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# Basic biosecurity manual for tilapia hatchery technicians in Bangladesh

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# Contents

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Introduction	4
What is biosecurity?	5
The need for biosecurity	6
Activities for effective biosecurity	7
How are diseases introduced into a hatchery?	8
How can new, healthy-looking fish be sick?	9
How does disease spread within a hatchery?	9
What are the requirements for biosecurity?	9
Appropriate hatchery design for biosecurity	10
Good water supply	11
Ensuring high water quality	12
Minimizing the risk of disease from new fish	13
Minimizing stress in fish	14
Proper nutrition	15
Hatchery equipment	16
Disinfecting hatchery items	17
Cleaning and disinfection protocol	18
Disinfectants used in hatcheries	19
Vehicles/transport	20
People management	21
Treatment and disposal of wastewater and solid waste	22
Training hatchery staff	23
How to spot sick fish and act to minimize losses	24
Sending sick fish to a laboratory	25
Recordkeeping	26
Emergency contacts	27

# Introduction

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Tilapia was first introduced to Bangladesh from Thailand in 1954 followed by several other import initiatives. Tilapia has since become increasingly popular in Bangladesh, particularly among the poor because of its taste, nutrient quality and low cost. It can be grown under subsistence conditions, as well as in commercial intensive culture, and as a freshwater fish it can tolerate brackish water in coastal areas. Tilapia production in Bangladesh has taken off recently, increasing from 20,000 metric tons in 2000 to 250,000 in 2014. Bangladesh now produces over 4 billion tilapia fry every year from over 400 tilapia hatcheries. This increase in production could be even higher if the broodstock had been of good quality. The country's tilapia broodstock had seriously deteriorated over the years because of a lack of good management, which resulted in inbreeding, the mating of closely related fish. This has led to poor growth and higher susceptibility to disease outbreaks.

Tilapia hatcheries in Bangladesh intensively practice hormonal sex reversal to produce mono-sex male tilapia seeds. Since WorldFish introduced Genetically Improved Farmed Tilapia (GIFT), which is a faster growing variety of Nile tilapia, from Malaysia, several hatcheries have begun to produce mixed-sex tilapia fry to grow into tilapia broodstock for further production of mono-sex GIFT fry. With increased production and dissemination of both mono-sex and mixed-sex tilapia by hatcheries, there have been disease outbreaks in Bangladesh tilapia broodstock facilities, hatcheries and nurseries as well as farms.

With the onset of Tilapia Lake Virus (TiLV) outbreaks in several Asian countries, WorldFish, in collaboration with Bangladesh's Department of Fisheries, has developed a program to improve biosecurity in the tilapia industry throughout the country. As the first step, a training program has been designed and conducted to train a group of specialists called Master Trainers on improving tilapia hatchery biosecurity. This manual is a result of that program. The Master Trainers will use this manual for training tilapia hatchery technicians countrywide on how to improve biosecurity in hatcheries.

# What is biosecurity?

**Biosecurity** is the establishment and implementation of a system or procedures to prevent the introduction of pathogens into a fish hatchery from outside the facility or into a section of the hatchery from another section in the same hatchery.

**Pathogens** (bacteria, parasites, fungi, viruses) are infectious agents that can cause disease.

Biosecurity is a common-sense method of prevention to avoid contact between animals and pathogens. It does not have to cost too much money, and it is good practice to use in any farm. If biosecurity measures are

not followed, more time is used and more money is spent trying to cure a disease when it does appear.

For fish hatcheries, biosecurity consists of various, simple, sometimes zero-cost measures that will **keep pathogens away from fish and keep fish away from pathogens**. The principles of biosecurity can be applied in both large-scale animal production units and backyard or small-scale animal production units. These principles may, however, be difficult to follow in aquatic environments compared to terrestrial, and different measures of biosecurity may have to be applied in different circumstances.



Good example of a closed up hatchery to reduce the risk of introducing pathogens.

# The need for biosecurity

Owners invest a substantial amount of money to establish a hatchery to produce fry/fingerlings, and they expect to generate income from their investment. In any industry, care must be taken from the beginning to ensure the facility is properly designed so that routine operations can run smoothly. The expectations are that fry or fingerlings produced from a hatchery for distribution to farmers must be of high quality and have good survival rates.

In any live animal production facility, there is always the risk of introducing pathogens that can cause disease. Diseases can come from many sources, such as new broodstock, contaminated equipment, birds and other animals. They can even find their way into a hatchery during routine operational activities. A disease outbreak can cause severe financial losses and be a serious setback for a hatchery operator.

Because of this, biosecurity measures are needed to minimize the risk of financial loss. High priority is usually given to breeding and maintaining broodstock. Even though biosecurity prevents the introduction of pathogenic agents by using prophylactic measures to avoid a crisis, hatchery operators often give it low priority. Instead, they usually take the crisis management approach whereby action is taken only when fish start dying in large numbers.

Biosecurity measures are crucial for the successful operation of a hatchery. This manual provides a very basic understanding of how the introduction of pathogenic agents can take place in a hatchery and what needs to be done to minimize the risk of an outbreak.

## Benefits of biosecurity

Biosecurity allows hatchery owners to minimize the risk of the following:

- the occurrence of a disease outbreak
- high fish mortality
- high financial losses from the loss of fish
- a setback caused by the disruption of production
- high operation costs to clean up the premises after an outbreak
- project failure
- loss of clients, who will no longer trust the quality of the fry/fingerlings.

After an outbreak, even doing a thorough cleanup of the hatchery will not guarantee that the fry/fingerlings produced are free of the disease. They may continue to carry pathogens, especially if it is a disease caused by viral infections like TiLV. Implementing biosecurity is about adopting good management practices, which cost less than treating diseases. Implementing biosecurity assures a successful project.



A well-lit hatchery is essential to do the work efficiently at any hour of the day.

# Activities for effective biosecurity

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To properly implement biosecurity measures in a hatchery, attention has to be given to the proper procedures. This ensures that pathogens are

not introduced from outside the hatchery and subsequently spread within it by contamination, resulting in fish dying.



Figure 1. Biosecurity measures for hatcheries.

# How are diseases introduced into a hatchery?

Bringing in fish carrying pathogens (mostly without showing signs of disease) from outside (other countries, other farms, the wild) can introduce pathogens resulting in an outbreak among fish already in the hatchery.

Tilapia can be infected with pathogens such as

- common protozoan parasites, *Ichthyophthirius multifiliis*, *Trichodina* sp., *Eimeria* spp., *Myxosoma* sp., *Nosema* sp., *Henneguya* sp., and *Hexamita*;
- monogeneans flukes;
- helminths such as *Acanthostomum* spp. and *Acanthogyrus* sp.;
- bacteria such as *Pseudomonas* sp., *Aeromonas* sp., *Flavobacterium columnare*, *Francisella* sp., *Streptococcus* spp.;
- viruses such as TiLV.

Bringing contaminated water and equipment from outside can also introduce pathogens into a hatchery.

To overcome the introduction of new diseases into a hatchery or farm, operators must take the following precautions:

- As much as possible, avoid bringing in live fish into the hatchery, from other countries or from other farms outside your facility.
- If fish must be brought in from outside, seek advice from the authorities (Department of Fisheries), before doing so. Fisheries authorities will help check for a reliable source of fish, free of harmful pathogens and disease.
- Always ensure that a health certificate, certifying that fish are free of harmful pathogens, is accompanied with the consignment of fish. Authorities will/should conduct necessary tests on fish brought into a hatchery to ensure they are healthy and free of harmful pathogens.
- Keep newly brought fish separate (quarantined) to make sure they are free from pathogens and disease before mixing them with existing fish in the hatchery. Diseases introduced with new fish when mixed with local farm fish can cause severe mortality if they have not been examined by a reliable laboratory.



Photo credit: WorldFish

Individual tanks must have their own items, such as beakers, pails and nets, to collect fish, and tanks must not share water to avoid contamination, which can spread disease.

## How can new, healthy-looking fish be sick?

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New fish brought into a facility may look healthy and yet symptoms of disease can appear just a few days after transportation. This is caused by the stress of transportation. If fish are overly stressed during transportation, they will be at high risk of infection from pathogens, which cause disease in just a few days. This usually happens to young or weak fish. These situations end up in high mortalities.

To avoid fish mortalities after transportation, operators must implement the following procedures:

- Purchase (source) fish from a nearby facility to avoid the stress of long transportation times.

- Purchase fish from a reliable source that has no recorded disease outbreak at the farm. These farms are usually certified by the fisheries authorities, who should provide a health certificate certifying that the fish are free from harmful pathogens/diseases.
- Send fish to a laboratory for examination to ensure they are free of pathogens.
- If pathogens are detected and the disease cannot be treated effectively, do not introduce the fish into the hatchery. Instead, dispose of them appropriately.
- If the disease can be effectively treated, introduce the fish into the hatchery after treatment.

## How does disease spread within a hatchery?

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In a hatchery, various items are moved around during daily operations, including buckets, nets, siphon hoses, clothing, footwear and other materials. These items can accidentally come in contact with sick fish or pathogens and transmit diseases. Transmission can also occur through people, or animals such as rats, mice, squirrels, cockroaches and other stray animals.

To avoid the spread of disease, the following precautions must be taken:

- Limit the movement of items within the premises and keep animals out.

- After disinfection, discard water used to bring new fish into the hatchery.
- Before use, disinfect items such as beakers or anything that is introduced into a fish tank.
- Disinfect all items used in a hatchery as described on page 19.

## What are the requirements for biosecurity?

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Before establishing a new hatchery, proper planning must be done to ensure the facility can be used successfully.

A proposed building must

- be on higher ground and far from other hatcheries or farms, because the farther the distance the lower the risk of infection from neighboring farms;

- be free from flood-prone areas and have a facility capable of properly discharging effluent;
- be accessible by road to transport fish and other materials;
- have access to electricity and a clean water supply.

# Appropriate hatchery design for biosecurity

The success or failure of fish production depends on a hatchery's design. Hatcheries should be designed to ensure good biosecurity to prevent the introduction of pathogens while allowing efficient as well as cost-effective running of the hatchery.

To achieve reliable production of high quality larvae, production facilities must implement the following:

- Construct buildings using inexpensive and locally available materials.
- Seal buildings to prevent the entry of animals, such as rats and birds, which can bring in and spread pathogens. This will also reduce high fluctuations in temperature, which can stress the fish.
- Put in proper fencing to prevent the entry of animals and unauthorized persons.
- Ensure constant aeration (24 hours) of the fish.
- Provide sufficient lighting.
- Have different compartments for different operations in the hatchery. The main section for live fish may consist of a hatchery section, an area for holding fingerlings and a separate room for quarantining or

for new introductions. The sections where live fish are kept must have the highest priority in terms of biosecurity. Movement in this area must be limited to essential staff only. Each division must have its own footbath and equipment, and handwashing is a must for each section. Avoid going from the quarantine room into the hatching area.

- To avoid cross-contamination, install separate entries for other sections in the hatchery (storage rooms for feed and equipment) so that staff do not have to go through the live fish section.
- To prevent cross-contamination, make sure each tank has its own water inlet and outlet that do not flow from one tank to another.
- At the entrance to the hatchery, install a drive-thru dip to sanitize vehicles.
- Provide footbaths and handwashing stations at the entrance to the hatchery.
- Ensure the packing area is located near the main entrance of the hatchery.
- Isolate aerators and water pumps to avoid disturbances from noises and vibrations.

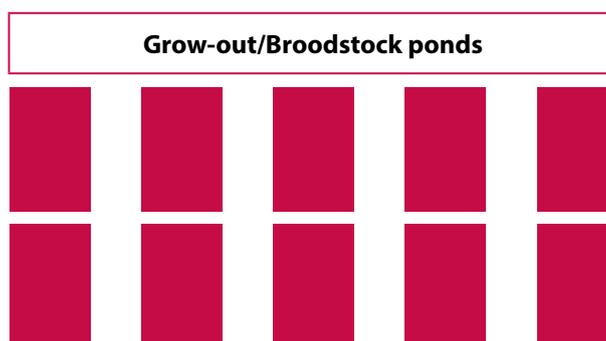
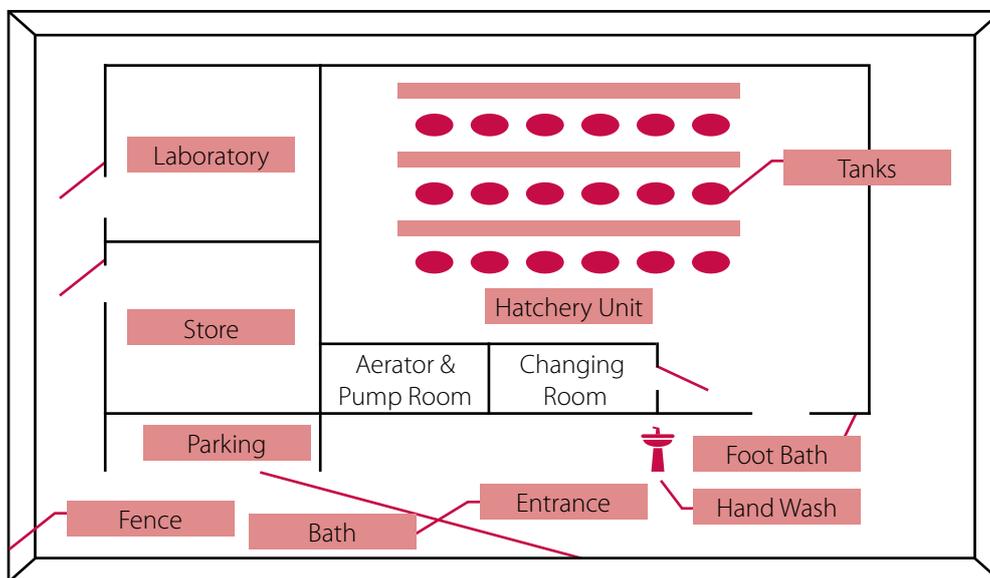


Figure 2. Design for a biosecure hatchery.

## Good water supply

Clean water is essential to maintain good fish health. Poor water quality will result in low larval survival and affect overall hatchery production. Therefore, a hatchery's water supply should be pathogen-free or treated appropriately. Water should be drawn preferably from bore wells and should be filtered

before use. If water is obtained from an open source, it should be treated using a sand filter, UV light or ozone before use. Avoid splashes and aerosols between tanks since these can spread pathogens. If water is contaminated with arsenic or other heavy metals, it should be treated before use.



Various models can be used to filter water supply to the hatchery.

## Ensuring high water quality

Water quality is the most important factor affecting fish health and performance in aquaculture production systems, so having good water quality is necessary for a hatchery. Operators must ensure that the physical and chemical conditions of the water remain within the optimum ranges for fish under culture, using reliable instruments to take

measurements of the water quality, including temperature, dissolved oxygen levels, pH and ammonia and nitrite levels. The instruments should be calibrated to ensure reliable readings. If the readings are not within the acceptable ranges, appropriate measures must be taken to correct the situation because changes to water quality can stress the fish.



A small lab for testing water quality and simple examinations of fish smears.

# Minimizing the risk of disease from new fish

When new fish are introduced into a hatchery, they can contain pathogens that can spread disease throughout the facility. Although newly purchased fish may look healthy, they can carry pathogens while showing no signs of disease. If proper precautions are not taken, the pathogens will spread and contaminate the hatchery. Once pathogens are introduced into a hatchery, it is difficult to get rid of them.

To minimize fish deaths from disease, hatcheries should implement the following measures:

- Purchase healthy fish from reliable suppliers. Good farms are regularly monitored by fish health experts and certified free of disease.
- When there is a threat of a new pathogen, such as TiLV, make sure fish sellers have a certificate or laboratory test results proving that the fish are free of specific pathogens.
- When there is cause for concern of a new pathogen, seek a second opinion by sending the fish to an independent, reliable laboratory for testing.
- Maintain fish at the optimum stocking density. Tanks should not be overcrowded because this can stress the fish and make them susceptible to disease.
- If fish eggs are purchased, have them examined for pathogens as described above for new fish consignments. In some cases, disinfect fish eggs to remove pathogens from the surface.
- To avoid transmitting diseases from sick to healthy fish, remove sick fish and place them in quarantine (isolated) away from the healthy fish population.
- Always maintain cleanliness in the hatchery and the surrounding areas.



Photo credit: WorldFish

Broodstock tanks kept indoors.

# Minimizing stress in fish

Stress can weaken fish, making them easily susceptible to any pathogens in the water. To lower the risk of infection, hatcheries must minimize the handling of fish and implement proper day-to-day procedures.

## Handling fish

- Do not transfer fish more often than is necessary. When appropriate, use anesthesia to sedate the fish to minimize stress during handling.
- Remove live fish from water only when necessary.
- Use a smooth tray or plate to scoop fish. Do not hold live fish by the gills or tail.
- Avoid rough handling to minimize mucus/scale loss.

## Routine hatchery procedures

- Monitor fish frequently and check their behavior. Any abnormal behavior is an indication of stress or disease.
- Maintain good water quality parameters.

- Provide proper nutrition/feed.
- Remove any excess feed by siphoning it from the tank.
- Ensure an appropriate number of fish are in a tank. Do not allow overcrowding.
- Avoid the potential risk of introducing diseases as described in previous sections.
- Regularly remove dead or dying fish. Disease can spread through water or when healthy fish consume dead or dying fish infected with pathogens, so it is important to remove and quarantine (isolate) sick fish.
- Examine dead fish to determine the cause of death.
- After every harvest, disinfect tanks and accessory equipment, such as pumps, filters, pipes and trays, in the hatchery before introducing new fish.
- Clean and disinfect hatchery items and the surrounding premises (break cycle).
- Keep accurate records of growth rates, feed conversion ratios and disease.



Photo credit: WorldFish

Stock appropriate densities of fish to avoid stress. High stocking densities will increase susceptibility of fish to pathogens.

## Proper nutrition

Proper nutrition during larval stages is crucial to meeting the production plans of a hatchery. If fish larvae are provided with good quality feed, they will grow quicker and be more resistant to stress and disease. However, live feed such as rotifers sourced from aquatic environments pose a higher risk of transmitting disease than commercial feeds. Care must be taken to provide proper feed for a balanced diet and that is free of pathogens.

The following protocol should be adopted for procuring and storing feed:

- Obtain good quality feed from reliable sources. Poor quality feed can also cause disease.

- Use feed before the expiry date to retain the nutritional contents and to avoid old feed becoming contaminated with pathogens.
- Keep feed away from rats and other animals, and store it in a cool, dry, secure place to retain the nutritional contents.
- Do not use fresh feed (trash fish, bivalves, etc.) that could contain pathogens. Use fresh feed only if it can be treated to remove pathogens.
- Commercial pellet feeds are generally safe and present a low risk of disease transmission.



Photo credit: WorldFish

Feed must be stored in a cool dry place so as to retain vitamin C, which is easily oxidized, and to avoid contamination by fungus, which can cause disease.

## Hatchery equipment

To prevent disease transmission, good cleaning and disinfection procedures should be carried out to avoid introducing and spreading diseases. All tanks and equipment should be thoroughly cleaned and disinfected after use and before starting a new production cycle. In addition, filters need to be washed and disinfected at regular intervals.

Hatcheries should adopt the following protocols to minimize the risk of contamination:

- Do not take any hatchery items outside the facility.
- Use reliable instruments to make measurements.
- Clean, disinfect and dry all hatchery equipment (nets, buckets, boots, etc.) regularly after use.
- Flush sand filters and remove the sand to dry in the sun.
- Wash and disinfect tanks at the end of every production cycle.
- Limit the movement of equipment. Ensure that each tank has its own small items (beakers, scoop nets, buckets, etc.) and do not use them in other tanks. If sharing items between tanks is absolutely necessary, disinfected the items after use.
- Maintain a clean work environment.



Filter bags and other items used in a hatchery must be soaked in disinfectant for a few hours and sun dried.

## Disinfecting hatchery items

A necessary component of disease prevention and control in a hatchery is disinfection. Diseases affecting one larval tank can easily spread to other tanks through contamination.

Good sanitation and disinfection procedures are as follows:

- Apply appropriate disinfectants at the proper concentrations and duration.
- Disinfect all hatchery equipment (trays, nets, etc.) regularly and dry them thoroughly.
- If necessary, wash items thoroughly after disinfection to remove any toxic residues.
- Flush sand filters and remove the sand to dry in the sun.

- Soak airbag filters in disinfectant and dry them in the sun.
- Wash and disinfect tanks at the end of every production cycle.
- Store nets and other equipment off the floor.
- Do not use hatchery equipment in other places because of the risk of cross-contamination. If it is absolutely necessary, disinfect them properly after use.

**Antimicrobial agents** are used for disinfecting nonliving objects or surfaces to destroy or inactivate pathogens.



Disinfect all items in a hatchery after the harvest of every consignment.

# Cleaning and disinfection protocol

Proper cleaning and disinfection procedures must be practiced to ensure items treated with chemicals are thoroughly disinfected.

For proper disinfection, the following steps must be undertaken in order:

1. Manually remove dirt and organic matter, otherwise the disinfectant may not be effective.

2. After removing the dirt, wash the item with soap and water.
3. Rinse with water.
4. Apply an appropriate disinfectant at the proper concentration and duration.
5. Rinse again to remove disinfectant.
6. Dry (if possible under the sun).



Sand filters and UV light used for treating the water supply to the hatchery.

## Disinfectants used in hatcheries

A disinfectant is an agent that destroys infection-producing organisms. Concentration and duration are important factors that are dependent on the conditions and procedures undertaken. Wear protective gear when handling disinfectants, and follow instructions carefully. Expired disinfectants should not be used and instead discarded properly.

A list of some common disinfectants and dosages for various applications are given below (Table 1). This list is intended for informational and educational purposes only. Please seek the advice of professionals on the use of disinfectants.

Disinfectant	Concentration	Duration	Comments
Benzalkonium chloride	250–500 ppm	10–30 min	Plastics, floors, footbaths, walls, equipment and furnishings.
Didecyl dimethyl ammonium chloride	400 ppm	5 min	Plastics, floors.
Phenols	2%–5% active ingredients	10–30 min	General disinfection.
Chlorine	200–500 ppm	10–60 min	All surfaces except plastic. When cleaning tanks, disinfect for 24 hours, neutralize, rinse and dry.
Ethyl alcohol	70%–80%	10–30 min	Hands, tools, work surfaces.
Isopropyl alcohol	60%–80%	10–30 min	Hands, tools, work surfaces.
Iodine	100–250 ppm	20–30 min	Antiseptic on tissues. Follow product label instructions if using for egg surface disinfection.
Hydrogen peroxide	3%–30% (weight percentage)	5–30 min	General disinfection.
	3–5%	5–15 min	Follow label instructions to treat fish or disinfect eggs.
Virkon® Aquatic	0.5%–1% or 50–100 g per 10 L of water	10–15 min	General disinfection. Commonly used for footbaths.
Chlorhexidine (most solutions contain 2% active chlorhexidine)	Add 100 ml to 1 L of water for disinfection	5–10 min	General disinfection. Commonly used for footbaths.

Sources: Bowker JD, Trushenski JT, Gaikowski MP and Straus DL, eds. 2014. *Guide to using drugs, biologics, and other chemicals in aquaculture*. American Fisheries Society Fish Culture Section.

Yanong RPE and Erlacher-Reid C. 2012. *Biosecurity in aquaculture, Part 1: An overview*. SRAC Publication No. 4707.

Table 1. Common disinfectants, with dosages and applications.

## Vehicles/transport

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Minimize the risk of vehicles introducing and spreading diseases within and off the hatchery. Unauthorized vehicles should not be allowed inside hatchery premises. Vehicles that are allowed to

enter should have their wheels and undercarriage disinfected by passing through a bath at the gate entrance. The disinfectant should be replaced regularly according to the instructions on the label.



Photo credit: Worldfish

A drive-thru bath to disinfect vehicle wheels. To ensure the effectiveness of the disinfectant it has to be added frequently to the bath.

# People management

It is important to minimize the risk of staff and visitors transferring diseases on, within and off the hatchery. If procedures are not followed, someone who has visited another site may be carrying pathogens that can contaminate the hatchery. Similarly, frequent movement of staff between different sections within the hatchery can also transmit pathogens.

To avoid contamination from people, hatcheries should implement the following procedures:

- Restrict the movement of people and staff.
- Use the hand wash and foot bath at the entrance of the hatchery.

- Do not allow unauthorized people inside the hatchery.
- Maintain a visitors' logbook.
- Have hatchery personnel escort visitors into the facility.
- Restrict visitors from fish tank areas.
- Replace the disinfectant regularly according to the instructions on the label.



Signboard on sanitation and disinfection procedure at entrance of the farm.

# Treatment and disposal of wastewater and solid waste

## Wastewater

Hatcheries must ensure that water discharged from their facility is free from pathogens. Proper treatment and discharge will reduce the risk of disease within the hatchery and others in the vicinity.

Treat wastewater to an acceptable level before discharge to avoid the spread of any disease by following these procedures.

- Release wastewater from the hatchery into sedimentation tanks.
- In treatment tanks, chlorinate and dechlorinate wastewater from sedimentation tanks before discharge.
- Do not discharge water close to the intake point.

## Solid waste disposal

Waste products such as dead animals, wastewater and processing waste can be vectors for transmitting disease into a hatchery.

Proper disposal must be carried out to reduce the risk of spreading disease by doing the following:

- Dispose of solid waste properly according to local regulations and laws.
- Bury or burn dead fish to prevent the spread of disease.



Hatchery wastewater is treated in a pond before being discharged outside. This reduces the risk of chemicals used in hatchery or pathogens contaminating the environment.



# How to spot sick fish and act to minimize losses

Just like any other animal, fish will show symptoms when they are sick, so it is important to frequently watch the fish carefully to observation any changes in behavior. The two most obvious symptoms are a lack of appetite (or none at all) and slower movement. Other symptoms include blood spots, extra mucus, a swollen abdomen and cloudy and/or swollen eyes. Depending on the disease, fish will die daily or they may die in large numbers within a few days. (Stress makes fish more susceptible to disease, so to decrease overall stress on the fish, reduce overcrowding, keep the temperature constant, maintain good water quality and provide adequate feed. These will reduce mortality among the fish.)

To minimize losses, hatcheries should implement the following procedures:

- If an outbreak occurs, report the situation to the nearest authorities so that quick action can be taken to control the spread of the disease.
- Remove sick fish and place them in a separate tank in another section of the hatchery so that they will not infect healthy fish.
- Have an expert examine some of the sick fish and suggest whether they should be treated or killed. If the disease can be cured, treat all the remaining fish in the tank. If the disease cannot be treated, bury all of the sick fish to avoid spreading the disease and then disinfect the entire hatchery, including the equipment.
- Take action immediately by following the previous steps within 2–5 days, depending on the disease.



Monitor fish frequently and remove dead or dying fish.

# Sending sick fish to a laboratory

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In most cases, sick fish require further examination in a laboratory before an accurate diagnosis can be made. In such cases, sick fish can be submitted to a laboratory in three ways.

## Packed in oxygenated bags

- Pack live sick fish in oxygenated bags and send them to a laboratory. Do not pack too many fish in a small bag, however, because this can kill the fish.
- Depending on the size of the fish, provide the laboratory with a sufficient number of samples to determine the cause of the disease. If the fish are small, 10–20 should suffice.
- Along with the sick fish, include a bag of healthy fish so that the laboratory expert can compare them to the sick fish to determine the disease. Remember to not pack too many fish in a small bag. Label the bags (or boxes) properly. Write the owner's name (or the farm name) and tank number where the fish were collected from.
- On a separate sheet, include details such as when the fish started showing symptoms, how many fish are infected and when they started dying (if applicable) as well as any other information, like the number of tanks involved and the percentage of mortality.

## Preserved in formalin

- If the laboratory is too far away, preserve the fish in formalin (referred to as 10% buffered formalin), which is specially treated. Buffered formalin filled bottles are usually available in fish health laboratories.
- If the fish are very small (fry), slit the fish vertically from anus to gills and fix in a buffered formalin vial.
- If the fish are big (fingerlings, juveniles), kill and dissect the fish as follows:
  - Cut the spinal cord behind operculum (pithing).
  - Slit the fish ventrally from anus to gills.
  - Remove viscera away from the kidney and puncture the swim bladder for proper fixation of the kidney.
  - Slit muscles lengthwise on either side of the body (for fish larger than 5 cm in length).
  - Place fish in fixative at a ratio of 1:10 (fish to fixative)
  - For fish larger than 10 cm in length, open the intestinal tract and make several slits in the liver, spleen and kidney for better fixation.
  - Divide the head lengthwise along the midline to allow fixation of the brain.

## Send in an ice box

- In certain cases, fish can be sent to a laboratory in an insulated box filled with ice. If this is used, make sure the fish have been freshly collected from the tank.

## When sending fish to a laboratory, take the following precautions:

- Do not send any dead fish to the laboratory for examination.
- Always check with the laboratory first before sending fish for examination.
- Ask how many fish the laboratory requires and whether they should be sent in oxygen, in formalin or on ice.
- Notify the laboratory when the fish have been sent and inform the lab of the date they will arrive.

# Recordkeeping

Good record keeping is essential in a hatchery operation. All activities must be recorded to make it easier to trace or investigate an event that could have links to the possible cause of a disease outbreak. Recordkeeping must be accurate and reliable. All records must include the date of the event, a signature of the person who made the entry and any additional remarks or comments.

Hatcheries should keep records of the following activities:

- visitors to the hatchery
- movement of fish from outside or within the hatchery
- purchase and introduction of new fish
- changes in fish behavior
- fish mortality along with any symptoms
- reports on disease investigations received from laboratories or reports from experts visiting the hatchery
- handling or treatment of fish
- water quality parameters
- number of each fry consignment produced and to which farm these consignments were sold
- training offered to staff members
- changes in hatchery operations, such as introducing new feed, change in water supply, use of new disinfectant and new dosage.



Photo credit: WorldFish

Prompt and correct diagnosis from a proper laboratory will help implement appropriate measures to control the spread of the disease in the hatchery.

## Emergency contacts

In case of a disease outbreak or any related emergency, please contact your district fishery officer. The contact phone numbers are given below.

District	Telephone Number
Bagerhat	46862445
Bandarban	36162338
Barisal	43168018
Bhola	49162407
Bogra	5160570
Borguna	44862396
Brahmonbaria	85158501
Chadpur	84163165
Chapai Nababgonj	78152482
Chittagong	312580982
Chuadanga	76162388
Comilla	8176151
Cox's bazar	34163268
Dhaka	9558883
Dinajpur	53164486
Faridpur	63163223
Feni	33174046
Gaibandha	54151643
Gazipur	02-9261283
Gopalganj	26685454
Hobigonj	83163350
Jamalpur	98163620
Jenidaha	45162857
Jessore	42165752
Jhalakathi	49863258
Joipurhat	57162224
Khagrachori	37161726
Khulna	41763016
Kishorgonj	94161927
Kurigram	58161501
Kustia	7162189
Lalmonirhat	59161346
Laxmipur	35161465
Madaripur	66161442
Magura	48862341
Manikgonj	7710391
Meherpur	79162543
Moulvibazar	86152813
Munshigonj	7611591

District	Telephone Number
Mymensingh	9166748
Naoga	74162585
Narayngonj	02-7630625
Nator	77162590
Netrokona	95161404
Nilfamari	55161570
Noakhali	32161681
Norail	48162033
Norshindi	02-9462410
Pabna	73166068
Panchogar	56861369
Patuakhali	44162501
Pirojpur	46162597
Rajbari	64165583
Rajshahi	721760245
Rangamati	35162327
Rangpur	52162929
Sariotpur	60161656
Satkhira	47163318
Sherpur	93161447
Shirajgonj	75162137
Sunamgonj	87161497
Sylhet	821716241
Tangail	92163678
Thakugaon	56153463



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