8 HEALTH MONITORING AND DISEASE MANAGEMENT

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Introduction

The culture of marine finfish in cages was successfully initiated in Japan in 1950s and in South East Asia during 1970s. In the initial years of cage culture, fish seed for culture was collected from the wild. Recent developments in hatchery technology and seed production of commercially important marine finfish and shellfish have ensured the continuous supply of seed for mariculture practices. The disease control and health management are important issues for sustainable aquaculture. The disease occurrence causes major economic loss to aquaculture farmers. Production costs often increase due to disease outbreaks and treatment procedures followed to overcome death of fishes during culture. In natural aquatic environments, disease problems are unnoticed as diseased/weak/stressed fishes are easily removed by predators and very few occurrences of disease outbreaks are reported. Moreover in natural environment fish are not crowded as in captive culture conditions, which ultimately causes stress in fishes frequently.

The health of aquaculture organisms is a state of physical well-being. The fish health management in aquaculture is management practices designed to prevent fish disease and successful fish health management begins with prevention of disease rather than treatment. Adequate and proper nutrition of farmed fishes is important for overall health which improves the immunity of fish and strengthens fishes to fight against variety of disease agents of aquatic environment. Early detection of behavioural changes and clinical signs in culture animals is critical for proper diagnosis of the disease. The daily observation of fish behaviour and feeding activity allows early detection of disease so that diagnosis can be made before the majority of the population becomes sick. However, disease types and severity are greatly influenced by the species of fish, the conditions in which the animals are cultured and management practices.

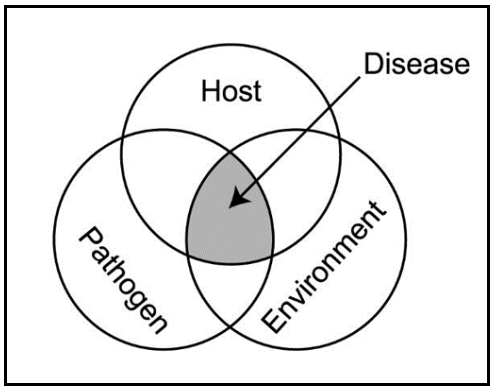

Fig. 1: Disease is a complex interaction between three important factors namely, the susceptible fish (host), the causative agent (pathogen) and the environment. Environmental factors such as water quality parameter fluctuations cause stress in fishes contributing to disease outbreak.

Fish cultured in floating cages become susceptible to disease when different environmental factors such as temperature, salinity, dissolved oxygen and suspended particles fluctuate abruptly or widely and due to often unavoidable handling operations. Once conditions suitable for pathological changes develop, progress to disease in warm water environment is rapid. Fish species cultured in various regions reflect these environmental differences. Other warm water areas where cage culture is practiced on a commercial scale are the tropical islands of the Pacific Ocean.

Disease encounters in cage cultured fishes may be classified as follows; (Kinne, 1980)

1. Genetic
2. Nutritional
3. Environmental (light, temperature, salinity and oxygen; natural and man-made pollutants)
4. Physical injuries during handling
5. Infectious diseases (virus, bacteria, fungi, etc.)

Many of the diseases occurring in fishes are non-communicable and if diagnosed correctly and their causes determined, some changes in daily management practices will control and eradicate disease problems.

In comparing cages with other aquaculture systems, diseases with a genetic and nutritional basis are likely to affect fish to lesser extent and can be excluded. Genetic disorders and mortality of fish seed after stocking in cages can be minimised by verifying the

fish seed source. Diseases caused due to nutrition of fishes are difficult to diagnose and their treatment needs specific knowledge. Nutritional diseases can be controlled by using commercially available formulated feeds but precautions should be taken while storing and feeding such feeds. In case of fresh diet, use of uncontaminated and properly stored feeds reduces the cause of problems.

Caged fish tend to be more subject to environmental change than those grown in other systems. Environmental conditions such as adverse variations in temperature, pH, light and oxygen may cause problems and needs to pay serious attention to overcome them.

Inappropriate mesh size of cage nets, over-stocking, presence of predators and different sized fish seed used during stocking can also cause physical injuries to fishes and make organisms susceptible to pathogens if handled without due care.

Diseases caused in fishes due to parasites and micro-organisms are communicable and therefore need to be diagnosed and treated properly to avoid losses. Parasites, during their life cycle, depend on other living organisms for nourishment and growth. Parasitic diseases of fish are frequently caused by protozoa and metazoa (including acanthocephalans, nematodes, cestodes, trematodes, leeches, crustaceans and even other fishes such as lampreys). Variety of parasites infests gills and skin of fishes and derives nutrition from host fish causing weight loss, irritation and finally death of fish. Pathogenic microorganisms occur naturally and are distributed widely in aquatic systems. Infection by pathogens in fish is usually triggered by stress conditions and physical injuries of fish in farm conditions. Fungi (saprophytic organisms) and viruses (obligate intracellular parasites incapable of independent replication) are also very common in aquatic environment. Fungi invade living fishes under certain circumstances, often through lesions caused by some other agents, whereas viruses invade cells and direct them to manufacture viral specific proteins, which further helps to form new viruses invading other cells and infected cells die often.

As discussed above, infectious and non-infectious diseases affect fish. Infectious or communicable diseases are caused by pathogenic micro-organisms *viz.* bacteria, fungi and virus. Specific scheduled treatment is necessary to control such infectious disease outbreaks. Whereas diseases caused due to environmental fluctuations, nutritional problems and genetic disorders are non-infectious.

Disease risks can be minimized by avoiding sites where a pre-development survey reveals parasites or disease agents to be present in the wild fish or intermediary hosts.

However, problems may still occur through the introduction of diseased stock to the farm or the attraction of birds and other opportunistic predators.

The infectious diseases observed in cage culture are listed in the Table. 1

Plate.1. Viral nervous necrosis

Plate. 2. Iridoviral disease

Plate.3. Lymphocystis

Plate.4. Pasteurellosis

Plate.5. Streptococcosis

Plate.6. Vibriosis

Plate.7. Vibriosis

Plate.8. Bacterial enteritis

Plate.9. Tail rot

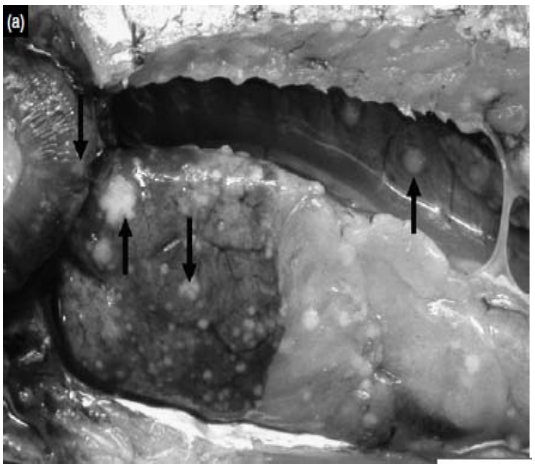

Plate.10. Nocardiosis

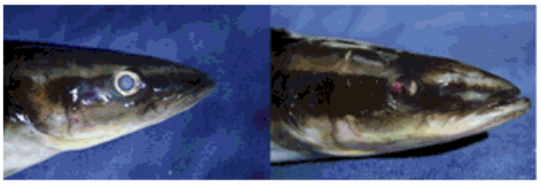

Plate.11. Neobenedeniasis

Plate.12. Sea lice infestation

Plate.13. Amyloodiniosis

Plate.14. *Octolasmis spp*. infection

Plate.15. *Cryptocaryon sp.* White spot disease

Diagnosis and treatment:

Accurate and advance diagnosis of disease outbreak in cages should be done through thorough health monitoring protocols. Bacterial, fungal and parasitic disease outbreaks take some days to become noticeable whereas viral disease outbreaks are comparatively rapid and cause mass mortality in cultured animals. In most of the cases, external examination of diseased fish is sufficient but in few cases post-mortem examination of dead fishes is required for accurate diagnosis of disease. Fish or tissue samples of diseased fishes may be sent to well-equipped laboratories for disease diagnosis.

The disease affected fishes can be treated following four methods (Roberts and Shepherd 1997);

1. Bath treatment of diseased fishes in chemical/drug and water mixture
2. Direct application of chemicals/drugs to fishes
3. Oral administration of chemicals/drugs through food
4. Biological control

Bath Treatment:

Water soluble chemicals are used for bath treatment of fishes, which is mostly used to treat fishes affected with skin and gill diseases. But chemicals added to cages will disperse in environment. Cage nets are lifted and fishes are gathered in enclosed plastic or canvas structures and then treated to avoid pollution in environment. This is a very time consuming and expensive method to treat fishes in open sea cages. During bath treatment, usually oxygen consumption of fishes increases and aerators can help to reduce down stress. Following precautions should be taken during bath treatment of fishes (Roberts and Shepherd 1997);

- Fish should not be fed for 24 h prior to treatment.
- Plastic and non-galvanised containers should be used to mix chemicals.
- Concentration of chemicals to be applied must be calculated carefully to avoid overdose of chemical.
- Bath treatment to the fishes should be avoided during high temperature period.
- Fishes should be monitored during and after treatment. Aeration should be provided if fishes are in stress.
- Course of the treatment should be completed, otherwise disease may continue with severity.

Direct application:

In case of valuable fishes or brood stock fishes, individual fish treatment is preferred. Injection of drugs to individual fish is administered.

Oral administration through feed:

In some diseases, chemicals or drug incorporated feeds are used to control the disease. The disadvantage is that, it is difficult to convince feed manufacturers to incorporate medicines in small quantities in commercially prepared feed. In case of fresh feeds such as trash fish or wet pellet diet, chemicals or drugs can be simply mixed prior to feeding. , In dried pellet diet, feeds are incorporated with chemicals or drugs by using gelatine mixture or suitable binders. Feeding should be commenced within 24 h after mixing drugs with feed pellets as some drugs degrade within 24 h.

Biological Control:

In case of parasite infestations to fish, use of chemicals or drugs has many disadvantages. In such case, wrasse *viz. Crenilabrus melops, Ctenolabrus rupestris* have

proved effective lice control agents against ecto-parasites of cage fishes. Use of wrasses is cheaper and more effective lice control method.

Measures to minimize disease risk in farm:

1. Selection of suitable strains of certain disease resistant fishes
2. Careful site selection; free from anthropogenic pollution sources
3. Selection of healthy, uniform sized fish seed from hatchery for stocking
4. Regular observation of fish and notice of unusual behaviour or changes in colour and body shape should be carried out. Regular fish sampling is often recommended as part of disease control strategy.
5. Avoid overcrowding of fishes in cage.
6. Water quality parameters should be monitored and maintained within optimum requirements of fish.
7. Fresh food free from any fungal or bacterial growth should be avoided. Overfeeding in cages should be avoided.
8. Dead fishes should be removed immediately and diagnosed for reasons.
9. Minimum and gentle handling of fish should be done to avoid physical injuries to fish.
10. Disinfected equipments should be used for sampling.

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