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**TRANSPORTATION OF FISH: LIVE FISH &
SHELLFISH; TRANSPORTATION OF RAW FISH
TO LOCAL MARKET & PROCESSING CENTERS;
IMPROVEMENT NEEDED IN
TRANSPORTATION**



Introduction

- Transportation of fish to the consumers is one of the main concern for fisheries professionals. If consumers don't get good quality fish, the production will become meaningless.
- Supplying fish live to the consumer is probably the best way to ensure that the the fish he gets is absolutely fresh.
- Transportation of live fish though confined to the ornamental fisheries & fish seed, live table fish transportation is gaining its importance now-a-days with changing life-style of people.
- Frozen fish transportation is very critical as during transportation chances of quality degradation is most.

Factors affecting transportation of
live fish.....

Feed

- ▣ **Generally the fishes aren't fed during transportation** to avoid the accumulation of metabolic waste which will make high oxygen demand.
- ▣ **Generally feeding is stopped 24 hrs prior packaging & transport begins.** This is done to minimize the release of metabolites

Respiration

- In order to keep the fish in live condition, adequate amount of oxygen have to provide through aeration.
- As a result of respiration, CO_2 is produced which lead the fish in stress condition
- CO_2 gets dissolve in water & make it acidic which can be prevented by addition of some buffering agent or by using hard water.
- Accumulation of free CO_2 also hampers the respiration of fish. This can be solved by increasing O_2 concentration in the air or by replacing air with oxygen.
- Replacement of air with oxygen may increase the survival time of fish.

Accumulation of Metabolites

- Accumulation of metabolites is one of the major problem in live fish transportation & it can't be totally avoided. Degradation of these products increases oxygen demand.
- About half of the nitrogenous excretion of the fish consists of ammonia which is very much toxic to fish even in 0.5-1.0 ppm concentration.
- Sometimes ammonium hydroxide is produce which is very much toxic to fish.
- Discharge of metabolic waste may be controlled by lowering the metabolic rate of fish.
- Several chemical substance are used for absorption & removal of metabolic waste such as clinoptiolite or activated charcoal.
- Through selective ion exchange process NH_3 can be removed

Water Temperature

- For live fish transport, fish has to be packed in water at cold temperature as-
 - ❖ Metabolic activity decrease
 - ❖ Oxygen affinity of blood decreases when temperature increases.
 - ❖ Rate of oxygen dissolution is high.
- Before transportation, fishes have to be acclimatized to avoid cold shock specially for warm water fishes.
- Rapid temperature change of 5°C can lead to cold shock

Overexertion of fish

- Catching & subsequent hauling should be in such a way that the fish need not to struggle more as the more it struggle, more its quality will loose.
- Overexertion leads to lactic acid production which reduces oxygen carrying capacity of fish & sometime cause death.
- Over exhausted fish should'nt be allowed for transportation.

Use of Anesthetics

- The more the fish is in quiescence stage less will be its metabolic activity.
- Chloral Hydrate, Tertiary Methyl Alcohol, Methyl Parafynol are some of the anesthetic agent which are used in transportation of live fish.
- The anesthetic should **produce only a stage of sedation in fish & not beyond that.**

Conditioning

- Generally the environment in which live fish is transported is different from the natural environment from which it is caught.
- Immediate transfer of the fish to the transport medium will cause severe stress increasing the metabolic rate & fouling during transit.
- So the fish is subjected to conditioning to make them adapt for new environment.
- Conditioning is done in tanks filled with well-aerated water & at a constant temperature & pH close to transport condition

Use of Anti-foaming Agent

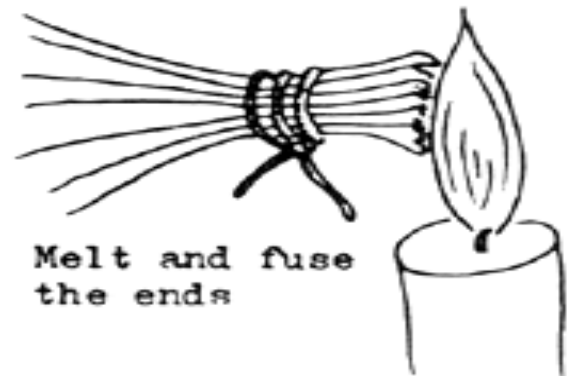
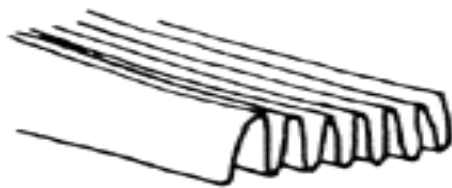
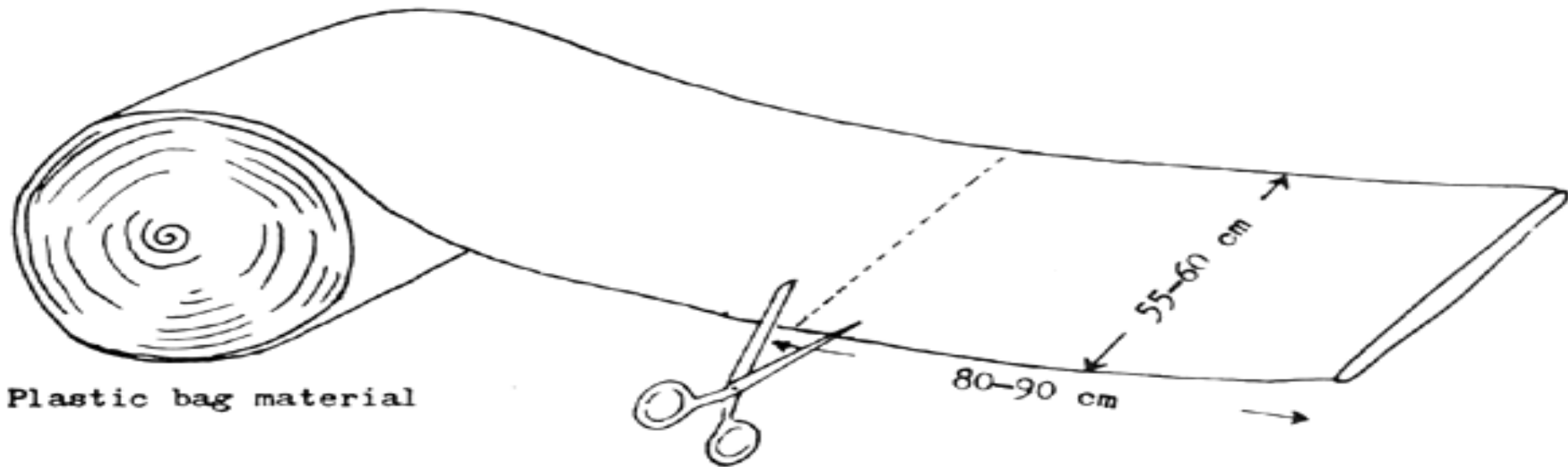
- Foam production has been experienced in the live fish transportation of fish.
- Thick foam develops from the mucous & organic matter will cover the water surface reducing the availability of oxygen. Thus create hamper in the respiration of the fish.
- This problem can be eliminated by using anti-foaming agent.

Method of Transportation of Live Fish.....

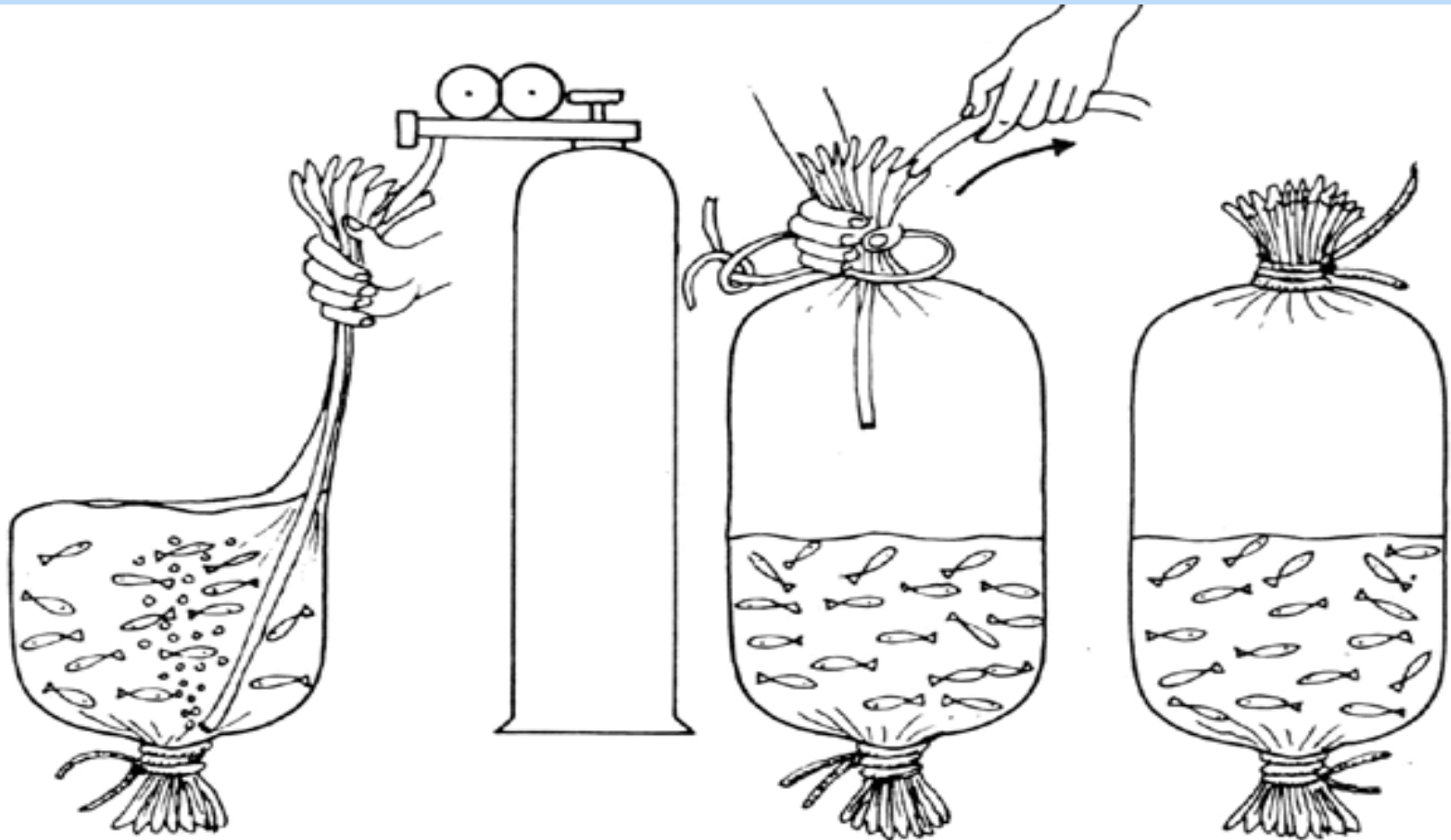
CLOSED SYSTEMS OF FISH TRANSPORT

- The closed systems are represented by polyethylene bags and other sealed transport units.
- They are used mainly for the transport of Ornamental fish & fry, fingerlings & Post-larvae of cultured fish.
- The transport of fry in polyethylene bags with oxygen is particularly widespread in the world, being used as a very effective method.

Procedure of closing the bottom end of a polyethylene sleeve



Procedure of filling the bag with water, stocking with the fish, displacing the air, introducing oxygen and closing the upper end (Woynarowich and Horváth, 1980)

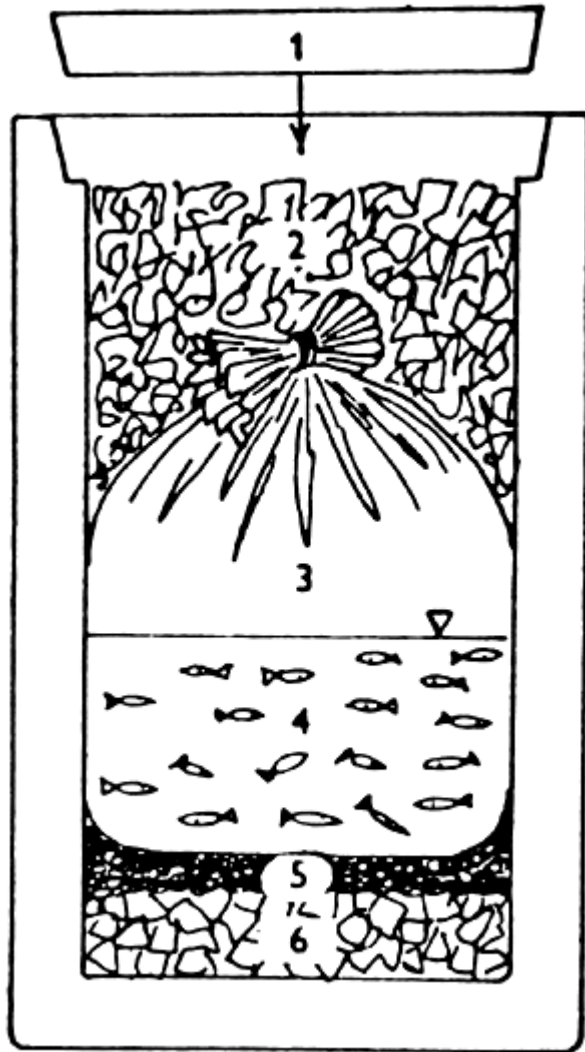


(4) Press out air from inside and bubble oxygen through the water

(5) Blow extra oxygen to inflate the bag, remove the pipe and tie the bag tightly

(6) Bag ready to be transported

Transport of a bag in styrofoam case (Vollmann-Schipper, 1975)



- ❖ 1 - lid,
- ❖ 2 - insulation filling,
- ❖ 3 - oxygen atmosphere,
- ❖ 4 - water with fish,
- ❖ 5 - insulation lining, e.g., foam rubber,
- ❖ 6 - ice

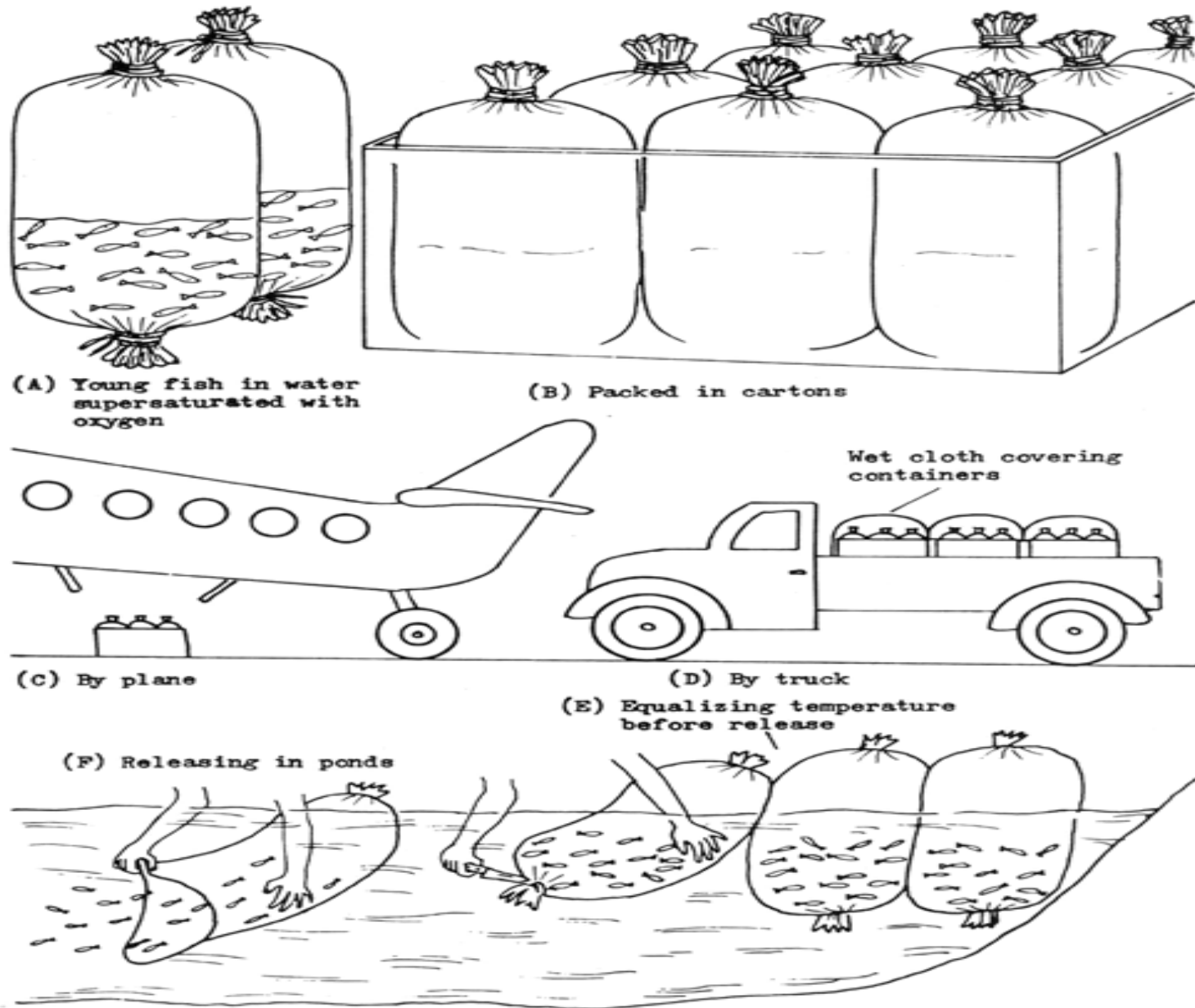


Fig: Transport of fish packed in plastic bags (Woynarowich and Horváth, 1980)

Advantage

- It substantially reduces the total volume and weight of transport water,
- It enables public transport to be used for fish-transport purposes,
- Makes it possible to prolong the transport time.
- It is economically advantageous.

Disadvantage

- Transport of table size fish is quite difficult.
- Packing material may get distorted.
- Availability of oxygen is limited.
- For long duration transport it is not suitable.

Tank method

- Method employed in bulk transport of live fish & involves shipping live fish in live well boats or tankers.
- Such units are equipped with circulation & aeration systems where water is aerated before feeding back to tank.
- Tanks are rectangular, constructed of aluminum, fiberglass or plywood covered with fiberglass. and equipped with insulated top doors for loading .
- Temperature of the tank is kept low to hold more fish in the tank.
- Average fish load is 200-250 kg/ 1000 liter of water whereas for short journey it can be even 450-500 kg/ 1000 liter of water

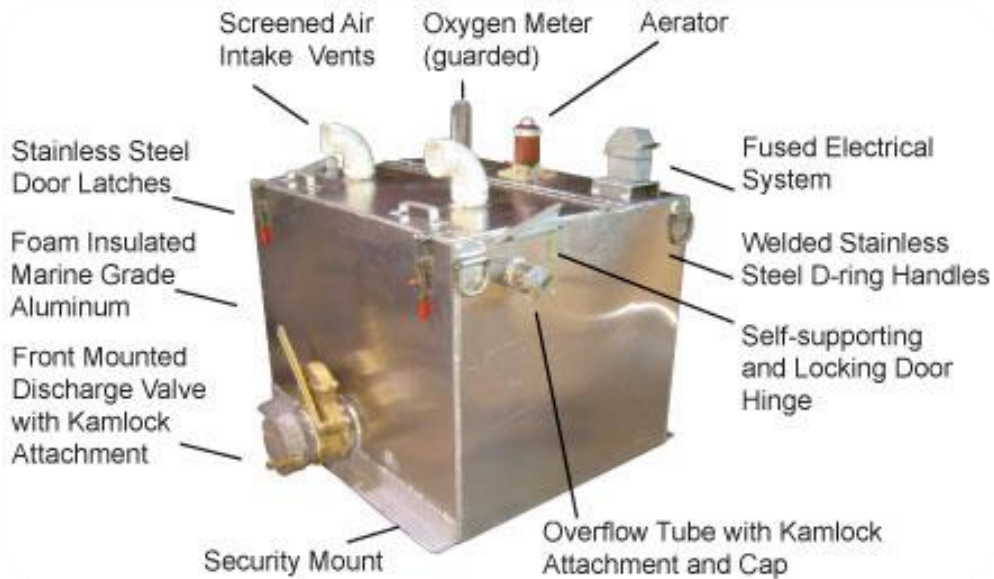


Fig: Live Fish Transportation Tank



Fig: Live Fish Transportation Truck loaded with tanks

Advantage

DisAdvantage

- Transport of table size fish is quite easy due to more space availability.
- Chances of holding material distortion is less.
- Higher amount of fish can be easily handled.
- Adequate availability of oxygen
- For long duration transport it is suitable.

- It substantially increases the total volume and weight of transport water.
- Specific vehicle is needed. public transport can't be used for fish-transport purposes.
- Installation cost is high
- It is economically disadvantageous.

Method of Transportation of Live Shellfish....

Waterless Method

- Many molluscan shellfish like clams, mussels, oysters can remain live out of water for quite sometime if suitable environment is provided.
- Important requirements for live transportation of these animals:
 - Maintenance of sufficiently low temperature in the tolerance range of the animal
 - Maintenance of high relative humidity (approx. 70%) to keep the environment moist
 - Availability of sufficient oxygen in the package

Transportation of Shrimp

- For short distance transport of live shrimp, water is the most common medium used in closed or open system.
- For long distance transport, hibernation technique is used for some species such as *P. japonicus* which can withstand low temperatures upto 4⁰ C & survive in a moist atmosphere.
- First the shrimps are hibernated by lowering the temperature 4⁰C & placed alternative layer-wise with moist swa-dust in a fiberboard box lined with PVC sheet.
- Shrimps remain alive at least for 14 hours.
- For shrimp like *P. monodon* & prawn like *M. rosenbergii*, closed bag system or open tank system is used using aerators for relatively shorter journey.

Lobster Transportation

- Lobsters are transported live under conditions of low temperature, availability of sufficient oxygen & appreciably high humidity.
- After harvest lobsters are maintained under conditions of minimum stress in a closed tank system where seawater is circulated through a biological filter.
- Only healthy lobsters which has quick response to a prod to the antenna between their eye-stalk should be choose for transportation
- Lobsters are pre-chilled in water over a 12 hour period to about 4⁰C before packing.
- Pre-chilled lobsters are packed in layers separated by moistened material in a box laid with ice-pads & impregnated with silicon to absorb water.
- During transportation RH & temperature should be maintained at 70% & 1-7⁰C respectively

Crab Transportation

- Before transportation the crab claw & legs are tied to avoid injury to the neighbor & also to the handlers.
- Some crab such as *Scylla serrata* can survive out of water whereas for transportation of other crab high humidity (>70%) & 0⁰-5⁰C is maintained.
- Use of ice to control the temperature in the package is not advisable as very low temperature & contact with ice-melt water is lethal to crab. So frozen gel packs are used to bring down temperature.
- First a frozen gel pack is placed & over that moist material such as jute, saw-dust etc. are layered. The temperature controlled crabs are then layered over this & the packing is continued with alternate layer of crab & moisture absorbing material.
- Crabs packed this way will survive at least for 24-30 hrs.
- For local market transportation the claw & legs are tied & sent to market.

Raw fish transportation

Raw Fish Transportation in Local Market

- Raw fish are delivered to local market where they are to be sold immediately are likely to be consumed within a few hours and no harm is done if they are partially thawed on arrival at their destination.
- Raw fish transported in local market are generally in frozen condition.
- The frozen fish are carried by covering ice or sometimes without ice in un-insulated containers depending on how long the journey takes.
- Raw fish are transported to local market by means of public transport, rail or sometime in cycle or bike depending on the quantity of the material.
- Enclosed vehicles, however, should be used or at least a cover provided to protect the fish from direct sunlight.

Improvements Needed....

- ▣ Before transportation fish should be properly washed.
- ▣ Proper icing should be done.
- ▣ Insulated carrier should be used.
- ▣ Enclosed vehicles, however, should be used or at least a cover provided to protect the fish from direct sunlight.
- ▣ Carrier should be washed properly after each transportation

Raw Fish Transportation to Processing Centers

- Fishes that are to be transferred to processing centres are transported in frozen condition in an insulated vehicle as they are intended to process further & export to other countries.
- The vehicles are preferably insulated with some form of refrigeration equipment to maintain the air space at a temperature of approximately -20C.
- The processing centers receive the raw fish from the harbor or the place of harvest.

- The following lists refrigeration methods that may be used:
 - Mechanical refrigeration using either wall coolers or forced convection coolers blowing air throughout the storage space. In some cases, a jacketed system for distributing the air is employed. This is the most common system.
 - Rechargeable eutectic plates.
 - Solid or liquid carbon dioxide or liquid nitrogen can be used with a total loss system.

Improvements Needed....

- Prior to loading, the vehicle or container should be pre-cooled and the loading should proceed quickly.
- Palletized loading and the formation of a sealed connection between the vehicle and cold store are both helpful in keeping the temperature rise at this stage to a minimum.
- The size of a package affects the speed at which it warms; the smaller the pack the greater is its surface area in relation to its volume and the quicker it warms.
- Packaging the product in a master carton will clearly reduce the temperature rise during handling outside a refrigerated space.

References

- Balachandran, K.K (2012) Post-harvet Technology of Fish & Fish Products
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- Google Image



Thank you!

