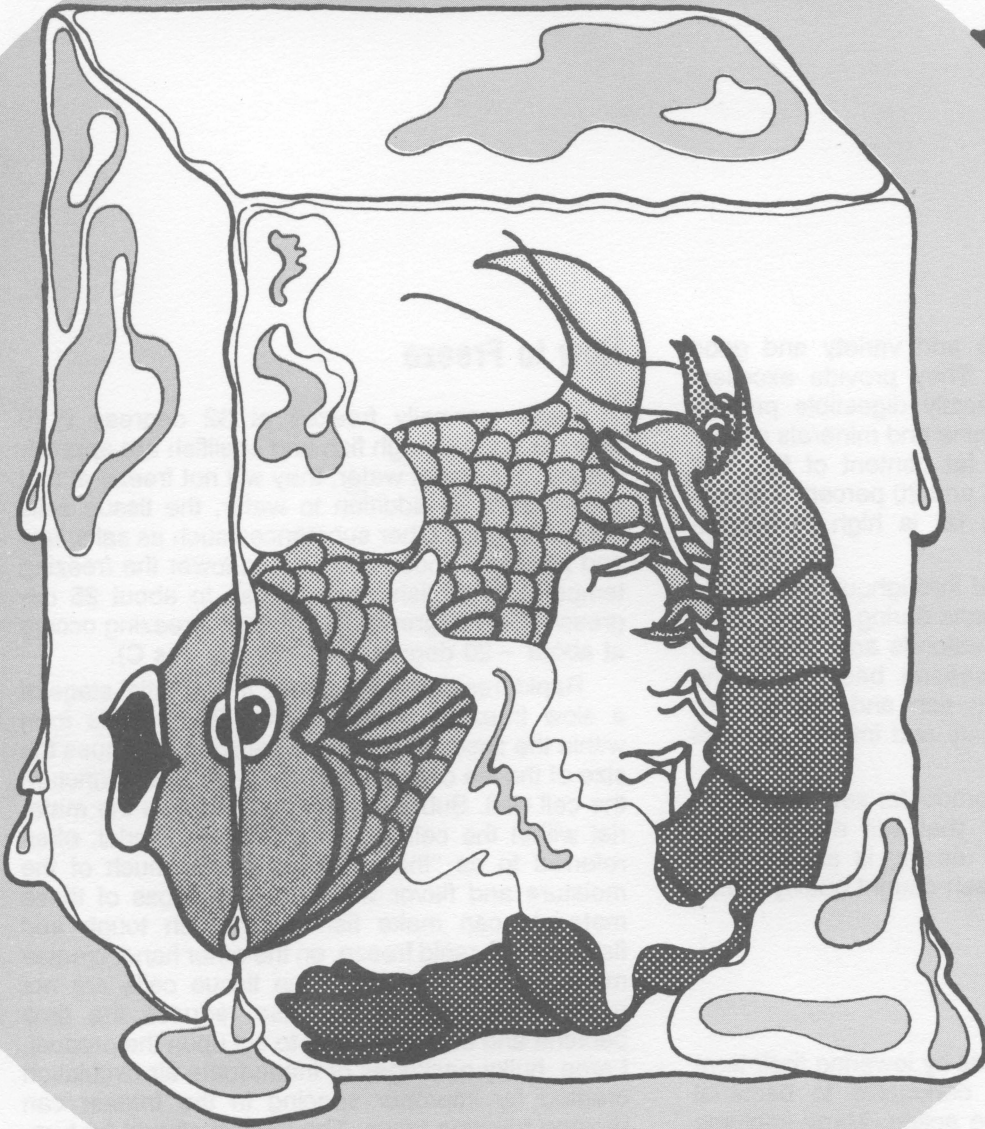


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FREEZING FISH AND SHELLFISH



Freezing Fish and Shellfish

Ranzell Nickelson and Annette Reddell*

Good quality seafoods add variety and good nutrition to family meals. They provide excellent sources of high-quality, easily digestible protein. Seafoods also supply vitamins and minerals essential for good health. The fat content of fish and shellfish ranges between 5 and 20 percent depending on the species. This fat is high in polyunsaturated fatty acids.

Seafood may be served throughout the year by freezing good quality products during peak production seasons. Generally, seafoods are less expensive during the harvest season because of the abundant supply. Freezing fish and shellfish for future use can add versatility and interest to meal planning.

Like many other food products, seafoods must be handled in a manner that will maintain the highest possible quality. Freezing is an excellent means of preserving the fresh-caught quality of fish and shellfish.

Why Freeze?

Freezing preserves foods by lowering their temperatures to a point not conducive to bacterial growth and natural enzyme action. Many spoilage bacteria are destroyed by freezing, and those that survive are unable to grow at the low temperature. A fresh seafood product can spoil when bacteria are not present. Natural enzymes that help fish digest food and carry on natural metabolism in the cells of the fish or shellfish may continue to be active after the animal dies. These enzymes begin to digest the tissue of the fish or shellfish and cause the quality to deteriorate. Enzyme action can be inhibited or slowed down by freezing.

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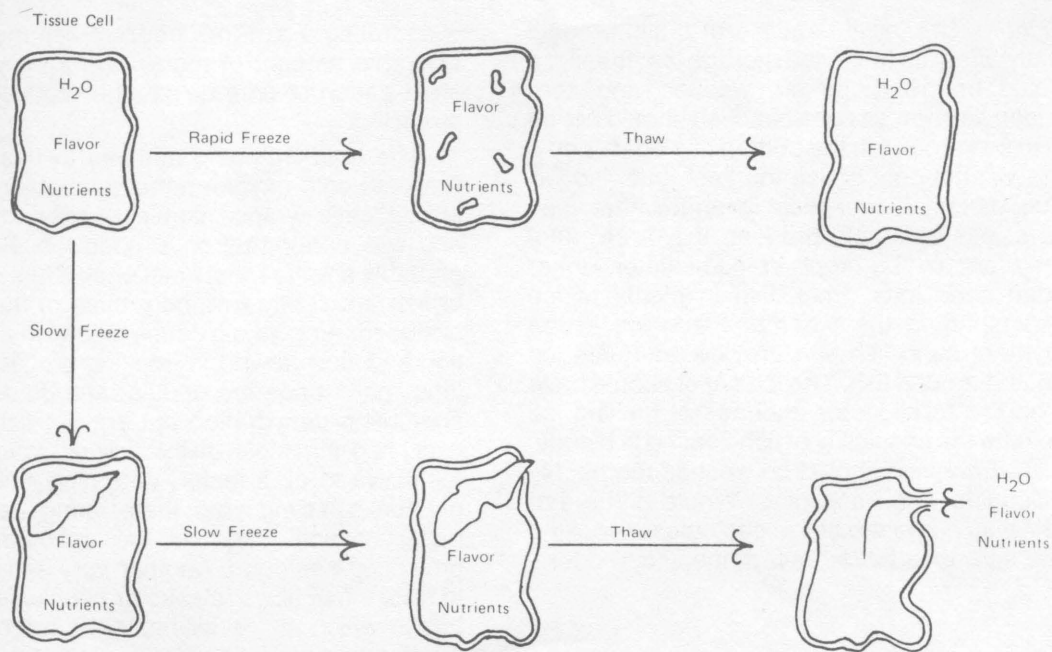
How to Freeze

Water normally freezes at 32 degrees F (0 degrees C). Although fish and shellfish are approximately 75 percent water, they will not freeze at that temperature. In addition to water, the tissue cells contain various other substances such as salts, fats and proteins. These substances lower the freezing temperature of fish and shellfish to about 25 degrees F (-4 degrees C). Complete freezing occurs at about -20 degrees F (-28 degrees C).

Rapid freezing is important. In the initial stage of a slow freezing process, small ice crystals form within the tissue cells. As the freezing continues the size of the ice crystals increases until they puncture the cell wall. Subsequent thawing allows the material within the cell to escape. This material, often referred to as "thaw drip," contains much of the moisture and flavor within the cell. Loss of these materials can make fish or shellfish tough and flavorless. A rapid freeze, on the other hand, creates many small crystals and the tissue cells are not ruptured. Rapid freezing also reduces the time bacteria and enzymes have to act upon the product. Large, bulky packages or inadequate air circulation created by improper spacing in the freezer can prolong freezing times. The freezer should be turned to its coldest setting prior to freezing, and then returned to its normal setting once the product is frozen.

Selecting Products for Freezing

Freezing only maintains quality, never increases it. The quality of a frozen seafood is directly related to the quality of the product before it is frozen. Only high-quality fish and shellfish should be considered for home freezing, whether it is bought or caught.



Rapid freezing preserves freshness and flavor.

Bought — Various criteria can be used to evaluate the quality of fish and shellfish. These range from complicated bacteriological and biochemical tests to simple sight and smell evaluation. Sight and smell are the common ways of determining the quality of fish and shellfish products. All good quality fish and shellfish should be free of objectionable odors or discolorations.

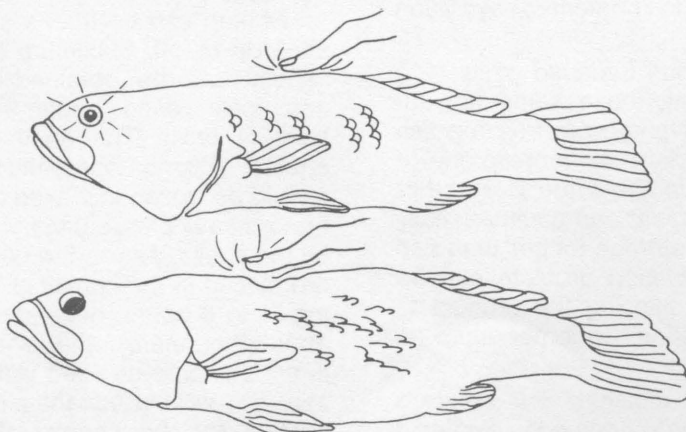
Other criteria for fish include: eyes usually full and clear; gills free of slime; bright, shiny skin and a firm flesh that springs back after being pressed with the finger.

Heads-on shrimp should have the heads relatively well attached to the tail. Tails should not have

the pinkish color that develops after cooking. "Brown" and "Pink" are common names of important shrimp species, and are not related to abnormal discoloration. Black discoloration along the shell is not considered a serious defect unless it affects a sizable portion of the flesh.

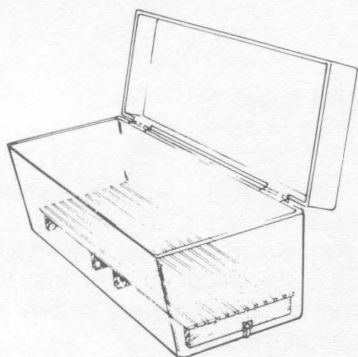
Whole crabs purchased for home cooking and freezing should be purchased alive. Crab meat should be free of discoloration and objectionable fish and ammonia-like odors.

Whole oysters also should be alive at the time of purchase, and their shells should be tightly shut. Shucked oysters should have a clear liquor and be free of sour odors.



Fresh fish (top) have clear, full eyes and firm flesh.

Caught — The initial handling of a fish product can greatly affect its taste and storage life. Ideally, a fish should be gilled, gutted, washed and adequately iced as soon as possible. Fish should not be allowed to flop around in the bottom of a boat or on a pier. This will not only bruise the flesh but also will speed up certain biochemical changes that may produce a less desirable product. If fish are kept alive they should be kept in cool water under uncrowded conditions. Pack fish in plenty of ice before transporting them home. Place ice in the belly cavity of each fish and provide adequate ice between and around fish. The ice chest should have a false bottom to allow for drainage of melting ice and eliminate the possibility of fish floating in bloody, dirty water. Each fish should be washed thoroughly before cleaning and packaging. Whole crabs that die on the way home are still acceptable for cooking if you are sure they have been properly cared for.



The ice chest should have a false bottom to allow for drainage.

Why Wrap or Glaze?

There are two reasons for wrapping or glazing a seafood product. One is to prevent oxidation (rancidity) and the other is to prevent dehydration (freezer burn).

Although fish is nutritious because of its high polyunsaturated fat content, these same polyunsaturated fats are a disadvantage in freezing fish products. Polyunsaturated fats are more prone to oxidation than the saturated fats found in other meats. Consequently, red meat and poultry usually can be kept under frozen storage longer than fish products. Most of the oxidation problem can be overcome by wrapping or glazing the product to keep the air out, and lowering the temperature as much as possible.

Dehydration, or loss of moisture, can create a dry, tough product as well as speed up the oxidation process. This also can be prevented by wrapping or glazing the product to prevent moisture from

evaporating. Frost-free freezers can remove a considerable amount of moisture from a product in a short period of time unless the product is properly protected.

The best wrapping material to use is one that prevents both oxygen penetration and water vapor loss. Plastic wraps, aluminum foils, freezer paper and wax cartons all do a good job. Plastic wraps probably are the most functional. If individual pieces of fish are tightly wrapped, most of the air can be excluded. Air pockets cause oxidation and dehydration and slow down the freezing process. Polyethylene "poly" bags are popular and do a good job of preventing dehydration but are not satisfactory for excluding air. Most of the "cling" wraps are more restrictive to air transfer. Wrapping individual fillets or chunks in cling wrap, then storing them in freezer paper or poly bags, is the optimum means of protecting seafoods. Another very satisfactory way to freeze fish fillets, steaks or chunks is in a plastic bag in which all the air has been forced out. Load the bag in a sink full of cold water. Hold the fish in the closed end, and when the bag is brought upside down out of the water, a vacuum is created as the water runs out. Seal the bag and place it in the freezer. For ease in defrosting, freeze just enough seafood in each bag for one recipe preparation.

Glazing is the process of applying a thin ice film over the product. After fish and shellfish have been frozen, they are dipped into cool water (in some instances corn starch or corn syrup is added). The water freezes on the product and forms a glaze. Glazes are an excellent means of preventing oxidation and dehydration, but they are fragile and must be handled carefully. After glazing, the product should be wrapped in freezer paper or stored in a plastic bag.

Freezing Shrimp

Shrimp can be frozen cooked or raw, with the shell on or off. Maximum storage life and quality usually can be obtained by freezing what are commonly called "green headless" shrimp (raw, shell-on tails). The shell offers extra protection against oxidation and dehydration. Shell-on shrimp should be frozen in waxed cartons, plastic containers or heavy plastic bags that will not be punctured by the shells. After a thorough washing, the shrimp are placed in the container and frozen. After freezing (4 to 8 hours, depending on the package size and temperature), the plastic containers or wax cartons should be filled with cold water and refrozen. This will exclude the air and create a protective coating for the shrimp. Some methods involve freezing shrimp in water. This can produce a "mushy" shrimp and delay freezing times. If you

choose to freeze shrimp in this manner, pack the shrimp with ice, then fill the container with water. This will speed up freezing time.

Plastic bags of shrimp can be formed to fit existing freezer space and save space in the freezer. To glaze shrimp in plastic bags, first freeze the shrimp in the bags, then pour enough cold water into the bags to cover all surfaces of the shrimp, and refreeze. This process can be repeated as needed during the storage period.

Shrimp usually are available year-round, but peak supply and lowest prices occur between July and October. Frozen in the manner described and maintained at proper temperatures, shrimp can be stored from 8 to 12 months with no significant changes in quality.

Freezing Fish

Fish are marketed in various forms:

1. *In-the-round* — Whole, intact fish just as they come out of the water. Allow 1 pound per serving.
2. *Drawn* — Entrails and sometimes gills removed. Allow 1 pound per serving.
3. *Dressed* — Entrails and scales removed. The head, fins and tail may or may not be removed. Allow 1 pound per serving.

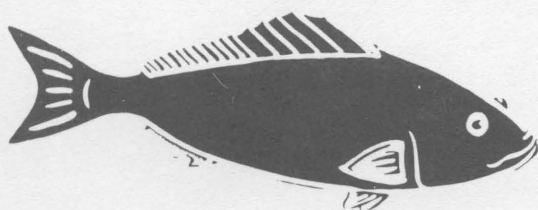
4. *Fillets, chunks and steaks* — Fillets with or without the skin on are usually boneless portions removed from the sides of the fish. Chunks and steaks are made by cutting cross sections of the fish; these contain segments of the backbone. Allow one-third pound per serving.

Fish should not be frozen in-the-round, as the intestinal contents may impart off-odors and off-flavors to the flesh. Digestive enzymes and bacteria found in the intestinal fluids also can begin to digest the fish flesh before the product freezes.

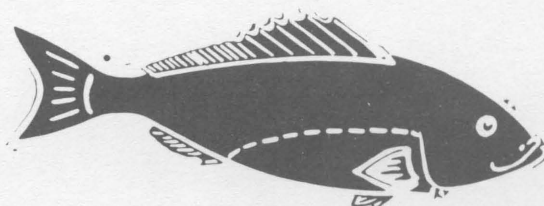
The dark flesh of fish is usually less stable in frozen storage. Soaking in salt water may remove some of the darker pigment in the meat but may actually enhance the development of rancidity. The dark material along the backbone should be washed from pan-dressed fish and the dark muscle streak from larger fillets should be cut out prior to freezing.

For convenience and to save space, the fish to be frozen should be in a final use form such as pan-dressed, fillets or steaks. After cleaning, scaling, trimming and washing, the fish can be wrapped in a plastic wrap or frozen and glazed. Fish also can be frozen in plastic containers or waxed cartons as described for shrimp. Freeze in quantities suitable for single meal preparations.

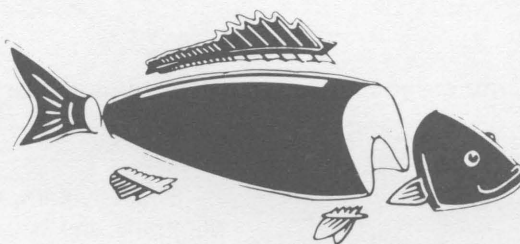
Fish usually are available the year-round. Peak



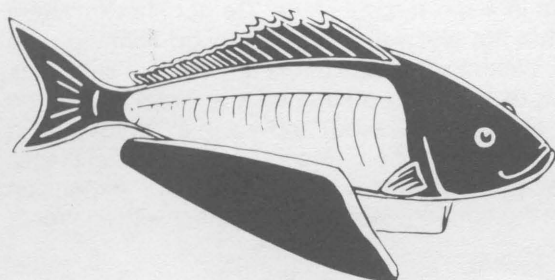
In-the-round



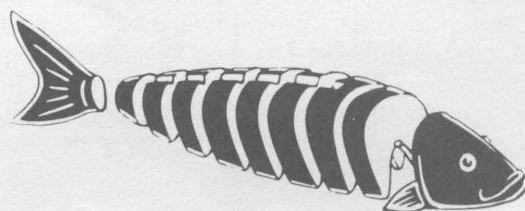
Drawn



Dressed



Fillets



Chunks and steaks



harvest seasons for the more common species are as follows:

Redfish — November through February
 Trout — January through June
 Red Snapper — March and April
 Black Drum — October through February
 Croaker — August and September
 Flounder — October through February
 Mullet — February through April
 Sheepshead — November through January
 Catfish, freshwater — March and April

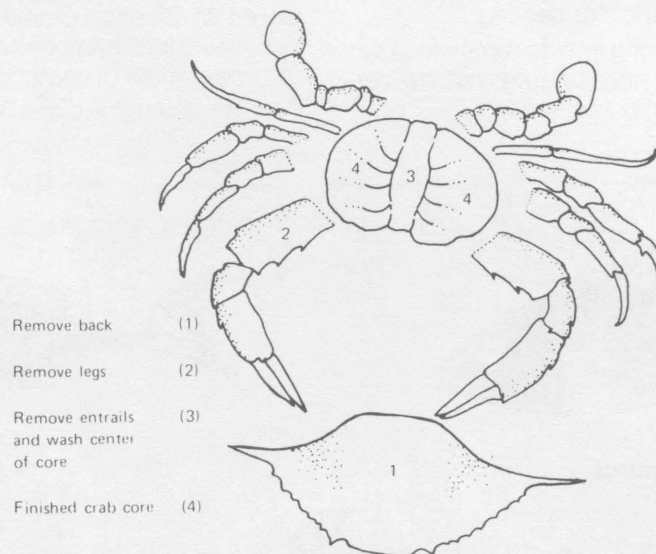
The frozen storage life of a fish depends to a great extent upon its fat content. Low-fat fish can be stored from 3 to 6 months, sometimes longer, with little deterioration in quality. Low-fat fish include redfish, croaker, sheepshead, trout, red snapper, flounder, catfish and all shellfish. Because fish of a higher fat content are more easily oxidized, their storage life is 1 to 3 months. Fish in this category include tuna, mackerel, mullet and salmon.

Freezing Crabs

Picked crab meat has never been satisfactorily frozen because severe textural and flavor changes develop during frozen storage. Recent research indicates that rapidly frozen crab cores (portion remaining after debacking and cleaning) can be stored without significant quality loss. The thawed cores can be picked prior to consumption.

Crab cores can be prepared in two different ways. The live crab can be boiled for 8 to 10 minutes, then debacked, the gills and entrails cleaned, then the crab washed and frozen. A second method involves debacking, cleaning and washing, then boiling and freezing. The second method is probably better since less handling is involved after the crab is cooked. Rapid cooling after cooking is essential, so individual cores should be wrapped and frozen or frozen and glazed as rapidly as possible before they are wrapped in a larger package.

Peak blue crab harvest is between May and November.



Crab cores can be easily frozen and stored.

Freezing Oysters

Consumers often are disappointed when they expect frozen oysters to taste as good as fresh, shucked oysters "on-the-half-shell." It is almost impossible to avoid changes in flavor, texture and color, as well as drip loss, during frozen storage. With proper handling and freezing techniques these changes are not severe, especially if the product is to be cooked after thawing.

Shell oysters should be alive at the time of purchase and can be kept alive for 2 to 3 days if stored in a moist, cool place. Do not shuck oysters that will not close after being tapped lightly on the shell. Wash the outside of the shell before shucking. Shuck oysters into a strainer (the liquor should be clear and can be saved) and wash to remove sand and pieces of shell. Place oysters in a plastic container and freeze. Allow space for expansion within the container and cover oysters with a layer of

water after they have frozen. Use small containers to insure rapid freezing.

Recent research indicates that steaming shell-on oysters for 15 minutes not only makes shucking easier, but also inhibits some of the natural changes that take place in fresh frozen oysters. Steamed, frozen oysters have been shown to be acceptable for as long as 6 months if dipped in 1 percent ascorbic acid prior to freezing.

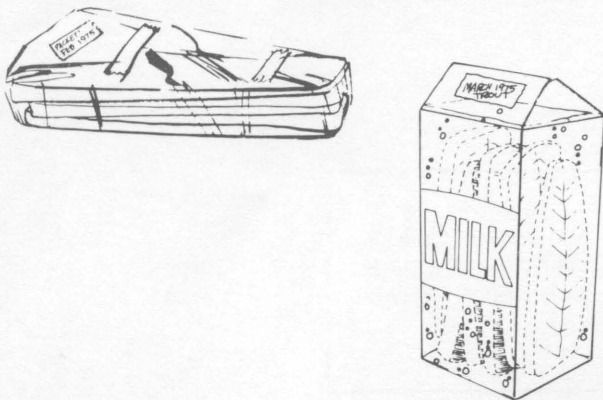
Peak oyster harvest occurs between October and April.

Labeling Packages

It is important that packages be labeled before they are placed in the freezer. Include the following information:

- type of fish or shellfish
- amount frozen
- market form
- date

Informative labels will help you select the kind and amount of seafood to thaw for a meal, and whether the fish is dressed, steamed or filleted will help you decide on a recipe preparation. The date will enable you to rotate the stock and keep the frozen seafood as fresh as possible.



Thawing Frozen Seafoods

Proper thawing is just as important as proper freezing. Improper thawing can greatly reduce the

quality of the seafood product. As a rule, seafoods should be thawed as quickly as possible, but never in hot water or at room temperature.

Slow thawing in a refrigerator creates excessive drip loss and can give spoilage bacteria time to produce off-odors and off-flavors. Some estimates suggest that 12 to 18 hours are required for a 2- to 4-pound fish to thaw in a refrigerator. Thawing at room temperature can create uneven thawing and cause thin sections to spoil before the thicker portions thaw. Thawing in hot water greatly denatures the proteins and creates excessive loss of moisture and flavor. Thawing under cold, running water is the fastest and best means of thawing. Seafoods can be thawed successfully in the microwave oven on the lowest setting. Seafoods can be cooked frozen, but extra cooking time is needed.

Refreezing Seafoods

For highest quality, keep seafoods frozen until they are defrosted for use. If frozen seafoods thaw before needed, they may be refrozen *if* there are ice crystals still present and if they have been held in the refrigerator for no more than 2 days. The quality of the seafood may deteriorate after refreezing, but it will be safe to eat.

If Your Freezer Stops Working

If power is interrupted or the freezer fails to refrigerate properly, do not open the freezer unnecessarily. If the freezer is full, food usually will stay frozen for 2 days. In a freezer less than half full, food may not stay frozen more than 1 day.

If the freezer may not be back to normal operation within 1 to 2 days, use dry ice to keep the temperature below freezing and to prevent spoilage of frozen seafood. Fifty pounds of dry ice in a 20-cubic-foot home freezer should hold the temperature below freezing for 2 to 3 days if the freezer is less than half full, and for 3 to 4 days in a full freezer. The dry ice should be obtained quickly following interruption of power. Move all food from the freezing compartment of the freezer to the storage compartment. Place dry ice on boards on top of the packages, and do not open the freezer more often than necessary. Do not use dry ice in a small, poorly-ventilated room.

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