**Pond environment monitoring**

***General considerations***

Proper pond management involves a regular and steady supply of nutrient for sustained production of fish food organisms. The supply of nutrients could be from within the pond itself or from outside. It is also required to regulate the physico-chemical parameters of the pond ecosystem within the safe tolerance limits of the cultured fish species. This necessitates periodical monitoring of pond environment and taking corrective measures in time. Most of the parameters can be easily measured at the pond site while some require laboratory facilities. The monitoring gives reliable guidelines for fish farmers to optimize fish production.

***Parameters to be monitored***

It is essential for extension workers to name and code-number the ponds in their area. Such coding may be based either on postal district/unit/village farmer's name, etc. The fish farmer should record the following information on his fish farm:

*Nature of pond:* Perennial or seasonal; nursery pond, rearing pond or stocking pond.

*Water area:* Measurement of the water area is essential in order to know the size of the pond for proper fish stocking and quantifying the production processes. This can be done easily with the help of a bamboo pole of known length.

*Age:* Age is one of the most important parameters, since it has direct relevance with the productivity of the pond which usually varies from one year to several hundred years.

*Management:* Management status should record the existing management techniques and its level (intensive or extensive). The species of fish present, details of culture activities, stocking structure and density, fertilization, feeding, harvesting, marketing, etc, need to be recorded. To obtain qualified data on the organic carbon and biogenic nutrient load it is necessary to know the number of livestock and human population associated with the particular pond.

**The fish farmer should also monitor the following parameters on a routine basis.**

*Water colour:* The visual colour of the pond water is a simple but important reflection of the basic production processes.

*Water transparency:* Water transparency measured with a Secchi disc is intended to quantify the result of those processes which determine and modify the visual colour. However, a low transparency may result either from high turbidity alone or from dense algal population and thus cannot reflect the correct trophic or production level of the water. However, the Secchi transparency readings together with the visual colour provide valuable information on the productivity of the water.

*Water depth:* The primary water source is usually the rainfall during the monsoon. After the rainy season the water level gradually decreases which results in a very shallow water column by the end of the dry season. The water depth can be measured with a 4–5 m long bamboo pole fitted at its base with a wooden disc of 25 cm dia.

*Soft sediment depth:* A soft sediment layer is usually present in the pond bottom. The depth of this layer can be measured with a 6–8 m long bamboo pole having a wooden disc of 10 cm dia at its base.

*Solid sediment depth:* In older ponds, in addition to the soft sediment layer, a solid sediment layer with a low water content is also present. The thickness of the layer can be measured with a 6–8 m long bamboo pole with a sharp end. The total thickness of the soft plus solid sediment layers has a direct relation to the age of the fish pond, at times the sediment layer measures more than 2 m. Such thick sediment, having a rich nutrient content, is anaerobic in nature with slow bacterial decomposition and mineral cycling rates. This should be properly utilized for fish culture.

*Chemical environment in the water column:* The water is chemically characterized by pH, alkalinity, NH4-N, NO3N and PO4-P measurements following standard methods. Normally the pH and alkalinity do not change from pond to pond on the same types of maternal soil. The measurements of NH4-N, NCO3-N and PO4-P indicate the basic inorganic nutrient status of the pond.' Simple chemical parameters such as dissolved oxygen and pH may be measured using field kits. Slightly alkaline water (pH 7.0–8.5) and oxygen levels of 6–9 ppm indicate optimum condition.

*Dawn oxygen:* Fish ponds usually exhibit wide fluctuations in the dissolved oxygen content from day to night. This diurnal oxygen fluctuation is normally measured to calculate the community metabolism of the whole pond while quantifying the production and respiration processes in the ecosystem. A single measurement just before sunrise would be an important indicator of the risk of fish kill due to oxygen depletion.

**Fish diseases, symptoms and their diagnosis**

*Saprolganiosis*

**Symptoms: -** Brown flakes grow on the body like white cotton wool. **Treatment: -** Submerging small ponds in a 1: 1000 potassium solution of 3 percent ordinary salt solution or copper sulphate solution for 1-5 minutes in 1: 1000 potassium solution for 5-10 m water is effective.

*Bankiomycosis*

**Symptoms: -** Diseased fish try to drink air on the upper surface due to rotting of the slits, suffocation. Repeatedly opens and closes the mouth. **Treatment: -** Prevention of pollution, increasing the level of water in the pond with fresh water or using 50-100 kg / ha of lime or bathing in 3-5% salt solution or in ponds with 0.5 m depth rate of 8 kg / ha Using copper sulphate from.

*Ulcer (wound)*

**Symptoms: -** Wounds found on the head, body and tail. **Treatment: -** Use of potash in the pond at the rate of 5 mg / l, lime 600 kg / ha (3 times at 7 days intervals), cephase solution in 1 liter of water and put it in the pond,

*Dropsy (ascites)*

**Symptoms: -** water in internal organs and in the abdomen. **Treatment: -** Proper arrangement of clean water and food to the fish, lime at the rate of 100 kg / ha after 15 days (2-3 times)

*Protozoan Disease "Costiasis"*

**Symptoms: -** Small macular disorder on body and gills. **Treatment: -** 10 minutes in 50 ppm formiline solution or 10 minutes in 1: 500 glacial acetic acid solution.

*Catla Eye Disease*

**Symptoms: -** First symptoms of corneal redness in eyes, fall of eyes at last, faded color of gills etc. **Treatment: -** Potash 2-3 ppm, food to teramycin 70-80 mg per kg of fish weight (up to 10 days) , Use of injections according to the weight of streptomycin 25 mg per kg

*Ecothiopthyriosis (itching whitening)*

**Symptoms: -** Excessive mucus secretion, small white rash appear on the body. **Treatment: -** Every day for 7-10 days, 200 ppm Fargillan solution is used for bathing hours, 2 percent of ordinary solution for more than 7 days. Experiment,

*Trichodinosis and Schiffidiosis*

**Symptoms: -** Difficulty in breathing, restless body rubbing on the side of the pond, excessive synovial secretion on the skin and gills, **treatment on the body: -** 2-3% in a simple salt solution (5-10 minutes), 10 pp caper Use of sulphate solution, use of 20-25 ppm formoline

*Mixosporidiosis*

**Symptoms:** mustard seeds on the skin, monoplasm, gills and apicalum. **Treatment: -** Immerse 1-2 equal white lacquer minutes in 0.1 ppm formalin, 50 ppm formalin, 15-25 ppm formalin in the pond every other day, till the disease ends Use, more diseased fish should be killed and the fish should be transferred to another pond.

*Coastiosis*

**Symptoms: -** Excessive syphilis, secretions, difficulty in breathing and aggravation. **Treatment: -** bathing in 2-3% ordinary salt 50 ppm formalin solution for 5-10 minutes or in 1: 500 glacial acetic acid solution (up to 10 minutes)

*Dactylogarillosis and Gyradactylosic (Trematodes)*

**Symptoms: -** The outbreak occurs on the gills and skin and black color in the body. **Treatment: -** 5 minutes alternately in 1: 2000, acetic acid and sodium chloride 2 percent solution in 500 ppm potashium *(gynecological)* solution. To bathe.

*Diplostomiasis or black spot disease*

**Symptoms: -** Black spots on the body. **Treatment: -** The life cycle of the parasite should be broken. Stop snails or birds

*Ligulesis (laceworm)*

**Symptoms: -** The abdomen swells due to the collection of worms. **Treatment: -** The life cycle of the parasite should be broken, for this, life-related organisms snails or birds are not allowed to enter the pond, immersed in 1: 500 Formalin solution for 10 minutes, using 1-3% salt solution.

*Argulosis*

**Symptoms: -** Weak deformed form, red small spots on the body etc. **Treatment: -** Gumoxin spraying of lime at the rate of 0.1-0.2 g / litre is best to use two to three times in a fortnight after expelling the pond water for 24 hours. is. Dissolve 35 mL spermethylene medicine in 100 litres of water and use it three times in a span of 5-5 days in the pond at the rate of 1 ha.

*Larynesis (anchor worm disease)*

**Symptoms: -** bleeding vascularity, weakness and spots on the body. **Treatment: -** Due to mild disease infection, use of 1 ppm gamaxine or bromos 50 in the pond at the rate of 0.12 ppm

*Other diseases EUS (ulcerative) ulcerative syndrome*

**Symptoms: -** In the initial stage, red spots are found on the body of the fish, which gradually become darker and rot. Ulcers are also found on the belly, head and tail of fish. Finally, the fish dies. **Treatment: -** Effective treatment of 600 kg of lime per ha. Cephex 1 litre per hectare is also effective.

**Important Health Management Measures**

Understanding and managing the undrainable pond environment is the key to successful fish health management and profitable fish culture, and to ensure this the knowledge of the role of various environmental components in the occurrence of disease outbreak is essential. The main thrust of such measures is directed toward:

minimizing the stress on cultured fish;

prevention of the introduction of serious disease agents;

confinement of disease outbreaks to affected areas;

minimizing losses from disease outbreaks.

The following important measures are the key components of successful fish health managements:

* **Surveillance and maintenance of water quality:** Abrupt and wider fluctuations in some of the environmental parameters such as dissolved oxygen content, pH, turbidity, temperature, additions of some chemicals, detergents, pesticides and naturally produced toxic substances such as hydrogen sulphide, ammonia, dinoflagellate toxins, etc., often cause stress in fish and predispose them to infectious diseases.
* It is always advisable to stock the pond only with healthy and genetically vigorous fry and fingerlings so that they may have better growth rate and resistance towards diseases. Prior to stocking, samples of the stocking material should be examined to check their health status. This avoids any risk of introducing infected stock in the pond. However, the stocking materials should also be prophylactically treated before releasing into the pond (detailed under Chemoprophylaxis).
* Overstocking may lead to biological crowding resulting in waste build up, decreased availability of natural food, depletion of dissolved oxygen, deterioration of water quality, etc., and hence it is advisable to follow the recommended stocking density for nursery, rearing and stocking ponds.
* **Minimizing handling stress:** The rougher the handling, the greater is the stress and the risk of disease. Care should be taken not to break the protective mucous coating of the skin. During summer months netting should always be done early in the morning and it is better to have minimum possible handling during hauling. High temperature during hot water causes increased metabolic activity and induces more stress upon them.
* **Poisoning of pond -** Wild fish population is one of the most potential sources of disease-producing organisms. Use of chlorinated lime (bleaching powder) is the most suitable material for this purpose, since it kills all the wild fish species, molluscs, tadpoles, frogs, crabs, etc., and also disinfects the pond water and soil. It is applied at the rate of 40–50 ppm. Mahua oilcake is also a widely used piscicide, but it fails to disinfect the pond. In nursery and rearing ponds it is desirable to have second poisoning with malathion at the rate of 0.25 ppm 4 or 5 days prior to stocking.
* **Disinfection of appliances -** All required appliances such as fry carriers, hapas, utensils, buckets, nets and gears, etc., require thorough cleaning and disinfection before being put to use. Some of the pathogenic organisms are found adhering to them and may cause disease if they are allowed to come in contact with the host fish species. Disinfection can be done by washing or immersing in a concentrated solution of disinfectant. Some of the most effective and easily available disinfectants for such use are chlorine, sodium hydroxide, sodium chloride potassium permanganate, etc. Chlorine is probably the most widely used disinfectant in fishery management and is easily available as a solution of sodium hypochlorite and powder of calcium hypochlorite (bleaching powder).
* **Proper feeding -** In addition to the natural fish food which is made available by fertilization, an adequate amount of good quality supplementary feed is essential for maintaining healthy growth of fish. Any deficiency in quantity and quality of feed may cause various diseases by increasing susceptibility to many infections.
* **Prevention of entry of unwanted fish:** Most undrainable ponds lack proper embankments. Most of these ponds have channels in the embankments connecting them with outside waters during the rainy season. Most of the ponds lack even proper embankments. These channels are the vulnerable sites through which some of the wild unwanted fish species or other animals get entry to the pond. Fixing fine meshed screen into these channels may eliminate the risk of entry of unwanted fish species into the pond. Pond embankments may also be raised to prevent risk of inundation and entry of undesirable animals and fish species. Some fish-eating birds, molluscs, etc., serve as intermediate hosts for many parasites that infect fish. Tadpoles and frogs may also act as carriers of certain parasites and bacteria which ultimately may infect carp species and hence such animals should not be allowed in the pond.
* **Separation of young and brood fish:** Brood fish may serve as carriers of disease-causing organisms without exhibiting any clinical symptoms. They sometimes become survivors of previous epizootics due to build up immunity but retain some of the pathogens. To avoid such risk, the best course is to separate the young ones from the adults.
* **Removal of dead fish from the pond:** Dead and apparently sick fish should be removed. A daily log of losses must be kept. Such records will provide valuable insight into the problems and may lead to their solution.
* Occasional application of potassium permanganate at the rate of 2 or 3 ppm is recommended for increasing dissolved oxygen concentration and hauling prophylaxis. Dip treatment in 500–1 000 ppm solution of potassium permanganate for a few seconds before releasing adult fishing ponds is also a very effective and practical prophylactic measure. Short bath for a few minutes in 2 or 3% common salt solution is also a safe and inexpensive prophylactic measure against a wide range of parasitic an microbial pathogens.