

GUIDELINES ON THE USE OF LARVIVOROUS FISH FOR VECTOR CONTROL

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1. BACKGROUND

Integrated Vector Management (IVM) is a rational decision-making process to optimize the use of resources for vector control. Key elements of IVM are advocacy, social mobilization, strengthening of regulatory and legislative controls for public health, empowerment of communities, collaboration within the health. Other sectors are in planning, decision-making, use of available resources for vector control, implementation of evidence-based strategies and capacity-building.

IVM includes implementing all feasible strategies safely with or without insecticides to manage the vector population in such a way that disease transmission is kept under check. The multiple strategic components recommended and used under the public health programme are Environmental Management, Chemical Larviciding, Outdoor Fogging, Long Lasting Insecticidal Nets, Indoor Residual Spray and Larvivorous Fish.

The overall success in malaria reduction is attributed to comprehensive implementation of multiple strategies including robust surveillance, complete treatment and integrated vector control management including use of larvivorous fish.

With continued focus on surveillance, prevention, and treatment, effective vector control is possible.

2. INTRODUCTION

Fish have been widely used in public health, since as early as 1903. One of the most successful and widely used biological control agent against mosquito larvae is the top water minnow or mosquito fish *Gambusia affinis*. Fish other than *Gambusia* which has received the most attention among larvivorous fishes is *Poecilia reticulata* (the common guppy fish).

3. ADVANTAGES OF USE OF LARVIVOROUS FISH

- a. The larvivorous fishes are self-perpetuating after its establishment and continue to reduce mosquito larva for long time.
- b. The cost of introducing larvivorous fish is relatively lower than that of chemical control.
- c. Use of fish is an environment friendly method of control.
- d. Larvivorous fish such as *Gambusia* and *Poecilia* prefer shallow water where mosquito larvae also breed.

Do's- Fish should be preferably introduced in **wells, stagnant ponds, quarry pits, large burrow pits,** and other **artificial/Ornamental water bodies** before the high mosquito breeding season to maximize impact

Don'ts: Fish should not be released into **natural water bodies** or **any artificial water body with outlet into natural water body**

4. CHARACTERISTICS OF LARVIVOROUS FISH

- a. Should be small in size to survive in shallow water.
- b. Small in size (not more than 7 cm in length) to enable them to move about freely in the shallow water in weeds
- c. Should be surface feeders and carnivorous.
- d. Hardy and flourish both in deep and shallow waters
- e. Should be able to survive in the absence of mosquito larvae
- f. Should be easy to rear
- g. Able to breed prolifically in confined waters
- h. Should be able to withstand a wide range of temperature and light intensity
- i. Should be hardy and able to withstand transport and handling
- j. Should be insignificant/useless as food for other predators
- k. Should have preference for mosquito larvae over other types of food available at the water surface.

5. Types of Larvivorous fishes that may be used for vector control:

- a. *Gambusia affinis* and *Poecilia reticulata* are used under the programme for larval control and have been proven to be very effective.
- b. Some Alternative Indian Indigenous fish species (e.g., *Channa stewartii*, *Mystus bleekeri*, *Rasbora daniconius*, *Amblypharyngodon mola*, *Colisa lalia*, *Notopterus notopterus*, *Puntius* spp., *Heteropneustes fossilis*, *Mystus vittatus*, *Anabas testudineus*): show positive larval predation efficiency however more research is required before introducing in the programme.

6. TYPES OF LARVIVOROUS FISH HATCHERIES

The Hatcheries can be established at:

- State headquarter (Mother Hatchery)
- District Hatchery
- PHC/Sub- Center Level Hatchery

6.1 Mother Hatchery

Mother hatcheries should be established at state headquarters,

- a. Mother Hatchery (State Headquarters) should have dimensions 10m × 10m × 1.5 -2 m concrete with central separator
- b. Entire tanks should be brick made, lined with good quality of cement plaster, thickness of wall about 0.5 m. The tank should be divided into two portions of equal size of 5 m X 4 m with central separator of 0.5 m thick. Area- sufficiently big for construction of 2 tanks of 5 m X 4 m (one for laying young ones and other for holding mature full-grown fish). Depth of water in the hatchery should be 1.5 – 2 m. Proper outlet at the bottom of tank should be provided. Outlet should open below the ground, not in any open water body. Overflow outlet about 5 cm below inlet protected with proper wire mesh to prevent escape of fish and their fry.
- c. Locally available submerged vegetation may be used in the tanks.

- d. Salinity of water should not exceed 20 gm/litre. These fish may survive salinity up to 52 gm/litre. But it cannot reproduce at this salinity level.
- e. Hatchery should not be subjected to strong water current and should be protected from heavy rains and floods.
- f. Floor of tank 0.5 m thick with slope from the partition towards sides. Proper inlet at
- g. 1.25 m height. Bottom of tank covered with uniform thickness of sand for about 10 cm. The bottom should be seeded with organic matter about 2 kg/m².
- h. The tank should be allowed to mature for 10-15 days and minimum 25% of water should be replaced once a week.
- i. The fishes should be transferred from the tank to avoid over population.
- j. In case of scarcity of natural food, artificial food such as waste flour (*atta*) may be given to avoid death of fishes.
- k. Dechlorinated water should be used in the fish tanks, in case of chlorinated water supply, leave the tank open for 48 hours before introducing the larvivorous fishes.
- l. Presence of insecticides can be lethal to the fish.

Note: Inflow and outflow pipe of hatcheries should have a steel/brass wire-mesh of size 1mmX1mm to prevent escape of larvivorous fish into natural water bodies. The wire-mesh should be checked from time to time.

Hatcheries at District and PHC level should be constructed with following Dimensions:

- a. District Hatchery: 5m X 5m X 1.5m (Concrete)
 - b. PHC/Sub- Center Level Hatchery: 2m X 2m X1.5 m (Concrete) or Circular shaped 2m diameter and 1 m depth with 10cm thickness of the wall concrete or varies depending upon the space available
- The other specifications are same as Mother Hatcheries

7. TRANSPORTATION OF FISHES

- a. The fishes are best transported in small containers of up to 40 litres, such as plastic buckets and jerry cans, or in strong plastic bags, half filled with water from the rearing pond.
- b. Fish should be transported in water at ambient temperatures and should not be exposed to direct sunlight. The containers should have sufficient openings to allow flow of air.
- c. Take polythene bag of 3 -5 litre capacity, fill it with 1.5 lit water. Introduce the fish in the bag till the total volume of water and fish is two litres. Bubble the oxygen in bag from O₂ cylinder or from air pump. Close the mouth of bag with a string leaving sufficient space at the top. Put the bag in a thermocol container and close the mouth of container.
- d. The container should be transported for a period of 24 hours without further filling oxygen. If the period of transport is more than 24 hours then arrange for change of water and oxygenate.

7.1 Precaution during Transportation of larvivorous fishes

- a. Fish do not tolerate sudden temperature changes.
- b. Preferably the fishes should not be given any food for 10-12 hours period prior to packing for transportation.

8. COLLECTION OF LARVIVOROUS FISHES

- a. Fishes should be collected with help of netting, which is fitted on a circular iron ring of 60 to 90 cm diameter with a wooden handle.
- b. Sufficient quantity is collected by repeated dips.
- c. Collection in bucket or drum till they are packed for transportation.

9. RELEASE OF LARVIVOROUS FISHES

- a. To release the fish in a water body, measure the temperature & perimeter of water body.
- b. Release the fishes at the rate of 5-10 fish per linear meter.
- c. If the larval density is high more fish up to 20 can be released.

9.1 Precautions during release of Larvivorous fishes:

- a. Fishes should be released in the morning or in the evening (preferably during natural diurnal light).
- b. Before releasing ensure that, the temperature of water both in container and in the larval habitat is more or less same.
- c. Clean out dense vegetation from the water body.
- d. Ensure that water body is free from predators of larvivorous fishes.
- e. Care should be taken to prevent the escape of fishes into the natural habitat.

10. WHERE TO USE LARVIVOROUS FISHES

- a. Fish should be preferably introduced in all wells in the rural and peri-urban areas before the high mosquito breeding season to maximize impact. However, the fish may be used in such wells even if the seeding has been delayed.
- b. Fresh water bodies with no outlets into natural water bodies such as stagnant ponds, quarry pits, large burrow pits, and margins of ponds should be targeted apart from wells. Such places should be surveyed and numbered to facilitate subsequent monitoring of impact.

11. MONITORING-

- a. Supervisors should check the fish hatcheries at least once a month during the high transmission season.
- b. Generally, these fishes are released where the vector breeding is observed. After release, reduction in density should be monitored at weekly interval.
- c. All the sites where fish have been introduced should be checked for:
 - i. Whether fish have been introduced or not
 - ii. Whether the fish are surviving or not
 - iii. Identification of possible reasons, in case the introduced fishes are not surviving.

12. REPORTING

- a. Monthly report to state programme officer and to NCVBDC containing following information:
 - i. Number of fish hatcheries established
 - ii. Name of urban and rural areas using larvivorous fish
 - iii. Number of unused wells marked for the introduction of the fish
 - iv. Number of sites in the urban areas marked for the introduction of the fish.
 - v. Field reports of supervision of 10% of the sites
- b. Community participation and response

13. MAINTENANCE and REARING OF LARVIVOROUS FISH CULTURE AND UPSCALING

To ensure a continuous supply of larvivorous fish for mosquito control, a hatchery should be established where fish can breed before release into local waters. Organic manure such as cow dung can be added to promote microorganism growth as fish food, and reeds should be planted to provide shelter for young fish. Tanks should have small fountains for fresh water supply.

Once established, fish usually do not require feeding, though supplementary food accelerates multiplication in larger water bodies. Fish may be fed with wheat-flour balls, ensuring tanks and food remain free of leeches. If fish disappear after introduction, restocking should be done.

For mosquito control in wells and similar habitats, fish should be introduced at about 10 fish per square meter with an equal male–female ratio. Fish density should be monitored and replenished as needed, as declines occur due to limited food and lack of shelter, sometimes leading to starvation.

Stocking of wells, ornamental tanks, and similar habitats should begin at least one month before the Vector Borne Diseases season, with regular monitoring of fish activity and mosquito larval density.
