Hazard Control and Harvest Technology

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All food items produced and harvested go for human consumption. The case of seafood harvested is also not different. With the advent of development, the food consumption pattern is also undergoing drastic changes. The pattern of raw material purchase at household level is fast giving way to ready to cook and ready to eat products. Many raw food materials are converted in large scale into ready to eat and ready to cook items. Globalization of food production and processing is bringing in yet another dimension for food production and use. Quality and safety of the food is an important criterion that decides the entry of any food material in the world market. To achieve safety and quality of mass-produced food items, several quality assurance systems were developed. One of the most widely used quality assurance system for food safety and quality is HACCP (Hazard Analysis Critical Control Points). Many developed countries and the FAO/WHO have already accepted HACCP as a mandatory requirement for all activities of food harvesting, processing and marketing. Out of compulsion from importing countries we have also implemented HACCP in Indian sea food Industry.

Hazard Analysis Critical Control Point is a safety and quality assurance system which has built in provisions for ensuring safety of all food products right from cultivation, harvest, processing and storage/marketing. As far as seafood industry in India is concerned processing, storage & marketing is well taken care of. However the culture and harvest aspect is yet to get the due attention from the safety point of view. The recent rejection of shrimp consignments from India on account of the presence of antibacterial substances chloramphenicol and nitrofuran residues is an indication of the total negligence of safety aspect by farmers involved in aquaculture/mariculture. As culture is not a topic of interest in this Winter School on Fishing Technology there is no scope for detailed discussion on culture practices for safety.

Since this Winter School lays emphasis on harvest technology, it is worthwhile to look into the HACCP criteria, which are relevant during fishing/harvest operation. To have a clear idea about the hazards/safety risks arising out of raw material or the harvested fish/shell fish, it is essential to look into the possible hazards associated with fish/shell fish. The most common hazards encountered in harvested raw materials are tested below.

i. Biotoxins.
ii. Toxic heavy metal residues like lead, cadmium and mercury.
iii. Sea Urchin spines in fish/shell fish.
iv. High Bacterial load and spoilage.
v. Occurrence of Public Health indicator organism and pathogens.

Biotoxins

Biotoxins are important from safety point of view are PSP and DSP. Paralytic Shell fish Poison(PSP) as the name indicates cause paralysis and in extreme cases death of man, where as Diarrhoeatic Shell fish Poison (DSP) produce diarrohoea in consumers. Both these toxins are of algal origin. The algae *Alexandrium caterulla, Dinophysis acuta* and related species are the culprits. During post monsoon summer day these algae multiply in certain locations in the sea. The algal blooms are characterized by red to brown coloured algal mass in sea water and it often moves with tide. Consequently these algal blooms are also known as red tide. Depending on the species these algae produce PSP (Saxitoxin) or DSP (Okadaic acid) toxin and the toxin containing algae will be distributed all through the water column. Filter feeding organisms like bivalves consume these algae in large quantities and accumulate the toxins as they are immune to these toxins. These toxins will remains in active form for 10 to 14 days in the body of the bivalves. During these days any organism feeding on the affected bivalves will be subjected to poisoning. However, certain predators like rays, crab and octopus which feed on these bivalves are reported to be immune to PSP and DSP toxins and at the same time retain the toxin.

In other words the algal blooms or red tide phenomenon indicates a safety risk as far as the fish and shell fish especially bivalves and bivalve eating fishes and shell fish of that area. So from food safety point of view areas prone to red tide shall be avoided for fishing. If any algal bloom occurs fishing in such areas shall be avoided for 14 days after the algal bloom disappears, as the toxins will remain active for a fortnight even after the algae dies out.

Toxic heavy metal residues

As a result of industrialization and various anthropogenic activities specific locations of large water bodies like lake, sea and oceans get polluted with various chemicals. Of these chemical pollutants, heavy metal residues and chlorinated pesticide residues are the most detrimental to food safety. Once these residues enter the body of fish/shell fish there is no mechanism to either detoxify or excrete them. Consequently with more and more exposure and ingestion of these residues their level in the fish and shellfish increase and often reach toxic levels. Consumption of such contaminated fish/shell fish can lead to various health risks. A classical example of such heavy metal residue poisoning is the ill famous “minamata disease”. Minamata disease arose as a result of eating mercury contaminated shellfish from Minamata Bay in Japan. The disease is characterized by body pain followed by paralysis and death of the affected individual. Later it was established that the disease was due to mercury poisoning the mercury coming from a land based factory effluent and the shellfish of the bay accumulated the metal in the form of highly toxic methyl mercury. On identification of the cause, the entire area was closed for fishing. A similar case of cadmium poisoning was reported from Goa is the eighties and the polluting industry namely a zinc smelting unit was closed to prevent pollution of the coastal waters of Goa.

Recently, there is an effort to conduct detailed study on the occurrence of toxic heavy metal and organo-chlorine residues in the marine ecosystem. The information so collected will be formulated into a GIS, which will tell us contaminated areas if any. There will also be suitable notification prohibiting fishing from such contaminated areas. The fishing crew shall refer to such GIS information as well as notifications and avoid fishing from notified areas, so that what is harvested is sure to be safe for human consumption.

Physical hazards in shrimp

The harvest of shrimp during monsoon season was found to contain sea urchin spines piercing into the edible tissue. This happens as a result of the pressure at the cod end where shrimp and juveniles of sea urchin are pressed together causing piercing and breaking of sea urchin spines into the shrimp tissue. Such spines in shrimp tissue are a cause for injury to the consumers and hence there is chance for rejection of such consignments.

The best technique to avoid such hazards is to avoid monsoon trawling. Now as a conservation measure many maritime states in India are implementing trawl ban during monsoon season, which takes care of this safety risk arising out trawling during monsoon.

High bacterial load and spoilage

Fish caught from even oceanic waters will be containing a characteristic microflora, which will be unique to the environment. However most often these bacteria will be non pathogenic but will be active spoilers. Whenever fish is live there is an active immune system, which will keep the bacteria under check. Once fish is dead the immune system will break down and bacteria get a free pass to enter the fish tissue, degrade its components and use it for bacterial multiplication. This bacterial activity will be optimum at temperatures of 25°C to 40°C. Quite often the fish landed on board is kept at ambient temperature especially in single day fishing operations. This will lead to active multiplication of bacteria and in fishes like tuna, mackerel etc. cause production of scombro toxin (histamine), which is a serious health risk. To avoid this safety risk it is essential that the fishing boat, whether for single day or multiday fishing shall have a insulated fish hold of sufficient capacity and sufficient ice so that the catch is chilled with ice in 1:1 proportion in the insulated fish hold. This will significantly reduce bacterial multiplication and spoilage as temperature of such chilled fish will be around 0°C to 4°C. For better results the fish coming on board the craft shall be immediately sorted on a clean stainless steel platform, washed with clean sea water (never use water from shore waters as it will be contaminated with pathogens and indicator organisms). In case of vessels operating for deep sea prawns blackening of catch is a serious problem. To overcome this use of sodium metabisulphite is advised. The crew of such vessels shall be trained in metabisulphite treatment. An ideal treatment shall be dipping the deep sea prawn immediately after catch in a 0.2 to 0.5% solution of sodium metabisulphite for one minute, followed by chilled storage of drained prawn in the fish hold.

Pathogens and public health indicator organisms

Fish caught from outer sea is always free from pathogens and indicator organisms. (*Vibrio parahaemolyticus* is an exception – as it is found in marine ecosystem also). However many a marine catch on inspection was found to contain pathogens and the indicator organisms. All these organisms are risk factors and often a cause for rejection by importing country causing huge loss to the exporter.

Occurrence of indicator organisms and pathogens in sea caught fish is a sure indication of poor hygiene and sanitation practice observed by the fishing crew. The following will ensure hygiene and sanitation on board the fishing craft.

- All workers shall be certified fit to handle food materials by a registered medical practitioner. The workers shall also undergo stool culture test to rule out healthy carrier condition and immunization against typhoid and cholera.

- The fish contact surfaces i.e. deck where catch is landed, fish hold, utensils, crates, workers hand etc. shall be cleaned with soap and brush, washing with clean sea water followed by sanitizing with clean sea water containing 20 ppm chlorine before the work starts as well as at the end of the day. These steps will effectively control possibility of contamination of the catch with pathogens and other public health indicator organisms from workers and fish contact surfaces.

If the above precautions can be taken for the vessel and by the crew the chance of safety and quality risks in the catch will be minimum and the products from such catch will be hazard free and safe for human consumption.