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# Disease prevention in shrimp hatcheries

Aquaculture Department, Southeast Asian Fisheries Development Center

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# DISEASE PREVENTION IN SHRIMP HATCHERIES

Disease prevention is a primary and cost-effective method in shrimp health management. To reduce the possibility of disease outbreaks, the **Fish Health Section** of the **Aquaculture Department** traced the development of diseases and came up with recommendations as guidelines in hatchery operations

***Development of Disease.*** Disease develops through the interaction of the prawn (the host) the causal agent (the pathogen), and the environment. In the presence of a susceptible host, a pathogen and predisposing environmental conditions (poor water quality, inadequate food, frequent handling, overstocking), disease is very likely to occur Improved environmental conditions, healthy prawns and absence of disease agents would therefore lessen the chance of a disease outbreak

The causal agents may be pathogenic organisms (viruses, bacteria, fungi, protozoa, helminths, microcrustaceans) or non-pathogenic adverse environmental conditions (extreme temperatures, low oxygen levels, chemical poisons). Living disease agents cause infectious diseases which generally result in gradual mortalities. Non-living disease agents cause non-infectious diseases that result in sudden mass mortalities.

The environment determines the balance between the prawn as host and the disease agent Microorganisms are always present in the water and some of them cause disease only when the prawn has been weakened through exposure to stressful environmental conditions

Hatchery personnel should realize that they themselves could transmit disease through their contaminated hands, clothing, and footwear Also possible carriers of disease agents are equipment such as water pumps, blowers, pipes, and materials such as scoop nets water hoses pails, glasswares. Spawners, live natural food like diatoms, rotifers and brine shrimp, and artificial diets could also be vehicles of disease transmission.

## Item One: Maintenance of Rearing Water

Ensure that the hatchery site is provided with an abundant supply of pollution-free seawater and freshwater

Install at seawater intake sand filters which will allow backwashing (Fig 1)

Filter water with a fine net or cloth (Fig. 2) or cartridge filter before stocking in tanks Clean filters regularly

Remove silt in water by sedimentation

Disinfect sand-filtered water with 5-20 ppm available chlorine for at least 12 hours Calcium hypochlorite (powder form) or ordinary household bleach may be used

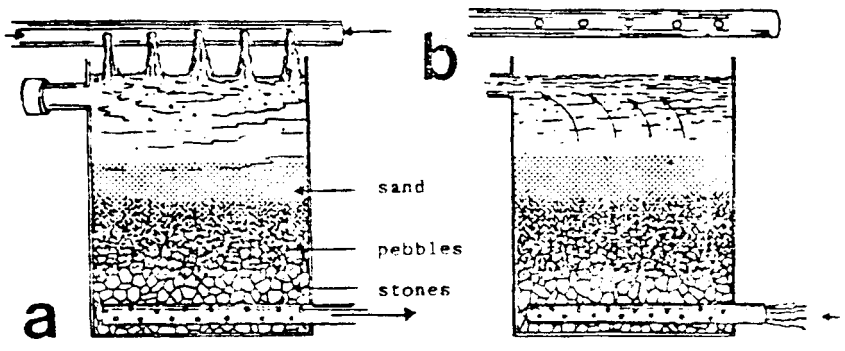


Fig 1 Sand filter system showing operational inlet flow (a) and reverse flow or backwashing (b)

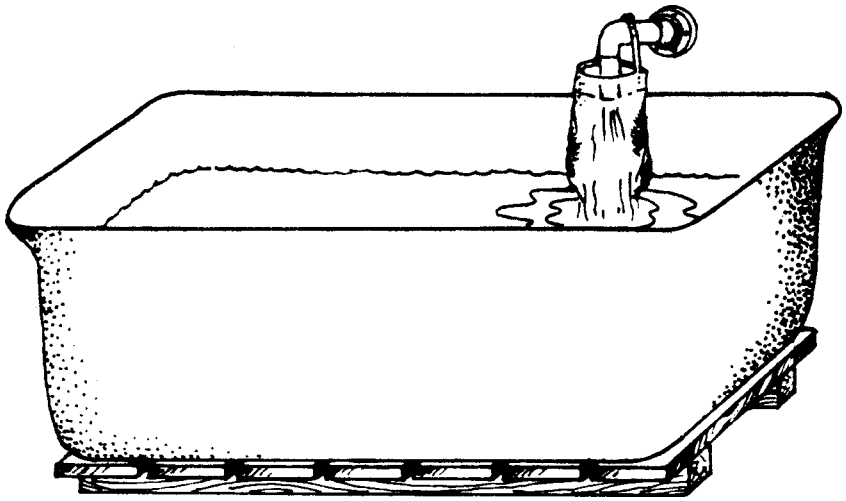

Fig. 2. Filtration of seawater using fine net.

- Sand-filtered water may also be sterilized with ultraviolet light.
- Aerate rearing water properly.
- Change water regularly (about 40-50% of total water volume daily) starting at Zoea I.
- Siphon off bottom sediments regularly to remove feces, organic debris, and uneaten feed and to minimize microbial multiplication.

Procedure for disinfecting rearing water with calcium hypochlorite (70% activity) is as follows:

1. Determine the amount of bleach powder required for the volume of rearing water (Table 1). Dissolve this amount first in a small volume of water (500 ml). For example, if the water volume is 0.5 ton or 500 liters and the desired concentration is 15 ppm, the amount of calcium hypochlorite needed is 10.8 g.

2. Fill the tank with the desired volume of water then add the calcium hypochlorite solution.

3. Allow chlorination of water for at least 12 hours and up to 24 hours, then check the residual chlorine level using portable kits available in the market. Neutralize remaining chlorine with equal amount of sodium thiosulfate ($Na_2S_2O_3$) before using the water.

Table 1. Guide for determining the amount of calcium hypochlorite powder (in grams) to be used for water disinfection

| Water volume tons (liters) | *Chlorine concentration* | | | |
|---|---|---|---|---|
| | 5 ppm | 10 ppm | 15 ppm | 20 ppm |
| 0.25 ( 250) | 1.4 | 3.6 | 5.4 | 7.2 |
| 0.50 ( 500) | 3.6 | 7.1 | 10.7 | 14.3 |
| 1.00 ( 1,000) | 7.1 | 14.3 | 21.4 | 28.6 |
| 2.00 ( 2,000) | 14.3 | 28.6 | 42.9 | 57.1 |
| 3.00 ( 3,000) | 21.4 | 42.9 | 64.3 | 85.7 |
| 5.00 ( 5,000) | 35.7 | 71.4 | 107.1 | 142.9 |
| 10.00 (10,000) | 71.4 | 142.9 | 214.3 | 285.7 |

The amount of calcium hypochlorite may be multiplied by different factors to obtain other chlorine concentrations. Ex.: To obtain 400 ppm chlorine solution in 1 ton water, multiply 28.6 g by 20 or 14.3 g by 40.

4. For chlorination with ordinary household bleach (with 5% available chlorine), use Table 2 to determine the amount of bleach to be used for a desired volume of water, then follow steps 2 and 3.

Table 2. Guide for determining the amount of bleach solution (in milliliters) for water disinfection

| *Volume of water (tons)* | *Chlorine concentration* | | | |
|---|---|---|---|---|
| | *5 ppm* | *10 ppm* | *15 ppm* | *20 ppm* |
| 0.25 | 25 | 50 | 75 | 100 |
| 0.50 | 50 | 100 | 150 | 200 |
| 1.00 | 100 | 200 | 300 | 400 |
| 2.00 | 200 | 400 | 600 | 800 |
| 3.00 | 300 | 600 | 900 | 1,200 |
| 5.00 | 500 | 1,000 | 1,500 | 2,000 |
| 10.00 | 1,000 | 2,000 | 3,000 | 4,000 |

A flow-through water system may be adopted. There should be regular monitoring of rearing water quality parameters such as salinity, pH, dissolved oxygen, ammonia, and temperature (Table 3).

Table 3. Recommended safe levels of selected water quality for shrimp and prawn larvae

| Parameter | Safe level |
|---|---|
| Salinity | 30-35 ppt |
| pH | 7.3-8.3 |
| Dissolved oxygen | 3.5 ppm (lower limit) |
| Ammonia ($NH_3$) | 0.02 ppm (upper limit) |
| Temperature | 27°-30°C |

## Item Two: Care of Equipment and Materials

- Provide properly labelled materials like beakers, scoop nets, pails, etc. for exclusive use in individual tanks.
- Materials like brushes, pails, scoop nets, water hoses, and glasswares may be disinfected in between use in different tanks by dipping in 400 ppm chlorine followed by a thorough rinse with clean freshwater.
- Coat wooden and concrete tanks with non-toxic epoxy paint.
- Disinfect tanks in between rearing periods.
- Use PVC or non-toxic plastic pipes, pails, and equipment parts.
- Backwash or clean filters regularly.
- Maintain equipment properly to prevent oil spill and contamination with corrosive metals.

## Item Three: Disinfection of Tanks

1. Drain and rinse tank.
2. Scrub tank bottom and sidewalls using powdered detergent and stiff plastic brush (Fig. 4).
3. Rinse thoroughly to remove soap suds and loosened contaminants.

4. Disinfect with 100-200 ppm chlorine for 1 hour (see Tables 1 & 2). Scrub tank bottom and sidewalls again.
5. Rinse several times with clean freshwater.
6. Allow to dry under the sun and let stand for 1 or 2 days.

## Item Four: Personnel Precautionary Measures

- Wash hands with soap and water before preparation and administration of feed and before other jobs are undertaken.
- Place disinfection rugs and trays for footwear or feet at the entrance of hatchery facilities using 200 ppm chlorine solution (4 ml bleach per liter solution) or 3% lysol solution (30 ml per liter solution) (Fig. 3). Wash rugs and change disinfectant regularly.
- Minimize entry of unauthorized personnel into hatchery premises.

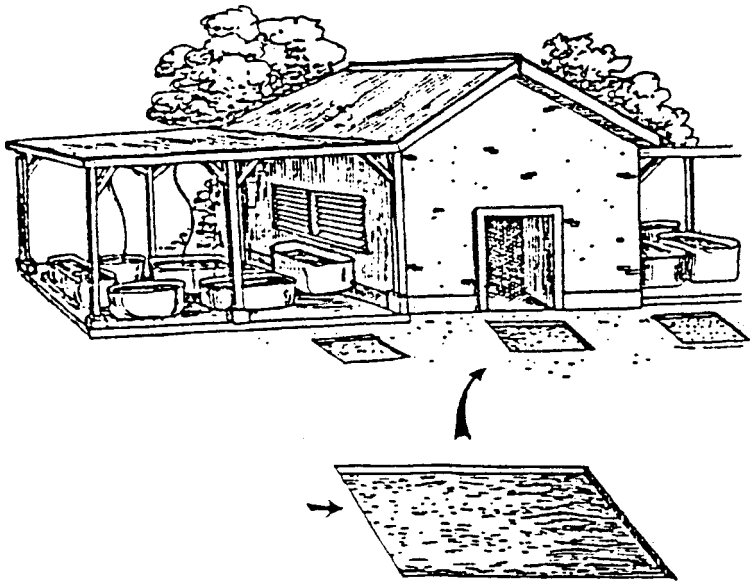

Fig. 3. Disinfection rugs and trays at entrances of hatchery facilities.

## Item Five: Feeds and Feeding

- Use pure culture of the specific natural food for feeding.
- Do not use collapsed or old cultures for feeding.
- *Artemia* cysts may be decapsulated in chlorine solution.
- *Artemia* cysts may be disinfected in 10 ppm formalin (Table 4) or 30 ppm chlorine (Tables 1,2) bath for one hour just before hatching.
- Store commercially prepared diets and other feeds (egg yolk, mussel meat, etc.) in the freezer.

## Item Six: Handling Spawners, Eggs, and Larvae

***Spawners***

- Use healthy spawners.
- Handle spawners with care.
- Provide flow-through water before spawning to remove surface contaminants.

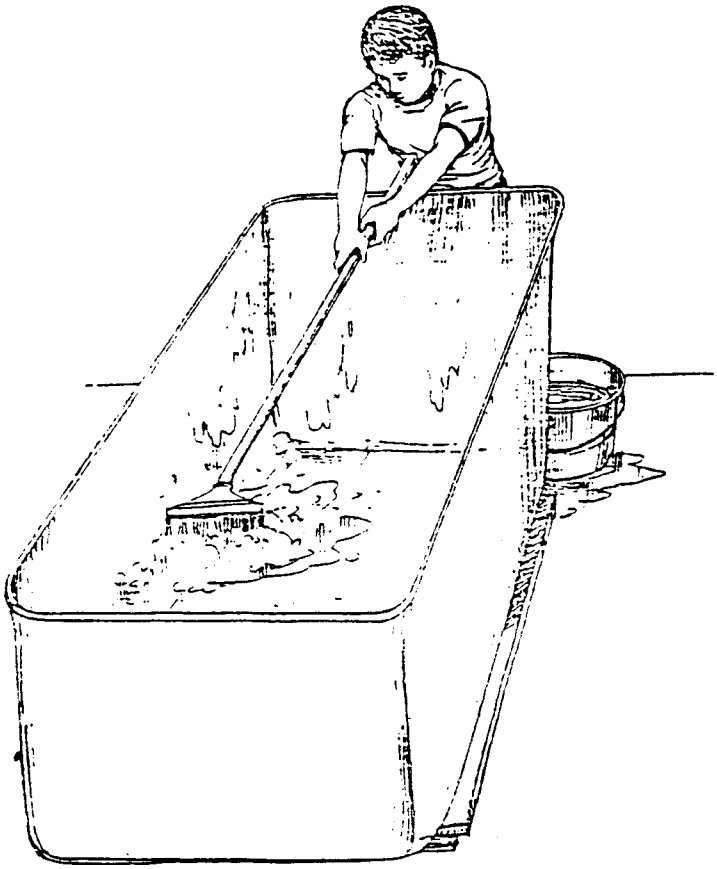

Fig. 4. Cleaning of rearing tank with stiff brush and detergent.

Table 4. Guide in the preparation of formalin solutions

| Formalin concentration (ppm) | Volume of formalin solution (ml) per 10 liters | per 100 liters |
|---|---|---|
| 10 | 0.1 | 1.0 |
| 100 | 1.0 | 10.0 |
| 500 | 5.0 | 50.0 |

A 37-40% formalin solution should be considered as 100% stock. If a white precipitate forms, filter the formalin stock before use. Dilute the solution in seawater.

- Spawn broodstock in individual tanks.
- Remove spawners immediately after spawning.
- If spent spawners are to be kept for rematuration, maintain and quarantine these in individual tanks for at least two weeks before stocking in broodstock tanks.

***Eggs and Larvae***

- Collect eggs using a fine-meshed (0.25 mm) nylon screen, then rinse several times with clean water.
- Eight hours before hatching, eggs may be disinfected for 2-4 hours with 20 ppm laundry detergent (Table 5),and then rinsed thoroughly with complete water change. Dissolve the

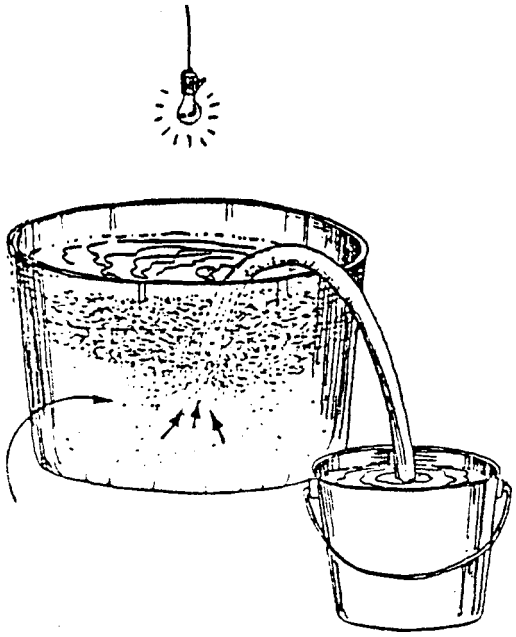

Fig. 5. Healthy nauplii are attracted to light.

detergent in a small amount of fresh water, add to the egg culture tank, and mix gently.
- Separate healthy nauplii from unhatched eggs and weak nauplii. Healthy nauplii are attracted to light (Fig. 5).
- Avoid overcrowding of larvae in rearing tanks. Optimum stocking density is 50,000 to 100,000 nauplii per ton and 10,000 to 30,000 postlarvae per ton.
- Monitor larval condition daily by visual and microscopic examination.

Table 5. Guide in the preparation of 20 ppm laundry detergent

| Volume of rearing water (liters) | Amount of detergent (grams) |
|---|---|
| 1 | 0.02 |
| 5 | 0.10 |
| 10 | 0.20 |
| 100 | 2.00 |
| 500 | 10.00 |
| 1,000 | 20.00 |

## Item Seven: Useful Terms Defined

| | |
|---|---|
| Backwash | : to clean by reversing water flow |
| Carrier | : one that transmits disease germs |
| Cartridge filter | : tubular filter device made up of spun polypropylene material inserted inside a filter housing case |
| Cross-contamination | : transmission of disease or disease agent from one tank to another |
| Debris | : organic waste from dead cells or unused food |
| Diagnosis | : the act of identifying the disease and its cause |

| | |
|---|---|
| Host | : organism (animal or plant) on which another organism depends for subsistence |
| Infectious | : transmissible from one diseased individual to another; contagious |
| Larvae | : newly hatched shrimps or prawns |
| Microorganism | : germ or organism that cannot be seen unless a microscope is used |
| Pathogen | : any disease-producing microorganism |
| ppm | : parts per million or milligrams per liter or grams per ton |
| ppt | : parts per thousand |
| Precipitate | : amorphous or crystalline solid that separates from the liquid |
| Quarantine | : isolation of material or animal to prevent the spread of infectious disease it carries |
| Residual | : remaining |
| Spawner | : adult female prawn capable of producing eggs |
| Susceptible | : easily affected by disease |
| UV | : ultraviolet radiation |

Source: **Recommended Practices for Disease Prevention in Prawn and Shrimp Hatcheries** by G.D. Lio-Po et al.. Aquaculture Extension Pamphlet No. 3, SEAFDEC Aquaculture Department. Tigbauan, Iloilo, Philippines. May 1989.

# ANTIBIOTICS IN HATCHERIES

The regular use of low concentrations of antibiotics has become widespread in penaeid shrimp hatcheries, but this practice induces the rapid development of antibiotic-resistant bacteria. The genus *Vibrio*, one of the groups of bacteria most affected by this practice, includes some potent human pathogens (disease-causing organisms) that associate with fish and shellfish, especially shrimp.

The first recorded use of antibiotics in the rearing of prawn larvae was in Tahiti for the culture of *Macrobrachium rosenbergii*. Since then the use of antibiotics in shrimp hatcheries has become widespread, although by no means universal.

Antibiotics are used in hatcheries to reduce mortalities either by controlling the general level of bacteria in the culture water or, more specifically, by controlling the level of *pathogenic* bacteria.

In larval culture of *M. rosenbergii*, comparisons were made between bacterial populations and pathology in two hatcheries, one using a green water system and the other a clear water system with water changes, plus antibiotics halfway through the cycle. The results were equivocal: one of the green water hatcheries had low bacterial counts and low incidence of pathology, while the other green water hatchery and the clearwater hatchery that used antibiotics were similar in terms of bacterial counts and numbers of larvae showing pathological signs.

There is no possible way that larvae can be reared in an environment that is free of bacteria, but the sources of bacteria can be reduced through water filtration, ultraviolet treatment, etc., and antibiotics are merely an additional weapon in this battle to control bacterial levels. But the question must be asked: Is this the right approach? At some point every organism must develop the ability to withstand attack by other organisms. Over-zealous protection from bacteria may be the last thing larval animals need for healthy development.

***A controllable system.*** One of the problems of running a commercial hatchery is allowing for failure of larval batches. When antibiotics are used, failure is effectively written into the