

Scientific health management strategies in aquaculture

- As we all know that Aquaculture is the fastest growing food producing sector in the world and it is expected to produce significant quantities of fish in the coming years to meet the growing global demand for aquatic animal products.
- The expansion and diversification of the sector, along with globalization and trade liberalization have resulted in aquatic animals and animal products moving around the world rapidly, causing serious disease outbreaks stemming from incursions of pathogens through unregulated Transboundary movements.
- It has become necessary to develop appropriate strategies for establishing national regulatory frameworks to improve responsibility in Transboundary movement of live aquatic animals and increased the production level.

Risk analysis for aquatic animal movement

- The experience gained in understanding and applying the risk analysis process as a decision-making tool for live aquatic animal movement has influenced the use of risk analysis in the field of aquaculture.
- The aquaculture sector is now considered to be the emerging agricultural sector, the catalyst of the ‘blue revolution’, the answer to the world’s future fish supply, the fastest food-producing sector and the future of fisheries, so the industry has a real need for effective biosecurity programmes.
- Biosecurity measures are now being carefully considered in aquaculture (e.g. proactive disease risk analysis) to reduce the probability of a biological agent spreading, and to mitigate the adverse impacts that may result.
- Such biosecurity measures use the risk analysis framework that includes the best information available on husbandry, epidemiology and sound science.

Quarantine and health certification

- Quarantine has often been thought of as simply a procedure applied to all imports of living aquatic animals.
- During the last 10 years, however, this thinking has changed considerably, with quarantine now increasingly viewed as a comprehensive process relating to both imports and exports, and including pre-border, border and post-border activities; it is now considered by national governments as one aspect of the ‘National Aquatic Animal Health Strategy’ within the risk analysis framework.
- Quarantine is considered to be an important risk mitigation measure, which, singly or in combination with other health management measures, can be effective in reducing disease risk.
- Health certification is an important and integral component of the quarantine process and a prerequisite for international movement of live aquatic animals.

Disease surveillance and reporting

- Once infectious disease occurs, it is impossible to cure entire fish population in the pond water body.
- Therefore, disease surveillance and reporting play very important role to monitor the diseases.
- The surveillance and reporting disease outbreak has to be quickly report to the health expert to prevent further increase in the area.
- The fish farmer need to be provide accurate picture of the disease situation in the incidence pond.
- Regularly active surveillance has to be done to check the emerging diseases and if required technical guidance can be provided on aquatic disease diagnostics, surveillance by the district fisheries department.

Emergency response to disease epizootics

- There are many examples of the devastating impacts that aquatic animal disease outbreaks can have on the livelihoods of aquafarmers, for example:
 - – outbreaks of epizootic ulcerative syndrome (EUS) in freshwater and brackishwater fish in Asia (during the 1980s and the 1990s)
 - – outbreaks of viral encephalopathy and retinopathy in marine fish in Asia (ongoing since the 1990s)
 - – outbreaks of white spot syndrome virus (WSSV) and Taura syndrome virus in penaeid shrimp in Asia and Latin America (ongoing since the early 1990s).
- The final outcome of disease surveillance, reporting, and scientific health management in aquaculture will reduce the incidence of infectious disease, increase production and boost the personal and national economic.

Management practices strategies

- As we know that diseases outbreak is due to interaction of three factors i.e Weak body immune system, virulence pathogen and polluted aquatic environment.
- Therefore, maintenance of aquatic water quality parameters is one of the major factors to control the outbreak of infectious fish diseases.
- **Water Quality parameters management:**
- **1. Dissolved oxygen (DO) depletion-** DO is one of the crucial factor in aquaculture system.
- DO depletion can occur for several naturally occurring reasons, most of which are highly controllable or treatable.
- The primary cause of oxygen depletion in a water body is from excessive algae and phytoplankton growth.
- During the night, the photosynthetic organisms consume oxygen through respiration.

- Aquatic plankton such as algae and other phytoplankton die, the process of decomposition also requires significant amounts of dissolved oxygen.
- Temperature also plays a prominent role in dissolved oxygen levels.
- High water temperatures above 30 °C reduces the dissolve oxygen level.
- On cloudy days even, the production of oxygen through photosynthesis is slowed down.
- Additionally, without wind circulation of the water also stops preventing the surface diffusion of atmospheric oxygen.
- Oxygen deficient water harm fish populations, even causing die-offs.
- In general, most fish species grows within a range of 5–12 ppm dissolved oxygen. However, when the level drops below 4 ppm they stop feeding, become stressed and begin to die.

- During morning hours, depletion of dissolved oxygen can be managed channelizing fresh water, beating water with bamboo pole, spraying water with open containers and bamboo baskets and mechanical aeration using paddle wheels.
- The farmers often make children swim in ponds and use ducks to swim in pond and aerate the water, apart from operating aerators.

Turbidity management

- Turbidity describes the “cloudiness” or “muddiness” of water.
 - It can be caused by many substances, including microscopic algae, dissolved organic substances, suspended clay particles, and colloidal solids.
 - Though moderate level of phytoplankton turbidity is desirable for aquaculture, turbidity caused by clay particles is generally undesirable, as it keeps light, required for algal growth, from penetrating the water and can also clog fish gills.
- Flocculating substances like alum @ 15 to 25 mg/L or gypsum @ 100 to 300 mg/L are very effective for controlling clay turbidity.

- But these chemicals are not always easily available to many farmers site or may be not affordable economically to many.
- So, for controlling clay turbidity, farmers can use organic matters like chopped paddy straw or pieces of banana stem and periodically remove the same from the pond, in addition to lime, to reduce clay turbidity.
- Clay particles may get attached to the straw and their settlement at the pond bottom causes correction of turbidity.
- Banana stem actually binds dissolved and suspended particles in the water column and thus clear water by coagulating the particles.
- The application of lime to ponds to clear unclean water and addition of pieces of banana stem also can be apply together.

Water pH control

- pH is approximately the negative of the base 10 logarithm of the activity of the hydrogen ion.
- Water with pH less than 7 are acidic and greater than 7 are basic.
- The optimal range of pH in water for fish culture is 6.5 to 8.5 ppm.
- Scientific fish culture prefers a neutral to slightly alkaline water pH for better growth of fish.
- Farmers hardly have laboratory facility to check it out.
- The experienced farmers mainly taste the water to check water pH.
- Although this technique doesn't provide very specific measure of water pH, but it provides the information whether the water is acidic or alkaline.

- Based upon this crude observation, farmers decide to take required action to correct water pH suitable for fish culture.
- Apart from using lime (200 kg/ha), farmers can use ash of banana plants to increase the water PH.
- The banana trees are rich in potassium and are alkaline in nature, which actually helps in pH correction.
- Simple way to correct the pond pH by using banana pseudo stem can be used to increase pH through their alkaline secretion by cutting them into pieces and immersing in pond water.

Aquatic weed control

- Aquatic plants are natural and important components of the aquatic environment.
- Among different aquatic plants the microscopic plants (algae) form the base of the aquatic food chain.
- Larger algae and plants when present in limited number provide habitat for fish and food organisms, and all plants produce oxygen by virtue of their photosynthesis during the day.
- But excessive growth of the plants can have a detrimental effect on a water body and its inhabitants.
- Aquatic weeds can cause fish mortality due to the oxygen depletion during night.
- Moreover, decrease in dissolved oxygen level also occurs due to die-off and decomposition of the plants in water body, which also turn the water polluted.
- The presence of large aquatic plants limits the space for free movement of fish and block light penetration which prevent photosynthesis by microscopic plants and cause fish kill.

- Fine mesh nets and bamboo poles are used to drag algae, macrophytes and aquatic weed from one end of the pond to other for removal.
- Beat the water with bamboo poles to break the continuity of the algal mat and control the spreading of the weeds over the pond surface.
- Grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), black carp (*Mylopharyngodon piceus*), common carps (*Cyprinus carpio*), Puntius (*Puntius sarana*), and duck should be introduced in the culture system to feed upon and counteract weed problem.
- Algal bloom were also controlled by keeping few floating water hyacinth (*Eichhornia crassipes*), locally known as Kochuri pana which absorb nutrient and heavy metals, making them limited for the growth of algal bloom.

Control of tadpoles and snails in ponds

- Many aqua-culturists have economic loss due to the presence of the snails and tadpoles in ponds by competing for food and habitat in pond ecosystem and effecting fish growth.
- Sorting and removing tadpoles and snails from harvest nets affects production quantification and is time consuming.
- Moreover it subjects fish to severe mechanical injury and stress.
- Tadpoles and snails may also substantially reduce primary production, effectively compete for space and artificial feed and serve as vectors for fish disease and as parasites in fish.
- Current methods used to control tadpoles using chemicals but generally it is not advisable because chemical compound can destroyed the other aquatic beneficial microorganism.

- Moreover, chemical methods are costly, not affordable by the poor farmers, often haphazard, and not highly effective.
- Therefore, farmers can apply ash @ 40-45kg/ ha pond or lime @ 20-25 kg/ha around pond periphery for two consecutive weeks to remove tadpole.
- Also remove the submerged substrates from water to avoid hatching of adhesive tadpoles eggs deposited in the substrate.
- To control over population of snails that created hindrance in fish culture, use banana leaf, coconut leaf, palm leaf and bamboo baskets, which are thrown in the pond for a period of 15 – 20 days.
- Snails use those materials as substratum. Then those materials were removed from ponds along with attached snails.

Removal of poisonous gas

- Aquaculturist often face problem of toxic gas formation at pond bottom sediment due to over loading of organic manures.

- Moreover, leaves from trees often fall on to the pond and sink to the bottom, get rotten and produce a high concentration of poisonous gases dissolved in the water.
- In such cases, fish get stressed due to water quality deterioration and often kills fish.
- Identify the such problem by observing the air bubbles and often foaming formed in pond surface water.
- Banana stem in considerable quantities are used to manage such problems.
- Manually raking the pond bottom by dragging tree-branches and bamboo poles horizontally at the pond bottom to release out the humus gas from sediment.
- Hollow bamboo poles are also placed vertically from the mud of the pond bottom upto surface water level to release gas through the pole from the pond bottom.