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TRANSPORT TECHNIQUES OF FISH SEEDS AND LIVE FISHES TO AND FRO FROM WATERSHED PONDS

CENTRAL SOIL & WATER CONSERVATION
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FOREWORD

Fish farming in Water Harvesting Structures (WHS) and watershed ponds is increasingly recognized as one of the interventions in Integrated Watershed Management (IWM) programs. The WHS and watershed ponds often proposed for multiple uses including fish farming contain turbid water for most periods and are located in far-off places from the fish hatcheries or nurseries and fish markets or human settlements. Technical knowledge on fish behaviour prevalence of turbid water in WHS and long travel distance necessitates the need for and practical skills of fish handling for transport of fish seeds and cultured fishes.

Success of fish farming depends on the supply of quality fish seeds and techniques of their effective transfer from the source to the ponds with minimum stress, which depends on the practices adopted in fish conditioning, packing and transport. Therefore, fish farmers and watershed managers of north-western Himalayas need to be familiar with the principles, techniques and practices of fish transportation to ensure maximum fish survival during transportation. I am sure that the fish transport techniques refined at the Institute during various outreach programs would benefit fish farmers and watershed managers or water resource users immensely.

(K.S. Dadhwal)
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TRANSPORT TECHNIQUES OF FISH SEEDS AND LIVE FISHES TO AND FRO FROM WATERSHED PONDS

INTRODUCTION

- Stocking good quality and healthy fish seedlings or fingerlings is a prerequisite for successful fish culture and optimum profit. Similarly, price for fish produce is often higher if live fishes are transported suitably to markets and supplied afresh to consumers.
- Often, fish seedlings are transported from Water Harvesting Structures (WHS) to other culture ponds since they are for equently used for production of both table-size fishes and fish seedlings.
- Sometimes, transport of large size live fishes, especially brooders is also necessary for breeding purpose. Also, fish fries and juveniles are transported and released into rivers for fish replenishment under river ranching or rehabilitation programmes.
- Conditioning of fish seedlings (preparing for transport) and their transport with least stress from source to WHS or ponds increase fish survival rate, better the transport economics and provide healthy seeds for stocking or fishes for other indented purposes.
- The traditional method for transport of fish seeds using open containers or *hundies* and slings practiced in plains may not be fit for north-western Himalayas and WHS & watershed ponds.

TECHNIQUES FOR TRANSPORT OF LIVE FISHES

- Two basic transportation systems are available for live fish transport, *i.e.,* (i) The closed system of transport: packing of fishes in polythene there bags under oxygen pressure and (ii) the open system, where fishes are transported in water-filled open carrier of trucks.

- Transport of fish seedlings in ploy-says filled with limited water and oxygen reduces the volume and weight of transport water and provides economical advantages for transport up to 48 hours. During fish transport in closed systems with pressurized oxygen atmosphere, oxygen content in water is not a limiting factor usually.

- Large size fishes in higher quantity can only be transported in open carrier of trucks up to a short distance which can be covered in a maximum of 12-14 hours.

GUIDELINES FOR TRANSPORT OF LIVE FISHES

- Various life stages of fishes (Table 1) are required to be transferred from the source to WHS or other locations.

Table 1: Terminology of various life stages of fish transported

Sl. No.	Life stages of fish	Description
1.	Fish spawns	Freshly hatched and baby fishes
2.	Fish fries	Few days old baby fishes
3.	Fingerlings	Few weeks old baby fishes
4.	Fish yearlings	Fish fingerlings maintained on higher density and limited feeds in ponds or WHS to stunt growth over a year or season, to be used for subsequent stocking or culture.
5.	Fish seedlings	All fish fries, fingerlings and yearlings used for fish culture.
6.	Brood (large) fishes	Sexually mature fishes harvested for breeding or reproduction.
7.	Large and adult food fishes	Large fishes harvested from fishponds or rivers, meant for human foods and animal feeds.

- During live fish transport, fishes remain in a limited quantity of water that causes crowding, increased oxygen consumption due to increased metabolism in fishes leading to higher concentration of CO_2 and ammonia, reduction of pH and bacterial contamination in transport water.

- Reduce fish excitement by careful handling, since excitement or anxiety increases oxygen consumption three to five times. If transport duration is reduced transport density may be increased moderately. Further, more number of fishes can be transported in mild colder environment since respiratory requirement of fishes is lesser in colder climate.
- Before packing, keep ready all the required fish collection nets, fish counting & distribution devices, water mugs, tubs, oxygen cylinder, transport containers, poly-bags, threads to tie etc. to finish the operation as quickly as possible.
- After packing fish seedlings, they should be transported immediately to the destination through shortest and smooth routes without undue delay so as to minimize fish mortality during transportation.
- Transport the seeds either during morning or evening or night to have the benefit of cooler journey transit.

CONDITIONING FISH SEEDLINGS

- Conditioning prepares fish seedlings to newer environment with their higher density.
- Collect fish seedlings from the source pond using knot-free (nursery net with 0.3-0.8 cm mesh size) dragnet or *hapa* net and with smooth handling. Rough handling of small size fish seedlings may injure and kill them even before they are transported for conditioning or packing.
- Condition the fish seedlings harvested by keeping them in small enclosure or *hapa* erected inside the source pond itself or water tank or trough or pool (Photo 1) established nearby using source water for 10 hours to 2 days depending on size of fish seedlings, temperature of water & atmosphere and duration of transport involved.

Photo 1: Water pools used for acdimatization of fish seeds

- Bigger size seeds, warmer temperature, wide temperature difference between water of source and destination and longer transport duration require conditioning for longer duration.
- During conditioning, provide no feed or maintain on very limited feeds in order to keep the gut of fish seedlings empty, reduce metabolic activity and hence addition of nitrogenous wastes into transport water and mortality of seeds. Fishes survive transport better if they are starved and no or minimum feeds remain in their stomach.
- Preferably provide artificial aeration (process of adding oxygen into water) using blowers or aquarium aerators and water sprinkling if such facilities exist.

TRANSPORT MEDIUM AND PRECAUTIONS

- Pack fish seedlings in source pond water as far as possible. If source pond water is silty, turbid and muddy, collect the water in separate tank or trough and allow silts to settle down first for 10-24 hours as may be required and use only top clean water collected carefully for conditioning & packing seeds.
- Packing seeds in turbid water causes gill-chocks since sediments will be filled in gill rackers that lead to respiratory problems & death.
- About 10-30% tap or canal water may be added to source water, if source water is turbid or scanty. Increasing the percentage of water from different source would increase mortality rate.

- While using tap water and groundwater, chlorine should be evaporated by agitation for 5-10 hours or stagnating for 24 hours and water should be well aerated to increase oxygen, especially in groundwater.

- Fish seedlings should be acclimatized first to the different source water if unavoidable to use it, by adding or sprinkling gradually the new water to the source water before packing.

GRADING AND PRE-PACKING PREPARATION

- Grade fish seedlings (Photo 2) as per size and species, if possible, using suitable means of sieve or manual isolation to pack size and species wise separately, to reduce disturbance due to inter-species and sizes during transport and help easy identification or categorical stocking of fish seedlings.

- Stocking fingerlings with wide size variations is often undesirable in order to achieve uniform growth of stocked fishes.

- Usually, common carp (*Cyprinus carpio)* and air breathing catfishes (*Clarius* spp.) are more hardy and amenable for transport in higher density or under minimum oxygen pressure. The hardiness of fish seeds of other species is in the

Photo 2: Fish seeds collected for packing

order of catla (*Catla catla*) > mrigal (*Cirrhinus mrigala)* and rohu (*Labeo rohita*) > grass carp (*Ctenopharyngodon idella*) > silver carp (*Hypophthalmichthis molitrix)*. Give more attention during the transport of less hardy species.

- Retain weak fishes in source itself or eliminate from the transport consignment since stressed fishes and seeds die quickly either during transport, stocking or soon after stocking and become source of microbial infection.

- Give a brief bath to fish seeds in diluted (1-2 parts per million) potassium permanganate ($KMnO_4$) before packing for disinfection. Addition of 0.3-0.5% sodium chloride (NaCl) or calcium chloride ($CaCl_2$) salt to transport water reduces handling stress and later-stage mortality.

SAMPLING AND QUANTIFICATION OF FISH SEEDS

- Take 3-4 random samples by volume using a small perforated cup to count the number of seedlings per cup and to determine number of cups per bag or consignment required for transport.

- Sometimes, random sampling of fish seedlings is done on weight basis to determine number of seeds per given weight, say 200 seeds counted in 100 gm weight and a total of 8 kg seeds packed or transported to get 16000 number of seeds. Pan of balance made of bamboo splints is used to drain out water while weighing quickly for weight based samplings.

- Weight based sampling gives a chance to account water while weighing since it is done quickly before water drains out fully. Volume based sampling is preferred over the weight based sampling since the latter is stressful.

PACKING IN POLYTHENE BAGS

- Avoid both thicker and thin polythene bags since the former poses difficulty to tie the bag tightly and the latter often bursts out during transport.

- Use 15-25 kg capacity plastic bags with 65-75 cm length, 40-45 cm width and 30-50 micron (0.03-0.05 mm) thickness with moderate softness, flexibility for better handling knot making and tensile strength. Place a bag inside another one to provide safety and sufficient resistance to puncturing, if thinner bags are unavoidable to be used.

- Constrict the bottom of the bag in a zigzag folding and tie the folded bottom end tightly to avoid leakage and give a cylindrical shape to the bag after packing for protection and easy stacking while transportation.

- First, put the polythene bag with a closed bottom end in the outer transport case such as cardboard carton to in cam if used.

- Pour transport (source) water to 20-30% capacity of the bag, check for leakage, if any and place inside the required number of fish seedlings (Table 2). Then, expel air from the space above water in the bag.

- Introduce the hose, connected to the pressure regulator of an oxygen cylinder into the bag and hold tightly the upper end of the bag around the hose by hand.

- Release oxygen from the cylinder to blow the bag slowly. Stop the supply of oxygen when the bag is filled to remaining

Table 2: Guidelines for transport density

Seedlings size (gm)	Numbers of seedlings per bag	Transport duration (hrs)
1-5	2000	12
1-5	1000	24
10-30	20-30	Up to 8
30-60	10-20	Up to 8
60-100	8-10	Up to 8
>100	Transported in open tank or carrier	Up to 12-14

70-80% capacity, leaving little free space (3-5%) inside the bag. If sun stroke is expected in transit on sunny days. Do not blow the bag fully and tightly with oxygen to avoid bursting during transportation, especially.

- Quickly draw out the hose from the bag and twist the upper end of the bag twice or thrice by holding tightly, fold the top end of the bag to prevent oxygen leakage or overpressure and tie tightly using cotton or jute thread. The packing procedures are depicted in Photo 3.

Photo 3: Packing of fish seedlings

AFTER-PACKING AND TRANSPORT GUIDELINES

- After packing, check the plastic bags for any leakage or abnormal behaviour of fish seeds inside and change the fish seedlings to newer bag if leakage or any other problem is found.

- Keep the packed seeds in safe and shade or colder environment.

- The packed bags with seeds can be transported to short distance carefully as such without any outer cartons. For longer distance, keep the packs in tin cans or card board cartons. Old newspapers or cloths may be kept in between poly-packs and the cartons to avoid pressure and shock during transport.

- Keep extra polythene bags, source water and twine along with oxygen cylinder, if possible to replace bags or repack during long distance transports, if need arises.

TRANSPORT OF LIVE FISHES IN OPEN TRUCKS

- Polythene bags may be useful for the transport of fish seedlings up to certain sizes. Up to 1-5 gm of size is easily transported and up to 25-30 gm at reduced density with greater care.

- Though transport of fish seedlings in open carrier of trucks lined with plastic sheet to hold transport water may be traditional in nature, it is preferable for the transport of bigger size fish seedlings or live fishes.

- This method of transportation is more suitable for WHS or ponds located in far-off and remote places. Various carriers including Tata Sumo, Tata 407, Tata 408, Tata *Hathi*, Mahendra Utility etc. can be used for transport of fishes. Cost of transport reduces with increasing size of truck carrier and consignment.

- Line the carrier with thick plastic sheet and fix it firmly to form a water pool as per requirement in the area from front to rear side of the carrier.

- The pool made in the transport carrier may be compartmented to act as baffles to prevent water surges, permit separation of fish species or sizes and facilitate fish stocking at different sites on a single trip.

- Fill the lined carrier with required source water, check for any leakage and introduce fish seedlings or fishes to be transported. About 20,000-30,000 fish seedlings of 5-10 gm size per 1000 litre water can be transported for a distance of 4–12 hours duration (Photo 4).

Photo 4: Fish transported in a water pool established in place of the back-seat of a.

- Quantum of water and density of fishes maintained in the carrier varies as per size of fishes and duration of transport involved. If bigger size seeds are transported, transport density may be reduced or quantum of water increased. Give care to avoid pile-up or smothering of seeds during transport due to higher density or limited water quantity.

- If problems due to oxygen depletion and surfacing of fishes occur during travel, change 10-20% or little more of transport water gradually with new water of the same temperature, if available. Temperature can be known using simple thermometer or by feeling.

- Sprinkle water over the pool and monitor condition of fish seedlings intermittently during the transport.

- Gently splash water with a small '*hundi*' or hands without causing stress to create wavy action, facilitate oxygen dissolution from atmosphere and help fish seeds remain inside water while transportation. Heavy agitation may cause stress to fish seeds.

CARE DURING STOCKING OF FISH SEEDS IN PONDS

- The packed seeds in closed polythene bags are often carried further with care in baskets made of bamboo splints, provided with cushion in sides using old gunny sacs, to ponds at down below reaches in valleys or hills, where vehicle cannot reach.

- Upon arrival to the destination, the closed bags on the surface of receiving water to balance the temperatures of transport water and pond water (Photo 5). Check the condition of seeds for their position, swimming, resting behaviour, agility or reaction to light & touch and dead individuals before release into pond (Photo 6).

Photo 5: Fish seed packs floating on the pond water before release

Photo 6: Inspection of fish seeds upon arrival at destination

- Open the bags to release after 5-15 minutes when the temperature of the water in bags reaches close to the level of water of receiving pond.

- Release fish seedlings slowly by adding receiving water to the transport water in the bags and by allowing fishes to swim out of bags into pond water. Before releasing 1-2 ppm of $KMnO_4$ may be applied in the area of pond water where fish seedlings are introduced to disinfect them.

- Before releasing into pond water, fish seedlings can be introduced into a small *hapa* established inside pond for close monitoring of fish seeds before finally released into pond water after 2-5 hours (Photo 7).

- While releasing seedlings from truck, add water of receiving pond gradually to the water in the open truck used for transport and after 15-20 minutes of acclimatization to the new water, release the fish seedlings from the transport truck slowly and carefully into pond water using small *hapa* or scoop net.

Photo 7: Release of fish seedlings into a hapa

PRACTICAL UTILITY AND ECONOMIC POTENTIAL

- The fish transport techniques refined provides 90-95% transport survivability with only 2-3% delayed mortality after stocking.
- Live fish transport practices form the basis for successful fish farming in the region and rednces the cost of fish cultivation at least by10-20% through increasing fish survivasility and reducing the need for additional fish reads.
- Supply of live fishes in market fetched 20-30% more price.

OUTREACH AND SCOPE OF APPLICATION

- The techniques of fish transport outlined here and their benefits have been demonstrated to farmers and watershed managers and planners of the region. The techniques have benefited resource-poor fish farmers of remote and hilly areas to a large extent since they provide healthy fish seedlings for successful fish culture (Photo 8).
- The techniques are suitable for the entire north-western Himalayan region, where fish culture systems like ponds, tanks, paddy fields exist.

Photo 8: Farmers taking fish seedlings to their ponds for culture

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