19—1.83 16	0.38 ± 0.02 0.24—0.54 16	42 ± 3 21—69 24	212 ± 10 180—273 25
Crab, King (leg) <i>Paralithodes camtschatica</i>	76.8 ± 0.07 69.2—79.3 17	20.1 ± 0.5 17.2—24.9 18	1.81 ± 0.06 1.28—2.52 18	0.40 ± 0.03 0.22—0.67 18	55 ± 4 40—80 12	228 ± 10 160—320 18
Lobster, Spiny <i>Panulirus argus</i>	75.6 ± 0.3 74.2—79.0 23	23.1 ± 0.2 22.0—25.6 20	1.71 ± 0.02 1.51—1.96 20	0.33 ± 0.03 0.17—0.55 15	47 ± 4 20—80 18	237 ± 11 150—320 19
Shrimp, Alaskan Mixed spp.	77.4 ± 0.3 75.5—79.7 20	20.1 ± 0.4 16.7—26.2 22	2.26 ± 0.14 1.41—3.77 19	0.64 ± 0.02 0.44—0.85 20	49 ± 4 40—80 14	187 ± 4 170—210 12
Shrimp, Asian Mixed spp.	84.0 ± 0.4 81.0—87.3 20	15.2 ± 0.4 13.1—18.8 20	0.77 ± 0.03 0.53—0.96 21	0.42 ± 0.17 0.12—3.00 16	68 ± 5 30—90 14	181 ± 10 130—230 10
Shrimp, Brown <i>Penaeus aztecus</i>	76.2 ± 0.1 75.2—76.5 20	21.4 ± 0.2 17.2—23.3 23	1.63 ± 0.01 1.54—1.72 20	0.14 ± 0.01 0.05—0.28 20	59 ± 2 40—80 19	248 ± 5 220—290 18
Shrimp, Maine <i>Pandalus borealis</i>	81.5 ± 0.5 77.9—86.0 19	17.1 ± 0.4 13.5—20.2 23	1.30 ± 0.06 0.93—1.86 20	0.39 ± 0.05 0.12—0.82 19	54 ± 4 40—80 11	177 ± 9 150—270 14
Shrimp, Mexican Mixed spp.	80.4 ± 0.3 78.5—82.5 22	18.1 ± 0.3 16.5—20.6 23	1.40 ± 0.04 1.14—1.68 20	0.18 ± 0.03 0.06—0.55 18	95 ± 2 70—120 14	176 ± 4 150—210 18
Shrimp, White (Gulf) <i>Penaeus setiferus</i>	77.4 ± 0.2 76.4—78.7 20	20.6 ± 0.1 19.5—21.6 21	1.41 ± 0.02 1.26—1.57 20	0.20 ± 0.02 0.05—0.40 20	50 ± 1 40—60 20	233 ± 9 150—290 17
Shrimp, White (South Atlantic) <i>Penaeus setiferus</i>	76.2 ± 0.2 75.3—79.5 22	22.0 ± 0.2 20.9—23.5 20	1.90 ± 0.05 1.86—2.03 20	0.17 ± 0.02 0.06—0.26 15	64 ± 3 50—90 17	281 ± 11 160—350 17

¹ Mean and standard error of the mean.

² Range.

³ Number of analyses.

Table 4 - Proximate composition, calcium, and phosphorus content of the edible portion of raw Mollusca.

Mollusca	Proximates				Minerals	
	Moisture g%	Crude protein g%	Ash g%	Ether fat g%	Ca mg%	P mg%
Clams (Hard Shell)	191.8 ± 0.1	4.41 ± 0.17	1.97 ± 0.02	0.21 ± 0.02	65 ± 3	69 ± 3
<i>Marcenaria mercenaria</i>	190.8—192.5 ²	3.20—6.24	1.79—2.16	0.10—0.42	20—91	50—130
	20 ³	19	20	20	31	26
Clams (Soft Shell)	83.3 ± 0.9	9.51 ± 0.43	1.19 ± 0.09	1.27 ± 0.16	53 ± 3	152 ± 6
<i>Mya arenaria</i>	76.6—90.8	5.48—11.68	0.62—1.99	0.42—2.64	17—73	110—206
	20	20	17	20	27	24
Clams (Surt)	79.4 ± 0.2	15.6 ± 0.1	2.29 ± 0.10	0.34 ± 0.06	41 ± 3	194 ± 5
<i>Spisula solidissima</i>	78.2—80.9	14.6—16.7	1.10—3.05	0.10—0.87	17—80	110—265
	20	20	20	20	31	36
Oysters (Long Island)	85.4 ± 0.2	7.86 ± 0.23	1.11 ± 0.02	1.13 ± 0.07	52 ± 3	145 ± 6
<i>Crassostrea virginica</i>	82.5—86.6	6.65—10.28	0.93—1.28	0.75—1.89	30—70	110—240
	20	20	20	20	20	20
Oysters (Maryland & Virginia)	88.3 ± 0.2	5.77 ± 0.24	0.65 ± 0.02	1.06 ± 0.08	36 ± 4	121 ± 5
<i>Crassostrea virginica</i>	87.0—90.0	4.48—7.86	0.55—0.83	0.56—1.97	20—70	100—140
	21	20	20	19	17	7
Scallops (Bay)	78.8 ± 0.7	14.1 ± 0.1	1.42 ± 0.02	0.20 ± 0.03	32 ± 5	207 ± 5
<i>Pecten</i> sp.	76.4—87.8	12.9—14.8	1.25—1.59	0.09—0.43	20—80	180—250
	20	19	20	20	16	17
Scallops (Calico)	77.8 ± 0.4	16.9 ± 0.1	1.79 ± 0.01	0.21 ± 0.02	32 ± 2	215 ± 5
<i>Argopecten gibbus</i>	76.8—83.6	15.9—18.5	1.71—1.89	0.11—0.31	20—60	160—270
	20	20	20	19	19	20
Scallops (Sea)	78.2 ± 0.2	18.2 ± 0.1	1.50 ± 0.02	0.17 ± 0.02	22 ± 1	234 ± 16
<i>Placopecten magellanicus</i>	77.2—79.7	17.1—19.0	1.38—1.84	0.02—0.32	20—30	150—320
	21	20	20	20	15	16

¹ Mean and standard error of the mean.² Range.³ Number of analyses.

APPENDIX

Cleaning and Dressing Fish

- a. Wash fish. Remove scales by scraping the fish gently from the tail to the head with the dull edge of a knife.
- b. Remove the entrails after cutting the entire length of the belly from the vent to the head. Remove the head by cutting above the collarbone.
- c. Break the backbone over the edge of the cutting board or table.
- d. Remove the dorsal or large back fin by cutting the flesh along each side, and pulling the fin out. Never trim the fins off with shears or a knife because the bones at the base of the fin will be left in the fish.
- e. Wash the fish thoroughly in cold running water. The fish is now dressed or pan dressed, depending on its size.
- f. Large dressed fish may be cut crosswise into steaks for freezing, if desired. Cut steaks about 3/4 of an inch thick.
- g. To fillet: With a sharp knife, cut down the back of the fish from the tail to the head. Then cut down to the backbone just above the collarbone. Turn the knife flat and cut the flesh along the backbone to the tail, allowing the knife to run over the rib bones. Lift off the entire side of the fish in one piece, freeing fillet at the tail. Turn the fish over and cut fillet from the other side.
- h. If you wish, you may skin the fillets. Lay the fillet flat on cutting board, skin side down. 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 the skin by running the knife forward while holding the free end of the skin firmly between your fingers.
- i. Commercial practice indicates that it is a good idea to give fish steaks and fillets a 30-second dip in a 5-percent salt solution before wrapping and freezing. To make a 5-percent salt solution, use 2/3 cup salt to 1 gallon of water.

FISH YIELDS (APPROXIMATE)

	Edible portion (Percent)
Whole	45
Drawn	48
Dressed or pan dressed	67
Steaks	84
Fillets	100

