

Suitable Conditions for Freshwater Fish in India and Their Evaluation

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Abstract

The significant food component of Indian is fish and fish related aquaculture. In our country India a fish and aquaculture production is in good condition face is a major food part of Indian people. This area has in current times approximately 2 million people involved and thus it is quite a prominent and important area of Indian food. India has near out 7% of fish production of whole world and contributes 1.2% in GDP of India. During these times this industry is experiencing numerous issues because of over pollution and over production. Here a wide analysis for these problems.

Keywords: Fish disease, opportunistic pathogens, aquaculture production, elaborated, stocking density.

Fish farming requires knowledge of the water quality parameters to have a healthy and successful yield. The parameters include temperature, turbidity, alkalinity, pH level, water hardness, ammonia, nitrite, dissolved oxygen, and salinity. Fish farming, or aquaculture, is a complex practice which requires to pay close attention to the multiple factors of the aquatic environment.

The Importance of Water Quality in Fish Farming

Fish farming is a thriving sector of the aquaculture industry, but its success hinges on the ability to maintain optimal water conditions. Factors such as water temperature, pH level, dissolved oxygen, turbidity. Understanding and managing these water quality parameters are pivotal for the prosperity of the fish farming venture.

Physical Parameters of Quality of Water

Two essential physical parameters of water quality in fish farming are temperature and turbidity. Both directly influence the survival & growth of fish, and hence, necessitate careful management.

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Received 02 Sep. 2024; Accepted 25 Oct. 2024. Available online: 30 Oct. 2024.

Published by SAFE. (Society for Academic Facilitation and Extension)

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1. Temperature: Temperature is a prominent factor in aquaculture as fish are poikilothermic animals, meaning their body temperature adjusts to match their environment. Each fish species has a specific temperature range within which it can survive, grow, and reproduce. Fish's metabolic activities, behavior, feeding patterns, and disease resistance are all influenced by water temperature.

2. Turbidity: Turbidity refers to the cloudiness or haziness of a fluid caused by large numbers of individual particles

High turbidity levels can have both good & bad impacts in this area. On one hand, moderate levels of turbidity can provide benefits such as protection from predators, the creation of a more natural environment, and the provision of food resources for some species. For example, certain types of carp and catfish thrive in turbid waters as they are filter feeders, feeding on microscopic organisms suspended in water.

On the other hand, excessive turbidity can have detrimental effects on fish health and pond productivity. High levels of suspended particles in water can clog fish gills, leading to respiratory distress and even death. It may also cause a decrease in the level of light penetration, thus restricting photosynthesis and consequently causing low oxygen concentration. This may form poor habitat to fish that require well-oxygenated waters to live and flourish.

Chemical Parameters: Quality of Water

Several types of chemical points of water quality impact fish farming. The knowledge of these parameters and the values that are optimal is essential in keeping the environment healthy to fish.

1. pH Level: Its measure of high acidic or basic water is. The range of pH scales are 0 to 14, with 7 considered neutral. The Values below 7 signify acidic conditions, while values above 7 indicate basic or alkaline conditions. Most fish species thrive in water with pH levels ranging from 6.5 to 8.5. However, each species has its own specific range for optimal growth. Any significant deviation from this optimal range can cause stress to the fish, affect their growth rate, and even lead to higher mortality rates.

For instance, when the pH level is too acidic (below 6), it can increase the toxicity of certain substances in water like ammonia, which is harmful to fish. Conversely, extremely alkaline (greater than 9) environment may damage the protective mucous lining of the fish and expose them to diseases and parasites. Thus, it is important to have the right pH level in order to have successful fish farming.

It is important to monitor and adjust water quality parameters to fish farming regularly. The parameters must be checked by fish farmers regularly with the help of different testing kits which are sold in the market. In case there is any variation outside the optimal range the corrective action should be taken like addition of buffers to restore the balance.

2. Alkalinity: In its turn, alkalinity is the ability of water to counterbalance acid. This property of water is crucial towards the balanced and healthy environment of the fish. Alkalinity, as well as other water quality parameters of fish farming, aids the establishment of a healthy aquaculture environment.

The alkalinity plays a major role which is evident in its influence on PH. It is used as a buffer to stabilize the pH levels, which may cause sudden fluctuations that may be harmful to the fish. Being highly alkaline, the pH of the water can easily vary causing the fish to be stressed, which can cause poor growth and higher vulnerability to diseases.

Also, alkalinity is a crucial source of carbon to support photosynthesis in aquatic plants, which are part of the food chain and oxygen provision in the water. Alkalinity is an essential part of the habitat of fish as this process is essential to their survival and reproduction.

Nevertheless, balancing the alkalinity is a fine art; an alkalinity of 50-300 ppm is said to be the best in terms of fish farming since it helps in counteracting the pH changes. Below this level may result in unreliable PH levels and block nitrification - one of the essential processes in the nitrogen cycle where the toxic ammonia is transformed into less poisonous nitrates. On the other hand, excessively high alkalinity can lead to hardness and high pH which could be detrimental to certain species of fish.

3. Hardness: The significance of water hardness in fish farming is indisputable. Fish have a need for some minerals in their metabolism; and these minerals are usually found in the water in which the fish dwells. The two main elements of water hardness are calcium and magnesium. Calcium and magnesium, the two primary components of water hardness. Additionally, the minerals also assist in keeping the pH balanced of the water that cannot be overly acidic or alkaline, which can be harmful to the health of fish.

But, as with most aspects of life, it is a matter of balance. The concentration of the hard water used in fish farming should be moderate. Excessively soft, fish can become mineral deficient, which impacts the growth and well-being of fish. Conversely, excessively hard water may result in the accumulation of harmful mineral deposits in the gills of the fish which may result in breathing difficulties.

Then, what is the optimal level of water hardness to raise fish? This may differ based on the fish species under farming. An example would be whereby certain species require soft water

that does not contain a lot of hardness, but others flourish in hard water. But, in most cases, in the case of fish culture, it would be preferable to ensure that the hardness of water is higher than 50 ppm.

4. Dissolved Oxygen: Dissolved oxygen is of an extremely crucial role in fish farming industry. The same way that we as humans require air to breathe, fish and other aquatic life require oxygen that is dissolved in water in order to survive. One of the essential water quality parameters of fish farming is the level of dissolved oxygen. It can greatly impact the growth, health, and survival of the fish stock.

The role of ensuring the presence of optimum levels of dissolved oxygen in fish ponds and tanks is difficult to overestimate. Fish use oxygen to breathe, digest and metabolize. When the levels are too low, the fish might become stressed, stop feeding, grow at a slower rate or even die. Besides aiding in the life processes of the fish themselves, dissolved oxygen helps in the breakdown of organic substances and in oxidation of poisonous chemicals.

Therefore, one of the essential components of successful fish farming is monitoring and control of the dissolved oxygen levels. Dissolved oxygen can be influenced by several factors such as temperature, salinity, pressure and biological activity of the water body. An example would be the photosynthetic plants and algae that synthesize oxygen in the day and use it in the night. This may lead to varying levels of oxygen daily which should be well controlled.

Close monitoring of dissolved oxygen and other water quality parameters of fish farming is not only a good practice but also a requirement.

5. Ammonia: Ammonia is the by-product of fish excretion and decay of organic substances, e.g. uneaten food and dead vegetation. It's also part of the nitrogen cycle in the aquatic ecosystem.

The success of a fish farm is therefore very crucial in maintaining the optimum levels of ammonia. Fish farmers should also test the water on a regular basis to determine the level of ammonia with the help of test kits. The ideal level is close to zero. Any upsurge must be dealt with promptly to avoid the damage of the fish.

To control ammonia levels, fish farmers have a well-balanced ecosystem. These involve avoiding overstocking of fish, over feeding and proper filtration. Other farmers employ natural processes such as the introduction of nitrifying bacteria that change the harmful ammonia into less harmful products.

6. Nitrite: Nitrite is a typical constituent of the nitrogen cycle, and is mainly generated through the bacterial oxidation of ammonia in fish waste. It's a vital consideration among the water

quality parameters for fish farming. Nitrite is not as toxic as ammonia but still when used in large amounts, it may be a great danger to the health of fish.

The amount of nitrite present in the water would be an indicator of the effectiveness of the biological filtration. When the nitrite levels are high, it is an indication that the biofilter is not properly processing fish waste and thus accumulated harmful substances. It is therefore necessary to check and control the level of nitrite on a regular basis to ensure that the environment has proper growth of fish.

The optimal level of nitrite in fish farming should be maintained at the minimal level that is usually below 0.75 mg/l though this varies according to the species of fish. Excessive amounts of nitrite may result in nitrite poisoning that is observed in fish by decreased growth rates, increased susceptibility to illness, and even death in severe situations.

It is not merely about keeping the nitrite levels optimum so that your aquatic livestock survives immediately. It is also beneficial in the long-term to your fish farming business. When fish are raised in a healthy environment with adequate water quality parameters, they tend to grow faster and stronger, giving you better yields and higher profits.

Therefore, it's clear that understanding and controlling nitrite levels is an essential aspect of fish farming. By regularly testing your water and taking action when needed, you can create a thriving environment for your fish and boost the success of your farm.

7. Salinity: Salinity, or the concentration of salts in water, is one of the key water quality parameters for fish farming. It plays a vital role in fish health, growth, and reproduction.

For example, aquaculture fish such as ictalurid catfish, pangasius, and common carp, thrive in salinities below 5 g/L, while others such as Atlantic salmon, tilapia, and rainbow trout flourish in salinities up to 20 g/L

While marine and estuarine species can be raised in inland saline water, they may struggle to survive and grow optimally due to inadequate salinity, resulting in ionic imbalances from low levels of potassium (K^+), magnesium (Mg^{2+}), and calcium (Ca^{2+}), or a combination thereof. To address this, mineral supplements are administered to bolster the concentrations of essential ions.

Salinity influences various biological and physiological processes in fish. It affects the osmoregulation process, which is the mechanism by which fish balance their body fluids with their surrounding environment. When the level of salinity is too high or too low, it may interfere with this balance resulting in stress, disease, or even death.

Moreover, salinity influences the oxygen solubility in water. Salinity level is high and this may interfere with survival and growth of fish as the oxygen level is lowered. Conversely, the decreased salinity raises the amount of oxygen and offers a more favourable habitat to fish.

Improving Water Quality in Fish Farms

Maintaining optimal water quality is a continuous process involving various strategies. These include:

- Regularly monitoring water quality parameters and adjusting them as needed
- Using aeration devices to increase the oxygen content in the water
- Managing fish-feeding practices to control waste and reduce ammonia levels
- Regularly cleaning the pond and removing waste materials
- Using water treatment methods when necessary, such as liming or using water conditioners

Future of Fish Farming & Water Quality Management

As the aquaculture industry continues to grow, so does the importance of water quality maintenance and management. Technological advancements are paving the way for more efficient and accurate monitoring systems.

Conclusion

The parameters play a vital role in water quality mostly the area of fish farming & aquaculture. To have successful fish farming, we must make serious actions to practice by enforcing the hard and regulation, and by making sure that masses participate.

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