Live Fish Transportation: Technology assuring quality

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Introduction

Seafood is a major commodity in the food Industry with significant contributions in overseas market. It has also opened up new opportunity of exploring domestic market especially among the growing middle-class and the consuming population of high value food products. Among the different items exported from India, frozen fin fish and shrimp accounts for about 75% of the total volume of seafood exports. On account of its recognition with respect to its nutritional relevance, the global demand for this commodity has increased substantially urging an increase in its productivity by boosting aquaculture production. Simultaneously the relevance for an effective processing and marketing technology to deliver it to the customers in its prime quality assumes utmost significance.

Unlike other agri products, the major problem associated with the seafood preservation and its marketing include catch uncertainity, high perishability, bulkiness of material, high heterogeneity, high storage and transportation cost. In this scenario, more focus is required towards the development of newer supply chain models with effective management strategy. Different methods of processing and preservation of seafood guarantees quality and safety to different extent. Of this, one of the most obvious method that can be adopted is keeping them alive till it reaches the table. Marketing of fish in live condition not only attracts customers for its quality but also provide an important avenue for farmers to obtain high profit margins.

However, survival of fish is a major concern with respect to the live fish transportation. Fish are transported live for several purposes viz., re-stocking, live marketing, or delivered to process-ing plants for slaughter. This transportation stage is decisive due to the labor as well as cost involved and hence at most care is required to prevent the commodity loss on account of mortality or injury as it influences the profit margin. A number of internal as well as external factors need to be considered critically for improving the survival of fish during their transportation throughout the food chain. Stress associated with the live fishes is one of the greatest concerns affecting the health status as well as its survival during transportation and storage. Addressing this issue can effectively improve the survival rate and allied biochemical quality changes. Stress in these aquatic organisms include evident symptoms like colour variations, speedy respiration, behavioural changes like nervousness etc. On the other hand delicate, invisible effects include various changes in the blood of the fish that drastically reduce its capacity to tolerate variations in water quality. Careful handling practices coupled with thorough knowledge on the tolerancy conditions of fishes are mandatory for effectual transportation and storage protocol.

The quality criteria of customers are to be met in the target species for successful delivery of live commodity and hence the procedures prior to, during as well as after transportation play an important role in addressing the success of live-fish transports. Right from the harvest, measures need to be taken in proper handling of the subject so that stress can be avoided or reduced to a minimum.

Harvesting and holding of live fish: Fish is harvested either from capture environment or cultured farms for live transportation. Harvesting of fish/shell fish in the early morning or night hours is recommended as the ambient temperature is lower to avoid drastic temperature swings. Line fishing or trapping are the best capture techniques that can be adopted for harvesting fin fish as these are the

least damaging techniques, thus less stressful to the species. Nets with knotless mesh is always recommended for harvesting live fishes as they minimize the damage caused to skin and scales on account of smooth surface. Further the time period for which they are left in gear should be minimized to prevent damage. Fish should be removed carefully from the gear to reduce the damage or stress caused to the organism. Physical damage to skin, scales etc may be unappealing and further can result in infection affecting the value of fish. On harvesting, air exposure should be kept to absolute minimum as it may lead to drying out. Further fish should be handled gently while transferring from net to captive tanks. Practices like dropping or throwing of fish will kill or injure them. Hand picking viz., grabbing the body or the tail is not generally recommended as the force applied to handle them may often severely damage the fish.

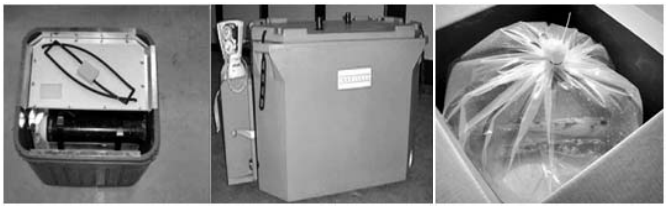
On harvesting, the fish should be held in proper conditions to minimize stress and maximize survival. In this regard, an elementary prerequisite for captive fish is the ample supply of clean oxygenated water. This is essential as the captured fish will be highly stressed affecting its respiration rates, and may cause secretions like mucous as well as excreta affecting the water quality of the holding tank. Lowering of temperature helps to reduce the metabolic rate and brings about a state of lethargy making handling easier and less stress to the species. Hence transferring the species to a well aerated tank with lower temperature is desirable. For this, the temperature is lowered slowly from the ambient temperature to a maximum of 10^{o}C lower, over a period of about 30 minutes. This is generally accomplished by adding ice directly into fresh water or ice sealed in plastic bags, if holding tank contains seawater so as to avoid dilution of seawater. Hibernation technique is widely adopted technique in transporting marine organisms viz., prawns and lobsters in non-aquatic condition. Employing coffs, which are fully enclosed cages generally ranging from 1 -3 m^3 to hold fish immediately after capture, is also practiced for holding harvested fish. However the drawback to such coffs is its steel mesh material which may cause considerable damage to the fish. As an alternative, aquaculture nets made from soft knotless netting material attached to a solid frame can be used for coff construction.

Live fish are commonly held and starved for a period of time, generally 24 to 48 hours prior to packing and transport, a procedure known as 'purging'. The objective of starving is to reduce the water quality degradation on account of faecal matter excreted by the organisms which further leads to bacterial decomposition and associated ammonia accumulation.

Transportation of live fish: For effective live fish transportation, in-depth understanding on the optimal environmental condition for minimal stress and maximum survival is required. When the fish leaves its natural environment, it must be in a self sustainable environment that supplies necessary vital needs such as optimal temperature, oxygen etc.

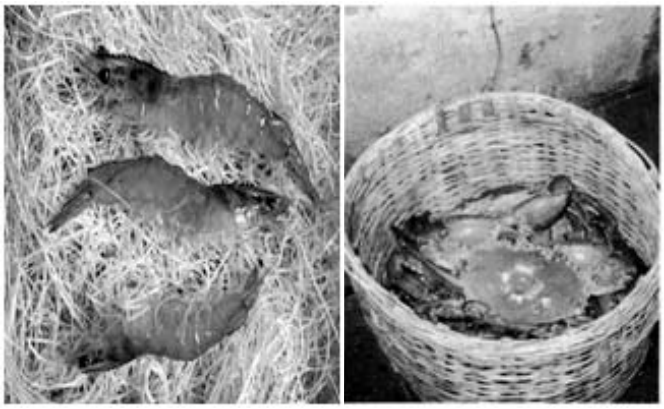
However modifications in existing environmental conditions during transportation viz., waterless system, may require additional care and adaptation procedures. In general, the methods used for fish transportation must ensure marketing of high-quality fish in a safe mode, satisfying all state and federal regulations.

Commonly, there are three transport systems for live fish/shell fish: the closed water system where fish is transported in a self sustained closed bag or container with water; the open system or tank method wherein water-filled containers of different types with requirements for survival supplied continuously from outside sources are employed; and the modified waterless system without any water, except for being kept damped by using pre-chilled sawdust or wood shavings. The choice of this transportation system depends on the quality and quantity of the transported species, transportation facility available, transportation duration, size of market etc.



Closed transportation System

Open transportation System



Waterless transportation System

Status of live fish market

Globally live fish trade is well established, mainly in most of the South-east Asian and Southern pacific regions. In India, initially live fish transportation was confined to the North-eastern states but on account of the augmented demand for live seafood commodity, currently there is a highly lucrative market for live fish. However in the Indian scenario, live trade is mostly limited to carps as well as air breathing hardy fishes like cat fishes. Practices of transporting live fish include the use of primitive techniques like transportation in traditional baskets made of bamboo or coconut coir lined with leaves to large plastic containers or aluminium vessels for short distance transportation. Insulated or non-insulated containers with ice or cooling gels to large trucks are also employed for local transportation. Hauling trucks with more sophisticated facilities such as assembly for filtration, oxygen generation, refrigeration and reticulation of water are used for large scale operations involving long distance transport of high value seafoods but are very expensive. All these are open transportation systems wherein facilities for aeration, recirculation etc. are supplied from external sources. Globally, a few companies are involved in trade with patented devices employing self sustained closed live transportation systems with inbuilt oxygen supply, biological filtration and refrigeration units viz., Fish Pac (Australia), Aquahort Ltd (New Zealand), Austmarine Mfg. Pty Ltd. (Australia), Spirex Aquatec Ltd (UK), etc. However cost is a major disadvantage with these systems which generally range from 2 to 10 lakhs and more depending on the design advancements.

Future scope

Studies on live fish transportation have suggested the relevance of considering variations in osmoregulatory and water-quality sensitivity among different fishes viz., marine as well as fresh water species, during the designing of live transportation protocol. The individual diverseness within species is also accountable and depends various factors like health status, life stage etc. Hence the procedures prior to, during as well as after transportation play an important role in addressing the success of live-fish transports. Intense studies need to be carried out in this angle for effective transportation protocols. Further in India, a customized design of live fish container to facilitate the transportation of a variety of fishes under economic mode is presently not available. Hence research and development need to be focused towards this aspect to bring about a compact device considering the economic factors to meet the demand of seafood consumers in different sectors of the society. Filling this gap can facilitate the availability of fresh and quality fish to the customers in different parts of the Country. Intense research is being carried out by ICAR-CIFT in this regard for the design and development of a model live fish transportation system.