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NOTES ON FREEZING SHRIMP

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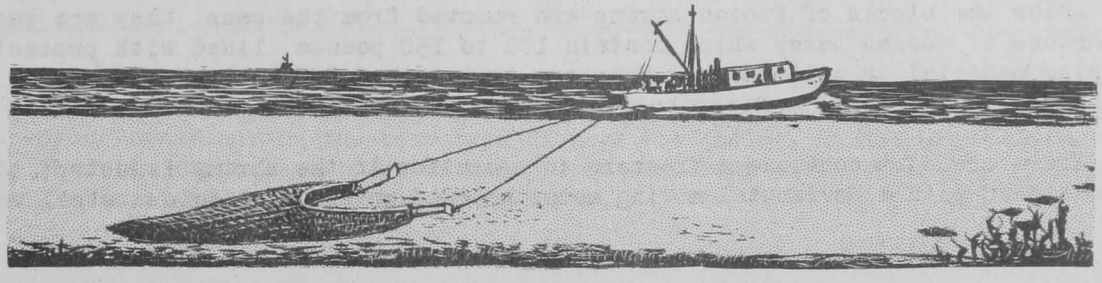
Shrimp are one of the most popular of all seafood products available to the consuming public. Due to this popularity, there is an almost universal demand for it during all months of the year. The requirements to supply the market are satisfied by the wide distribution of the fishing grounds and the success with which a good quality product can be preserved by freezing and canning. The largest catch is landed in the South Atlantic and Gulf area. Some States have closed seasons on shrimp fishing. They do not run concurrently, however, so shrimp are caught somewhere in the area throughout the year.

Practically all of the shrimp are captured by means of a trawl which is towed slowly along the ocean floor by the vessel. This trawl is a large funnel-shaped bag flattened at the top and with otter boards on the right and left sides which hold it open so that the shrimp can be entrapped. At intervals, depending upon the volume of shrimp in the bag of the trawl, it is hoisted aboard the vessel and emptied on the deck. The net is again thrown overboard for another drag while the crew of the vessel separate the shrimp from the various other species which also may have been caught in the trawl. As the shrimp are sorted, they are stored in bins in the hold of the vessel with alternating layers of ice and shrimp until the bin is full. Some crews remove the heads of the shrimp while at sea. This saves considerable space in the storage bins, since the tails of the shrimp are the only edible portion and therefore are the most valuable. When the shrimp are landed whole, the head portion is sent to a meal plant and manufactured into shrimp meal which is valuable as a poultry feed.

This first handling operation aboard the vessel is of great importance because of its effect on the market value of the shrimp when they are finally offered for sale. If permitted to lie on the deck of the vessel in the hot sun for several hours, shrimp deteriorate rapidly, and, as a result, the quality is reduced. It is of the utmost importance to pack shrimp in adequate ice at the earliest possible time whether they are to be sold fresh, cooked, canned, or frozen for future sale. Care should be exercised in the handling to be sure that the shrimp are not bruised, since a bruise causes more rapid deterioration by reason of enzyme and bacterial action.



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SHUCKING AND GRADING

Upon landing, the shrimp are washed thoroughly with fresh cold water to remove any foreign material. Some of the shrimp are shucked or shelled before freezing. The shucking operation consists of the removal of the shell from the tail portion of the shrimp. This is accomplished by gently squeezing the tail and loosening the shell at the same time. The cold water usually shrinks the meat so that the shell is separated except at a few points and a gentle squeeze will break it loose from those points where it may be attached to the shell.

When the shrimp are landed with heads on, the heads are removed after the washing operation. They are then graded by size according to the number required to make a pound. The sizes vary with the season and fishing area--as the season progresses the shrimp become larger and move from the inshore grounds to the deeper offshore grounds. The large or jumbo size is the most valuable commercially. In some markets, three grades are required, in others only two are common, while the Office of Price Administration set up seven grades for pricing purposes during the life of that organization.

DEVEINING THE SHRIMP

In some of the shrimp handling plants, the sand vein or intestine of the shrimp is removed by hand or mechanically after it has been shucked. In the latter method, the shrimp is fed into the machine in such a way that a rotating plow cuts under the vein and completely removes it. When left in, the vein often turns black and detracts from the appearance when marketed, since it is on the outer side of the tail portion of the shrimp.

PACKING FOR FREEZING

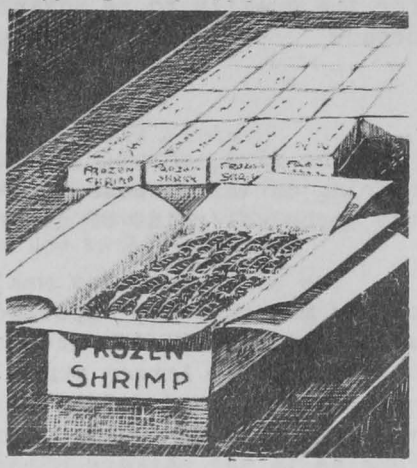
When the shrimp have been graded they are placed in one-, five-, or ten-pound waxed cartons for freezing. The one-pound size is marketed for family consumption, and the larger sizes go to hotels and restaurant trade. Some of these are fitted inside with a liner of some wrapping material which is further protection against oxidation and loss of moisture while the shrimp are in cold storage. In others, the cartons have several holes in the bottom approximately one-half inch in diameter. After the freezing is completed, the cartons are immersed in cold water and quickly removed. The frozen shrimp cause a glaze of ice to form on their surfaces giving them a protective coating, and the surplus water drains from the carton through the holes in the bottom.

Some plants freezing shrimp pack them in metal pans designed for this purpose. They may contain up to 30 pounds, but are usually of five- and ten-pound capacity. The shrimp are packed tightly in the pan and frozen after which the block is removed and glazed by dipping in cold water, or after the pan has been packed with shrimp the spaces between the shrimp are filled with cold water. The shrimp are then frozen in a block. This method reduces evaporation of water from the shrimp to a minimum during the freezing period.

After the blocks of frozen shrimp are removed from the pans, they are packed in cartons or wooden boxes which contain 100 to 150 pounds, lined with protective wrapping material or cellophane. They are then stored for future shipment or may be shipped immediately to distribution points throughout the country.

There are a few continuous freezers in operation in the shrimp industry; these are designed with a horizontal moving metal belt of woven or stainless steel wire.

The freshly washed shrimp drop onto the belt as they come from the washer and are carried through an insulated box fitted with freezer coils. The speed of the belt is so regulated that the shrimp freeze individually while passing through the low temperature of the box. At the discharge end, the frozen shrimp are weighed into cartons containing 30, 40, or 50 pounds and, in a few instances, 100 pounds. The cartons are lined with a protective material or bags fitting the carton. When the carton is filled with the necessary weight, it is sealed and placed in the storage room to await shipment.



FREEZING COOKED SHRIMP

Some of the peeled or shelled shrimp are cooked before freezing. The shrimp are cooked in kettles or vats fitted with steam coils and containing a brine solution. The strength of the solution varies between 5 to 10 percent salt brine, as does the time of cooking, in different establishments. A brine solution of 15 percent strength has been recommended for this purpose by some who have investigated this method of preparing shrimp for freezing, but unless the cooking time is reduced accordingly, deterioration in storage is more rapid. After cooking, the shrimp are quickly cooled and packed in various size cartons. The cartons of frozen cooked shrimp are either stored for future market or are immediately shipped for distribution.

Storing frozen cooked shrimp is a difficult problem since, when the storage period is prolonged, the shrimp become tough and fibrous and the quality definitely deteriorates. It is suggested that the cooking time be held to a minimum. This has been defined as only long enough to cause sufficient hardening of the meat to bring out the pink coloration and make it firm to handle. A time limit of not more than four minutes in boiling brine is suggested. Immediately after the cooked shrimp are removed from the brine, they should be immersed in cold running water so that the cooking or blanching will stop. If the brine bath is prepared in the early morning for use throughout the day and is kept at a boiling temperature throughout the period of operation, a considerable amount of water will evaporate. This will cause a constant increase in the brine strength during the day. As a result, those shrimp cooked in the early morning will be of a different quality than those cooked just before operations have ceased for the day. This can be remedied by checking the brine strength with a salinometer at hourly intervals during the day and adding sufficient water to compensate for the water lost through evaporation.

Table 1 - Salinometer Values for Mixtures of Salt and Water

Salinometer reading	Salt, lb.	Water lb.	Salinometer reading	Salt, lb.	Water lb.
100	26.3	73.7	50	13.3	86.7
90	23.7	76.3	40	10.7	89.3
80	21.1	78.9	30	8.1	91.9
70	18.5	81.5	20	5.5	94.5
60	15.9	84.1	10	2.6	97.4

After cooling sufficiently, they can be packed in the various type packages and either placed in a cooler or immediately in the freezer. A sealed moisture-vapor-proof container is the best type package for shrimp. If these are not available, then the shrimp should be either glazed in blocks or individually by dipping in cold water immediately after freezing.

The storage period for frozen cooked shrimp should not be longer than one month. When stored longer than this, the denaturization has progressed far enough for the quality to be adversely affected. They become tough and a loss of flavor occurs.

PACKAGING SUGGESTIONS

The size, shape, appearance, and material making up the container have a bearing on the success of freezing and storing shrimp. This is true not only from the technical point of deterioration but also from the marketing view.

The size container making up the package selected depends upon the portion of the market it is expected to reach. Hotels and restaurants seldom, if ever, are interested in the one-pound size package, while the homemaker will probably not consider a larger size. In any case, it is advisable for the packer to select a carton of just sufficient size to contain the exact quantity of shrimp with a minimum of space remaining not filled in the package. If considerable air space remains in the package after it is filled, there will be a transfer of moisture from the contents to the inside surfaces of the package. This will result in freezer burn and the development of off odor and flavor of the shrimp in the package. The longer the storage period the greater will be the deterioration from this cause.

In selecting a shape for a package, it should be remembered that a long flat package will freeze quicker than a short thick one. This is a distinct advantage since it is desirable to freeze all of these products as rapidly as possible.

The material from which packages are made should be of a heavy enough grade so that the shape is retained during the handling process. Many of the cartons available are heavily coated on both sides with wax so that they are waterproof and will not lose their shape during the handling. Although the wax on the cartons makes them waterproof and gives them rigidity, it does not form an airtight package which will prevent moisture loss in cold-storage rooms. In order to obtain an airtight moisture-vapor-proof package, it is necessary to use a liner inside the carton or a tight bag of cellophane or some other wrapping material. It is also possible to wrap the container in moisture-vapor-proof material and seal it, this is known as an overwrap and can be made moisture-tight by sealing. A package which will otherwise lose moisture can be made moisture-tight by this procedure.

The appearance of a packaged food has considerable effect upon its retail sales appeal. If a package is neat, clean, and attractive, it is more often purchased when on display in a retail store than one which does not impress the homemaker. This should be kept in mind when preparing any packaged seafood for sale.

There is little available information dealing with the efficiency of freezing in the various types of freezers. It has been reported that in a plate-type froster where the packages are in contact with refrigerated surfaces on two sides, freezing takes place in a period of approximately two hours when the temperature of the plates is -40° F. This is a relatively short time as compared to the cold blast at the same temperature, which requires from six to eight hours to freeze the same weight of shrimp.