

How to Get More Money for Your Catch

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Top quality extremely fresh looking fish will be sold at high prices immediately after being landed. Any boat offering this type of catch on a regular basis will build up an excellent reputation and attract the most demanding and affluent customers. All captains can achieve these results with careful handling of the product and the help of a simple inexpensive refrigeration system.

The deterioration process starts as soon as the fish is killed and each subsequent handling accelerates this action. Bacteria are present in any living fish. Their level varies depending on location, temperature and depth. Bottom species have the most inherent bacteria. Normal bacterial fauna will not harm healthy living fish, but, as soon as death occurs, they will begin to multiply, destroying the tissue and eventually affecting the quality of the product. The growth of bacteria will vary according to the temperature of the fish. At 85°F, under ideal conditions, one bacterium will multiply to over 64 million bacteria in a period of 8 hours. Ideal conditions for bacteria growth include food, water and proper temperature. Enzymatic action is also of importance and can be reduced by freezing. Oxydative action is another factor which gets worse at high temperatures.

To combat these processes, fishermen must avoid leaving the dead fish on the hook of the line, in the net or trap for long periods of time. Exposure on deck should be avoided as much as possible.

Bacteria are also present on deck, fishing equipment, clothing and in the fish hold. Cleanliness is very important. Decks and gear must be washed in between catches, and the fish hold after each trip. The quality of the lining of the fish storage hold is also important and a smooth fibreglassed surface is best.

It is useful to have a roof over the deck, providing needed shade when catch is cleaned and gutted. A chilled water tank with two compartments is also recommended on deck. One tank will be used to store the product until cleaning time, the other one to keep it until it is possible to transfer it to the main fish hold or to freeze it. Water temperatures of 32 to 35°F are adequate.

On a small boat a water chiller system will cost less than \$3000, not including the installation. The installation costs vary according to the type of boats, engines and tanks. Tanks can be very well built at a low cost, using sheets of polyurethane foam, 4 inches thick, and covering them with fibreglass.

The compressor for the refrigeration can be belt driven directly from the main engine. When not used for chilling fish the tanks can be cooled down, letting a few inches of ice build

up around the evaporator coil to store cooling capacity. A pump or an agitator can be added to increase the heat exchange. It is necessary to change the water frequently in order to avoid bacteria build-up.

The same type of tanks can be used in the fish hold for product storage. Shrimp are being kept for up to 16 days in this manner. In this case water must be changed every 2 to 3 days. One extra tank should be kept only to pre-cool the water needed for the storage tanks. The quality of shrimp kept this way will be better than that of those preserved on ice but inferior to properly frozen shrimp. Some fish species should not be subjected to this treatment as it adds too much salt to the product.

Seafood can also be stored on ice in an insulated fish hold. The quality of the ice should be carefully checked as ice made with polluted water will only add to the bacterial contamination. It should be taken into account that in many countries ice is expensive and often hard to come by and that ice making equipment often breaks down under demand and so forth.

When fishing is not very good, the length of the trip will, nevertheless, be limited by the period of time over which the ice will last. Ice, because of its weight, will also add to the boat's fuel consumption, therefore increasing costs. This problem can be greatly diminished by the use of a good ice maintenance system with evaporator-blower or holding plates. Less ice will be needed at the beginning of each trip and it will last longer, thus providing fishermen with some precious extra days of fishing. In this case, again a compressor driven by the main engine can be used or, on larger boats, it can be driven by an auxiliary engine.

The use of a blower type evaporator may remove too much moisture from the fish hold. Holding plates contain a eutectic solution which will freeze during the refrigeration cycle and hold the temperature for 8 to 10 hours. This allows fishermen to shut off their engine when not working without losing ice or damaging the catch. On short trips, holding plates can replace ice altogether without drying out the product. However, on longer trips ice is still necessary to keep moisture, and to avoid hot spots in a big pile of fish or against the hull. But even with that taken into account, holding plates still are economical.

One of the best solutions is to spray the fish with chilled sea water. Without adding any salt, the water can be chilled to 28-29°F and sprayed on the fish. In this way the catch is kept at a lower temperature than with fresh water ice. The boat will no longer have to wait in line for ice in the port or to come back before its hold is full. The trip to the fishing grounds can be made faster and with a lower fuel consumption. The refrigeration equipment will be started only when fishing begins.

In most cases spray systems are driven by a small auxiliary engine. They can be directly powered by the main engine, but this presents some inconvenience. The output of these systems is directly related to the speed at which the engine is running.

When fishing, the refrigeration load is at its maximum, but the output of the system would be at its minimum because of low R.P.M. on the engine.

Equipment hydraulically driven by a variable volume pump will accomplish an excellent job if fitted with a load censor which will adjust the output of the pumps according to the load. The hydraulic pump also can be driven by the main engine or by an auxiliary one. If the main engine is used, it must be kept running even while at the dock waiting to unload. With an auxiliary engine, fuel can be saved since the main engine can be turned off without affecting the temperature of the fish hold.

In some installations the hydraulic pump on the main engine, for the fishing gear, is interconnected to the hydraulic pump on the auxiliary engine. This creates a back up system in case of breakdown of the auxiliary. It can also be energy saving since some of the fishing gear can be used without having the main engine running.

For vessels with generators it is, of course, possible to install an electrically powered system.

An evaporator blower, as previously mentioned, is not a good solution for keeping fish, especially when no ice is used. The air circulation and the blower will remove a lot of moisture from the fish and cause it to lose weight. The look of the product will also be affected and, as a result, the value of the catch could be greatly diminished.

Freezing, when done correctly, is obviously a good method of preserving seafood. It must be done at a high speed. The quicker the freezing process, the better the final quality will be. My time allowance makes it impossible for me to go into the details of freezing aboard a vessel. I will limit myself to enumerating the different methods most commonly used: (1) Air blast - a powerful evaporator blasts frigid air (-20 to -60°F) on the fish, (2) Brine tanks - where fish are dipped at temperatures of 0 to -10°F , (3) Brine spray - for larger fish, and (4) Contact plates and plates with blower - used especially for fillets at temperatures of -20 to -30°F . To avoid freezer burn (dehydration), packaging, bagging or glazing is necessary.

Selection of Refrigeration Equipment.--It is my company policy to sit down with each customer and discuss his individual needs in order to design a system that will be appropriately suited to his own type of operation. Many factors must be taken into account when choosing a system; among these some of the most important are: (1) Whether chilling only is wanted or is freezing desired, (2) Amount of fish caught daily, (3) The size of the vessel and the type of fishing whether it is trawling, longliner, seining, trapping, or other, (4) Volume of the fish hold with the thickness and type of its insulation, (5) The length of the fishing trip, (6) The zone where fishing is done, i.e., tropical, other, (7) Type of market where product will be sold.

Sizing of Selected Equipment: The heat load.--The dimensions of the fish hold and the thickness of the insulation will determine the heat gain through the hull and deck. A vapor barrier is

important to avoid moisture migration into the insulation. The type, location and size of the opening or door must be considered as well as the length of time it is kept open. The number of fan motors on the evaporators as well as the number of humans working in the hold has to be taken into account. The biggest heat load is obviously the quantity of fish to be refrigerated daily. If the product is to be cooled only, from 80 (26.7) to 28°F (-2.2°C), 40 BTU per pound are needed (or 22 Kcal per kg). More BTU will be required if the fish has been left out in the sun. When freezing is desired, 40 BTU are still needed to bring the temperature down to 28°F plus 101 BTU to freeze it and additional 20 BTU to bring it down to -20°F (-28.9°C).

Minus 20°F is a good temperature for short time storage. Longer periods of storage should be done at colder temperatures. In other words, a total of 161 BTU per pound or 89 Kcal per kg must be planned for. It is of the utmost importance to carefully estimate what may be the maximum load of fish caught. Exceeding the capacity of a system may cause a lot of fish to spoil.

The equipment must be manufactured especially for the marine environment and not be modified land based machinery. Otherwise, it will never work properly and will not last under the harsh marine conditions of salt water and air. The engine should be fresh water cooled and the brand should be chosen so that parts will be readily available in the area where the boat is based. The most commonly used brands are, Volvo, Kubota, Perkins and Peter for small engines and Mercedes, Caterpillar and GM for larger ones. In order to resist corrosion, only cupro nickel 90-10 water condensers should be used and the water pumps should be the best that can be found on the market. Each system is protected with a high pressure control and a thermostat. For water chillers, double thermostats are used to prevent freeze-up damage. One regulates the temperature, the other acts as a safety device in case of malfunction of the first one. All the electrical controls must be of marine grade. Anything of inferior quality will deteriorate rapidly due to almost instant corrosion of the mechanism.

I recommend the use of hydraulic motors on the refrigeration equipment, especially on evaporator blowers which are subjected to the high moisture content of the fish hold and to spray during clean up periods. Hydraulics are also the best solution for agitators and pumps. The life expectancy of hydraulic systems is much longer than that of electrical ones and their safety record is better. I am in favor of using an auxiliary engine and hydraulics to run the refrigeration equipment. These systems are strongly built but kept simple enough so that maintenance is at a minimum and service is easy. When a system is entirely electric it depends on the generator, wiring, circuit breakers, relays and motors which generally are not at their best on a fishing boat, especially a small one.

No matter what equipment is decided upon in the end a buyer should always ensure that it is built with standard off the shelf parts for easy repairs in the future.

The advantages of having a refrigeration system are not limited to the better quality of the catch. A refrigeration system also brings a greater freedom, independence from the ice

plant and it gives access to better, less frequented fishing grounds. Fishing no longer has to be limited to areas near the market location. There are still some countries in this world where the lack of refrigeration is responsible for the loss of huge quantities of seafood. Do not waste this sorely needed source of protein: refrigerate.

Today, I have only briefly described the refrigeration needs and some solutions for small and medium size boats. For those of you who want more details or who require information on systems for larger vessels, I will be available; you may write my office and we will be glad to help you select a system suited to your needs.