# Fish Health Management in Aquaculture

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## Introduction

Fish health management has become an integral continuous operation for preventing sudden outbreak of epizootics that occur due to environmental deterioration, improper feeding, overcrowding, etc. Sound status and normal functioning of all bodily organs denote healthy condition while any deviation from the normal functioning of one or of several organs due to adverse factor(s) is termed as diseased condition. For normal functioning, every individual requires a set of parameters within the physiologically acceptable limit of the species cultured. Any adverse fluctuation in these parameters either singly or cumulatively puts stress or predisposes to ill health, disease or even cause mortality. In the aquatic ecosystem, host (fish), pathogen & the environment are in balance state. Disease develops when there is an imbalance in these components (Fig. 1) caused by any stressors. Therefore, disease occurs if the balance between various stress producing factors e.g. adverse genotypic and physiological properties of fish, malnutrition, adverse ecological parameters and action of pathogens and parasites and the susceptible fish is lost shifting the balance adversely towards the susceptible fish.

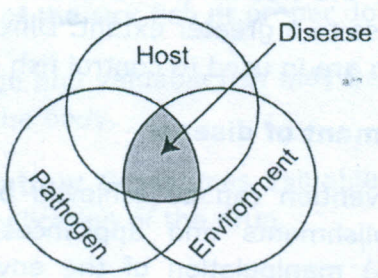


Fig 1. Occurrence of fish disease in an environment

**Important factors contribute to fish disease**

- ✓ Rapid change in temperature
- ✓ Rapid change in pH
- ✓ High suspended solid loads
- ✓ High stocking density
- ✓ Insufficient dissolve oxygen
- ✓ Hydrogen sulfide
- ✓ Poor nutrition
- ✓ Poor handling
- ✓ Others

**Different types of disease**

In a pondecosystem system, different types of disease may occur which can be broadly categorized into six categories.

1. Bacterial disease
2. Viral disease
3. Fungal disease
4. Parasitic disease
5. Nutritional disease
6. Environmental disease

**Principles of fish disease control**

Even though many developments have occurred in the area fish health management, there is still believed on the principle "prevention is better than cure". Maintaining the health of the environment, one can to protect the occurrence of disease to a greater extent. Different prophylaxis measures and chemical application are in used to control fish disease.

**Prophylaxis treatment of disease**

Disease prevention can be achieved by (1) proper sanitation of the environment establishments and appliances, (2) chemo-prophylaxis, (3) vaccination and (4) manipulation of the environment. The culture system should be properly prepared so as to create a pathogen free and hygienic

congenial environment for the species to be stocked. Clearance of aquatic weeds, de-siltation, quick lime application, etc. may help to maintain the ecosystem productive. Careful selection of quality stocking material having better resistance towards disease and faster growth rate helps a lost in achieving higher production. Before planting fish to new grounds they should undergo through quarantine checks so as to eliminate any undesirable traits or any disease agent. Diseased fish which carry virulent pathogens and are unmanageable should be destroyed to prevent the spread of the disease.

**Different method of chemical treatment**

Treatment may be applied in very many ways and the particular type of treatment to be applied is to be decided as per the specific situations encountered. There are three way of applying the treatment e.g. (1) adding chemical to the water, (2) adding chemical to the feed and (3) administering chemicals directly to individual fish. Different types of treatment are:

1. **Dip:** Fish are placed in a hand net and dipped into a concentrated solution of the drug for one to three minutes or less.

2. **Flush:** Here concentrated solution of the drug or chemical is added to the inlet and allowed to pass through the tank or the raceway with the water flow.

3. **Short bath:** Here the required amount of chemical or drug is added directly to the rearing or holding unit and left for a specified period of time.

4. **Indefinite bath:** This is most widely used in ponds where a low concentration of a chemical or drug is applied and is allowed to dissipate naturally.

5. **Feeding:** Treatment through feed aims at reaching the chemical in to the stomach of the sick fish at proper dosage.

6. **Injection:** Large and valuable fish may be treated by injecting the medicine in to the body.

7. **Topical application:** Sometimes valuable fish may be treated by direct topical application of the drug.

Planning of effective treatment depends on several factors such as:

- Correct diagnosis of the disease.
- The prognosis of the disease.
- Economics of the treatment operation
- Knowledge about the disease causing organisms
- Tolerance of the fish to the drug or chemical.
- Water quality of the environment.
- Type of the fish i.e. species size, age, physiological condition etc.
- Properties of the drug or chemical
- Other course of action.

**Common bacterial disease**

Some of the important bacterial pathogens which cause diseases are *Aeromonashydrophila, A. salmonicida, Pseudomonas fluorescens, Flexibactercolumnaries, Edwardsiellatarda, Vibrio alginolyticus, V. parahaemolyticus,* etc.

***Edwardsiellosis***

The causative organisms for this malady is *Edwardsiellatarda,* which produces extreme emaciation, anaemia, loss of skin, peeling off and dropping of skin, gas filled foul smelling abscesses. The disease is termed as "Emphysematous putrefactive disease" (EPD), aptly describing the gross appearance of infected fish. The organisms are a serious pathogen in the hatchery. Contaminated water is the main source of infection. Gross-changes in the spawn are characterized by deformities in the body and opacity. The spawn become lethargic and show abnormal swimming behaviour.

Although the disease can be controlled by antimicrobial compounds, water quality improvement is the single most important factor which can prevent the disease. Iodine preparation in diluted form can cure the disease if applied for 3-4 days.

***Aeromoniasis***

*Aeromoniasishydrophila* and *A. salmonicida* have been described as primary and secondary pathogens of fishes throughout the world causing varieties of diseases. The diseases occur as an acute, subacute or chronic form in fishes. Haemorrhagicsepticaemia or red mouth disease, dropsy, ulcerative disease or pop-eye disease are caused by *Aeromonas* organisms. External signs of the diseases are varied which include erythema (redness) at the base of the fins, in and around the mouth, skin within the opercula and around the anus. The organisms are capable of producing severe skin ulcerations. Internal signs are characterized by severe congestion and/or petechial haemorrhages in the peritoneum and most of the visceral organs. Slicing through the muscle may show pinpoint haemorrhages.

Fish can be protected from *Aeromonas* infection by reducing physical stress, correcting nutritional deficiencies and avoiding injuries. Fish or fish eggs should not be transported from infected geographical areas to non-infected areas. Oxytetracycline 50-70 mg/kg body weight in feed for 10 days.Sulfamerazine 200 mg/kg body wt for 7 days in the feed. External disinfectants may be used once a week in the water to reduce the population of bacteria.

***Bacteria Gill Disease (BGD)***

Bacteria gill disease is attributed to a combination of unfavourable environment condition with infection of gills of myxobacteria of the genus Cytophaga. Besides this a large number of gram negative bacteria have been reported in gill diseases. The disease is characterized by proliferation of gill epithelium and in extreme cases fusion and necrosis of the gill filaments occur. The affected fish show sluggish movement and signs of asphyxiation and surfacing. Poor environmental condition and over-crowding are the main triggering factors.

Bath in dimethyl-benzyl-ammonium chloride @ 2 ppm or ethyl mercuric phosphate for 1 hour has been used successfully to control the disease.

***HaemorrhagicSepticaemia***

The aetiology of haemorrhagicsepticaemia is under dispute. The disease is clinically indistinguishable from *Aeromonas* infection, although *Pseudomonasfluoroscens* has often been isolated from diseased fish showing septicaemia lesions. The disease is manifested either in acute or chronic from. Large haemorrhagic skin lesions are common signs followed by heavy mortalities. In acute cases severe congestion and haemorrhages are noticed in the visceral organs, whereas in chronic cases the disease is characterized by fibrinous peritonitis. Petechial haemorrhages are seen in the internal wall of the air bladder.

Oral administration of oxytetracycline or kanamycin have been reported to give good result.

***Vibriosis***

This is one of the most significant diseases of cultured fish usually caused by *V. anguillarum, V. parahaemolyticus* and *V. alginolyticus.* Diseased fish shows haemorrhages in the mouth region, opercula and ventral surface of the body. Hyperaemic intestine, swollen spleen and necrotic kidney are other gross pathological findings. Peritonial and abdominal dropsy may also develop in some cases.

Prevention through immunization is the best method to control this disease. It can also be controlled by feeding a diet containing 0.02% furazolidine for two weeks. Sulfamerazine @80-120 mg/kg body weight is recommended as a suitable control measure.

**Common viral diseases**

***Lymphocystis Disease***

This disease is observed in most freshwater and saltwater species. Clinically, fish are presented with variably sized white to yellow cauliflower-like growths on the skin, fins, and occasional gills. Occasionally, this virus may go systemic with white nodules on the mesentery and peritoneum. The disease gains entry through epidermal abrasions. The virus infects dermal fibroblasts.

***Channel Catfish Virus (Herpesvirus)***

Channel Catfish Virus is seen in fry or fingerling channel catfish (less than 10-gram weight) during the summer when water temperatures are above 22°C. Clinically these fish usually show erratic swimming or spiralling followed by terminal lethargy. Mortality is very high. Haemorrhage at the base of the fins and skins, ascites; exophthalmos; and pale gills. Infection is direct with transmission of the virus in the water or feed. Piscivorous birds, snakes, or turtles may mechanically carry the virus from pond to pond.

***Herpesviruscyprini(Fish Pox)***

This is a non-fatal disease and observed in carp and other cyprinids. Elevation of the epidermis with the formation of white to yellow plaques over the body of the fish. Healed lesions usually turn black.

***Infectious Hematopoietic Necrosis (IHN)***

The disease is observed in the fry of trout (rainbow) and salmon (Chinook and sockeye) with mortality up to 100%. Clinical signs are fish become lethargic or hyperactive, become dark due to increase in pigmentation, exophthalmus, abdominal distension, and faecal cast seen Haemorrhage on skin and viscera primarily at base of fins, behind the skull, and above the lateral line.

***Viral disease management***

Specific drugs for viral disease treatment are not available or difficult to develop since virus is host cell dependent for all its metabolic machinery. Virucidal chemicals capable of killing virus outside the host are available like chlorine, iodine, ozone and UV rays. Vaccines in general are not found to be effective in fish viral disease management. Poor immune system of the fish and young age at infection are some of the responsible factors. So, avoidance of the virus in culture system is the best strategy. This can be achieved by proper screening of brood, seed and certification programme.

**Parasitic disease**

The parasite itself is the primary factor responsible for some epizootics and hence is a primary stressor. Parasitic forms commonly associated with diseases in fish are *Ichthyophthirius, Ichthyobodo, Cryptobia, oodinium,*

*eimeria, Trichodina, Trichodinella, Tripartiella, Glossatella, Microsporidia, Myxosporidia, Gyrodactylus, DactylogyrusSanguinicola, Posthodiplostomum, Diplostomum, Ligula, Ergasilus, Lernaea*and *Argulus.*

***Ichthyophthirusmultifilis***

It is a holotrichus ciliate protozoan. If burrows into the skin and gills and causes pin-head size spots producing the while spot disease or Ich. The parasite penetrates the mucus coat and the upper layer of the dermis causing hyperplasia of the epidermal cells around the site of infection. The parasite feed on RBCs of the host. The mature parasites live in cysts of the hypodermis and gills. The parasitic cysts on the gills affect respiration to a great extent the fish becomes extremely emaciated and may finally die. The trophozoite is oval to round in shape and it uniformly ciliated around the body and there is a crescent shaped macronucleus. The mature parasite leaves the host and by rapid division produces about 250-1000 ineffective young parasites in about 12-18 hours. After about 36 hours these young parasites (about 0.03-0.04 mm in size) swim freely in search of new host and if they do not find a host and they die in a fewdays. The tomites and trophozoites are pear shaped causing mild to severe inflammation and epithelial erosion. Ichthyophthiriasis decreases haemoglobin concentration and death is probably due to osom regulatory failure. Fingerlings are more susceptible to mortality due to Ich infection.

***Ichthyobodonecator (Costia nectar)***

It is a flagellated, rounded to kidney-shaped (10-20 µm by 5-10 µm) ectoparasite belonging to the class Zoomastigophorea. It has one pair of short posteriorly directed axostyles or flagella. There is also one pair of free moving flagella used for jerky free swimming movements and for attachment to the host body and gills. Ichthyobodo attaches to the host by means of a flat disc from which small bundles of micro tubules extend into parasite as food vacuoles. Reproduction occurs mainly by binary fission. It is an obligate parasite and may diet within 30-60 minutes without the host. Icthyobodo has a seasonal incidence in some situations. The parasite cause hyperplasia of the malphigian cells and exhaustion of the epidermal goblet cells beneath infested areas which is followed by intercellular oedema or spongiosis of the underlying epidermis. Severe infestations cause gill congestion and death.

***Cryptobia***

These are the blood parasites which make the host emaciated with sunken eyes causes "Weakness disease". Cryptobia is a biflagellate.

***Eimeriacyprini***

Eimeriacypriniplehn is found in the intestinal mucosa of young carp. This parasite causes enteritis and emaciation. E. subepithelialisMoroff and Fiebiger cause formation of yellowish nodules in the colon and rectum of diseased carp.

***Trichodina, Trichodinella, Tripartiella and Glossatella***

These are the ciliate protozoans which infect the carp skin and gills. These are easily recognized being spherical organisms (about 40 µm diameter) having miniature spiked wheels with cilia. Due to the sucking action of these parasites the epidermal cells of the host are irritated and secrete a lot of slime and ultimately die. The parasite then feeds on these dead cells. Asexual reproduction occurs by binary fission.

***Microsporidia and Myxosporidia***

The spores of microsporidia are very small with a vacuole at one end opposite to the polar capsule, the spores are gram-positive and at the anterior end the small granule is positive in the periodic acid-schiff reaction. In stained preparations the nuclei appear to lie in a deeply staining girdle at the center of the spore. The cytoplasm occupies the entire intrasporal cavity. The membranous structure of the polaroplast gives the appearance of the anterior vacuole. Infection results in new host by ingestion of mature spores. When an infected adult fish dies, a concentration of spores are released and there is chance of new host getting the infection. Several microsporidia are parasites of the ovary, testes, gills, kidney, etc.

Myxosporidian spores are more frequently found on skin gills, fins, eyes, brain, kidney, gall bladder etc. Under heavy infection they cause emaciation, hamper gonadal development and may result dropsy condition along with *Aeromonashydrophila.*

### *Gyrodactylus and Dactylogyrus*

These are the monogenetic trematodes which infects the fish. *Gyrodactylus*infects both skin and gills whereas *Dactylogyrus* infects the gills. These parasites feed on the blood and epithelial debris of the host. *Gyrodactylus* is viviparous. Lack of eyespots, presence of two anchors and a larva in utero are diagonostic feature of *Gyrodactylus*.

### *Sanguinicola*

It is a blood fluke, which is a serious parasite that causes thrombosis and occulusion of gill capillaries by release of the parasite's eggs. It also causes gill haemorrhage, necrosis, exophthalmos and loss of the health.

### *Posthodiplostomum and Diplostomum*

These are the digenetic trematodes whose matacercarial cysts are seen as balck nodules in the host body. Diplostomum infests the eye and may cause blindness. The parasites cause serious epizootic particularly in young fish.

### *Ligula*

*Ligula intestinalis* is a large fleshy tape worm and is an endoparasite. The presence of such large amount of parasitic tissue in the body cavity of the host compresses the visceral organs and gonadal maturation is inhibited.

### *Ergasilus and Lernaea*

These are the two most problematic parasites of fish which at time causes serious losses. Eragasilids feed on epithelial cells and causes local damage which may lead to secondary infection by fungi or bacteria.

*Lernaea* is commonly known as anchor worm. The head of this parasite has ancho-spaped, chitinous appendages. When the free swimming larva of the parasite meet a fish it penetrates through the skin of the host into the underlyng muscles. There is a decrease in the number of red blood corpuscles and of the haemoglobin content of the host due to this parasite.

***Argulus***

This is also an arthropodan parasite which perforates fish skin by its mandibles. It causes severe skin damage and anaemia and also ulcerations, which may lead to secondary infection.

***For external protozoa***

- ✓ 25 ppm of the mixture of formalin + 0.1 ppm malachite green: Use for upto 6 hours daily in tanks. At 3 to 4 days intervals in ponds.
- ✓ HCHO-200 ppm for 1 hour or less daily, 15-25 ppm pond application.
- ✓ Malachite green (Oxalate) –0.1 to 0.15 ppm at 3-4 days intervals in pond
- ✓ $CuSO_4$-2 ppm mixed with 3 ppm citric acid in ponds with calcium carbonate level above 200 ppm.

***For internal protozoans***

- ✓ Diametridazole-0.15% in food daily for 3 days.
- ✓ Enheptin –0.2% in food for a day
- ✓ Furazolidone 1 ppm for 1 hour or 25 mg per kg body weight of fish per day for 14 days.

***For monogenetic trematodes***

- ✓ HCHO used as against external protozoans.
- ✓ Dipteryx, neguzon, malathion, chlorophus: use in the pond at 0.25 ppm, repeat if necessary
- ✓ $KMnO_4$-5-10 ppm for 1-2 hours and 3 to 5 ppm in ponds.

***For digenetic trematodes***

- ✓ Di-n-butyl tin oxide or dibutyltin dilaurate-250 mg per kg of fish or 0.3% of food for 5 days.

***For cestodes (tape worms)***

- ✓ Di-n-butyl tin oxide or dibutyltindilaurate –250 mg per kg offish or 0.3% of food for 5 days.

***For nematodes (round worms):*** Santonin-0.04% g/fish

***For acanthocephalan:*** Same as for tematodes

***For leeches:*** Neguvon, Chlorophus, Malathion: use at 0.5 to 1 ppm pond application.

***For parasitic copepods:***

- ✓ For killing the larval stages Malathion, Neguvon, Chlorophus: 0.25-0.5 ppm, 3-5 times at weekly intervals.

**Common fungal disease**

***Saprolegnia***

Under stress condition when there is some injury on the body this fungal pathogen grows on the dead tissue at the site of the injury and forms a thick layer of fungal hyphae which scatter their spores outside the host. When the fungus grows over the necrotic tissue of the host it imparts a cotton wool like appearance. This fungus causes widespread damage particularly under stress conditions in young fish and in hatcheries. Since *Saprolegnia* is a secondary pathogen improvement of the general sanitation helps in controlling the infection.

***Branchiomyces***

This fungal pathogen causes "gill rot" in fish resulting in yellow-brownish discolouration and disintegration of gill issue. Infested fishes gasp for air. This fungal pathogen is very serious as it causes high rate of mortality. Large areas of the gill because of the infestation become necrotic and ultimately fall off.

***Achlya***

This is also a secondary pathogenic fungus. This parasite grows relatively with ease if there are areas of necrotic tissue or inflammation of the skin. Fish are more susceptible to his parasite particularly after breeding. The mycelium grows progressively through the skin of the host. The hyphae sometimes extend deep into the muscles of the host.

***Ichthyosporidium***

This pathogen belongs to the class phycomycetes and is an endoparasite. The main characteristic of this parasite in the host is numerous small ball-shaped cysts in the liver which damages the organ. It also attacks spleen, heart, kidney, gonads, brain, gills, musculature and nerve tissue behind the eyes of some host species. Patchy skin wounds and hoes in the bones and haemorrhages in the skin of the host are generally caused due to this pathogen.

***Aphanomyces***

*Aphanomyces* species are highly pathogenic to fish and cause mortality. The pathogen grows in the dorsal musculature of tropical freshwater fishes. Death of host occurs when dorsal skin is penetrates from within. Mortality occurs within seven to eight days. Apart from the above common forms recently *Aspergillusflavus, A. ochraceous*and *Fusariummoniliforme*were isolated from some of the EUS affected specimens CIFA.

***For external fungi***

Fish eggs:

- ✓ Malachite green- 5 ppm as one hour flush used daily
- ✓ 1,500 ppm as 10 dip, Formalin-2000 ppm for 15 minutes
- ✓ Malachite green-0.1 ppm for 1hour flush

*For fish:*

- ✓ HCHO 50 PPM + Malachite green 0.1 ppm for very short durations

**Epizootic Ulcerative Syndrome**

The primary etiological cause of this disease is still under controversy although some workers in the recent years have reported *Aphanomycesinvadans,* a fungus as the primary causative factors of EUS. Application of lime/ bleaching powder, Sokrena WS, CIFAX (a formulation of CIFA, Bhubaneswar), etc. are reported to control EUS disease effectively:

- ✓ Pond disinfection: Lime @ 60 – 100Kg/ 0.16 ha. (Apply 3 - 4 times at 3 weeks interval).
- ✓ Salt application: Apply Salt @ 200 – 300 Kg/ 0.16 ha when water becomes heavily polluted.
- ✓ Lime & turmeric: A mixture of 16 Kg lime with 1.6 Kg liquid green turmeric or dust turmeric can be spread in 0.16 ha water area.
- ✓ CIFAX: Dilute 160 ml "CIFAX" and spread all over the 0.16 ha water surface.
- ✓ $KMnO_4$ & Lime: A mixture of 500g $KMnO_4$ with 60 – 80 Kg lime spray all over the water surface of 0.16 ha.
- ✓ Alum: Dissolve 500g alum and spray over 0.16 ha water surface uniformly.

**Environmental disease**

The water quality in an environment fluctuates as a result of dynamic interactions between several variable. Fluctuations in the physicochemical parameters are often quite irregular in an ecosystem which needs quick monitoring and careful management so as to maintain a hygienically sound aquatic environment. Dissolved oxygen level below 0.3 is lethal to most fish species. Similarly low pH can cause bleeding (Haemorrhages) on the gills and heavy mortality. pH below 4 is lethal to fish. For efficient feeding, assimilation and growth, optimum temperature is also essential. Due to excessive deposition of organic material in the bottom sediment, rapid biosynthesis process occurs in some bacterial community. This leads to development of bloom of certain bacterial forms which increases the biological oxygen demand manifold resulting in decreased quantity of available oxygen for the fish. For proper gonadal development and maturity environmental parameters should be maintained within the optimum range.

**Nutritional disease**

Malnutrition in presence or absence of toxic materials adversely affected health of the fish resulting in impaired growth, poor food utilization and lowered resistance to diseases. Proper growth and gonadal development

is not possible without adequate balanced diet. Liver lipoid disease, scoliosis, lordosis, etc. are examples of malnutritonal disorders.

**Monitoring and management of fish health**

Effective monitoring through regular and frequent sampling and examinations and timely or corrective management measures are the keys to successful culture operations as there is no guarantee about the factors remaining constant over a given period of time. Periodical netting of part of fish population at least once in a month is a good practice that allows checking the growth rate and other defects. All the physico-chemical parameters of the environment should be first observed to detect any changed behaviour e.g. (1) erratic swimming movement, (2) resting near the margins, (3) loss of balance, (4) excessive or lack of mucus secretion, (5) change in normal pigmentation, (6) erosion of scales, fins, lesions on the body etc. and (7) loss of appetite etc. Adverse physico-chemical parameters of the environment should be corrected through efficient manipulation and management. Through detailed examination of the fish sample we can know the disease problem and accordingly curative measures and treatment can be given.

**Conclusion**

Success of fish production is directly proportional to the health of species. Hence health monitoring and management cannot be ignored at any time. With little care we can observe some of the abnormal signs, symptoms or behavioral changes at the sites itself. Whenever any such abnormality is noticed expert advice should immediately be sought to avoid losses due to ill health and mortality. If the stock is kept healthy returns would be rewarding.

The research on fish health management is mounting with the ever-increasing need for environment friendly aquaculture. Even though information's on disease diagnoses have been documented but there are very few information's on control of these diseases in aquaculture. Hence, more precise research information on the management of fish diseases will be helpful for betterment of the aquaculture industry.

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