Stocking the Breeders

The female breeders are stocked into the breeding hapas before the males. The ripe males are then transferred to the hapas with females that are most ready to spawn, with a stocking density of one male and three females per hapa. After fry are produced and collected, the males are separated from the female and returned to the male holding hapa.

Fry Collection and Incubation

The fry are normally collected early in the morning to reduce stress and mortalities. The first fry collection is initiated 10 to 14 days after stocking the breeders. For this purpose, a pole is placed under the hapa and lifted in order to divide the hapa into two compartments with the breeders all on one side. The male is removed and returned to the male holding hapa. Then the workers proceed to checking each of the females. Females with incubating eggs or young yolk sac fry in their mouth can be placed into the empty portion of the breeding hapa until yolk absorption is complete or until the fry are in the free-swimming stage. Free swimming fry or advanced yolk sac fry are rinsed out of the mouth of the mother into a tray or bucket. Eggs or yolk sac fry that have been accidentally released from the mouth of the female can be collected and transferred to artificial incubators. Both fry and eggs are rinsed and counted before transferring them to the nursery hapas or artificial incubators.

It is important to ensure a constant flow-through of water to the incubators to optimize the environment for the eggs or yolk sac fry. Upwelling incubator bottles are most commonly used. Trays are the second most common. Upwelling bottles provide better aeration and motion, while trays are more convenient for observation and removal of unfertilized eggs and dead embryos, both of which encourage fungal growth. The eggs usually hatch after 2 or 3 days. The fry are incubated until yolk absorption is complete and are then transferred to nursery hapas.

Tilapia hatching in trays

Tilapia hatching in upwelling bottles

Under FEEDing Pakistan project, with technical support of ASA/WISHH/SoyPak, first tilapia hatchery is established in private sector at Tawakkal fish farms in Muzaffargarh. Photo courtesy, R.S.N. Janjua, SoyPak (ASA/WISHH)

Pedigree Breeding Program and Marker Assisted Breeding

Genetically improved fish, such as the Genetically Improved Farmed Tilapia (GIFT) and Chitralada strains, have become popular for culture in developing countries (Wijenayake et al., 2005; Tan et al., 2011). These are fast growing strains that have been developed by genetic selection of desirable characteristics over successive generations. A continuous improvement of relevant traits over the generations requires a well-designed selective breeding program where the pedigree of brood fish is monitored to increase the accuracy of selection and to restrict inbreeding.

SEED HANDLING AND TRANSPORTING

Transporting Live Fish

One of the most frequent activities on any fish farm is the moving of fish around from one tank to another, or from pond to pond, or even the collection of broodstock from elsewhere. Sorting stock, stocking grow-out tanks, moving broodstock, harvesting fingerlings, sampling growth rates, and catching adult fish for selling are all examples of why someone needs to move fish. The following points need to be considered when moving fish. :

i. Crowded fish will soon die of oxygen depletion in buckets or small containers.

ii. Fish transferred to water of different temperature, pH, hardness or alkalinity, will need an acclimation period. The greater the changes, the longer the acclimation period.

iii. Transferred fish experience stress by catching them and confining them under crowded conditions. Stress makes them more susceptible to disease.

Short Distances

When moving fish short distances within the hatchery itself, they can be transported in buckets. Remember that certain fish almost invariably try to jump out of buckets so the buckets need lids or netting covers. Fish that jump out of buckets and fall on the ground are easily injured, lose their protective coating of slime, and may die within a few days of stocking.

Long Distances

Special protocols should be implemented when moving fish over longer distances, such as when stocking ponds with fingerlings or

obtaining broodstock. These fish should not be fed for at least 24 hours (preferably 48 hours with tilapia, due to their long gut length) before transporting them as they will foul the hauling water and poison themselves and other fishes. To purge or 'starve' fish prior to packaging and transporting they should be starved in clean, algae-free water in containers or tanks like plastic or concrete pools, with clean running water. This also allows sorting into different sizes for safe packing and transportation.

Packing Small Fish Or Fingerlings

Small fish (1-5 cm) can be packed in plastic bags placed in cardboard cartons for safe transportation. Hauling water should be of the same temperature from which fish were collected and should be rich with oxygen.

It is not advisable to pack fish using water from the rearing container which may contain elevated ammonia and/or low oxygen levels. It is preferable to use fresh and clean well water. Plastic bags should be a minimum 40 micron thickness for small fish and preferably 60-80 microns for fish like tilapia with sharp spines. One third of the plastic bag is filled with water. Required number of fish is transferred into it and the bag is inflated with oxygen. A half gram of Tris buffer can be added to maintain the pH level and a few pieces of activated carbon to absorb ammonia and small organic compounds. The neck of the bag is twisted several turns and then tightly tied with non-flexible string, strong rubber bands, or rubber castration rings. The inner bag is then placed inside an outer bag. Many people prefer to layer a couple of sheets of newspaper between the inner and outer bag to reduce chance of a fish spine puncturing both bags. The newspaper also darkens the environment for the fish, provides extra insulation and absorbs any water that may leak from small punctures. It is important to check the bottom of the bag to prevent small fish becoming trapped in the corners. This is essential and an often overlooked procedure; if a few fish become trapped in the corners and die, they will rapidly decompose in warm weather and poison many of the others. The bags are then placed within a cardboard box, bucket or polystyrene box to prevent them being punctured. The polystyrene boxes will help insulate the fish from rapid temperature changes.

When transporting the boxes they should not be placed in the back of an open truck, exposed to the sun or cold, as the small volumes of water will rapidly either overheat or cool down, so a canopy is

essential. On arrival at the destination the fish will be considerably stressed, and the bags should be carefully floated in the water for 15 minutes or more to equalize the temperature differences. Then the bags should be opened and kept floating by rolling the bag down to create a float. Receiving water should be added into the bag water for another five or ten minute to acclimate pH, hardness and alkalinity. Once this is done the bags can be tipped over and the fish are released.

Packing Large Fish

For large fish over 10-12 cm, plastic bags puncture too easily and other containers should be utilized. For small numbers of fish, Styrofoam or insulated coolers are good for transport. For larger numbers of fish, plastic 50-200 liter drums with a top that can be secured are useful. For short time intervals (<15 minutes) large fish can be moved around the farm in these drums without oxygenation, if not over-packed (not more than 5-10 adult fish per 100 liter drum). If the fish are likely to be in the drum for longer periods, portable battery-operated air-blowers or bottled compressed oxygen can be used to oxygenate the water using an airline and air stone in each drum. Drums should be filled to about 30% full when packing the fish, then lifted into the vehicle, and then topped up to 80% full with clean water to prevent too much sloshing and damage to the fish on rough roads. All this should be done under shade to prevent the water warming up to the point where oxygen levels deplete and fish may die due to suffocation. If hauling distance is long (2 hours or more), then provide oxygen to each container. A small air pump

working off the vehicle battery is adequate for small biomasses of fish. Compressed oxygen bubbled through the water is essential for trout or if the densities or total biomass are very high.

At the destination, the drums should be first partially emptied using buckets, then the drums lifted down and the fish poured slowly into the dam, pond or other container. If the receiving water is different to the drum-water temperature or pH, then some of this water should be added to the drum, water slowly, over half an hour, to equalize temperatures and pH. While this is being done, the flow of air or oxygen to the tanks should be kept operating.

Packing Un-Purged Fish Taken From a Dam Or Pond

It is unwise to pack fish that have been caught from ponds or tanks where they have recently fed to satiation. This is because they have a gut full of food that will be expelled in the packing water, thus polluting it. Tilapia are especially difficult in this respect due to their long gut length and their continuous eating habits. Tilapia caught and packed directly after capture will quickly foul the water. Only short journeys for unpurged fish are possible without oxygen or in some way purging the fish prior to packing. One solution is to hold them in a portable plastic pool, at the pond-side in the shade, with clean water, for some hours after netting them to attempt to purge them of most of the gut contents. Use of one or more portable air-blowers can assist in keeping this holding water well oxygenated. If purging is not possible, the maximum packing density recommended for carp and tilapia is no more than 6-10 adult fish per 100 liter drum for travel that is not more than 4-6 hours. Aeration will be essential.

Size-Sorting the Fish

After the fish have been collected in buckets, they should be sorted by sizes or species. If sorting is done quickly, small fish can be

returned to the pond to allow them to grow further. If size-sorting is needed, it is recommended that one or more portable fish pools be erected in a shady area near the pond to be harvested. All undersized fish can be immediately placed in these pools to rid them of the mud and other plant debris that invariably clogs their gills and fins while being netted. If large quantities of fish are to be caught, a flow of fresh water from a pipe may be required to keep the water in the portable pools. Fish may die quickly if hauled in warm or muddy water.

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