Role of Hydrobiological Factors in Aquaculture\Pisciculture

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INTRODUCTION

The productivity of a fish pond used for pisciculture is greatly influenced by various physicochemical and biological factors . Water used for cultivation gives maximum production only when it provides the optimal conditions required by the fish and other aquatic organisms. It is thus necessary to install a small laboratory in a fish farm to determine the quality of water being supplied to the fish pond. Determination of water temperature, pH, alkalinity, organic and inorganic contents , plankton are the most important among the factors and should be carries out regularly.

Principal factors influencing the life of cultivable fishes are as follows:

PHYSICAL FACTORS

The important physical factors affecting fish culture are temperature, depth, turbidity, light, shore conditions and pressure of water.

- Temperature: The temperature as an abiotic factor influences the vital activities of the fishes (breathing, growth and reproduction).It is important to note that the body temperature of fish varies with the variation in the temperature of water, and that the fishes have a optimal survival range. Salmon can spawn and grow best at 10 °C , tilapias at a range of 20-23 °C and major carps 20-37 °C . Temperature also influences various other factors , too, such as the amount of oxygen in water and growth of aquatic organisms serving as food for fishes .
- Breathing: The dissolved oxygen contents of water are tied to the water temperature. If the temperature rises, the oxygen contents of water reduce.

PHYSICAL FACTORS

The cold water fishes such as salmon, trouts etc. live at temperature below 20°C and are very demanding with regards to dissolved oxygen. The warm water fishes such as cyprinids living at temperature above 20°C are satisfied with lower oxygen contents.

- Growth: Fishes require a specific range of temperature , at which they grow most naturally. Thus, the carps grow moderately well between 20 °C and 13 °C , feebly between 13°C and 5°C and cease to grow below 5 °C. The optimum for tilapias is also below 20 °C and the fishes die below 12 °C

PHYSICAL FACTORS

- Reproduction: An optimum range of temperature is required for gonadal maturity and spawning in most fishes. Gonadal maturity of cyprinids and many silurids etc. takes place in summer and spawning occur at the drop in temperature during monsoon rains. Salmonids grow at a temp. range of 15 to 20°C, but require a temperature. below 10°C for spawning. Thus , if temperature does not fall, it limits the reproduction of these fishes . Generally speaking , the warm water is best for the production of cultivable carps.

PHYSICAL FACTORS

- Depth: Depth is another important factor influencing considerably the productivity of the pond. A shallow pond up to the depth of 2 meter allows light penetration up to the bottom and productivity increases due to photosynthesis. Deeper ponds on the hand have lightless bottom, resulting in accumulation of cooler water and poisonous gases with no photosynthetic activity, leading to reduced productivity. In shallow ponds , the water gets heated up and affects the pond's life adversely

PHYSICAL FACTORS

- Turbidity: The turbidity is due to the suspended particles of clay, mud , planktons and finally dived organic matters. The excess of turbidity prevents the penetration of light and so the photosynthetic activity of the plants(phytoplankton). The particles of silt and clay should therefore be settled in sedimentation or siltation before filling ponds with water.
- Light : Light penetration in water depends upon the factors like the intensity of light , preventing turbidity, the depth of pond, presence of shady plants along the bank of water body and presence of bottom feeder fishes in the pond.

PHYSICAL FACTORS

Light is necessary for photosynthetic activity of plants providing oxygen and food to the fish and organisms of water , serving as food for fishes.

❖Water Movements:

A flowing water is a pre-requisite for fresh water carps, though there are fishes which can thrive well in stagnant ponds.

Movement of water due to wave action , currents and drainage system favors the productivity of pond. Fast flowing water , however , has negative attributes because it brings about erosion of soil and turbidity and take away the fish food necessary of fish production.

CHEMICAL FACTORS

❖ Hydrogen Ion concentration (pH) :

The hydrogen ion concentration (pH) of pond water varies greatly depending upon the substances dissolved in it. An acidic pH below 4.0 is not suitable causing death of the most of the fishes. The pH 6.0 is considered less productive and between 6.8 to 9.0 is best for pond fishes.

The pH of pond may quickly change owing to several factors. As the heavy rain may bring acidic water in the pond, the marshy and peaty water have an acidic pH and water with poor mineral contents show a sudden drop in the pH.

As against the acidity, the hyper alkalinity is also not suitable for fish growth. It may occur due to inflow of effluents of high pH and by assimilation of all the available carbon dioxide by the plants in pond. Bandt (1936) asserted a top dangerous limit of pH to vary from 9.2 for trout to 10.8 for pike carp and tenches.

CHEMICAL FACTORS

❖ Dissolved Oxygen :

- Oxygen is one of the most important factor determining the success of a fish pond. It is required to fulfil the necessary need of the aquatic life and used in decaying process of dead organic matters in the pond.
- The principal source of oxygen is the photosynthetic activity of the aquatic plants. Oxygen released in day time is however, utilized by the plants for their respiration. Other source of oxygen is its absorption from the atmosphere which occurs on the entire surface of pond water. Winds present on the surface of water and other manmade disturbances also help in aeration of water of water.

CHEMICAL FACTORS

- A fish pond does well only when oxygen production and its use are well in balance. At night ,when photosynthetic activity ceases, the carbon dioxide level increases in the pond. During day time the amount of oxygen gradually increases with rise in temperature by resuming the photosynthetic activity of plants. A cloudy day causes a drop in oxygen level, and an increased rate of oxygen consumption of dead plants and animals, may trouble the fishes. Fishes respond to such deficit condition of oxygen by frequently rising to the surface and gulping in air.

CHEMICAL FACTORS

- Correction of oxygen level may be brought about by stirring the water with an oar or by running small motors (aerator mixer) to bubble the water in the pond. By removing the dense vegetation and dead organic matters from the water , much of the oxygen can be saved for fishes. Pond water may also be replaced by Lrge quantities of good quality of water. It is noteworthy that excess of oxygen , released by over photosynthetic activity of submerged plants may also endanger the life of fishes in general and fry in particular.
- Oxygen requirements of fishes also vary . Cold water fishes are more demanding (Salmon requires 11 mg\litre at 20 $^{\circ}$C) than the warm water fishes (eg. carp fishes which require 6-7 mg\litre oxygen dissolved in water at 20 $^{\circ}$C .

CHEMICAL FACTORS

❖Free Carbon dioxide

Carbon dioxide in ponds is released by the respiratory activity of aquatic animals and plants and by bacterial decomposition of organic matters. Water also absorbs it from atmosphere on its exposed surface. The CO_2 is required for photosynthetic activity of the plants. It also combines with the salts of Ca and Mg to form their carbonate and bicarbonates which become the principal source of nutrients in ponds. Higher concentration of CO_2 adversely affect the life of fishes and other aquatic organisms.

CHEMICAL FACTORS

❖ Nutrients:

- The productivity of pond also depends upon the availability of various nutrients in ponds. These include the carbon, hydrogen, oxygen, nitrogen, phosphorus, Sulphur, calcium, magnesium and a few trace elements. Of these, nitrogen , phosphorus and potassium are usually missing or in short supply to fishes in ponds. In absence of these , the fishes do not grow well, as also the phytoplankton and zooplankton.
- Fertilizers containing the missing elements like phosphorus , nitrogen and potassium are therefore added to supplement the available nutrients and to increase fertility of the pond. Various trace elements are required in traces but impart significantly to the productivity of water. These include manganese, copper , zinc, aluminum , molybdenum , nickel and cobalt etc.

BIOLOGICAL FACTORS

Biological factors constitute significantly to fish production in ponds. These are represented by a large number of aquatic plants and animals including vegetation, plankton, weeds and various bottom dwelling forms.

❖ Plants:

The vegetation is found forming four zones viz. the bottom zone vegetation, submerged vegetation, submerged free floating and surface zone vegetation. It includes the flagellates, blue-green algae, diatoms, *Vallisnaria, Hydrilla, Utricularia* and macro phytoplankton like *Euglena, Anabaena, Volvox* etc. Free floating vegetations comprises mainly phytoplankton. Common phytoplankton include chlorophyll bearing organisms like *Microcystis* etc. and achlorophyllous organisms like bacteria and fungi.

CHEMICAL FACTORS

➢ Animals:

- The zooplankton comprise mainly the protozoans , rotifers, copepods and the larval forms of crustacea.
- Among the weed dwelling forms are certain oligochaetes , insects and their larvae and several mollusks (e.g. Vivipara, Lymnaea etc.) . These are used as food by many omnivorous fishes.
- Bottom dwelling forms also contribute a good source of food to the bottom feeding fishes. These include a number of oligochaetes , insects and mollusks including the lemellidens.

Thanks

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