TRANSPORTING FISH FOR CULTURE

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Bolorunduro P. I.

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1.0 INTRODUCTION

The way and manner live fish are transported is a very important aspect of fish culture. In most cases, fries (freshly hatched and baby fish) and fingerlings (few weeks old baby fish) must be transported from hatchery to pond for stocking. Brood fish (sexually mature fish selected for reproduction) are sometimes transported into the hatchery to spawn. Spawning is the act of depositing eggs and producing young fish. It may even be necessary to transport live harvested fish to the market for sale. A fish farmer must be very familiar with the principles, techniques and practices of fish transportation so as to minimize fish death resulting from transportation. The ultimate aim of transportation is to provide healthy live fish at the destination. When a fish farmer or a live fish transporter obeys the principles and practices of transportation, risks resulting to death of fish will be reduced and by implication there will be less financial losses in the business. Fish are generally transported in containers such as cans of different sizes, pots of ceramic or metal, wooden or metal buckets, vats, barrels, plastic bags, styrofoam boxes, bottles, jugs etc. Generally, almost any clean, water proof container may be used. Certain containers provide good insulators from heat e.g. wood or styrofoam. Containers like metal or plastic are poor insulators and may have to be wrapped with wet towels or packed with ice to keep temperatures down.

Once fish have been placed in transport container they should be brought to their destination by the quickest possible means that will provide relatively smooth and direct route. This may be by foot, animal cart, bicycle, boat, vehicle etc.

2.0 CONSIDERATIONS IN FISH TRANSPORT

Fish transport must be done carefully in order to successfully take them to their destination. A poorly organized effort may easily result in death of fish. The following factors directly influence fish transport:

2.1 Tolerance to transport.

AFish are not potatoes@ is a famous saying in fish culture. They need tender, loving care if they are to remain strong and healthy . Tolerance of fish to transport is related to their ability to resist or adapt to stressful conditions. Their resistance also change as they pass through various life stages. Larvae (newly hatched fish which are still too young to feed on feeds supplements) are very delicate, just as brood fish which are ready to lay eggs. Table 1 below indicates stress tolerance levels of some commonly cultured fish.

Table 1. Stress tolerance of some commonly cultured fish species

Species	Common Name	Tolerance Level
Oreochromis niloticus	Tilapia	High
Clarias gariepinus	Catfish	High
Heterobrancus bidorsalis	Red mud catfish	High
Cyprinus carpio	Common Carp	Medium
Heterotis niloticus	African bony tongue	Medium
Bagrus bayad	Silver Catfish	High
Gymnarchus niloticus	Trunkfish	Low
Chrysichthys nigrodigitatus	Silver Catfish	High
Labeo cube	African Carp	Medium

2.2 Presence of food in the intestine

Fish survive transport better if they have no food in their intestines. For this reason they could be starved for 1 or 2 full days prior to the time they

will be transported. Brood stock are often conditioned for transport to spawning facilities by crowding them up in a seine net and releasing them. This procedure can be done for 2 consecutive days before moving them from their pond to hatchery for spawning. The fish stop eating and this helps them adapt to the stress of artificial spawning. Fish can also be harvested and held in net enclosures or tanks for 24 to 48 hours with clean, preferably gently running water. The fish pass food out of their intestines and will be in good condition for transport. If fish have disease or parasites they can also be treated easily in tanks prior to transport.

2.3 Age and size of fish

A lower weight of small fish can be transported per unit volume of water than large fish. Fish can be broadly classified into four main groups according to what life cycle stage they are in.

(i.) Newly hatched fish are called larvae or sac fry. They are slow-moving and possess a yoke which provides food for at least 24 hours supply after hatching.

(ii.) Post larvae do not have a yoke sac and are commonly called fry. Fry weigh less than 1g.

(iii.) A 3 to 4 weeks old fish weighing more than 1g may be called a fingerling juveniles (5-8 weeks) may weigh 3 -5g.

(iv.) Sexually matured fish are often called brood stock.

Table 2 provides a **Arule - of - thumb@** guide to determine how many fish of a given age group may be transported. These figures are based on transporting fish in sealed plastic bags containing oxygen and about 8 litres of clean water at approximately 18°C. These numbers are only a rough guide and may not work under all conditions for all kinds of fish. Tanks or containers must be used to transport fish if plastics bags are not available. Quantities of different sized fish that can be transported in sealed plastic bags (18 inch x 32 inch) with approximately 17.6 litres of water and pure oxygen are shown below.

Table 2. Guide on fish age group/size and transport rule

Fish size (g/l)	Duration of transport (Hours)			
	1	**12**	**24**	**48**
Newly hatched larvae	120	80	40	10
1/4 inch (0.64 cm) Fry	60	50	40	20
1 inch (2.54 cm) Fingerlings	120	100	75	40
2 inch (5.08 cm) Fingerlings	120	105	90	40
3 inch (7.62 cm) Fingerlings	120	105	90	40
Larger Fish	480	180	120	60

Recommendations for transporting different sizes of fish in tanks with different volume of oxygen at approximately 18°c are given below in Table 3.

3.0 LIVE FISH TRANSPORTATION METHODS

There are two basic transportation systems for live fish: the closed system and the open system. The choice of transport system depends on the facilities available to the purchaser, the distance, number and size of fish species.

3.1 Transportation by open system. The open system consists of water filled containers in which the basic requirements for survival are supplied continuously from outside sources. The simplest of these are small tanks, plastic containers, cans, buckets, bowls, boxes, calabashes, clay pots, trucks, vans, etc. (Figure 1).

Table 3 : Recommendations in transporting different sizes of fish with defused oxygen tanks

Fish size (g/l)	Duration of transport (Hours)			
	1	**6**	**12**	**24**
Larvae and Fry	NR	NR	NR	NR
1 inch Fingerling	120	60	30	30
2 inch Fingerling	240	180	120	120
3 inch Fingerling	360	240	120	120
8 inch Fingerling	360	360	240	180
Larger Fish	480	480	360	240

NR = Not Recommended

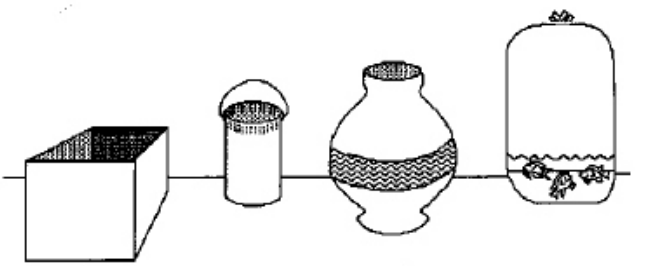


Figure 1 Various containers used in transporting fish

Procedure

i. Almost fill containers with clean water and transfer fish at rates not more than the following. (for open transportation less than 5 hours distance

Tilapia fingerlings - 200-230 fish 50 jerican of water.
Adult Tilapia - 100-150 fish bucket of water
Catfish fingerlings -500-750 fish/50 jerican of water.
Catfish Adult -150-200 fish jerican of water.
Catfish juveniles -400-500 fish/50L Jerican of water

ii. Cover water top with leaves to shade fish from sunlight and heat and to reduce splashing or net to prevent jumping out.
iii. Agitate water at intervals to help the supply of oxygen.
iv. As much as possible be fast and avoid delay in transit.
v. Allow fish to swim out freely from the container during stocking.

Open transportation method is suitable for movement of fish within the farm, for short distances and for periods not longer than 2 hour except for catfishes which can endure 5 hours. For longer distances, air or oxygen should be supplied constantly or intermittently. Transportation tanks, vans or trucks with facilities for air/oxygen supply can be used. Open method is suitable to transport catfishes for long distances but water must be renewed (changed) at intervals of 4-5 hours or less if the weather (water) gets hot. Ice block can be used to lower the temperature for longer hours of journey.

The advantage of this method is that it is simple, economical and requires no special skill for adoption. It is however risky. Fingerlings can die through water splashing in the container. Open method is also limited by time and distance.

3.2 Transportation by closed system.

The closed system make use of sealed containers in which all the basic requirements for fish survival are self contained. It is by far the most ideal method for live fish transport. The suitable container is oxygenated polyethylene (plastic) bags or tanks. They are best used for long distance transportation of fingerlings of Tilapia, Carp, Heterotis and other weak species of fish. Plastic bags should not be used to transport brooder/adult fish or post fingerling with sharp spines, as this will result in bursting of the container. It is essential to maintain adequate oxygen in the water while transporting fish using this method. The technique recommended for oxygenating water during fish transport is the use of pure bottled oxygen. It may be bubbled continuously into an unsealed container during transport, or injected into a plastic bag containing water and fish which is then sealed air-tight for transport.

When plastic bags are used, oxygen is added after water and fish. One-fourth of the bag usually contains water and fish and three fourths contains oxygen. After adding oxygen the bag is sealed shut with a twisted rubber band, string or other material. As a precaution against leakage, the first plastic bag should be placed inside a second bag whenever possible. The sealed double bag of fish is then placed in a box or other container for added protection and loaded onto a vehicle for transport. If properly packaged and insulated from heat, these containers can transport fish for 24 to 48 hours without water exchange.

Procedural steps to illustrate this method are given below.

Procedure:

1. Cut the plastic bag material to appropriate dimension as shown in figure 2

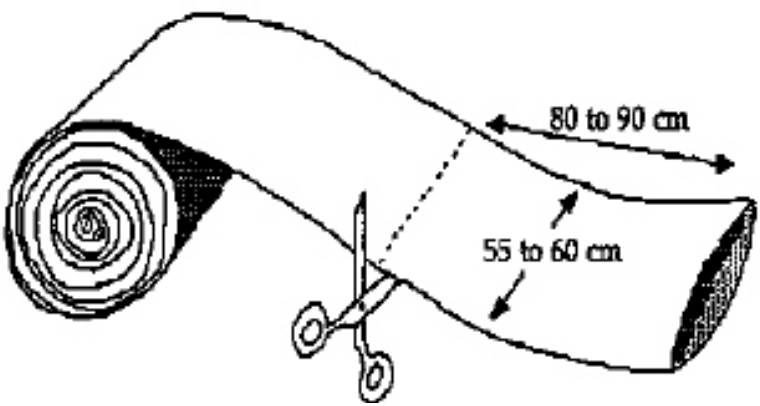
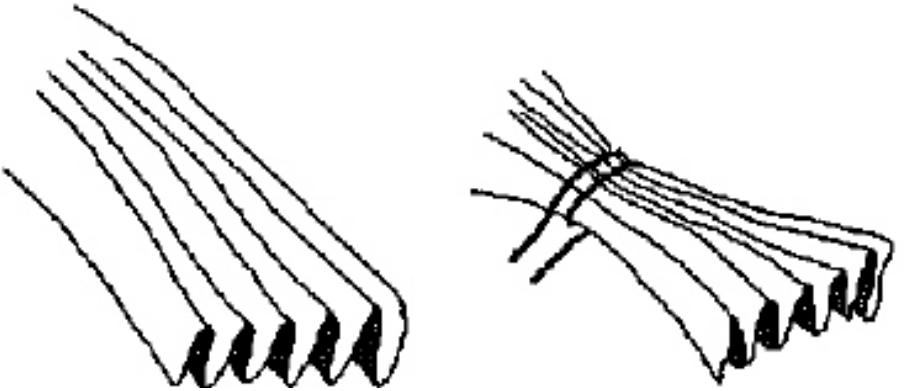


Figure 2 Cutingt the plastic bag material todimension.



2. Fold one end and tie it

Figure 3: Folding and tieing one end and tie it

3. Melt and fuse the tied end, then fill 1/4 with water to check for leakage (Figure 4).

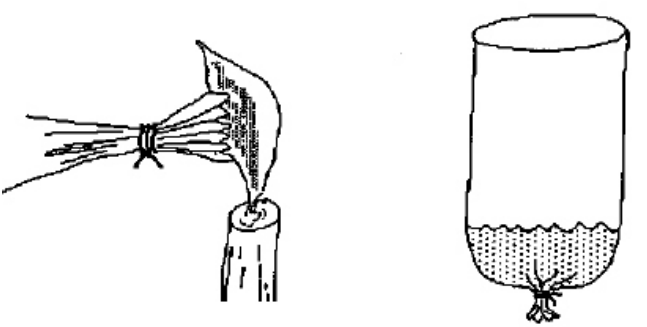


Figure 4: Melting and fusing tied end and filling with water.

4. Place a pre-determined weight or number of fish in the plastic bag.
5 Insert oxygen hose into bag, depress it to force out atmospheric air and slowly bubble pure oxygen through the water (Figure 5).

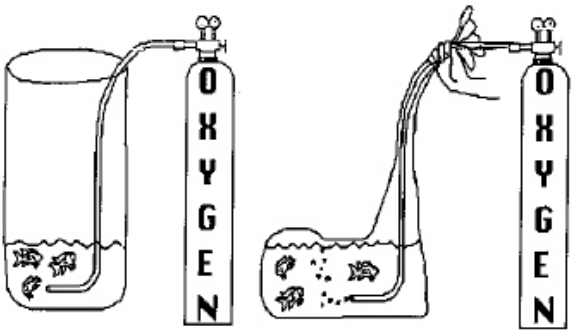


Figure **5**: Oxygen hose inseted into bag, 50 jerocan of water.
pure oxygen hose through the water. Squeeze bag closed while removing oxygen hose, and tie bag securely

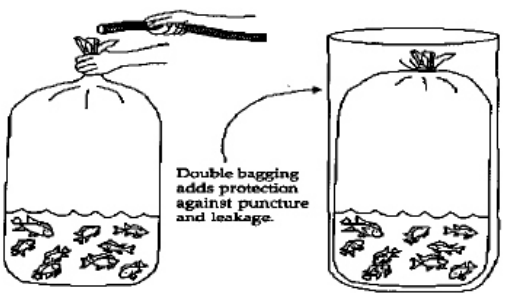


Figure 6. Squeeezing and tieing bag securely
7. Place the sealed bags into woven sacks, cardboard, or wooden boxes for protection during transport (Figure 7a).

Wet clothes placed over the bags will keep them cool. Ice may be placed on top of the bags in hot weather. Some form of shade can also be provided. Cut banana or coconut leaves are commonly used.

4.0 CHANGING WATER DURING TRANSPORT.

During hot weather or long trips, fish may rise to the surface and start gasping for air. This means oxygen in the water has been depleted and water should be changed. (Figure 7b).

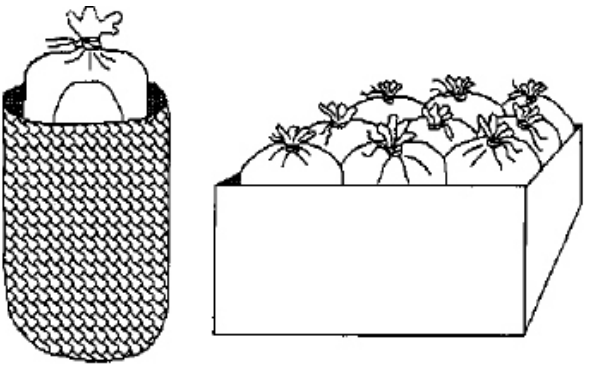


Figure 7a. Sealed bags placed in woven sacks or wooden box

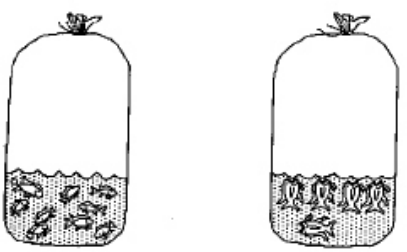


Figure 7b: Adequate oxygen depleted oxygen

The following precautions should be exercised when adding water to a container of fish or when transferring fish into fresh receiving water.

i. The new water should be clean, not muddy and should be free of chemical pollutants. Water from clean, clear-running springs or streams is best.
ii. Poorly aerated water from wells, or reservoirs should be avoided because of low dissolved.
iii. New water should be the same temperature as the original water.

To change water, empty half of the old water from the transport container and then refill with new water of the same temperature. The farmers can know this by using a simple mercury thermometer or feeling the water directly. Plastic bags can be squeezed around the neck and filled to allow water but not fish to escape. Siphon tubes are used to remove dirt and fish waste from the bottom of the transport container. Do not add water quickly into the container as this may injure fish. It should be added carefully. After 10 minutes change all of the water. It is advisable that the temperature of new water should not differ from that of the transport water by more than 3 degrees centigrade. If it does, replace only one fourth of the old water initially and wait 10 minutes, then replace one fourth of the water again and wait 10 minutes before completely changing the water.

5.0 AERATING TRANSPORT WATER.

Aeration is the process for adding pure oxygen or air into water for the purpose of increasing the dissolved oxygen content. Transport water can be aerated by agitation or air can be pumped into it during emergencies when water exchange is impossible and fish are clearly under stress. Agitation is the process of increasing the amount of oxygen in water by stirring, pouring, shaking or some other mechanical means. Agitation can be done in several ways. A small quantity of the old water can be removed and poured repeatedly from a height of 30 - 50 cm through a screen, or porous cloth back into the transport container (Figure 8). A person can also stick his hand into the water submerged up to the knuckles with fingers spread, and briskly wave back and forth. Electrical devices are also used for agitation.

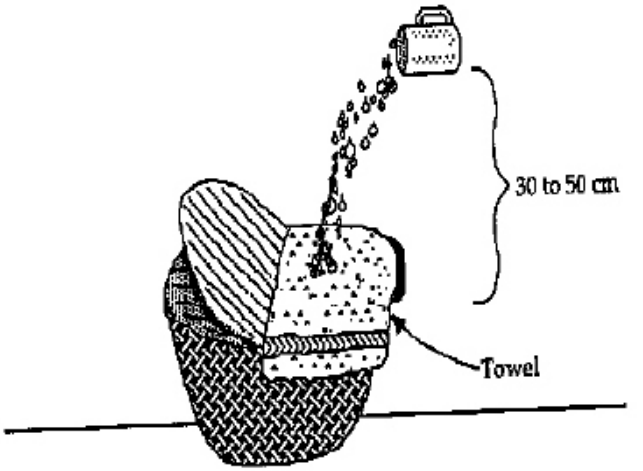


Figure 8. Pouring old water back into the transport container.

Pumping air into the transport water can be done continuously from the start of travel or as an emergency measure. The finest air bubbles possible should be pumped into the water. Oxygen diffuses faster through fine bubbles. Large bubbles forcefully pumped into the water may injure fish. Equipment which can be used includes bicycle tire pumps, battery operated aerators from aquarium shops, air filled inner tubes with air being squeezed through a regulated nozzle and any other locally built device (Figure 9).

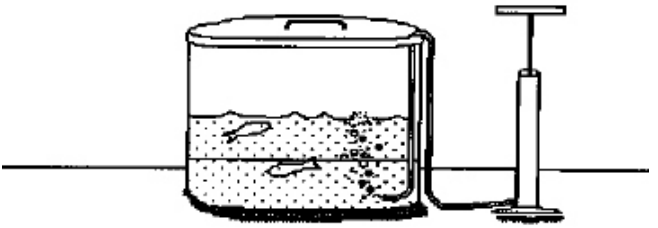


Figure 9 Pumping air into a transport container

Agitation can be done simultaneously with aeration. However these are only temporary measures and will not keep the fish alive very long. They may be tried until the water can be exchanged. **Do not** bubble your breath through the water. It contains carbon dioxide, not oxygen. You will only hasten the death of your fish by doing this.

6.0 TEMPERATURE OF TRANSPORT WATER

Warm-water fish species (tropical fish) are suitably transported in water temperatures ranging from 18 to 28 degrees centigrade. The ideal temperature is 21 to 25 degrees centigrade.

Warm water holds less oxygen than cold water. Respiratory requirements of fish are also greater at higher temperatures. Thus fewer fish can be transported per unit volume of warm water. The **golden rule** of fish transport is to always maintain sufficient oxygen in the transport water.

This can be done in the following ways:

1. Keep transport containers cool. They should always be kept shaded and out of direct sunlight. As water warms, it holds less oxygen, so prevent rapid warming of the transport containers.
2. Ice may be packed around containers on long trips (Figure 10). **Do not** add ice directly to the water containing the fish. Be careful to prevent water from dropping below 18°C when using ice.

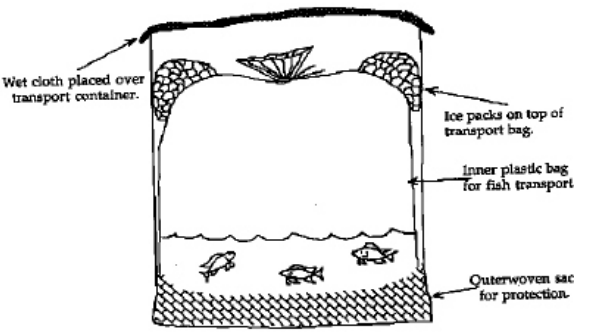


Figure 21: Packing ice around a plastic bag used for fish transport.

Figure 10: **Packing ice around a plastic bag used for fish transport**

3. A wet cloth may also be wrapped around containers to reduce temperature by evaporative cooling if ice is not available.

7.0 DURATION AND MODE OF TRANSPORT.

More fish can be transported per unit volume of water if the duration of transport is short. The fastest, smoothest and most direct means of transport possible should be used. A rough rider with long stops greatly decreases the ability of fish to survive transport. Fish should be transported with spacious, airy vans, if open method is used. And for both methods fish should be transported during the coolest part of the day or at night in hot weather.

8.0 STOCKING PROCEDURES

Stocking fish into their new home after transport can be the most critical aspect of the transport procedure. Temperatures of the transport water and water where the fish are to be stocked must be equalized before stocking the fish. This normally requires 15 to 30 minutes. A temperature difference no greater than 3 degrees centigrade is tolerable.

When fish arrive at their destination, the procedures used to change water during transport (Section 4.0 of this bulletin) must be followed to acclimatize them to the new water. This allows water temperature in the transport container to equalize with the new water, and allows fish to adjust to changes in the quality of the new water.

Plastic bags should be floated on the water surface where the fish are to be released while the water exchange and acclimatization procedure is done. Fish are then allowed to swim out of the bags into their new surroundings (Figure 11). Fish transported in containers which can not be set into the new water may be transferred with a soft net, or dipped out with a scoop or bucket. **Do not** pour fish from any height into their new environment (Figure 12). They will be weak after transport and can easily be injured by rough handling at this stage. Allow them to swim slowly into the water

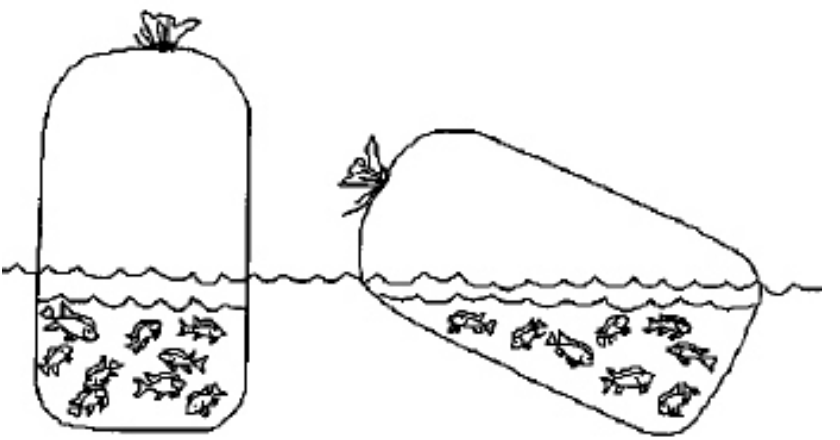


Figure 11: Float transport bags where the fish will be stocked

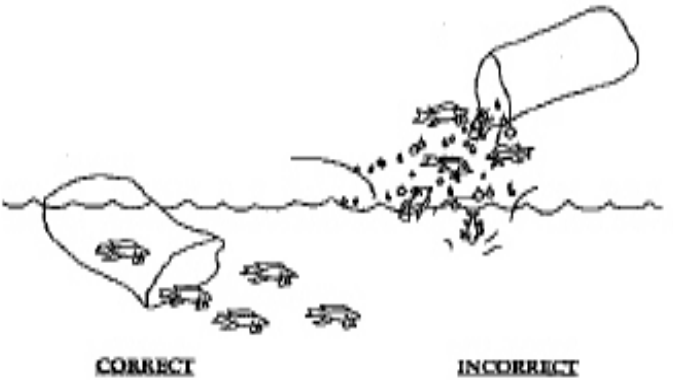


Figure 12: Immerse the bag and allow fish to swim out. Do not dump or pour the fish in. (b)

9.0 SUMMARY

i Pre -transportation handling activities such as harvesting, packaging and loading into the vehicle must be carried out without waste of time to minimize struggling and to avoid overcrowding and suffocation.

ii Remove weak and sick fish before packaging

iii Stop feeding fish 24 to 48 hours prior to transporting them.

iv Prepare all transport containers, oxygen and other equipment before setting out.

v Harvest fish for transport during the coolest part of the day (very early morning)

vi Quickly, but gently, lead harvested fish into a transport container

vii Insulate fish from heat during transport.

viii Transport fish on the fastest, smoothest means of transportation available

ix Petroleum products and other dangerous chemicals should not be in the same compartment with the fish. These can cause fish death.

x Upon arrival at their Anew home@, adjust fish to their new surroundings slowly by gradually exchanging water to avoid temperature shock.

xi. Alow fish to swim from the transport container into the new pond. Never throw or pour the fish into the pond.

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