Seafood Processing

Prepared by: Qurah-tu-Ain

Fish Processing

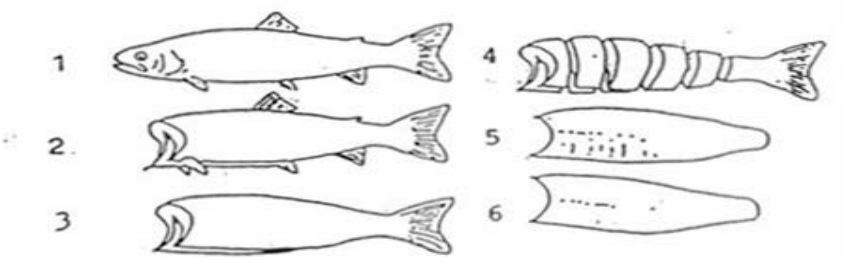
Fish:

The term ‘fish’ includes all fresh or saltwater finfish, molluscan shellfish, crustaceans, and other forms of aquatic animal life.

Handling of Fish:

After fishing, fish should be sorted and only those in good condition, healthy and not damaged be destined for sale as live fish. Fish so classified is first conditioned in water of appropriate quality. The conditioning process reduces stress, inhibits metabolism and at the same time food remains are removed from the alimentary ducts and the oxygen demand reduced. During the conditioning process fish is not fed which further inhibits metabolism and also limits the excretion of ammonia and carbon dioxide. In the short conditioning process 1 m^3 of water is sufficient for 50-60 kg of carp, 30-40 kg of pike, 20-25 kg of trout or pike-perch. The amount of oxygen dissolved in water depends on water temperature which should be rather low. But for stenothermal species such as carp water temperature should be not less than 10-12°C in summer and 5-6°C in spring and autumn. Optimal temperature for conditioning and transportation of trout is 5-6°C in summer and 3-5°C in spring. During winter fish tolerates temperatures of 1-2°C.

Nowadays, special tanks with aeration system and often with cooling and filtering systems are used for transportation of live fish. In simple solutions water is cooled by ice. Cooling is especially important during summer and in transportation over long distances. If all parameters, i.e., temperature, oxygenation, are properly maintained, and when the temperature does not exceed 10° C, the weight loss varies from 1 to 6%, and about 10% of carp and 20% of trout die during a six-day transportation in winter. At present, large valuable fish species are transported via air in which case they are placed in big plastic bags with aeration system.



Major forms of preprocessed fish:

1 - whole fish,
2 - gutted fish without head,
3 - gutted fish without head and fins,
4 - sliced whole fish after deheading and evisceration,
5 - fillet with ribs, and
6 - fillet without ribs, with or without the skin.

The products of preliminary processing can be sold or further processed to obtain value added products. In freshwater fish processing, particularly species such as perch, pike-perch and the cyprinids, the processing steps described above are executed manually with a wide variety of knives. Efficient preparation of fish is important when top quality, maximum yield and highest possible profits are to be achieved. This is important when fish is to be exported. Efficient fish preparation is a skill, only be acquired with practice. Several perfectly acceptable methods for cutting any fish exist; they may often give the same yield and similar end-products. In the future, the level of mechanization of fish processing in small processing plants will increase due to the constant pressure to reduce production costs and improve economic performance. The present level of mechanization is low which results from the overall limited production, seasonal availability of the raw product and lack of inexpensive, efficient mechanical equipment adaptable for processing of various fish species.

Stunning of Fish:

In many freshwater species the method of stunning is critical for final product quality because prolonged agony of fish causes production of undesired substances in the tissue. Oxygen deficiency in blood and muscle tissue results in accumulation of lactic acid and other reduced products of catabolic processes and consequently in a paralysis of the neural system. Red spots appear on the surface of the skin and in the muscle tissue near the backbone; these reduce quality.

Stunning of freshly caught fish or fish delivered live to a processing plant is best done with an electric current. First, the fish are placed in a tank of water and an electric current is then passed through the water to stun or kill the fish. Live fish are also slaughtered by cutting the aorta and bleeding to death when technological or ritual reasons require the removal of blood from the tissue before further processing.

Grading:

The processing sequence starts from grading the fish by species and size. Sorting by species or on the basis of freshness and physical damage are still manual processes, but grading of fish by size is easily done with mechanical equipment. Mechanical graders yield better sorting precision for fish before or after rigor mortis than for fish in a state of rigor mortis.

Size grading is very important for fish processing (i.e., smoking, freezing, heat treatment, salting, etc.) as well as for marketing. Automated sorters are rarely used in small plants processing freshwater fish because the raw product is usually already sorted on delivery and because of their high costs.

Automated grading is 6-10 times more efficient than manual grading. The sorting speed of different graders varies and depends on the type of device and size of fish sorted. Sorting capacity is 1-15 t/hour, and usually into three size groups.

Removal of Slime:

Slime accumulating on the skin surface of dying fish is a protection mechanism against harmful conditions. In some freshwater species slime constitutes 2-3% of body weight. Slime excretion stops before rigor mortis. Slime creates a perfect environment for micro-organism growth and should be removed by thorough washing. Eel, trout and carp require special care with regard to slime removal. Even small amounts of slime, which frequently remain after manual cleaning, result in visible.

Scaling:

Many freshwater species are routinely scaled; this is extremely labour-intensive when done manually. Some sources estimate that manual scaling of larger animals requires almost 50% of the total time necessary to produce headed and gutted fish without fins. Fish destined for skinning and filleting or to be smoked or minced in mincing/deboning separator is not scaled. Tools used for manual scaling are shown in Figure 3.6. Tools are moved over the body of fish from tail fin towards the head, pulling out the scales.

Washing:

Washing is intended primarily to clean the fish and to remove accumulated bacteria. The effectiveness of the washing procedure depends, inter alia, on the kinetic energy of the water stream, ratio of fish volume to water volume and on the water quality. A proper fish:water volume ratio for achieving the desired level of cleanliness is 1:1, however, in practice more water is usually used (twofold). Washing of gutted and headed fish should be done on termination of the processing operation. To improve the effectiveness of the cleaning procedure, various mechanized scrubbing devices are utilized which can remove up to 90% of the initial bacterial contamination. Potable water is used for washing in freshwater fish processing plants.

De-Heading:

The head constitutes 10-20% of the total fish weight and it is cut off as an inedible part. Although many mechanized de-heading machines had been developed for processing marine fish, freshwater fish are usually de-headed manually. The main reason is the lack of inexpensive equipment offering minimal tissue loss during this procedure.

A cut around the operculum, a so-called round cut, results in lowest meat loss. This technique is 4-5% more efficient than the straight cut commonly used in mechanized systems. The contoured cut, which runs perpendicular to the fish's backbone and then at an angle of 45^{o} is also advantageous. This particular de-heading technique is used when fillet, mainly boneless and skinned, is the final product. The head is removed with the pectoral bones and fins.

Gutting:

The purpose of gutting is to remove those fish body parts most likely to reduce product quality, as well as to remove gonads and sometimes the swim bladder. Evisceration of freshwater fish is labour-intensive and usually performed by hand. Gutting consists of cutting down the belly (fish may be de-headed or not), removal of internal organs, and, optionally, cleaning the body cavity of the peritoneum, kidney tissue and blood. Fish is cut longitudinally up to the anal opening, and special care is taken to avoid cutting the gall bladder. This procedure is performed on a table made of special material which is hard, easy to wash and does not absorb fluids. The table surface should be frequently rinsed and periodically disinfected.

Cutting away the Fins:

Manually cutting away the fins with either a knife, special mechanized scissors or rotating disc knives, is a labour-intensive and strenuous operation when handling larger fish. This operation is most frequently done after gutting during the production of de-headed whole fish and fish steaks. An automated device consisting of the rotating disc knives with a slit cutting edge, powered by electric motor facilitates and speeds up the fin removal procedure. The knife slot has a horizontal opening through which the dorsal and ventral fins are passed manually and cut out.

Slicing of whole Fish into Steaks:

Slicing of de-headed whole fish into steaks with a cut perpendicular to the animal's backbone is a very common fish processing method. The high technological efficiency of this processing technique compared to filleting and automated cutting into pieces, makes it popular with retail markets and the canning industry. The fish pieces obtained average 2.5 to 4.5 cm thick.

Smaller and medium size fish are cut manually in concave basins which have slots evenly spaced to facilitate slicing into steaks of equal thickness. A knife or a band saw is used to slice the fish. Sometimes a band saw is used to remove the head and cut the body into two parts, one retaining the backbone. Larger fish, particularly cyprinids, which have a massive and more solid backbone, need slicing mechanically. Numerous designs of such machines exist

Filleting:

A fillet which is a piece of meat consisting of the dorsal and abdominal muscles has been a most sought-after fish product in the retail market. Filleting efficiency depends upon fish species, its sex, size and nutritional condition. Manual filleting is very labour-intensive and largely depends on the skills of the workers. However, filleting of freshwater fish is not as widely applied as for marine fish.

Filleting machines for processing marine fish are quite costly and are not suitable for freshwater species; in the case of trout, for example, expensive multi-function devices have been designed which are not used in small processing plants.

Some fish markets sell fillets of carp, perch, pike-perch and smoked single or block fillet of trout. Besides fillets, other forms are processed, e.g., block fillet retaining some bones (boned fillet) and the simplest type of processed carp which is the de-headed whole fish cut into two halves, one retaining the backbone. Restaurants and fish stores use simple tools to streamline the

manual longitudinal cutting of fish. The same result is obtained by using a filleting device with a single rotating disc knife and two conveyor belts.

Skinning:

Only recently has skinning of freshwater fish fillets been introduced into processing plants. Manual fillet skinning is labour-intensive and difficult; a sharp knife and flat board made of metal or plastic are needed. The fillet is placed on the board skin-down, the meat is grasped in the left hand and the knife is drawn between the skin and meat.

The simplest and most inexpensive automated tool for skinning of fillet with or without scales has been in use since 1992, and it can be attached to the processing table. This tool consists of an oscillating knife powered with a small electric motor and a system of compression springs operated with a foot pedal. Water is not needed to operate this device. One end of the fillet is placed in a slit between the knife and compression element and the tip grasped manually in a wrench which allows the skin to be pulled off the meat from under the oscillating knife.

Meat-bone Separation:

In recent years a new trend has emerged to effectively process raw fish products which resulted in production of minced meat separated from inedible parts, such as bones, skin and scales. During filleting a considerable amount of meat is usually left along the ribs and backbone (30-50%). The carcasses are a source of minced meat. Minced meat is also produced from less valuable fish species after de-heading, their body cavities carefully cleaned and kidney tissue removed. Meat is separated from the bones, skin and scales, in automated devices called separators. In the separator meat is squeezed through holes into the cylinder under pressure applied by a conveyor belt partially encircling the cylinder (about 25% of the cylinder's perimeter). The cylinder rotates slightly faster than the conveyor. The openings in the cylinder are usually 3-7 mm in diameter. For processing of freshwater fish, the holes are 4 and 5 mm in diameter. The smaller the holes, the stronger the grinding action. Pressure applied by the conveyor to the cylinder can be regulated depending on the type and size of the raw product and on the whole diameter.

Crabs Processing

1. **Removing Legs and Claws:**

   Do this by holding the body in one hand and twist the class of the off with your other hand. Sometimes crab meat comes out of the legs and swimmer fin; you can eat that right up

2. **Throw out the Legs (Fins):** An explanation of how to eat the claws comes later.

3. **Shell and the Body of the Crab:** Flip the crab's body on its back to open the apron. The apron looks like a tab or a flap. Discard the apron; we are not going to eat that.

4. **Grab the Top Part and Bottom Part in Each Hand:**

   Apply pressure gently to separate the shells. Be careful when taking the top shell off. Throw out the top shell. Ensure you clean out the inside of the crab and remove the gills, lungs, and digestive organs.

5. **Break the Bottom Half in Two Halves:**

   Take either halves and cut it in half again. You can do this using your hands or knife. Press your palm down to break the chambers and pull apart if you decide to use your hands. Eat! Any meat that is firm and white is edible. You can use your fingers or thing metal seafood picks to pull the meat out.

6. **Pick off the Chunks of Meat in the Body**

7. **Crack the Claws:**

   Sometimes people tend to forget about the claws because they think there is not anything in them. However, there is very juicy and sweet meat in these legs that you can use for soups or crab cakes. To begin, take the hinged seafood cracker and hit the claws with a crab mallet, or use your knife. The easiest way to open a claw. Take your knife and lay it with the sharp side down on the middle of the red side of the claw. Use the crab mallet to gently hit the knife until it is halfway through the claw. Lastly, swivel the knife to the side. The claw will open and make it much easier to grab the crabmeat. Once you have snapped the shell open, eat the meat. Make sure you avoid the cartilage.


1


2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4


5


6

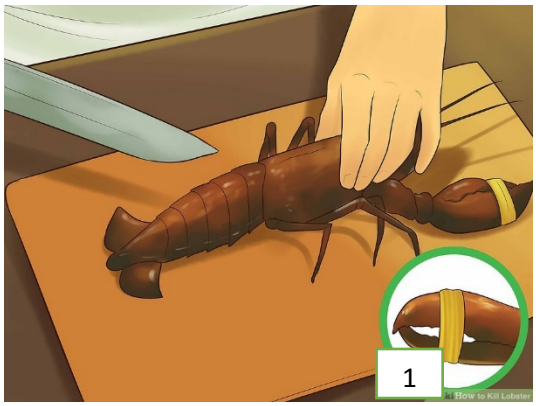
Lobsters Processing

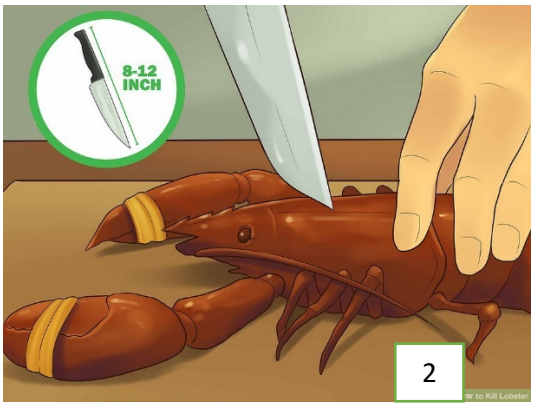
1. **Cutting Lobster's Head**
2. **Put the Lobster on a Cutting Board**

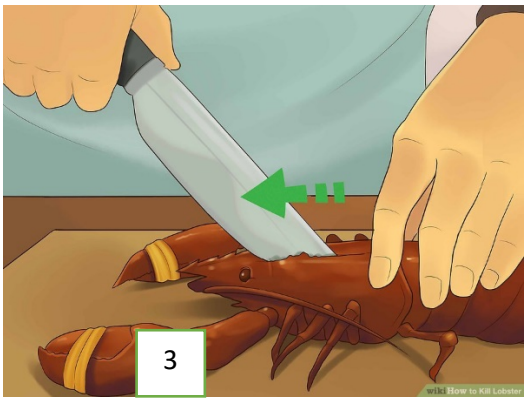
   You'll be using a large knife to kill the lobster, so pick up the lobster by its back and set the lobster on a sturdy cutting board. Also place a baking sheet underneath the cutting board so that any liquids that come out of the lobster don't cause a mess. Although the lobster's movements will likely be minimal, it can still potentially hurt you with its claws. Keep rubber bands wrapped around the lobster's claws while you handle it to ensure your safety.
3. **Place the Tip of a Large Chef's Knife Right Behind the Lobster's Eyes:**

   Get a large, sharp chef's knife that's 8-12 inches (20.3-30.5 cm) long. Locate the crack of the lobster's head, which should be centered between the eyes and about an inch or two (2.5-5 cm) behind them. Keep the lobster still by holding it firmly with your non dominant hand. Then place the tip of your knife on this spot with the blade facing the front of the head.
4. **Slice down through the Lobster's Head:**

   Make a strong, swift cut with the knife between the eyes and through the entire head. This will cut off the lobster's central nervous system, ensuring that it doesn't feel pain. Don't be alarmed if the lobster's legs, tail, and/or claws continue to move after you've killed the lobster. These are simply post mortem muscle twitches, which happen after death as a result of chemicals releasing from the lobster's nerve endings.







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